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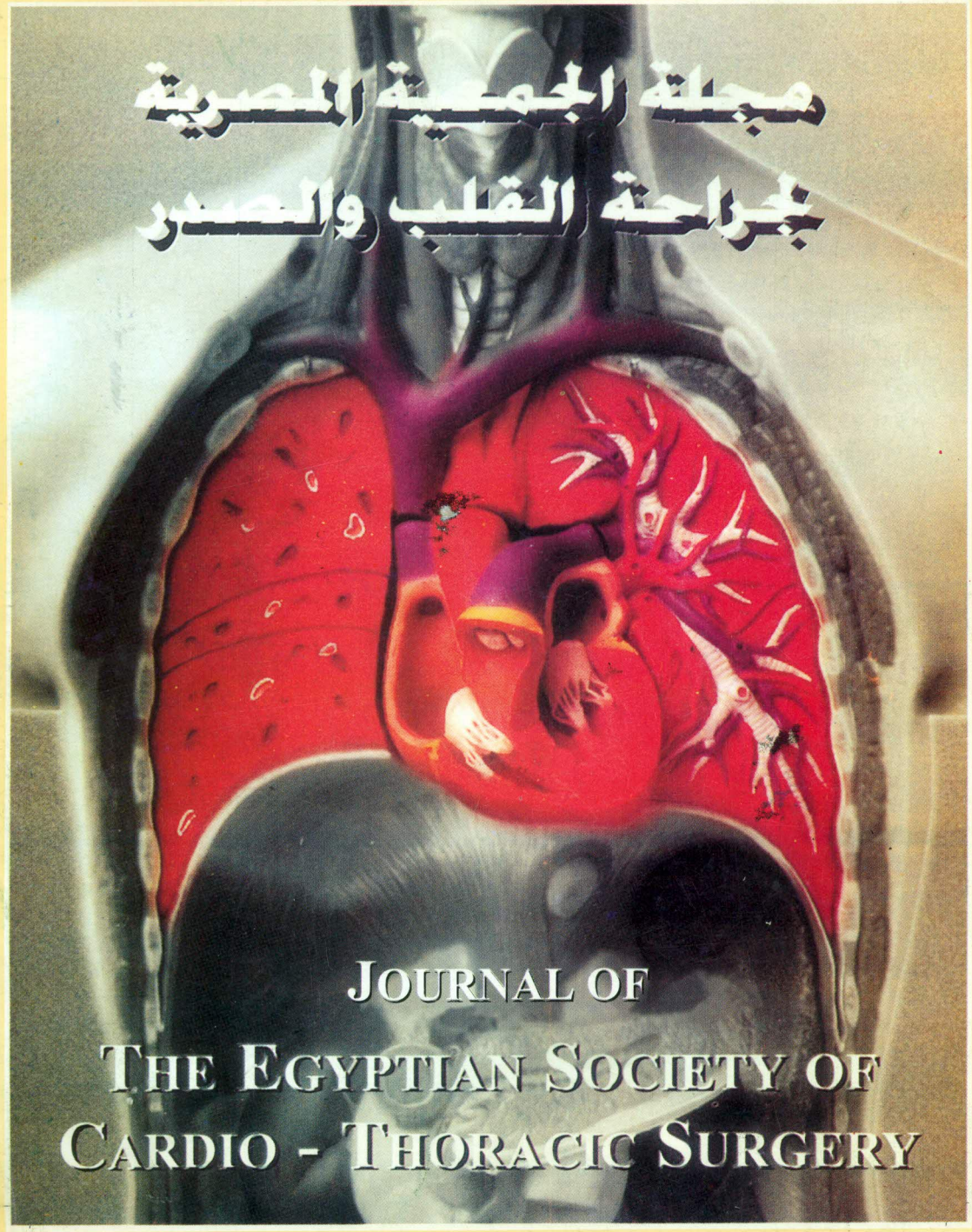

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JOURNAL OF THE EGYPTIAN SOCIETY OF CARDIO - THORACIC SURGERY

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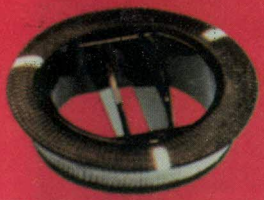

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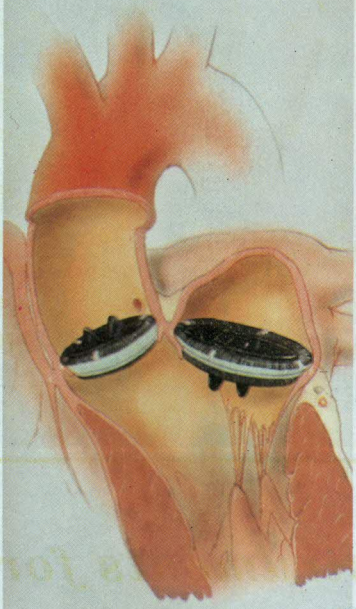

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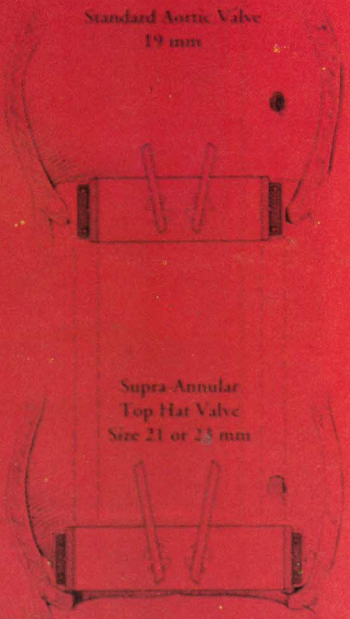

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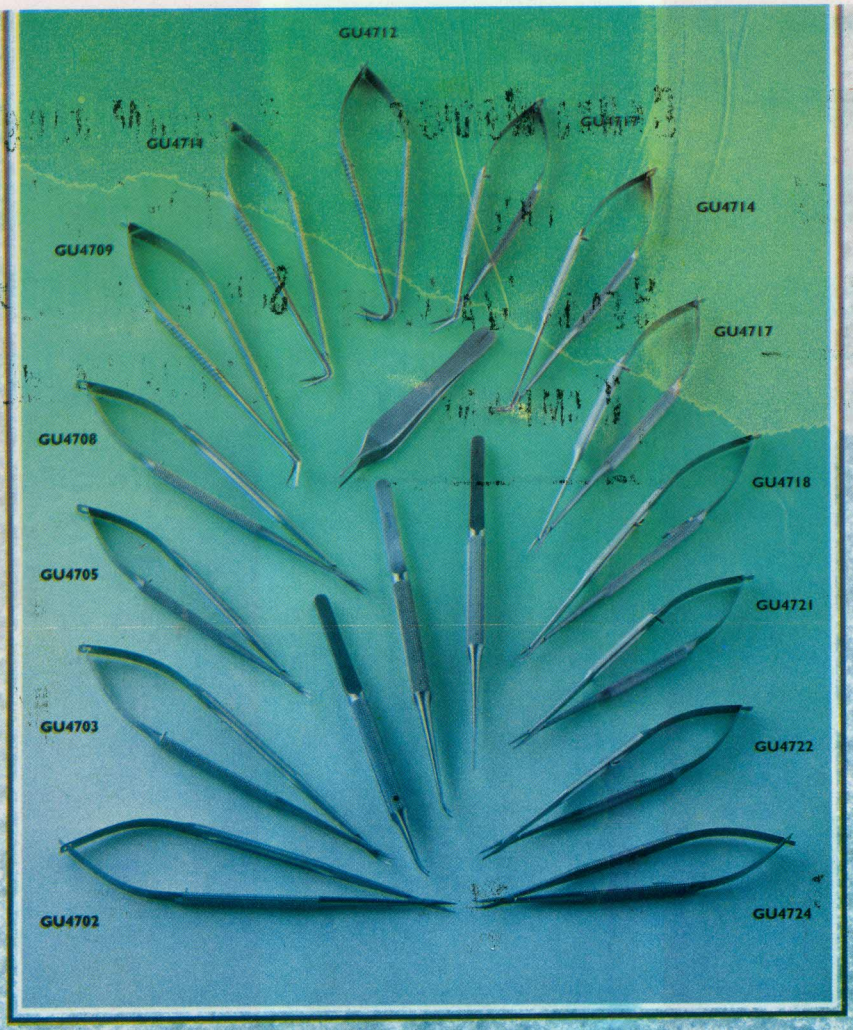

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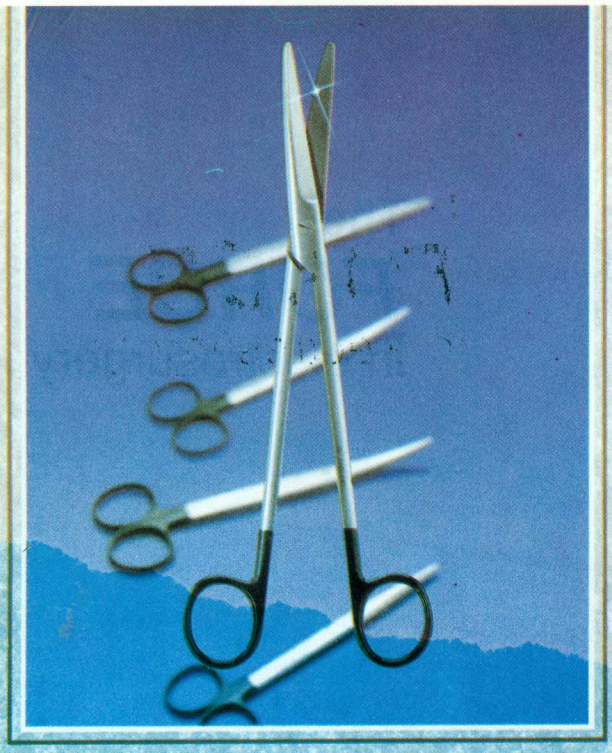

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Information for authors

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Left Ventricular Function Improvement After Successful Surgical Revascularization. Is Hibernation a Fact?, An Echo-Doppler Study

ABSTRACT

This study was performed on 37 coronary artery disease (CAD) patients who underwent coronary artery bypass grafting (C A B G) in Dubai Hospital, Dubai, U.A.E. The aim of the study is to detect the response of ischaemic myocardium (left ventricular function and wall motion) to complete surgical revascularization in patients with normal or depressed left ventricular function. Each patient was subjected to treadmill stress testing, echocardiography study and coronary angiography before C A B G. Echocardiography was repeated postoperatively before discharge, and after 3 and 6 months of follow-up. Regional wall motion abnormalities and left ventricular function both in systole and diastole were fully studied. In the whole patient group left ventricular function and wall motion improved significantly after surgery. In 23 patients who had normal preoperative left ventricular function i.e. left ventricular ejection fraction (LVEF) =or> 50%, the main improvement was in the regional wall motion. While in the group of patients with depressed preoperative left ventricular function i.e. LVEF =or< 50% (14 patients) the main improvement was in the global left ventricular function whereas regional wall motion started to improve after 6 months of surgery. We conclude that complete surgical revscularization can improve both left ventricular function and wall motion abnormalities in CAD patients, a clinical proof for the term hibernating myocardium.

Mohamed Radwan, M.D. and Mohamed Abdel Aziz Ali, M.D.

J. of Egypt - Society of Cardio thorac. Surg. Vol IV April, No 2.

Introduction

After CABG changes in resting left ventricular function are not consistent and depend on many factors that might include preoperative as well as perioperative factors. The most important of them all is the state of left ventricular function (1). Even in the absence of previous myocardial infarction, patients with CAD often present with chronic regional wall motion abnormalities and some degree of left ventricular dysfunction that can be reversible either spontaneously or after myocardial revascularization. In these patients, regional and global left ventricular

Department of Health & Medical Services, Dubi Hospital

dysfunction has been proposed to result either from prolonged postischaemic dysfunction (myocardial stunning) or from adaptation to chronic hypoperfusion (myocardial hibernation) (2). In patients with CAD, the left ventricular resting function is dependant greatly on the performance of non-infarcted collateral-dependent myocardium. These areas exhibit ischaemia induced chronic depression of wall motion and demonstrate marked ultrastructural alterations on morphological analysis. Improvement in the function of these areas after re-perfusion is responsible for the improvement in the overall left ventricular performance and regional wall motion abnormalities after successful revascularization (3). Thus; distinction between ventricular dysfunction arising from myocardial fibrosis, and underperfused but viable hibernated myocardium has important therapeutic and prognostic implications. Areas of viable myocardium will recover after re-perfusion, whereas fibrotic areas will not (4). The purpose of the present study is to detect the improvement response of ischaemic myocardium and left ventricular wall motion and function to successful complete surgical revascularization in patients with (CAD) whether with normal or depressed overall left ventricular contractility.

Patients And Methods

In the period from February to July 1994, all the patients scheduled for C A B G in the Cardiac Unit in Dubai Hospital, were enrolled in the study. However, only 37 patients of them have completed the study as far as the inclusion criteria and the completeness of the follow-up are concerned. Preoperatively each patient was subjected to treadmill stress testing, coronary angiography and 2D M-mode coloured coded echo doppler study using an HP SONOS 2500 with 2.5, 3.5 and 5 Mhz transducers. No patient included in this study had received a B adrenergic blocking or inotropic agent within 48 hours of the Echo study. Baseline echo was performed within 48 hours of C A B G surgery and was repeated in the pre-discharge period (within 7-10 days postoperatively) and after 3 and 6 months of follow-up.

Inclusion criteria for the study included absence of any perioperative complication with technically successful full revascularization, absence of any perioperative myocardial infarction or angina in the follow-up period. Also in all the included patients there were no other concomitant cardiopulmonary or valvular disease or evidence of left ventricular aneurysm or extensive scar involving more than 60% of the left ventricular segments examined.

C A B G was performed by the same surgical and anaesthetic team. Revascularization in all patients combined both left internal mammary artery as well as saphaneous vein grafts. Operations were conducted using the conventional cardiopulmonary bypass with

moderate hypothermia. Myocardial protection was achieved by antegrade crystalloid cardioplegia using St Thomas Hospital solution II.

Echocardiographic Analysis:

To evaluate regional wall motion, the left ventricle was divided into 16 segments in the apical, short and long axis views. The conventional scoring system developed by Sawada et al was used to examine the motion pattern of these segments (5) and in the manner recommended by the American Society of Echocardiography.

A regional wall motion score was calculated for each patient as the sum of the sum of all 16 segments divided by the number of segments evaluated (6). Left ventricular function was fully studied both in systole and diastole. Left ventricular ejection fraction (LVEF) as a representative of left ventricular systolic performonce was calculated by the conventional 2D Echo area length method (6) while isovolumetric relaxation time (IVRT), peak early filling velocity (E velocity) and peak late filling velocity (A velocity) and their ratio (E/A) were derived from doppler mitral valve signals as representatives of left ventricular diastolic performance (7).

After successful C A B G surgery and based on the preoperative left ventricular function determined by Echo, the entire patient group (Go = 37 patients) has been subdivided into two sub groups;

Group 1 (G1 = 23 patients), with normal preoperative left ventricular function, i.e. LVEF =or> 50% and

Group 2 (G2 = 14 patients), with impaired preoperative left ventricular function, i.e. LVEF < 50%.

Statistical Analysis

This was done by using students "t" test and "x2" test. Results are expressed as mean ± standard error of the mean. P value of less than 0.01 was considered significant. Comparisons were made between the post C A B G predischarge and the pre C A B G results and between the 6 month folow-up and the post C A B G predischarge results.

Results

Table (1) summarises the results obtained for the patient population (Go). Based on this data statistical comparison revealed significant improvement of LVEF in the post C A B G predischarge value compared to the preperative value. Also another significant improvement was obtained after 6 months of follow-up when compared to the postoperative predischarge results. IVRT and E/A ratio as indices of left ventricular diastolic performance also showed similar improvement, both in the predischarge echo and after six months of follow-up.

Table (2) summarises the results obtained from patients with LVEF =or> 50% (G1 = 23 patients). LVEF showed significant improvement after C A B G, but no further improvement was noticed in the follow-up period. Total Echo score for regional wall motion abnormalities showed significant drop after C A B G and it was nearly nor-

	Pre CABG	Post CABG pre discharge	3 months of follow-up	6 months of follow-up
EF (%)	51.7 ± 1.9	58.2 ± 1.3**	60.3 ± 1	61.9 ± 0.8**
Total echo score	7.3 ± 0.3	3.6 ± 0.3**	2.5 ± 0.4	1.9 ± 0.3**
I.V.R.T. (m sec)	124.7 ± 1.7	111.3 ±1.8**	102 ± 1.8	93.5 ± 1.7**
E/A (ratio)	1.0 ± 0.02	1.1 ± 0.02**	1.21 ± 0.03	1.25 ± 0.02**

Table (1)

	Pre CABG	Post CABG pre discharge	1 month of follow-up	6 months of follow-up
EF (%)	60.3 ± 1.1	63.7 ± 1.0*	64.4 ± 0.8	65.0 ± 0.9
Total echo score	6.9 ± 0.3	2.3 ± 0.8**	0.91 ± 0.2	0.21 ± 0.1**
I.V.R.T. (m sec)	123.2 ± 2.5	106.5 ± 2.0**	106.5 ± 2.0	86.9 ± 1.4**
E/A (ratio)	1.1 ± 0.02	1.2 ± 0.03**	1.2 ± 0.03	1.3 ± 0.02**

Table (2)

	Pre CABG	Post CABG pre discharge	1 month of follow-up	6 months of follow-up
EF (%)	38.3 ± 1.6	49.5 ± 1.3**	53.9 ± 0.9	56.8± 0.5**
Total echo score	8.3 ± 0.6	5.85 ± 0.49**	5.3 ± 1.7	4.98 ± 0.28
I.V.R.T. (m sec)	127.14 ± 2.2	120.8 ± 1.9	111 ± 2.5	104.2 ± 1.7**
E/A (ratio)	0.9 ± 0.04	1.0 ± 0.03	1.0 ± 0.03	1.17 ± 0.02**

Table (3)

* P < 0.01
** P < 0.001

malised after 6 months of follow-up. The same trend applied for both IVRT & E/A ratio.

Table (3) summarises the results obtained for patients with LVEF < 50% (G2=14 patients). The improvement in left ventricular contractility was noticed in post C A B G as well as on follow-up study. The improvement was very significant after 6 months of follow-up. Total Echo score for left ventricular regional wall motion abnormalities improved only after C A B G with insignificant changes in the follow-up. Left ventricular diastolic performance (IVRT & E/A) showed significant improvement only after 6 months of follow-up.

Discussion

Several studies have shown the effect of C A B G surgery in patients with CAD and depressed left ventricular function on severe regional wall motion abnormalities. In C.A.S.S. Registry Study, surgical treatment was shown to prolong survival particularly in patients with depressed LVEF (8). In another study examining the late results of surgical and medical therapy for patients with CAD and severe regional wall motion abnormalities, the seven years survival and freedom from non fatal infarction were greater in the surgically treated patients whether with low or normal LVEF (9). These results meet ours and also agree with reports of Topol et al (10) and Pazar et al (11). Improvement in left ventricular function and regional wall motion following successful revascularization can be explained by the term "Hibernating Myocardium" a term first used by Rahimtoola describing a state of persistantly impaired left ventricular function in the basal state attributable to chronic reduction in blood flow. Hibernation implies that if myocardial blood flow is enhanced, the function will improve (2). Because left ventricular function improvement after C A B G requires adequate revascularization and lack of postoperative graft occlusion, the adequacy of revascularization must be considered as a major determinant for postoperative improvement in left ventricular function and wall motion (12).

In this study the early postoperative improvement in the overall left ventricular function, the total echo score and the diastolic function, that was encountered in the all patient group can be explained in view of the improved blood supply to the ischaemic areas in the post C A B G period. The further improvement noticed in the follow-up period is explained on the basis of improved metabolic and morphological correlates of myocardial hibernation. In patients with normal left ventricular contractility (G1), most of the improvement is expected in the regional wall motion with parallel improvement in the diastolic function and relaxation. This

is mainly due to improvement in the function of ischaemic non infarcted collateral dependent segments of the myocardium. But in patients with reduced left ventricular function (G2), the main improvement is expected in the overall contractility parallel with less improvement in wall motion and diastolic function because of more scarring of the infarcted myocardium. These results and explanations are in agreement with the results of Vanoverschelde et al (3), Ragosta et al (12) and Iskandrian et al (1). However, other investagators reported more delay in recovery in wall motion after C A B G (13). These discrepancies can be explained by several factors; including different methods used for selecting patients, variable knowledge of graft patency, different timing of the postoperative evaluation, different methods in analysing wall motion and most important different techniques for cardiac preservation during C A B G.

In this study, the rapidity of recovery of hibernating myocardium after the complete surgical revascularisation although it agrees with other reports (4), but still is surprising. These findings suggest that even the akinetic areas in the myocardium is mostly composed of normal but down regulared myocytes. Previous experimental work (14), (15) in a rabbit model suggests that decreased intracellular pH may play a role in down regulating contractility in hypoperfused myocardium mainly by inhibiting calcium influx and reducing calcium sensitivity of the myofilaments. Perfusion by restoring normal cellular pH results in immediate recovery of contractility. The reversibility of the hypokinetic or even the akinetic segments after C A B G surgery represent clinical evidence that in CAD, chronic hypoperfusion can result in persistant left ventricular dysfunction (hibernating left ventricle). Identification of hiberating myocardium is important in selection of patients for C A B G since it may be useful in predicting early functional recovery postoperatively. An accurate non-invasive determination of myocardial viability will be important to identify patients who are still likely to benefit from C A B G. Myocardial perfusion radionuclide imaging, dipyridamole or dobutamine echocardiographic stress test or positron emission tomography can be clinically useful in selection of patients and in prediction of the results of C A B G surgery even in the presence of low LVEF (12) (4). Further studies in a larger number of patients are required to assess these approaches as useful tools in predicting long term benefit and survival of C A B G surgery.

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Emergency Valve Re-replacement

Abstract

Valve replacement still represents the main work load in our department due to the prevalence of rheumatic valve disease. Between January 1992 and December 1994, 1819 mechanical prosthesis were implanted electively in 1482 patients in our department. During the same period, 61 patients presented for emergency mitral, aortic or double valve re-replacement. The mean age was 28.5 ± 12 years (range 8 - 54 years), 37 (61%) were females and 24 (39%) were males. Only 2 patients were in NYHA class II, 36 (59%) were in class III and 23 (37%) in class IV. Thirty seven patients (61%) were in sinus rhythm and 24 (39%) patients were in atrial fibrillation. The left ventricular function was normal in two patients, slightly impaired in 40 (67%) patients and severely impaired in 18 (30%) patients. The reason for re-replacement was valve thrombosis in 41 (67%) patients, endocarditis in 14 (23.1%) patients, severe paravalvular leak in 2 (3.3%) patients and severe tissue valve degeneration in 4 (6.6%) patients. The procedure performed was mitral valve re-replacement (MVRR) in 49 (80%) patients, aortic valve re-replacement (AVRR) in 9 (15%) patients, double valve re-replacement (DVRR) in 3 (5%) patients. Eighteen patients (30%) were performed on urgent basis and 43 (70%) were performed on emergency basis. The mean cross clamp time was 55 ± 18 minutes (range 30 - 100 minutes) and the mean bypass time was 118±96 minutes (range 50 - 750) minutes. Results: There were 23 hospital mortalities for this highly risky group of patients. Stepwise regression was performed including the age, sex, rhythm, etiology, left ventricular function, NYHA class, presence of organ failure, year of surgery, surgeon, kind of operation, status of operation, and cross clamp time. It showed that the best predictor for hospital mortality was the presence of organ failure before surgery followed by the surgeon's experience, followed by the presence of depressed left ventricular function pre-operatively.

M.M. El-Fiky, A. Hassouna, T. El-Sayegh, A. El-Kerdany and I. Sallam

J. of Egypt. Society of Cardiothorac. Surg. 1996, Vol. IV April No 2

Introduction

Emergency prosthetic valve re-replacement still represents a challenge for the cardiac departments. Re-operations are technically more demanding for the surgeon than the original valve procedure due to mediastinal adhesions as well as the condition of the annulus after removal of the first prosthesis (Antunes, 1992). In addition, emergency procedures streches the capacity of the diagnostic, intensive care, anaesthetic and

Cardiac Surgery Department - Ain-Shams University

nursing teams to the limit. It also represents a considerable financial burden on the department. However, there is an obligation on the cardiac surgery departments to take on these patients and give them priority treatment.

Material and Methods

During a three year period, between January 1992 and December 1994, 61 patients presented to our department for emergency valve re-replacement. The mean age was 28.5 years (range from 8 to 54 years), 37 (61%) were females and 24 (39%) were males. From the 61 patients, 37 (61%) were in sinus rhythm and 24 (39%) were in chronic atrial fibrillation. Table 1 represents the functional classification of the 61 patients. Most of the patients were in NYHA class III or IV. The two patients in class II preoperatively were diagnosed to have valve thrombosis with high gradients across the mitral mechanical prosthesis by trans-oesophageal echocardiography which seemed to be only partially interfering with the valve function and were both done on emergency basis. Five patients developed organ failure prior to surgery; three developed renal failure secondary to prolonged low cardiac output; and the other two suffered from cerebral damage due to cardiac arrest before transfer to our department.

Echo-cardiography was performed for all patients on presentation to our department. The ejection fraction was normal in only 2 (3.3%) patients, impaired in 41 (67.2%) patients and severely impaired (less than 20%) in 18 (29.5%) patients. The patients were done as true emergency in 43 (70%) of cases and as rather urgent (performed the following morning before the regular list) in 18 (30%) of the cases. Table 2 enumerates the causes for valve re-replacement in our group. The 6 patients with severe paravalvular leak and degenerated tissue valve presented in class IV and were done as emergency cases.

The procedures performed (table 3) were mostly mitral valve re-replacement (49 patients). Only 9 patients performed aortic valve re-replacement and 3 patients underwent double valve re-replacement.

All patients were anaesthetized un-eventfully in the presence of two central lines, a peripheral venous cannula, an arterial line and a urinary catheter. Renal dose of dopamine and 1 ug/kg.b.w. of glyceryl trinitrate was started prior to induction and continued throughout bypass for all patients. Trasylol was given in a dose of 1-2 million units for all patients before re-sternotomy. The presence of high prothrombine time did not delay surgery. Fresh frozen plasma was transfused to these patients pre- and post-operatively.

Median re-sternotomy was performed using an oscillating saw after draping the groin for possible femoral access. Femoral artery cannulation was performed before sternotomy in five unstable patients and as an emergency procedure following right ventricular injury during re-sternotomy in one patient. Access was through a right antro-lateral thoracotomy and femoral arterial

Functional Class	No. of Patients	Percentage
Class II	2	3.3%
Class III	36	59%
Class IV	18	29.5%
Organ Failure	5	8.2%
Total	*61*	*100%*

Table 1: Functional class classification of the 61 patients.

Cause	No. of Patients	Percentage
Thrombosis	41	67.2%
Endocarditis	14	23%
Severe leak	2	3.3%
Tissue valve	4	6.5%
Total	*61*	*100%*

Table 2: Causes for emergency valve re-replacement.

Operation	No. of Patients	Percentage
MVRR	49	80.3%
AVRR	9	14.8%
DVRR	2	4.9%
Total	*61*	*100%*

Table 3: Procedures performed for our population. MVRR = Mitral valve re-replacement; AVRR=Aortic valve re-replacement; DVRR = Double valve re-replacement

	Survivors 38 patients		Mortality 23 patients		p value
Age	29.6 ± 10 Y		27 ± 14 Y		0.3502
Sex	14 (37%) 24 (63%)	M F	10 (43%) 13 (57%)	M F	0.8074
Rhythm	22 (58%) 16 (42%)	Sinus AF	15 (65%) 8 (35%)	Sinus AF	0.7665
LV Function	1 (3%) 31 (84%) 5 (13%)	N. Sl.Imp. Sv.Imp.	1 (4%) 9 (39%) 13 (57%)	N. Sl.Imp. Sv.Imp.	0.0014
NYHA class	2 (5%) 21 (55%) 15 (40%)	II III IV	0 (0%) 15 (65%) 8 (35%)	II III IV	0.4642
Organ Failure	0 (0%) 38 (100%)	Yes No	5 (22%) 18 (78%)	Yes No	0.0118
Status	12 (32%) 26 (68%)	Ur. Em.	12 (32%) 26 (68%)	Ur. Em.	0.868
Year	10 (26%) 11 (29%) 17 (45%)	92 93 94	2 (9%) 10 (43%) 11 (48%)	92 93 94	0.205
Aetiology	27 (71%) 8 (21%) 2 (5%) 1 (3%)	Throm. Endoc. Tissue Leak	14 (61%) 6 (26%) 2 (9%) 1 (4%)	Throm. Endoc. Tissue Leak	0.8577
Cross-clamp time	56 ± 19 minutes.		55 ± 18 minutes.		0.8899

Table 4: Comparison between the survivors and the hospital mortalities as regard the pre-operative and operative data. The statistical comparison was performed by chi-square test for non-parametric data and by un-paired double-blind t test for parametric data. M= Male; F= Female; N= Normal; Sl. Imp.= Slightly impaired; Sv. Imp.= Severely Impaired; Ur.= Urgent; Em.= Emergency; Throm.= Valve Thrombosis; Endoc.= Endocarditis; Tissue= Tissue valve degeneration; Leak= Leaking valve.

	Factor	F value	P value
First predictor	Organ failure	8.4	0.005
Second predictor	Surgeon	7.8	0.01
Third predictor	LV function	5.2	0.025

Table 5: Stepwise regression analysis for twelve pre-operative and operative factors as predictors of mortality. Degree of freedom = 1,60.

Cause	Number	Percent
Low cardiac output	14	60.9%
Cerebral damage	4	17.4%
Endocarditis	2	8.7%
Haemorrhage	2	8.7%
Thrombosis	1	4.3%
Total	*23*	*100%*

Table 6: Main cause of death for the 23 hospital mortalities.

cannulation in another three patients.

The cardiopulmonary bypass circuit included a membrane oxygenator for all patients. Ultrafiltration was adopted in patients with overt renal failure (3 patients), patients with severe pulmonary congestion (11 patients), or severly anaemic patients (9 patients). Pulsatile flow with moderate hypothermia (28-25°C) was employed to all patients.

Myocardial preservation was performed by infusion of cold (4°C) antegrade high potassium (22 mEq/L) cardioplegia with a pH of 7.5 at a dose of 20 ml/kg body weight. Half this dose was repeated every 25-30 minutes of cross-clamp time. Antegrade blood cardioplegia with warm re-perfusion was performed in only 4 patients using the Sheilly Haemotherm.

All the prosthesis used were mechanical bileaflet valves or disc valves. The valves

were inserted using interrupted stitches in all patients. The exposure of the mitral valve was through a left atriotomy posterior to the inter-atrial septum. Exposure of the aortic valve was through the previous aortotomy incision. Patients with ring abscess were dealt with by removing all necrotic material, cleaning the cavity with betadine and still the valves were inserted in the original ring.

Results

The mean cross clamp time was 55±18 minutes (range 30-100 minutes) and the mean bypass time was 118±96 minutes (range 50-750) minutes. The prolonged bypass times was due to trial of support of patients with low cardiac output.

From the 52 mitral prosthesis inserted, 40 (77%) were bileaflet valves and 12 (23%) were disc valves. On the other hand, from the 12 aortic prosthesis inserted, 7 (58.3%) were bileaflet and 5 (42.6%) were disc valves.

From this very high risk group of patients there was 23 (37.7%) hospital mortalities. Table 4 compares the pre-operative and operative profile for the survivors and the deceased. It showed that patients with severely impaired left ventricular function and patients with organ failure preoperatively had a significantly higher risk of mortality.

Stepwise regression analysis including seven pre-operative factors (age, sex, rhythm, aetiology, left ventricular function, NYHA class and organ failure) and five operative factors (year of surgery, surgeon, kind of operation, status of operation and cross-clamp time). The first predictor of mortality was the presence of organ failure preoperatively (Table 5). Three patients had acute pre-renal failure due to low cardiac output for more than 12 hours pre-operatively and died post-operatively from persistent low cardiac output. Two patients had cerebral damage due to prolonged cardiac arrest in the cardiology ward and died post-operatively due to the persistence of the cerebral damage.

The second predictor of mortality was the surgeon. More experienced surgeons definitely had better results. The third predictor of mortality was the pre-operative left ventricular function. Patient with pre-operative ejection fraction less than 30% had the highest mortality . The main cause of death was persistent low cardiac output (LCO) in 14 patients (table 6). Three of these patients were in acute renal failure preoperatively and another five were on considerable inotropic support before transfer to theatre. Cerebral damage was the cause of death in another four patients, two of them suffered from this cerebral damage preoperatively. Two patients died from repeat endocarditis after valve re-replacement in the presence of ring abscess; one of these patients underwent twice double valve re-replacement during the same hospital stay. Two patients died from bleeding; one of them during re-sternotomy and another patient died from rupture ventricle due to injury of the left ventricle during the removal of a degenerated tissue valve in the mitral

position. One patient died from valve re-thrombosis 26 days following surgery and presented to us with extensive cerebral damage due to massive embolism.

Discussion

Recent reports of mortalities of 35% - 40% in emergency procedures highlights the problem (Biglioli et al, 1994). Bortolotti reported a 57% mortality in emergency valve re-replacement (Bortolotti et al 1994). Because of the prevalence of rheumatic fever in our country and the increasing numbers of prosthetic valves inserted each year, we expect to see more patients presenting for emergency valve re-replacement in our department.

One of the most important lessons learned from our experience is to deal with patients with mechanical valve inserted with a very high suspicion index. The presence of a high gradient across the mitral prosthesis warrants immediate trans-oesophageal examination. The earlier the interference with these patients the better the results. Another lesson is to specify an emergency team in the department ready to deal with these patients as soon as they appear and not to delay interference at any cost. This will ensure immediate diagnosis and interference and would also ensure the lowest possible cross-clamp times for these critical patients.

We stopped taking on patients with impaired consciousness due to recent embolic or haemorrhagic cerebral episodes because of the consistently poor results of this group of patients.

On the other hand, patients with renal and/or respiratory failure are not denied their chance and are rushed to theatre as early as possible with higher risk.

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Determinants of Late Ventricular Arrhythmia After Total Repair of Tetralogy of Fallot

Abstract

Fifty seven patients (36 males) who underwent total repair of tetralogy of Fallot at Harefield Hospital between 1970 and April 1994 were studied. They represent "17%" of the total number operated upon during this period, and were randomly selected from the patients attending routine follow up visits. Seventeen patients were corrected transatrially and 40 transventricularly. All patients were evaluated by history and complete physical examination, chest radiogram, 12 leads electrocardiography "ECG", Doppler echocardiography, 24-hour Holter monitoring. Treadmill exercise test TET was performed in 24 patients. The mean age at operation was 4.86 years "standard deviation SD=8.37", the mean age at follow up was 11.85 years "SD=6.99". The mean cardiothoracic ratio "CTR" was 55.81 "SD=2.26". Thirty nine patients (69%) had significant pulmonary regurge "PR" on Doppler echocardiography. No premature ventricular contractions "PVCs" were present on routine 12-leads ECG. Twenty five patients (44%) had significant PVCs equal or more than grade 2 Lown's criteria). Ventricular arrhythmia "VA" on Holter monitoring was correlated with older age at operation (p=0.0305), transventricular route of correction (p=0.0159), severity of PR (P=0.0001), CTR (P=0.0305) and palliative shunts (p=0.0105), but was not correlated with the interval since operation (p=0.14). Ten out of 24 patients (42%) had significant PVCs on TET i.e. = or > 2uniform PVCs). Holter monitoring and TET had nearly equal sensitivity for detection of VA after TOF repair.

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Introduction

The operative mortality rate has decreased significantly after tetralogy of Fallot "TOF" repair to about 1%, since the new surgical procedure has been adopted (1,2).

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However, the incidence of late sudden death has been reported as 1 to 6% after TOF repair and postoperative ventricular arrhythmia 'VA' was considered the primary aetiology of late sudden death (3-7). The incidence of premature ventricular complexes "PVCs" after TOF varies from 6-50% in different series and depends on the method of investigation(8). The exact incidence, significance and causes

of these arrhythmias have not been fully elucidated. The purpose of this study was to attempt to clarify these issues.

Patients and Methods

57 patients (36 males) who underwent total repair of tetralogy of Fallot at Harefield Hospital between 1970 and April 1994 were studied. Patients were randomly selected from patients attending routine follow up and they represent 17% of the total number operated upon during this period.

The medical records were reviewed to confirm diagnosis and all patients had the following before operation: history and complete physical examination, laboratory investigations eg haemoglobin %, chest radiogram, 12 leads electrocardiography ECG, echocardiography and cardiac catheterization and angiography.

Family history of congenital heart disease was present in three patients, the father of one of the patients had VSD and two sisters had TOF with Down's syndrome. The age at operation ranged from 50 days to 51 years and the mean age at operation was 4.86 years "SD= 8.37", the mean age at follow up was 11.85 years "SD = 10.45" and the mean interval from surgery was 6.98 with "SD = 6.99".

The angiographic and echocardiographic diagnostic criteria for TOF were large perimembranous outlet ventricular septal defect "VSD" with infundibular pulmonary stenosis and antero-cephaled deviation of the insertion of the outlet septum relative to the rest of ventricular septum(9). Fifteen patients were acyanotic at the time of correction, five had Down's syndrome, five had atrial septal defect "ASD", three had patent ductus arteriorsus "PDA". The preoperative haemoglobin was more than 15gm% in 26 patients. All patients were in sinus rhythm and had evidence of right ventricular hypertrophy. Thirty six patients had cardiothoracic ratio more than 50% and 29 patients showed evidence of lung oligaemia on routine chest radiography.

Cardiac surgery

(a) **Palliative shunts:** 16 patients (28%) had previous shunts before total correction, (two left Blalock-Taussing shunts "B-T", five right Blalock-Taussing shunts, five modified right B-T shunts and one central aortopulmonary shunt).

(b) **Total repair** was performed utilizing low flow hypothermic cardiopulmonary bypass in all patients above the age of one year "37 patients" while 20 younger patients had deep hypothermia with total circulatory arrest.

Transventricular repair was performed in 40 patients using a transverse right ventriculotomy while transatrial repair was done in 17 patients.

During the transatrial approach, the VSD was closed through the right atrium and tricuspid valve utilising a dacron patch fixed by interrupted stitches with pericardial pledgetts. Pulmonary arteriotomy was done in 17

patients i.e. in all patients. Myomectomy was done through the pulmonary valve in 11 patients and pulmonary valvotomy was done in six patients. Pulmonary arteriotomy was closed by direct sutures in 13 patients. Pulmonary arteriotomy was closed by direct sutures in 13 patients and widened with pericardial patch in four patients.

During transventricular correction, the VSD was closed by dacron patch using interrupted stitches with pericardial pledgetts, transannlar patch was used in 20 patients, where homograft monocusp was used in 19 patients and dura patch in one patient. Right ventricular outflow tract "RVOT" patch was done in 31 patients as follows: pulmonary homograft with dacron patch inferiorly in four patients, pulmonary homograft monocusp in 12 patients, homograft homovital monocusp in three patients, gortex patch in five patients, dacron patch in five patients, and dura patch in two patients. Infundibulectomy was performed in 21 patients.

Doppler Echocardiography

Colour Doppler flow imaging was used with superimposing colour coded flow pattern on real time two dimensional images to map abnormal flow patterns through tricuspid and pulmonary valves. The severity of the regurgitation was measured by the use of jet length and jet area methods. Doppler windows for tricuspid valve were: apical 4 chamber view and short axis parasternal view while Doppler windws for pulmonary valve were long axis view of right ventricular outflow tract and high left parasternal short axis view (10).

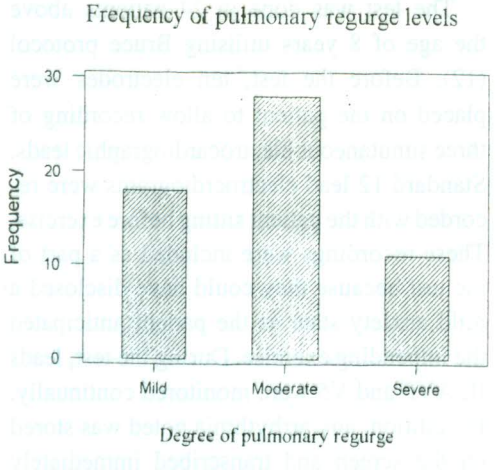

Figure I

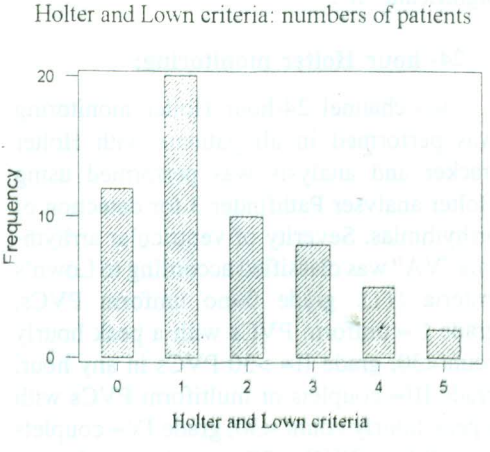

Figure II

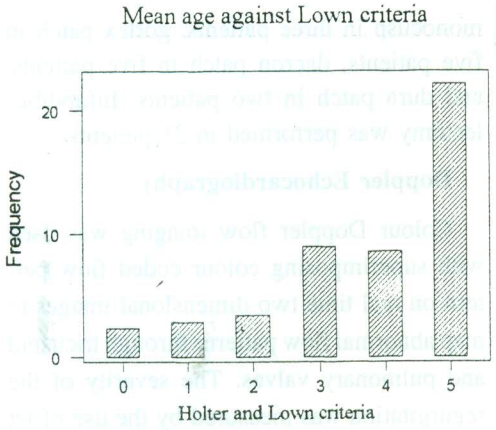

Figure III

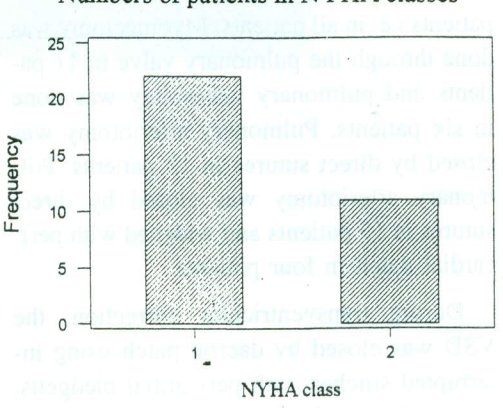

Figure IV

If the jet length was 1.5 cm beyond the valve, it was considered mild regurge; from 1.6 cm to 3cm, moderate and more than 3cm. severe. Moderate and severe regurge were significant "S".

24- hour Holter monitoring:

Two channel 24-hour Holter monitoring was performed in all patients with Holter tracker and analysis was performed using Holter analyser Pathfinder 3 for detection of arrhythmias. Severity of ventricular arrhythmia "VA" was classified according to Lown's criteria (11): grade 0=no uniform PVCs, grade I = uniform PVCs with a peak hourly count<30, grade II= >30 PVCs in any hour, grade III= couplets or multiform PVCs with a peak hourly count <30, grade IV= couplets or multiform PVCs >30 in any hour and grade V = ventricular tachycardia defined as >3 consecutive PVCs with a mean rate >110/minute. Ventricular arrhythmias were considered significant when =or> grade II.

Treadmill exercise test TET:

The test was done in 24 patients above the age of 8 years utilising Bruce protocol (12). Before the test, ten electrodes were placed on the patient to allow recording of three simutaneous electrocardiographic leads. Standard 12 lead electrocrdiograms were recorded with the patient sitting before exercise. These recordings were included as a part of the test because they could have disclosed a mild anxiety state as the patient anticipated the impending exercise. During the test, leads II, AVF and V5 were monitored continually. In addition, any arrhythmia noted was stored on the screen and transcribed immediately onto paper. The post exercise electrocardiogram was monitored and recorded every

Table I:

Group	No. cases	Holter & Lown's criterion	Mean age at op.	Mean post op period	Pulmonary regurge			Method of correction		
					Non-sig	Sig	% Sig	A	V	% V
1	12	0	2.3	4.0	7	5	42	6	6	50
1	20	1	2.8	6.8	11	9	45	8	12	60
2	10	2	3.4	8.6	0	10	100	0	10	100
2	8	3	9.0	8.3	0	8	100	3	5	62
2	5	4	8.5	7.7	0	5	100	0	5	100
2	2	5	22.1	11.5	0	2	100	0	2	100

A = transatrial correction; V = transventricular correction

Sig = significant

Table II: This table shows significant correlation between Lown's criteria, ventricular arrhythmias, and cardiothoracic ratic (p=0.031).

	Cardiothoracic ratio			
Holter & Lown's	Number of patients	Mean	Standard deviation	Median
0	12	54.5	3.5	54.0
1	20	53.7	3.9	52.0
2	10	59.2	5.1	59.5
3	8	57.4	3.2	57.5
4	5	57.2	2.6	57.0
5	2	58.0	0.0	58.0

minute for at least five minutes. The end point of the test occurred when, despite considerable verbal encouragement, a patient refused to exercise further. We did not find it necessary to stop the exercise test in any patient. The test was done always by one person. In addition to the exercise data, the 12 leads electrocardiogram was examined for ventricular arrhythmia. Data on arrhythmia were tabulated according to when they occured: before, during or after exercise. Recovery period was calculated from the end of the exercise until the basal pulse and blood pressure were reached. The test was considered positive if it induced =or>2 PVC.

Statistical Analysis

For comparing two populations, a two-sample t-test was used where the normality assumption was satisfied and a Mann-Whitney test was used otherwise. For comparing more than two populations, one-way analysis

Table III: There is significant evidence of greater Holter and Lown's grade for patients with a previous history of shunt (Mann-Whitney U test, p=0.0105; median grade without shunt=1.0, median grade with shunt=2.0).

Holter and Lown's criterion and previous shunt. Numbers of patients.

	Shunt	
Holter & Lown's	No	Yes
0	12	0
1	14	6
2	6	4
3	6	2
4	2	3
5	0	1

Precentages without and with shunt.

	Shunt	
Holter & Lown's	No	Yes
0	100	0
1	70	30
2	60	40
3	75	25
4	40	60
5	0	100

of variance was used for continuous data and a chi-square test for categorical data. Zero correlation was tested using a t-test, Pearson's product moment correlation was used where the normality assumption was satisfied and Spearman's rank correlation was used otherwise. Multiple regression was used to model the relationship between exercise time, maximum heart rate, maximum systolic blood pressure and the possible explanatory variables e.g. age at operation, interval since operation, PR, etc.

Results

History and clinical Examination:

Twenty two patients were in New York Heart Association "NYHA" class I and 11 were in class II, (figure 4). All patients had normal blood pressure and respiratory rate. None had cyanosis, clubbing or signs of heart failure. All patients had signs of pulmonary and tricuspid regurgitations with various degrees of severity, lungs were clear in all patients.

Chest Radiography:

Forty nine patients "86%" had cardiothoracic ratio CTR more than 50% and the mean CTR was 55.81% with "standard deviation SD=2.26".

Routine 12 leads electrocardiography "ECG":

All patients were in sinus rhythm. Right bundle branch block "RBBB" was seen in 41 out of 57 patients "74%". No premature ventricular contractions "PVCs" were present on routine ECG. None of the patients had complete heart block.

Doppler echocardiography:

Pulmonary regurge PR was mild in 18 patients (31%), moderate in 28 patients (49%) and severe in 11 patients (20%), see figure 1. Tricuspid regurge TR was mild in 33 patients (58%), moderate in 19 patients (33%) and severe in 5 patients (9%). Two patients

Table IV: shows types and severity of PVCs on TET

Types of PVCs	Number of patients	Percentage of patients
Unifocal only	5	50%
multifocal only	1	10%
complets only	1	10%
multifocal with couplets	3	30%

PVCs = "premature ventricular complexes"
This table contains ten patients who had significant PVCs "42%" on TET i.e. >2 uniform PVCs

Table V: Prevalence of significant routine ECG, Holter ECG and treadmill exercise ECG.

	Routine ECG		Holter ECG		Treadmill ECG	
	Number of patients	Percent	Number of patients	Percent	Number of patients	Percent
Not significant	57	100	32	56	14	58
Significant	0	0	25	44	10	42

had residual right ventricular outflow obstruction with gradients 20 and 35mmHg respectively and one patient had minimal left to right shunt through a small residual ventricular septal defect.

24-hour Holter monitoring:

Twelve patients (21%) were in grade 0, according to Lown's criteria, 20 (35%) in grade 1, 10 (18%) in grade 2, eight (14%) in grade 3, five (9%) in grade 4 and two (3%) in grade 5, i.e. 25 patients (44.1%) had significant VA on Holter monitoring =or>grade 2, (figure 2). We studied six potential risk factors for VA on Holter monitoring which include: age at operation, interval since operation, PR, method of correction "transatrial and transventricular", cardiothoracic ratio "CTR" and previous shunt. (Table 1) showed four risk factors: there was significant evidence ($p = 0.0305$) that greater age at operation is associated with higher grades of VA, (figure 3), but the interval since operation was not correlated with high grades of VA ($p = 0.14$). On the other hand, severity of pulmonary regurge was associated with higher grades of VA "$p = 0.001$", (figure 4). Also transventricular route of correction was associated with higher grades of VA "$p = 0.0159$".

There was significant evidence of higher grades of VA with increased cardiothoracic ratio CTR "p=0.0305" (table 2).

In addition higher grades of VA appeared to be more common in patients with previous shunt (p = 0.0105) (table 3).

Treadmill exercise test "TET":

Ten out of 24 patients "42%" had significant pvcs on "TET" i.e. =or> uniform PVCs. The types and severity of PVCs with "TET" is shown in table 4.

In this series two patients who had grade 5 and grade 3 VA respectively on Holter monitoring showed complete suppression of VA on TET. None of the patients who had no significant VA Holter monitoring developed it on exercise.

The age at operation, interval since operation and PR were not correlated statistically with VA on TET. The sensitivity of the 12 leads ECG, Holter ECG and exercise ECG for detection of VA is whown in table 5, where the incidence of significant PVCs was 0% on routine ECG, 44% on Holter ECG and 42% on TET.

Discussion

Significant ventricular arrhythmias "VA" were present in 44% of our patients who underwent ambulatory monitoring. This incidence is similar to that reported by others 2,7,13,14. Necropsy studies have shown myocardial fibrosis in patients whose repair was carried out at an older age, this fibrosis may be the substrate for the high incidence of ventricular arrhythmia and may result in multiple micro re-entry circuits (14,15).

Greater age at operation in our series was associated with higher grades of VA which was in agreement with two previous studies (16,17,18). On the other hand, longer interval since operation among our patients was not correlated with higher grades of VA which is different from the findings of several studies 2,7,19,14. Vaksmann et al (20) reported that patients with follow-up >10 years had significant increase in the incidence of arrhythmia on Holter monitoring, it is possible that the relatively short mean interval since operation "6.98 years"among our patients, was the reason why longer interval since operation was not correlated with higher grades of VA.

We found the route of correction was a risk factor for VA which was higher for transventricular route than transatrial one,thus confirming the findings of Kawashima et al(1) and Kobayashi et al (2). Conventional right ventriculotomy might be the site of macro-reetry circuits (21) and the ventricular scar was believed to provide a barrier around which tachycardia could circulate (22).

Pulmonary regurge was correlated, in our series, with the severity of ventricular arrhythmia. Zahka et al. (23) reported the association of ventricular bigeminy and couplets with the Doppler diagnosis of at least moderate PR. This may be due to longstanding elevated right ventricular end diastolic pressure which may cause myocardial fibrosis with subsequent VA. An increased CTR which suggests previous or current hemodynamic load or cardiac dysfunction was associated with higher grades of VA in

our series and others (24).

Another finding in our study was the correlation between VA and a previous shunt where the incidence of VA on Holter monitoring was greater in patients who underwent a palliative procedure before intracardiac repair. To our knowledge, this has not been reported before except in the study of Wessel et al (25) who observed such correlation on routine ECG but not on Holter monitoring. Furthermore, these authors found that the correlation was not significant except for patients with a Waterston shunt. In our series, no patient had Waterston shunt, 15 out of 16 patients (94%) had Blalock-Taussig B-T shunt. The left ventricular dysfunction due to chronic left ventricular overload from the systemic pulmonary artery shunts may explain this correlation. Furthermore, the older age at operation was another risk factor in these patients with previous shunt as we found 11 out of 16 (69%) had definitive repair at the age of four years or more.

James et al. (3) and Quattlebaum et al. (4) reported that patients who had PVCs on routine 12 leads ECG were at very high risk with a rate of sudden death of approximately 30%. Fortunately we have no patients with PVCs on routine 12 leads ECG, this may imply lower risk for our group.

Exercise testing is a more sensitive method for detecting ventricular arrhythmia than in routine 12 leads ECG. Our results strongly confirmed the results of Garson et al (19) as the incidence of PVCs on routine ECG was 0%, in our patients, while the incidence of PVCs on exercise test was 42%. The aggrevation or induction of significant VA by exercise indicated that the graded exercise test is useful in unmasking potential rhythm disturbances which are not apparent at reast (18).

We therefore believe that exercise testing should be performed in all patients who have repair of tetralogy of Fallot especially those who give history of palpitation or syncopal attacks and have no PVCs on routine ECG (18). A single uniform "PVC" may be detected on routine ECG in 2.4% of normal children, this VA was benign and the response of all these normal children was complete suppression of VA with exercise (26). On the other hand, the suppression of VA with exercise in patients with an abnormal heart is not necessarily associated with a benign outcome (18).

In our series there were two patients who had grade 5 and grade 3 according to Lown's criteria on Holter monitoring, and showed complete suppression of VA with exercise testing. It has been suggested that VA may be suppressed during exercise when the sinus rate approached or exceeded the rate of ectopic pacemaker, this may explain why some PVCs disappear on exercise (25). We did not find significant correlation between PVCs on treadmill exercise test and some risk factors e.g. old age at operation, long interval since operation and pulmonary regurge.

To assess the relative sensitivity of both treadmill exercise testing TET and ambula-

tory ECG monitoring for detection of VA, we found the incidence of significant VA on Holter monitoring was (44%) and on TET was (42%) which was similar to the results of others 7. We found TET and Holter monitoring had nearly equal sensitivity to detect VA and we believe that both methods are essential for long term follow up of postoperative TOF patients. Why do we say that? Do they unmask the same arrhythmias of patients or are they complementary.

Our study is somewhat limited by the fact that it is observational and not sequential, also by the relatively small number of patients, as it does not include all patients operated upon in our during the last 24 years.

However, the findings in this paper have some implications with regard to the question of how to avoid or minimize VA and sudden death after TOF repair. Our data suggest that early correction during the first two years of life, the use of transatrial transpulmonary route of correction as long as there is no contraindication for its use to avoid RV scar, primary correction without palliative shunt and avoidance of significant pulmonary regurge, may decrease the incidence of VA. The long term effects of the suggested policy as well as the need for the use of antiarrhythmic drugs in the high risk groups (27) need to be studied further. We hope that the results presented in this paper will help in understanding the causes of postoperative arrhythmias and optimising the results of surgical repair of TOF.

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Randomized Trial to Compare Cold Crystalloid Cardioplegia Versus Cold Blood Enriched Cardioplegia in Mitral Valve Replacement

Abstract

This is a randomized prospective study to compare two groups of patients as regard their cardioplegic treatment. Thirty patients were randomized between Group 1 receiving antegrade cold crystalloid cardioplegia and group 2 receiving antegrade cold blood enriched cardioplegia. All patients underwent un-eventful primary mitral valve replacement by the same surgical team. The pre-operative factors evaluated were the age, sex, NYHA class, CT ratio, mitral valve pathology, left ventricular function, left atrial dimension, pulmonary artery pressure and ECG data for all patients. The intra-operative factors evaluated were the need for tricuspid repair, cross-clamp time, the bypass time and the size of the valve inserted. Myoglobin levels were analyzed as an index of myocardial damage in 14 patients. Results: There was no significant difference between the two groups as regard all the pre-operative and post-operative variables evaluated indicating good randomization. Patients in group 1 had a significantly higher incidence of low cardiac output (LCO) (2 pts) when compared to patients in group 2 front of 15 pts.) (p=0.0464). The only predictor of LCO in all the factors studied was the cardioplegic treatment received by the patients (F = 4.268; p=0.0456). There was no significant difference between the two groups as regard the myoglobin levels probably due to small sample size. However, patients who developped LCO had significantly higher myoglobin levels.

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Introduction

Mitral valve replacement represents one third of the work-load of our department. Despite the simplicity of the procedure, it carries a relatively high risk of hospital mortality ranging from 3.5% (Isomura et al, 1994) to 9.2% (Braile et al, 1991). Prolonged aortic cross-clamp times has been incriminated as one of the most important predictors of mortality in most of these studies (Fernandez et al, 1994) which implies the importance of myocardial preservation techniques. Using a simplified way to deliver blood enriched cardioplegia in a pilot study of ten patients

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undergoing elective mitral valve replacement, there was no hospital mortality and none of the patients needed inotropic support in the post-operative period.

We aimed to compare hospital mortality and morbidity in two randomized groups of patients undergoing routine mitral valve replacement for rheumatic mitral valve disease. Myocardial preservation was achieved either by antegrade cold crystalloid cardioplegia (Group 1) or antegrade cold blood enriched cardioplegia (Group 2).

Material and Methods

This is a prospective study in which 30 patients admitted for elective mitral valve replacement were randomized between the two groups: "group 1" received cold crystalloid cardioplegia and "group 2" received cold blood enriched cardioplegia.

Patients were excluded from the study if: (1) significant aortic valve disease, (2) coronary artery disease. (3) ASD or VSD, (4) previous open or closed heart surgery, (5) significant systemic disease that can influence the outcome of surgery (e.g. endocarditis, rheumatic activity etc.), (6) patients intended for mitral valve repair, (7) patients with predominant mitral stenosis and (8) failure to give informed consent.

Patients were carefully examined to evaluate the risk factors for surgery. This included age, sex, NYHA class, CT ratio, mitral valve pathology, left ventricular function, left atrial dimension, pulmonary artery pressure and ECG data. All the data were immediately entered on the statistics program StatView II^R for further analysis.

Randomization was performed after opening the pericardial sac by drawing a card. This is to make sure of the absence of pericardial adhesions.

The general anaesthetic technique was the same in all the patients by the same anaesthetic team. A peripheral cannula was inserted for blood product administration. A radial artery 20G catheter was inserted and connected to a heparinized flush system for continuous blood pressure monitoring and arterial sampling. In addition, two central venous lines were inserted for vasoactive drug administration and central venous pressure monitoring.

Glyceryl trinitrate was started after inductution of anaesthesia at a rate of 0.8-2 ugm/kgm/min in a peripheral line and continued throughout the procedure. Dopamine at a rate of 3 ug/kg/min was started after aortic declamping for all patients as a routine. All the patients were transferred to the ICU ventilated and fully sedated and paralyzed.

All patients underwent surgery using standard median sternotomy and routine cardiopulmonary bypass. Sarns^R aortic arch cannula and two basket-tip venous cannulae were used for all patients. Bi-caval tapping was done in all patients. A membrane oxygenator was in the circuit in all patients with one and half liters of crystalloid priming and non-pulsatile perfusion. Systemic cooling was down to 28°C.

For patients randomized to group 1, following aortic cross-clamping, high potassium (25 mEq/L), cold (4°C) crystalloid cardioplegia was infused directly into the aortic root using a wide bore cannula in group 1 patients.

The anaesthetist infused the cardioplegia at a pressure of 150-200 mm Hg using a pneumatic pressure bag. The dose infused was 15 mls/kg and half this dose was administrated every 30 minutes of aortic cross-clamping. Ice slush was applied to the surface of the heart continuously until the cross- clamp was removed.

The standard cardioplegic solution used in our department was utilized. It is composed of dextrose -saline physiological solution to which 25 mEq/L KCL, 60 m Eq/L NaHCO3, 40 ml/L dextrose 25% and 100 mg/L xylocaine were added.

As for patients randomized to group 2, blood enriched cardioplegia was administrated antegradely by the anaesthetist in the same dose and same composition as group 1. The only difference is the addition of oxygenated blood to the cardioplegic solution to reach a haematocrit of 10-15%. This was achieved by adding 5 mEq Kcl to the ice cold 1 liter cardioplegia bag, discarding 300 mls, then replacing them with 300 mls of patient's blood through the aortic root before initiating cardiopulmonary bypass. A blood sample was withdrawn from the bag to check the potassium level, pH and haematocrite before infusion and any adjustments were made.

All the surgical procedures were performed by the same surgical team. The mitral valve was approached through a vertical incision in the left atrium parallel to and posterior to the interatrial septum. The mitral valve posterior leaflet was preserved in all patients. A St. Jude^{R} bileaflet valve was inserted in all patients using interrupted teflon-pledgetted Ethibond^{R} sutures. The orientation of the leaflets was perpendicular to the septum in all cases.

Samples were withdrawn for measurement of Myoglobin as a good indicator of myocardial damage (Seguin et al, 1988). This was done in 14 patients only in the study, seven in each group. Samples were taken pre-operatively from central venous line immediately after insertion (A); 10 minutes after de-clamping from the coronary sinus (B); 20 minutes after de-clamping from the coronary sinus (C); and 6 hours after surgery from the central venous line (D). Samples were taken from the coronary sinus through a central venous line inserted under direct vision before cross clamping and removed after sample "C" was withdrawn.

Evidence of low cardiac out-put was carefully monitored for all patients. No inotropic support was started unless highly indicated. A low systemic pressure with adequate filling, persistent acidosis, delayed peripheral warming, low urinary output or high central venous pressure were all indications for low cardiac output. The inotrope adopted in this study was epinephrine with a starting dose of 100 ng./kg/min.

Table 1: Showing the comparison between the two groups as regard all pre-operative factors. The p value did not reach significance with any factor. SD = Standard deviation; CI = Confidence interval.

	Group 1	Group 2	P value
Age			
Mean age in years	28.9	29.7	
± 1SD	8.5	7.1	
Minimum-Maximum	17-39	18-48	
90% CI	26-32	25-34	
Mann-Whitney test			0.7716
Sex			
Female	10	11	
Male	5	4	
Contingency Table analysis			0.6903
Valve pathology			
Pure regurge	9	10	
Combined lesion	6	5	
Contingency Table analysis			0.7048
Rhythm			
Sinus	3	5	
Atrial Fibrillation	12	10	
Contingency Table analysis			0.409
Cardio-thoracic ratio			
Mean ratio	0.753	0.767	
± 1SD	0.099	0.082	
Minimum-Maximum	0.6-0.9	0.6-0.9	
90% CI	0.71-0.8	0.73-0.8	
Mann-Whitney test			0.6456
Left ventricle EF.			
Mean	52	48	
± 1SD	9	9	
Minimum-Maximum	35-65	35-62	
90% CI	48-56	44-52	
Mann-Whitney test			0.2058
ESVI End Systolic Volume Index			
Mean	47.7	48.3	
± 1 SD	13.5	16.8	
Minimum-Maximum	30-70	27-75	
90% CI	41.6-53.9	40.7-56.1	
Mann-Whitney test			0.9338
Pulmonary artery pressure			
Mean	66.7	59.7	
± 1 SD	12	19	
Minimum-Maximum	50-90	30-90	
90% CI	61-72	51-68	
Mann-Whitney test			0.1962
Left atrial size			
Mean	6.5	5.8	
± 1 SD	1	1	
Minimum-Maximum	4.9-8	5-8	
90% CI	6-6.9	5.3-6.2	
Mann-Whitney test			0.1003

Table 2: Showing the comparison between the two groups as regard all intra-operative factors. The p value did not reach significance with any factor. SD = Standard deviation; CI = Confidence interval.

	Group 1	Group 2	P value
Tricuspid repair			
No	12	11	
Yes	3	4	
Contingency Table analysis			0.666
Cross-clamp time			
Mean	36	34	
± 1SD	3.5	4	
Min.-Max.	27-42	28-41	
90% CI	34-38	32-36	
Mann-Whitney test			0.2879
Bypass time			
Mean	56	58	
± 1SD	7	7.2	
Mini.-Max.	49-72	47-69	
90% CI	53-60	55-61	
Mann-Whitney test			0.5192
Valve size			
Size 27 mm	2	4	
Size 29 mm	7	9	
Size 31 MM	6	2	
Contingency Table analysis			0.2326

Results

The mean age for our population is 29±8 years. As for group 1, the mean age is 29±7 years and for group 2 it is 30±10 years. There was no difference between both groups as regards age using Mann-Whitney test p=0.7716. All patients were in NYHA class III. There was also no significant difference between the two groups as regard the sex distribution, valve pathology, rhythm on admission, cardiothoracic ratio, left ventricular ejection fraction, end-systolic volume index, pulmonary artery pressure or left atrial size (table 1).

All the surgical procedures were concluded uneventfully. Tricuspid valve repair was performed in seven patients. There were no significant difference between the two groups as regard the incidence of tricuspid repair, cross-clamp times, bypass times, or the size of valve inserted (table 2).

There were no intraoperative or post-operative hospital mortalities in both groups. However, low cardiac out-put with the need of inotropic support developed in 9 (30%) of these patients. Seven of these patients were in group 1 and only two were in group 2. Usinge contingency table analysis this was statistically significant (chi-square = 3.97; p=0.0464).

Patients in group 1 had significantly

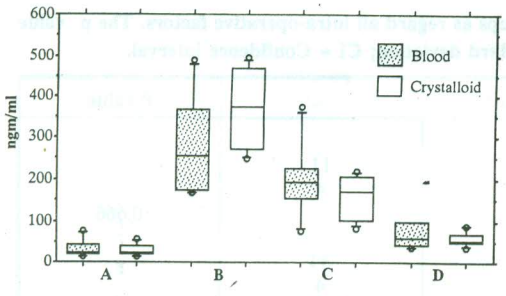

Figure 1: Showing a box plot for the myoglobin level at different sampling times for the two randomized groups. There was no significant difference at any time point.

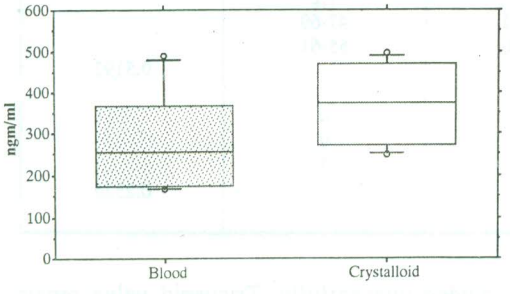

Figure 2: Showing a box plot for the myoglobin level at the time of re-perfusion (sample B) for the two randomized groups. There was no significant difference.

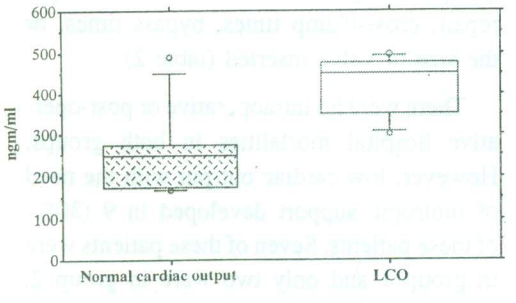

Figure 3: Showing a box plot for the myoglobin level at the time of re-perfusion for patients suffered from low cardiac output (LCO) versus patients who had normal recovery. There was a significant difference.

(p=0.0131) longer ventilation time (10.9±2.8 hours) when compared to patients in group 2 (8.6±2.9 hours). Patients in group 1 also stayed in the ICU longer (1.6±0.9 days) than patients in group 2 (1.3±0.7 days) but this difference was not statistically significant. Also patients in group 1 stayed longer in hospital (13.3±2.4 days) when compared to patients in group 2 (11.8±1.2 days) but this difference was also not statistically significant.

Stepwise regression analysis was used to analyze the effect of different preoperative and intra-operative variables on the development of low cardiac output. The pre-operative factors included in the analysis were the age, sex, rhythm, CT ratio, pulmonary artery pressure, ejection fraction, left ventricular end systolic volume and valve pathology. The intra-operative factors included in the analysis were the cross-clamp time, the need for tricuspid repair and the size of the prosthesis inserted. The cardioplegic treatment was the only factor to come out as significant (F=4.268; p=0.0456) after correction to all these factors. There was no significant difference at any time point between the two randomized groups as regard the myoglobin level (figure 1). At the time of re-perfusion (figure 2), although the group 1 had a higher myoglobin level in the coronary sinus (371±107 ngm/ml) when compared to group 2 (284±135 ngm/ml), this difference did not reach significance (p=0.2453).

From the 14 patients who had their myoglobin level estimated, seven developed low

cardiac output (LCO). The myoglobin level in these patients was 413±76 ng/ml and in patients who did not need any inotropes postoperatively was 256±114 ngm/ml (figure 3) and this difference was statistically significant (p=0.0181).

Discussion

Blood cardioplegia have extensively studied and its efficacy has been proven (Buckberg, 1989). Despite the main beneficial effect of blood cardioplegia has been identified as providing aerobic metabolism to the myocardium during cross clamping (Matsuwa et al, 1993), this is only true under normothermic conditions. During hypothermic heart surgery, blood cardioplegia still proved to be beneficial despite proven inability of the red blood cells to release oxygen. This is mainly due to the buffering effect of red blood cells (Buckberg, 1989; Lessana et al, 1992). This study is designed to explore the beneficial buffering action of blood.

The 30 patients included in this study were radomized and there was no significant difference between the two groups as regard all the pre-operative and intra-operative values evaluated (table 1 & 2). This indicated good randomization. The significant increase in the incidence of LCO in group 1 indicates the definite beneficial effect of cold blood enriched cardioplegia treatment.

The failure to demonstrate a difference between the two groups as regard the myoglobin level in the coronary sinus after re-perfusion is probably due to the small sample size and further studies and inclusion of more indices are on the way. On the other hand, the significantly higher myoglobin levels in patients who developed LCO indicates the sensitivity of this index on the prognosis of the patients.

In this study we tried to demonstrate the beneficial effect of blood enriched cold cardioplegia delivery due to its buffering action. The incidence of LCO was significantly lower in patients receiving this treatment. The way of delivery added no cost to the procedure unlike using the expensive disposable heat exchangers to deliver blood cardioplegia. We recommend the utilization of this simple technique.

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Comparison Study between Early and Late Open Mitral Commissurotomy. Three Years Follow Up

Abstract

Between january 1990 and December 1992, 42 patients underwent open mitral commissurotomy in National Heart Institute. All patients had pure mitral stenosis. Twenty two of these patients (group I) fulfilled the criteria for early mitral commissurotomy; young age (age between 12 to 18 years), with few symptoms and in sinus rhythm. The remaining 20 patients (groupII) who underwent operation were in more severe symptoms (classIII-IV), some with left atrial thrombus and in atrial fibrillation. All cases were followed up for 3 years.

Our results support the use of early mitral commissurotomy for young patients in sinus rhythm, who are with minimal symptoms (classI-II), and who have a mitral valve area of 1.5cm or less.

It has been suggested that early mitral commissurotomy could improve long-term results in patients with severe M.S.

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Introduction

It has frequently been suggested that early open mitral commissurotomy could improve the long-term results in patients with mitral stenosis. This policy, also proposed by Spencer(2), Bonchek (3), and Cohn and associates (4), aims to prevent development of atrial fibrillation. left atrial thrombus, peripheral and C.N.S embolism, pulmonary hypertension and tricuspid insufficiency.

Our study reports the long-term results from 22 patients (group I) who underwent early open mitral commissurotomy. these results are compared with those of another 20 patients (group II) who underwent operation during the same period of time.

Material and Methods

From January 1990 to December 1992, a total of 42 consecutive patients underwent operation at National Heart Institute, Imbaba, Cairo for pure or predominant mitral stenosis.

Patients with moderate or severe mitral insufficiency or coexisting aortic operation were excluded from the study.

The mitral valve was routinely evaluated with:

a) E.C.G.

** From. National Heart Institute ** From El Azhar University*

b) Plain X-ray, both postero-anterior view and dead lateral view with barium swallow.

c) Two-dimensional echocardiography.

d) Cardioac catheterization was performed in only 4 cases to rule out clinically suspected aortic valve disease.

The 42 patients were divided into two groups according tó functional class.

Group I, comprised 22 patients who underwent early mitral commissurotomy, their age ranged from 12 to 18 years; 12 females and 10 males. All were in sinus rhythm, had no history of peripheral or central embolism, they were with few symptoms or with mild to moderate symptoms (NYHA class I-II), no or mild tricuspid insufficiency, and all cardiothoracic indeces were normal. No radiologic, electrocardiographic, or echocardiographic evidence of severe tricuspid insufficiency or pulmonary hypertension was found.

Two-dimensional echocardiography showed that all cases had severe mitral stenosis with a flexible valve, no calcification, no left atrial thrombus and the mitral valve area was <1.5 cm2 (Table I).

Group II, comprised 20 patients who underwent operation for mitral stenosis, because of either symptoms of (NYHA class III-IV) or history of embolism. Their age, ranged from 20-35 years, 14 females and 6 males. All were in atrial fibrillation, with moderate to severe tricuspid insufficiency and pulmonary hypertension. Four patients had a systolic murmur (grade I/IV) indicating mild mitral insufficiency. Calcification was present in only 3 cases. The mitral valve areas was < 1 cm2. Three cases had previous closed mitral valvotomy (Table 1).

Surgical Technique

In brief, both commissures were opened as wide as possible, separating the subvalvular apparatus when it was obstructed. Valve competence was routinely tested after commissurotomy. Areas of commissural regurgitation were corrected by annuloplasty sutures. If residual incompetence was central, a Carpentier ring was implanted. In cases in which significant mitral insufficiency persisted despite annuloplasty, the mitral valve was immediately replaced.

Moderate or severe tricuspid insufficiency was corrected by annuloplasty according to the method of Devaga.

The base of left atrial appendage was routinely closed from inside the left atrium.

Sodium warfarin was administered routinely in all cases with left atrial throumbus, atrial fibrillation, when ring annuloplasty was used and when the mitral valve was replaced.

Follow-up

All deaths in the first week were considered operative deaths. Surviving patients were followed up for 1 to 3 years. Information was lost for only 3 patients (all from group II), and these cases were excluded.

Table (I): The clinical features of all patients (42 patients).

	No. of patients	
	Group I	Group II
1- Sex		
Male	10	6
Female	12	14
2- NYHA class		
I-II	22	0
III-IV	0	20
3- Age (year)		
12-18	22	0
20-35	0	20
4- Previous closed valvotomy	0	3
5- Preoperative arterial embolism	0	4
6- Rhythm		
Sinus	22	0
Atrial fibrillation	0	20
7- Mild preoperative mitral insufficiency	0	4
8- Cardiothoracic ratio		
< 0.5	20	0
0.5-0.65	2	18
>0.65	0	2

Follow-up involved, clinical examination. All radiologic, electrocardiographic, and two-dimensional echocardiographic date were recorded.

Results

Group I

All patients underwent conservative operation on the mitral valve (commissurotomy with separation of the subvalvular apparatus if indicated). Two patients required associated commissural annuloplasty.

In this group there were no operative or late deaths. Twenty patients were in sinus rhythm (class I), and were receiving no medication. Two patients were in functional class II (they had atrial fibrillation and were treated with digoxin).

One patient from this group required mitral valve replacement 2 years after the operation because of moderate-to-severe mitral insufficiency.

No patient had postoperative embolism. Four patients had a systolic murmur associated with mild mitral insufficiency which remained stable since the operation.

Two patients had evidence of mitral restenosis 3 years after the operation (mitral valve area less than 2 cm2). Two-dimensional echocardiography showed a mitral valve area of greater than 2 cm2 in 20 patients.

No one in this group needed tricuspid annuloplasty.

In this group about 95% of patients were classified as complication free at 3 years after the operation.

Group II

Thirteen patients of this group underwent conservative operation of the mitral valve (commissurotomy with separation of the subvalvular apparatus if indicated). Three patients required associated mitral annuloplasty (by using Carpentier ring).

The mitral valve was replaced with mechanical prosthesis in 4 cases, due to severe fibrosis and calcification of the valve and subvalvular apparatus.

14 patients needed associated tricuspid annuloplasty.

Three deaths occurred, one with conservative operation, another one with mitral valve replacement (operative deaths) and the last one with mitral valve replacement at the end of the second year (late death), due to severe insufficiency.

Two patients of this group had postoperative embolism (one with mitral valve replacement and one with conservative operation).

Three patients required reoperation during follow-up, due to moderate-to-severe mitral insufficiency.

Nine patients were in functional class I or II.

Six patients were in functional class III or IV due to severe pulmonary hypertension with right ventricular dysfunction usually

with mild residual mitral or tricuspid insufficiency.

Two-dimensional echocardiography showed a mitral valve area greater than 1.75 cm2 in all patients.

Discussion

It was clear from this study that the results of early operation seem to be more better than those of late operation.

Mitral valve replacement and associated tricuspid annuloplasty were significantly less prevalent in the early mitral commissurotomy group.

Results from follow-up of the patients with early open mitral commissurotomy showed:

1. Lower incidence of reoperation.
2. No post-operative embolism.
3. Lower mortality and morbidity.
4. Effect tolerance was more better than those of late operation.
5. Complication free survival after 3 years was significantly greater for group I.
6. Conservative operation was possible for the great majority of patients, with good mitral valve area.

The mitral valve of group I were in better anatomic condition, than those of group II. They showed less damage to the subvalvular apparatus, their leaflets were more flexible and no calcification. This favorable condition made conservative operation possible for the great majority of patients, thus obtaining the best possible postoperative mitral area. This beneficial area, reduced the need for reoperation on the long-term. Good hemodynamic results and the maintenance of sinus rhythm, explain the total absence of postoperative embolism in those patients who underwent early mitral commissurotomy.

Rowe and associates (14) showed that 40% of patients with asymptomatic mitral stenosis, in sinus rhythm showed no change over 10-year period.

The same study showed, that 16% of the patients died during that time, which coincides with the results obtained by Olesen (15).

Dalen (16) showed that, in 10 years, 58% of cases with mitral stenosis and few symptoms (class I or II) who died, were in sinus rhythm or showed atrial fibrillation.

The occurrence of embolism in cases of mitral stenosis and sinus rhythm can be assessed at an average of 1%, and it is clearly greater in patients over 35 years of age (16), in those having moderate mitral stenosis (18,19).

In 12.5% of cases, embolism is the first symptom of the disease (20).

Some authors (17) recommend systematic anticoagulation for all cases who have mitral stenosis and in sinus rhythm, to avoid the danger of embolism.

Conclusion

According to the results of this study, patients who undergo early open mitral

valvotomy show a long-term survival that is clearly better than that of patients who underwent operation at a symptomatic stage of the disease.

With the excellent long-term results of this small group, it seems logical to perform early open commissurotomy, for those patients who either are symptoms free or show few symptoms, and those who have moderate-to-severe mitral stenosis. They should be in sinus rhythm, have mild or non-existent mitral insufficiency, and have a flexible mitral valve, free of severe fibrosis or calcification.

One of the major indication for this conservative operation, was a young female in the child-bearing period and wishing to have children.

The results from these study appear to justify a policy of early open mitral valvotomy, for those patients who are symptom free or display few symptoms and have a mitral valve area of less than 1.5 cm2.

Also we conclude that mitral valve replacement and tricuspid annuloplasty were significantly more prevalent in patients, in whom open mitral commissurotomy was performed in late stage of the disease.

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Echocardigraphic Study of the Pericardium after Cardiac and Thoracic Surgery

Abstract

This study aimed to evaluate the occurance of pericardial effusion (PE) among 110 patients (pts) who underwent different thoracic (12 pts) and cardiac (98 pts) surgery in the Cardiothoracic Department Mansoura University Hospital.

Echocardiographic evaluation was done for every patient one day before the operation and on the 7th to 10th day postoperatively. Cases with pericardial disease, trauma, tuberculosis as well as haemorrhagic diseases were excluded from this study.

Postoperative PE was found in 14 pts after all cases of cardiac surgery (14.2%); in 4 after closed cardiac surgery (7.7%); in 10 after open cardiac surgery (21.3%) and no PE was found neither after thoracic surgery nor after surgery for PDA and aortic coarctation in whom no pericardiotomy was performed.

Sex and age of pts. as well as the presence of mild PE; organic TV disease, pulmonary hypertension or preoperative use of oral anticoagulant did not influence the occurance of PE after cardiac surgery.

We Concluds that the incidence of PE after cardiac surgery in our series was more or less the same as reported in the literature. The occurance of PE after cardiac surgery in our series was more related to: (1) Preoperative medication with aspirin and presence of atrial fibrillation; (2) Open heart surgery (bypass machine) (3) Implantable intracardiac aids (pericardial patches, rings and prosthesis especially the mitral valve prosthesis) (4) Postoperative use of oral anticoagulant Until a case controlled study to be performed; stoppage of aspirin for 10 days before any cardiac surgery is advisable.

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Introduction

Advances in cardiac surgery has allowed surgical correction of most congenital, rheumatic and coronary artery disease (Bolocki et al., 1975). (1)

Echocardiography is a non invasive valiable tool for evaluating cardiac chambers. It is useful in evaluating pericardial effusion (PE), and its degree as well as the presence

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Table 1: Types of chest and cardiac operations and the incidence of pericardial effusion (PE) after each operation.

Types of operation	Total No.	PE	Percent
A) Chest surgery *	12	0	Zero %
B) Cardiac Surgery (total)	98	14**	14.3%
1. Closed surgery (total)	51	4	7.8%
- Closed M. Valvotomy (CMV)	43	4	9.3%
- Ligation of PDA	7	0	Zero %
- Correction of Ao/Coarctation.	1	0	Zero %
2. Open cardiac operation (total)	47	10	21.3%
(a) For rheumatic disease (total)	33	9	27.3%
- Open M valvotomy (OMV)	7	1	14.2%
- MV repair with Carpentier ring	11	2	18.0%
- MV replacement	9	5	55.5%
- AV replacement	6	1	16.6%
(b) For Congenital disease (total)	14	1	7.1%
- Repair of VSD	5	0	Zero %
- Repair of ASD	5	1	20.0%
- Repair of AV canal defect	1	0	Zero %
- Excision of subaortic membrane	1	0	Zero %
- Pulmonary valvotomy	2	0	Zero %

*** Chest surgeries included: excision of anterior mediastinal mass or cysts (4 patients); excision of posterior mediastinal cysts (2 patients) decortication of pleura (2 patients); Lt pneumonectomy for multiple lung cysts (one patients); Rt upper middle lobecotmy (one patient for bronchiectasis and one patient for bronchogenic carcinoma) and repair of tracheo-esophageal fistula (one patient).**

**** Only one patient showed signs of tamponade (1.02%).**

Table 2: Echocardiographic features of PE observed after cardiac operations (14 patients).

Echo feature of PE (amount & site)	No. of patient	Precent
Minimal (posterior)	2	14.2%
Mild (diffuse)	7	50.0%
Moderate (diffuse)	2	14.2%
Severe (diffuse)	1	7.1%
Localized collection*	2 *	14.2%

* The 2 cases with localized pericardial collections were:

- One patient after repair of ASD and the collection was related to RA & RV.
- One patient after CMV with localized collection related to RV anterior wall as well as diffuse mild PE (from pericardial adhesion) and showed signs of RV tamponade which needed surgical correction.

or abscence of tamponade (D'Cruz & Hoffman 1991 (2) and Harvey, 1994). (3)

PE had been reported in as many as 56% of patients after open heart surgery (Stevenson et al., 1984), (4) with cardiac tamponade occuring in up to 4%. Such effusion and tamponade may occur in the early postoperative period, usually associated with acute bleeding or late (48 hours or more) after operation (Stevenson, et al., 1984 and El-Sayegh & Allam, 1990). (5)

Although the aetiology of PE and tamponade is not clearly understood, there is an apparent relation to postoperative anticoagulant (Ellison & Kirsh, 1974; (6) Fernando et al., 1977, (7) Hochberg et al., 1978 (8) and Jones et al., 1979) (9). Late tamponade (after 7 days) appears to be less frequent following open heart surgery for congenital heart disease (Merill et al., 1976) (10)

The aim of the present work was prospective estimation of the echocardiographic incidence of postoperative PE in patients with rheumatic, congenital or chest diseases who underwent corrective surgery and correlate its presence with any preoperative parameter which was not previously reported in the literature as well as operative procedure and post operative period.

Subjects and Methods

This study comprised 110 patients who were admitted and underwent either chest (12 patients) or cardiac (98 patients) operations in the Cardio-Thoracic Department, Mansoura University Hospital in the period from February 1994 to February, 1995).

Cases with pericardial diseases; trauma, tuberculosis as well as haemorrhagic diseases were excluded from this study.

Echocardiographic evaluation was performed by the author** for every patient one day before the operation and about the 7th to 10th post operative day using the ACUSON computed sonography 128XP/S with the conventional standard techniques according to Henry et al., (1980). (11)

Patients were classified according to the

Table (3): Comparative analysis of different operative procedure employed during cardiac operations on the occurance of PE.

Surgical procedure	Total No.	PE	Percent	Z test	P
- No pericardial incision	8	0	Zero %	4.06	<0.001
- Pericardial incision	90	14	14.8 %		
- No CP-bypass machine (Closed Ht surgery)	51	4	7.8 %	1.9	<0.05
-With CP-bypass machine (Open Ht surgery)	47	10	21.2 %		
- No implantable aids	16	1	6.2%	2.24	<0.05
- With implanatable aids	31	9	29.0 %		
- Natural pericardial patch	5	1	20 %	0.53	>0.05
- Artificial devices	26	8	30.7 %		
- Artificial rings	11	2	18.1 %	1.28	<0.05
- Prosthetic valves	15	6	40 %		
- AV prosthesis	6	1	16.6 %	1.73	<0.05
- MV prosthesis	9	5	55.5 %		
- Closing pericardial incision	43	4	9.3 %	1.6	<0.05
- Leaving pericardium opened	47	10	21.2 %		
- Closing pericardial incision.	43	4	9.3 %	0.32	>0.05
- Leaving pericardium opened + no. intracardiac devices.	16	1	6.3 %		
- Leaving pericardium opened + no. intracardiac device.	16	1	6.3%	2.24	<0.05
- Leaving pericardium opened + intracardiac devices.	31	9	29.0%		

CP = Cardiopulmonary AV = Aortic valve
MV = Mitral valve

nature of the disease and type of operations as illustrated in table (1).

Results

Are shown in Tables (1-8).

Discussion

Our results showed that no PE had occured after chest surgery (Table 1), and this can be explained by the fact that no pericardial

Table (4): Comparative analysis of incidence of postoperative PE in relation to postoperative use of oral anticoagulant.

Group	Total No.	Cases with PE	Percent	Z test	P
- Group using oral anticoagulant	26	8	30.7 %	2.31	<0.01
- Group not using oral anticoagulant	72	6	8.3 %		

Table (5): Comparative analysis of preoperative and postoperative prothromin activity (PA) in group with postoperative PE versus those without.

Prothromin activity (PA)	Group with PE (n = 14) MV	SD	Group without PE (n = 84) MV	SD	t	P
Preoperative-PA	85	± 10.4	85	± 13.1	0.6	>0.05
Postoperative-PA	71.3	± 14.9	82.4	± 12.2	2.6	<0.05
Preoperative versus, postoperative PA	t = 2.82 P<0.05		t = 1.7 P>0.05			

incision had been performed during the chest operation.

The incidence of PE after the whole cardiac surgery in our studied cases was 14.3% (Table 1) and ranged from zero% to 55.5% after different cardiac operations and only one case showed signs of tamponade (1.02%) which needed surgical evacuation? (Tables 1 & 2).

PE has been reported in as many as 56% of patients after open heart surgery with cardiac tamponade occuring in up to 4%

Table (6): Comparative analysis of preoperative clinical data and medication in relation to occurance of PE after cardiac surgery*.

Clinical Parameters *	Total No.	PE	%	Z test	P
- Congenital group	22	1	4.5%	2.75	<0.01
- Rheumatic group	76	13	17.1 %		
- Male group	40	6	15 %	0.01	>0.01
- Female group	58	8	14 %		
- Age < 20 years	41	6	15 %	0.0i	>0.05
- Age > 20 years	57	8	14 %		
- Atrial fibrillation	24	6	25 %	1.18	<0.05
- No atrial fibrillation	74	8	10.8 %		
- Organic TV disease.	11	1	9.1 %	0.51	>0.05
- No organic TV disease.	77	13	16.8 %		
- Pulm. hypertension	28	4	14.3 %	0	>0.05
- No pulm hypertension	70	10	14.2 %		
- Use of aspirin	25	8	32 %	2.7	<0.01
- No medication	55	3	5.4 %		
- Use of oral anticoagulant	8	1	12.5 %	0.50	>0.05
- No medication	55	3	5.4 %		
- Use of both aspirin and oral anticoagulant	10	2	20 %	1.13	<0.05
- No medications	55	3	5.4 %		

* There were 2 patients with tight mitral stenosis who had a preoperative minimal PE which disappeared after the CMV opeation.

(Stevenson et al., 1984). Such effusions may occur in the early post operative period, usually associated with acute bleeding or late (more than 48 hours) after operation (Stevenson et al., 1984 and El-Sayegh & Allam, 1990).

The low incidence of PE and tamponade among our patients could be explained by late echocardiographic evaluation (on the 7th

Table 7: Comparative analysis of some echocardiographic data in patients with postoperative PE versus those without Preoperative date.

Group	Parameter	LV				RVD	ARD	LAD
		ESD	EDD	EF	FS%			
Group With PE (14 cases)	MV	3.3	5.1	0.68	33.5	2.3	2.7	5.3
	SD ±	0.93	1.2	0.21	3.45	0.58	0.45	0.9
Group Without PE (84 cases)	MV	3.5	4.9	0.65	31.0	2.5	2.5	5.0
	SD ±	0.89	0.98	0.20	3.32	0.69	0.49	0.8
Group with PE vs no PE	P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

L V = Left ventricle
EDD = End diastolic diameter.
RVD = Right ventricular diameter.
FS% = Percentage of shortening of the internal diameter.
N.S. - Non significant
ESD = End systolic diameter.
EF = Ejection fraction.
ARD = Aortic root diameter.

to 10th day), and inclusion of cases who underwent both closed and open heart surgery in the series.

The observed PE after cardiac operation in our study was minimal in two patients (14.3%); mild in seven (50.0%) moderate in two (14.3%) and severe in one (7.1%). Localized collection was found in two patients (14.3%), one was after ASD repair and related to AVRA wall, the other was after CMV, compressing the RV and needed surgical evacuation (Table 2).

The previous reports about the pathogenesis of PE after cardiac surgery had related its occurance to a wide variety of causes as bleeding (intra or extra-pericardial); clot formation, osmotic effect of clots or rupture of hematomas; intrapericardial adhesions, the use of post operative anticoagulants as well as the effect of closure or leaving the pericardium open after the operation (Yacoub et al., (12) 1966; Zeiff et al., 1975 (13); Nandi et al., 1976 (14); Ofari-Krakye et al., 1981 (15) and Cross et al., 1989). (16)

We extend our analysis of data to pick up the possible mechanism of PE and its implication on the outcome of surgery.

**** Role of Pericardiotomy During Chest and Cardiac Surgery:***

The abscence of any PE after chest surgery and cardiac surgery in which no incision of the pericardium was performed (operation for PDA and aortic coarctation) delineates the role of pericardial incision and manipu-

lation in the pathogenesis of PE after cardiac and thoracic surgery (Tables 1 & 3). This denotes that pericardiotomy is the main corner stone for the occurance of PE after any cardiac surgery (Tables 1 & 3).

**** Role of Cardiopulmonary Bypass Machine (CP bypass): (Tables 3)***

A high incidence of post operative PE was found after open heart surgery versus closed heart surgery, (P<0.05, Table 3) and this can be explained by the use of heparin during open heart surgery. Also, this could be related to the hypothermia during the operation with its consequent effects on platelets and vascular endothelial damage which could increase the possibility of postoperative bleeding (Stewart et al., 1974 (17) and Colman, 1990). (18)

**** Role of Implantable Intracardiac Devices; in Open Heart Surgery: (Table 3):***

A high significant increased incidence of PE was found among those with implantable natural (pericardial patch 20%) or artificial devices (Ring, 18.1% and Prosthesis 40%) than those without any implantable aids (6.2%) (Table 3 P<0.05), and this could be explained by the immediate postoperative use of anticoagulants among patients with implantable intracardiac devices.

Although, there was a non significant change in the occurance of PE with either artificial or natural aids (20% vs 30.7%, p>0.05 table 3), there was a marked significant change in the incidence of PE with using different artificial aids [ring (18%) vs prosthesis (40%). P<0.05 table 3] and different prosthetic valves [aortic (16.6%) vs mitral prosthesis (55.5%) P<0.05 table 3]. The explanation of this is unclear as all operations were open heart surgery and with immediate postoperative use of anticoagulation.

**** Role of Pericardial Closure:***

Previous works had reported contradicatory data about various techniques for preventing PE and late cardiac tamponade after cardiac surgery. Although Radley-Smith and his associates, (1970) (19) advocated wider pericardial incisons in the hope of preventing blood accumulation in the pericardial sac, Cunningham and his associate (1975) (20) recommended a tight closure of the pericardium with the addition of mediastinal sump drainage. However, El-Sayegh and Allam, (1990) found that neither these two methods would have benificial effects.

The operative trend embloyed by the surgical team at Mansoura University Hospital is to close the pericardial incision by interrupted suture after CMV, and leaving the peicardium opened after open heart surgery. Analysis of data in table (3), showed that the incidence of PE was less after CMV than after open heart operation (Table 3, P<0.05). However in this type of operation (CMV); bypass machine was not used as well as no routine postoperative anticoagulation was given. Further analysis of CMV operation (closure of pericardium) versus OMV, pulmonary valvotomy, excision of subaortic

membrane, repair of VSD and AV-canal defect operations (no implantable intracardiac devices and leaving pericardium opened) showed no significant changes in the occurance of PE between both groups (P>0.05 table 3). This denotes that factors other than closure or leaving pericardial incision play a major role in the occurance of PE after cardiac operations, as implantable intracardiac devices (Table 3).

** Role of Postoperative Use of Oral Anticoagulant:*

Postoperative use of oral anticoagulant had significant increased incidence of PE (30.7%) than those without therapy (8.3%) (P<0.05 table 4) and this could be explained by blood accumulation from increased incidence of bleeding.

These data could be explained also from table (5) which showed a marked reduction in prothrombin activity in patients with post operative PE than those without (Table 5, P<0.05). This finding goes hand in hand with the previous reports that late postoperative PE and tamponade was related to postoperative use of oral anticoagulant (Ellison & Kirsh, 1974; Merill et al., 1976; Fernando et al., 1977; Hockberg et al., 1978; Jones et al., 1979 and El-Sayegh & Allam, 1990).

** Role of Aetiology of Cardiac Disease:*

A higher incidence of postoperative PE was found among rheumatic heart operations than congenital operations (Table 6 P<0.05). These data go hand in hand with previous reports that post operative PE and tamponade were less among operation for congenital heart disease (Merill et al., 1976) and could be explained by the use of oral anticoagulant after most rheumatic valvular operations. In our study, it was noted that the case who developed PE after ASD repair by pericardial patch, had used oral anticoagulant after the operation.

** Role of Preoperative Findings in Pathogenesis of PE after Cardaic Surgery:*

All the previous reports had related the occurance of PE after cardiac surgery to the postoperative use of anticoagulant and no reports had studied the implication of preoperative data in such patients. So we extend analysis of data for any preoperative findings which could be related to the occurance of PE after cardiac surgery such as atrial fibrillation (AF), tricuspid valve disease (TVD); pulmonary hypertension (PH) with functional TR; the use of oral anticoagulant or aspirin, sex, as well as age of patient and the presence or absence of preoperative PE (Table 6).

Relevant to this data, we observed 2 patients with tight MS who had mild PE before operation which disappeared compeletely after CMV (Table 6). The preoperative laboratory data in them had excluded the presence of any rheumatic activity and the effusion at that time was explained by the presence of PH & TR in one patient and organic TR in the other patient (i.e. passive PE from elevated central venous pressure).

The presence of organic TVD as well as PH with functional TR had no significant effect on the occurance of PE after cardiac surgery (P>0.05, table 6).

There was no influence of either the age or sex on the occurance of PE after cardiac surgery (Table 6, P>0.05).

The presence of AF had significant increased incidence of PE after cardiac surgery (P<0.05, table 6) and this could be related to the use of anticoagulant (pre, intra and post-operative periods) in these patients.

However, amazing enough in the same table (6), preoperative oral anticoagulant had no significant influence on the incidence of postoperative PE (Table 6, P>0.05). This can be proved also from table (5) which showed non significant changes in preoperative prothrombin activity among those patients who developed postoperative PE than those not developing it (Table 5 P>0.05).

Preoperative use of aspirin alone or in combination with oral anticoagulation was associated with a higher incidence of PE after cardiac surgery (Table 6, P<0.05).

From the above data, one can conclude that preoperative use of oral anticoagulant (alone) is the same as not using it, but using aspirin alone or associated with oral anticoagulant increases the incidence of PE after cardiac surgery and this can be explained by the antiplatelet effect of aspirin which could precipitate bleeeding and collection. Up to this momment, we recommend stoppage of aspirin 10 days before any cardiac operation until a case controlled study could be done.

There is no significant role of any preoperative echocardiographic data respensible for the occurance of PE after cardiac surgery (P>0.05, table 7).

In conclusion, PE had ocured in 14.3% after cardiac surgery and no PE had occured after chest or any cardiac surgery in which pericardium remains intact. The occurance of PE after cardiac surgery has been related to the CP-bypass machine and intracardiac implantable aids (natural or artificial) with use of intra and postoperative anticoagulation. Although the postoperative anticoagulants play a major role in the pathogenesis of PE after cardiac operations, the preoperative oral anticoagulation has no role for occurance of PE after cardiac surgery. Preoperative use of aspirin was associated with increased incidence of PE after cardiac surgery and so it is advisable to be stopped 10 days before any cardiac operation. Age and sex of patients as well as the presence of organic TVD; PH, preoperative PE did not influence the occurance of PE after cardiac surgery. Serial and early echocardiographic evaluation from the 2nd post operative day for 2 weeks is recommended to pick up any PE or collection after any cardiac operation especially those after open heart surgery.

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Operative and Heamodynamic Evaluation of Blood Cardioplegia

Abstract

We have studied 40 patients who underwent open heart surgery at the Cardiothoracic surgery department-Tanta University Hospital.

These patients were randomely categorized into two groups according to the type of cardioplegic solution used:

Group I: Patients received crystalloid cardioplegia

Group II: Patients received blood cardioplegia

There were 24 males and 16 females, Their ages ranged from 16 to 50 years.
We found statistically significant difference between the two groups as regards course of defibrillation, intotropic support requirement, cardiac output and cardiac index.
There was no statistically significant difference between the two groups as regards the incidence of myocardial infarction, incidence of arrhythmia, and creatine kinase enzyme.
We concluded that blood cardioplegia has emarged as an attractive and superior alternative method to crystalloid cardioplegia despite its sophisticated delivery system.

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Introduction

In cardiac surgery, improving myocardial protection is necessary to support the evolution of surgical techniques. (Loop, Higgins, Panda, Pearce and Estafanous 1992). (1)

Cardioplegia now is the most widely used technique of myocardial preservation. Also it has generally provided satisfactory results, some of its problems are still not completely resolved. (Menasche, Kural, Fauchet, La vergne, Commin, Bercot, Touchot, Georgiopulous and Piwinica 1992). (2)

Crystalloid cardioplegia is now widely used to provide myocardial protection during surgical induced ischaemia, this technnique which induces rapid cardiac arrest has been shown to allow good myocardial protection for up to two hours of ischaemia. (Silverman, Wright, Lewistky, Schmit and Feinberg 1985) (3)

The need to provide oxygen in the cardioplegic solution continues to be questioned inspite experimental and clinical studies establishing the superiority of oxygenated

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cardioplegic solution. (Castinella, Cunningham and Adams 1982) (4)

Blood cardioplegia is currently being employed as a means of supporting the heart during cardiac operation (Murphy and Armour 1992 (5) However the composition of cardioplegic solution that will produce optimum results is still under investigation. (Rousou, Dobbs and Englman 1982) (6)

Aim of the Work

The aim of this work is to study and evaluate the effect of blood cardioplegic solution versus crystalloid cardioplegic solution on postoperative myocardial performance.

Patients and Methods

This study included 40 patients who underwent open heart surgery in Cardiothoracic Surgery Unit at Tanta University Hospital during the period of the study. Our surgical procedures were correction of congenital and valvular heart disease.

Our patients were randomized into two groups according to the type of cardioplegic solution used.

Group I: Crystalloid cardioplegic group.

The group included 20 patients (13 Males and 7 Females) with age ranging from 17 to 45 years. In these patients crystalloid cardioplegia was used. The cardioplegic solution was delivered antegradely into the aortic route using ordinary venous cannula No. 14 which was inserted through a purse string suture or aortic route cannula or by direct coronary ostial cannulation using coronary cannula in cases in which the aorta was opened during surgical procedures, followed by maintenance multidose cardioplegia via the retrograde route through the coronary sinus using Gundrue retrograde coronary sinus perfusion cannula which was inserted blindly through a purse in the right atrium and was kept in place by inflating its balloon.

Group II: Blood cardioplegia group.

This group included 20 patients (9 males and 11 females) with their age ranging from 16 to 50 years. In these patients blood cardioplegia was used.

Delivery system of blood cardioplegia

Blood cardioplegia was administered via a commercially available Macchi system which mixes and cooles hyperkalaemic crystalloid solution with oxygenated blood in 1:4 dilution by mixing the calibre of the tubing coming from the cardioplegic solution and coronary part of the oxygenator to acheive final electrolyte concentration similar to group I.

The composition of cardioplegic solution was as follows:

Potassium Chloride	20 meq/L
Magnesium Chloride	15 meq/L
Sodium bicarbonate	2.5 meq/L
Calcium Chloride	2.0 meq/L

The constituants were added to 1 litre of Ringer's solution

After the initial delivery of a cardioplegic volume of about 15 ml/kg multidose cardioplegia was accomplished by re-infusion of about half the initial dose at 30 minutes interval or on appearance of electromechanical activity.

In each patient we studied the following:

A - Operative data:

The onset of arrest, return of electromechanical activity, course of defibrillation and ischaemic time were recorded incidence of perfusion related trauma and inotropic support requirement to wean the heart from the cardiopulmonary bypass.

B. Post-operative data:

Assesement of the immediate (first 24 hours) post-operative clinical course which was based on:

a. The incidence of rhythm disturbance.

b. Inotropic support requirement.

c. The incidence of myocardial infarction as evidenced by electrocardiographic appearance of new Q wave and elevated myocardial enzyme.

d. Haemodynamic studies.

Heart rate (HR), Mean arterial blood pressure, central venous pressure (CVP), cardiac output (CO), cardiac index (CI) and creatine kinase enzyme.

They were estimated and recorded post-operative at 1,4,8,16 and 24 hours interval. The cardiac output was measured by non-invasive technique using Datascope accuson II cardiac output monitor with suprasternal probe 3 MHZ.

Results

Two different types of cardioplegic delivery were evaluated in 40 patients who underwent open heart surgery and were divided in to 2 groups.

I- OPERATIVE DATA

1- Operative procedures:

All our patients underwent open heart surgery utilizing cardiopulmonary bypass, 34 patients had correction for acquired heart diseases and 6 underwent correction of congenital heart disease.

2- Ishaemic time:

In group I: The mean values of ischaemic time were 47.05±18.46 min.

In group II: the mean values of ischaemic time were 43.74±18.53 min.

There is no statistically significant difference between the two groups as regards the ishaemic time (P>0.05).

3- Onset of cardiac arrest:

The mean values of time required to achieve complete electromechanical arrest of the heart after the begining of administration of cardioplegic solution was 45 (±15.64) seconds in groups I and 43.25 (±16.80) seconds in group II.

4- Return of electromechanical activity:

Return of electromechanical activity occures before the time of the next dose of

cardioplegia in 3 patients (15%) in group I and in one patient (5%) in group II.

The difference between both groups is statistically insignificant. (P>0.05).

5. Course of defibrillation:

Spontanous defibrillation occured in only one patient in group I. the mean value of number of DC shock needed for cardioversion in group I was 1.35 (±0.81) and spontaneous defibrillation occured in 6 patients in group II and the mean value of number of DC shock needed for cardioversion was 0.6 (±50).

There is statistically significant difference between both groups. (P<0.05).

Table No. 1 :- Course of Defibrillation.

Type of Cardioversion	Group I	Group II
Spontaneous defibrillation	1	6
After one DC Shock	7	11
After More Than one DC Shock	12	3

6. Incidence of perfusion related trauma.

We had no incidence of coronary ostial injury nor coronary sinus injury in both groups.

II- POST-OPERATIVE STUDIES:

A- Inotropic Requirement:-

In group I, 8 patients (40%) needed inotropic support to wean the heart from cardiopulmonary bypass, 6 patients (30%) had true low cardiac output and needed the inotropic support for more than 24 hours.

In group II, 3 patients (15%) needed inotropic support to wean the heart from cardiopulmonary bypass, two patients (10%) had transient post bypass haemodynamic instability and needed this inotropic support for less than 24 hours and the other patient (5%) had true low cardiac output and needed the inotropic support for more than 24 hours.

There is statistically significant difference between both groups (P<0.05).

Table No . 2 :- Need for inotropic support .

	Group I		Group II	
	No.	%	No.	%
Transient (Less than 24 Hours)	2	10 %	2	10%
More than 24 hours	6	30 %	1	5%
Total	8	40%	3	15%

b- Incidence of arrhythmia:

In group 1: 5 patients (25%) experienced post-operative arrhythmia.

In group II: 4 patients (20%) experienced post-operative arryhthmia.

There is no statistically significant difference between the two groups (P>0.05)

c- Cardiac Output:

In group I the mean value of COP at 1,4,8,16 and 24 hours postoperatively were 3.08 ± 1.15, 3.30±1.21, 3.55±1.28, 3.82±1.43

Table No . 3 :- Post-Operative Cardiac Output (L/min).

	Group I	Group II
After 1 hour	3.08 ± 1.15	3.38 ± 0.97
4 hours	3.30 ± 1.21	3.90 ± 1.00
8 hours	3.55 ± 1.28	4.02 ± 0.98
16 hours	3.82 ± 1.42	4.15 ± 1.16
24 hours	4.10 ± 1.61	4.44 ± 1.17

and 4.10±1.61 L/min respectively.

In group II the mean values of COP at 1, 4, 8, 16 and 24 hours post-operatively were 3.38±0.97, 3.90±1.00, 4.02±0.98, 4.15±1.16 and 4.44±1.17 L/min respectively.

There is statistically significant difference between both groups. (P<0.05).

d- Creatine Kinase:

In group I the mean values of CK at 1, 4, 8, 16 and 24 hours post-operatively were 3811.08±280.68, 390.28±71.32, 220.25±111.44, 136.44±70.35 and 120.98±73.90 IU/L respectively.

In group II the mean values of CK at 1,4,8,16 and 24 hours post-operatively were 343.55±278.87, 152.55±53.88, 152.55±53.88, 123.45±47.07 and 98.30±32.54 IU/L respectively.

There is no statistically significant difference between the two groups. (P>0.05)

e. Cardiac index:

In group I the mean values of CI at 1,4,8,16 and 24 hours post-operatively were 2.09±0.79, 2.88±10.09, 3.05±1.09, 3.04±1.10 and 3.06±1.11 L/m2 surface area/min respectively.

In group II the mean values of COP at 1,4,8,16 and 24 hours postoperatively were 2.72±0.66,, 3.16±0.80, 3.38±0.85, 3.85±0.85 and 3.43±0.84 L/m2 surface area/min respectively.

There is statistically significant difference between both groups (P<0.05).

Discussion

Protection of the myocardium during periods of Aortic cross clamping has remained one of the major concern in open heart surgery (Grips, Stinson and Shumway 1973) (7).

In our study two types of cardioplegic solutions were evaluated in 40 patients who underwent open heart, they were randomized into two groups, each including 20 patients.

Statistical analysis showed that the two groups were well matched as regards preoperative haemodynamic studies, as well as the period of Aortic cross clamping.

1) Course of defibrillation:

In our study spontaneous defibrilltion occured in one patient in crystalloid cardioplegia group and in 6 patients in blood cardioplegia group and there was statistically significant difference between two groups.

These results are in agreement with that reported by Vaughn, Opie, Florendo, Lonel and Austin 1992 (8) who studied 346 patients; 96 patients received crystalloid cardioplegia

and 248 patients received blood cardioplegia. Only 5 patients (2.6%) in blood cardioplegia group required defibrillation whereas, 82 patients (84%) needed defibrillation in crystalloid cardioplegia group.

Follette et al, 1978 (9) reported that in 71 patients who received blood cardioplegia, all patients resumed asynchronous heart beats spontaneously after Aortic declamping. They found that hearts protected by blood cardioplegia occasionally began to beat spontaneously before each reinfusion of the cardioplegic solution, which suggests that their energy stores were sufficient to allow resumption of electromechanical activity after the cardioplegic solution was washed out by noncoronary collateral flow. Only 10% depletion of high energy phosphate occured and these values returned to normal after reoxygenation.

2) Inotropic support requirment:

- The adequacy of myocardial preservation was assessed by the need for inotropic and mechanical support, Codd et al 1985 (10).

In our study among 20 patients who received crystalloid cardioplegia, 8 (40%) patients needed inotropic support. In blood cardioplegia group 3 patients required inotropic support (15%) and there was stastically significant difference between the two groups. Similar results were reported by Codd et al (1985) they reported that 25 patients out of 97 patients who received blood cardioplegia needed inotropic support while 38 patients out of 84 patients who received crystalloid cardioplegia needed inotropic support.

Better results were reported by Gundry Sequiera, Razzouk, Maclaughlin and Baily 1990 (11) who studied 160 patients undergoing surgical procedures and receiving blood cardioplegia. Only 8% of these patients needed inotropic support.

Khuri et al 1988(12)studied 42 patients who underwent valve replacement. They reported that patients who received crystalloid cardioplegia required significantly more inotropic and mechanical support to be weaned from cardiopulmonary bypass than patients who received blood cardioplegia. They reported that myocardiasl pH during the period of Aortic clamping was a good indicator for adequacy of preservation of myocardial function and ultrastructure. The administration of blood cardioplegia markedly reduced the degree of H^+ ion accumulation compared to similarly administered crystalloid cardioplegia.

3) Cardiac output and cardiac index:

Iverson, Young, Ennix, Ecker, Moretti, Lee, Hays, Farrar, Robert, Maasteroson and Ivan 1984(13) reported that the mean postoperative values for cardiac output in the blood cardioplegia group were never significantly lower than pre-operative values and exceeded pre-operative within 8 hours. Mean values of cardiac output for the crystalloid cardioplegia group decrease significantly and did not exceed pr-operative values within 36 hours postoperatively. They reported also that repeated measurments of intra and post-

operative cardiac output and cardiac index were higher in blood than in crystalloid cardioplegia group.

In our study there were stastistically significant difference between the two groups in favour of blood cardioplegia.

Similar results were reported by Vaughn et al 1993(6) who found that the average postoperative cardiac index was 16% higher in blood cardioplegia group (3 versus 2.5 L/m2/min).

4) Creatine kinase enzymes:

In our study, the mean values of creatine kinase in crystalloid cardioplegia group were 38.08, 290.28, 220.25, 136.44 and 120.98 IU at 1,4,8,16 and 24 hours and were 343.55, 152.55, 123.45 and 98.30 IU for blood cardioplegia group at the same time interval, there was no stastistically significant difference between the two groups.

Our results are in agreement with Engelman et al (14) 1981 who studied 27 patients divided into 2 groups 14 received crystalloid and 13 who received blood cardioplegia and there was no statistically significant difference.

Conclusion

We concluded that:

1- Crystalloid cardioplegia is an established method for safe and effective myocardial protection as it is cheap and ventricular function is well preserved.

2- Blood cardioplegia has emerged as an attractive and superior alternative method to crystalloid cardioplegia despite its sophisticated delivery system.

3- We consider that blood cardioplegia may be particularly well suited for use in hearts with pre-existing energy depletion since blood cardioplegia has the advantage of preventing further energy loss during aortic clamping as in cases of poor left ventricular function or in operations with expected long ischaemic time.

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Video-Assisted Thoracoscopic Management of Pericardial Effusion

Abstract

In this work, we studied twenty patients with non-calcific, non constrictive pericardial effusion not responding to medical treatment. All the patients underwent Video-Assisted Thoracoscopic (VAT) Pericardiectomy at the Department of Cardiothoracic Surgery, Cairo University, with the aim of assessing the feasibility, advantages and complications of the procedure. Postoperative symptomatology was significantly improved. Ninety precent had improvement of their dyspnea. X-ray chest showed a decrease in the cardiac shadow and E.C.G. was of normal voltage in 90% of the patients. Postoperative echocardiography showed a significant decrease in the measurement of the pericardial effusion both anterior and posterior to the heart except in two patients (10%). Operative mortality was nil.

In conclusion, in our experience with 20 patients who underwent thoracoscopic pericardiectomy, we found it to be a safe and effective method of treating non-calcific non-constrictive pericardial effusive disease. Thoracoscopic pericardiectomy produces a wide pericardial resection, larger than that achieved by the subxiphoid route and with less attendant pain than that seen with thoracotomy. Those potential advantages make thoracoscopic pericardiectomy an attractive alternative although further prospective randomized studies are recommended to compare VATs pericardiectomy to other modalities of treating pericardial effusion.

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Introduction

Pericardial effusions often present difficult management problems. The goals of management center around identifying those patients requiring treatment of their pericardial effusion and then, toward providing lasting relief of the pericardial effusive process, and related symptoms, with measures that result in the least morbidity to the patient (Gregory et al., 1985)(1). Surgical management of medically recurrent pericardial effusions may often be required. Operative approaches commonly utilized include the subxiphoid pericardial window, and alternatively, pericardiectomy through an antero-lateral or a median sternotomy incision.

All the previously mentioned approaches

From Cairo University

have specific shortcomings. Although the subxiphoid approach is championed by some surgeons because of the relatively small operative insult related to the procedure, others criticize its routine use because of reported high pericardial effusion recurrence rates (Pichler et al., 1985)(2). Increased peri-operative morbidity related to the more extensive operative incision of thoracotomy or sternotomy is the primary negative influence of these latter approaches (Naunheim et al., 1991)(3).

Video-assisted thoracoscopic pericardiectomy was introduced as a mean of performing an extensive pericardial resection equivalent to open thoracotomy approaches. This video-assisted thoracoscopic surgical (V.A.T.S.) approach to pericardiectomy has the additional merit of operative morbidity comparable to the subxiphoid pericardial window technique (Mack et al., 1992) (4).

The aim of this work is to study the feasibility complications and advantages of video-assisted thoracoscopic pericardiectomy.

Patients and Methods

The material of this work is a prospective study of 20 patients studied at Kasr El-Aini Hospital, Department of Cardio-Thoracic Surgery, Cairo University from the 1st of January 1993 to the 1st of January 1995.

Every patient was subjected to the following:

I. Pre-operative assessment:

1) History: complete medical history with stress on past history of T.B., uraemia, malignancy, myxoedema or any previous operations especially those for malignancy.

2)Complete physical examination with special attention to general and local signs of pericardial effusion.

3) Laboratory investigations:

- Routine laboratory investigations.

- Sputum for cytological examination, culture and sensitivity, Z-N stain.

- T3, T4 and T.S.H. if hypo or hyperthyroidism is suspected.

4) Radiological examination: P-A and lateral views.

5) E.C.G.

6) Echocardiography:

- Both the M-mode and the 2-dimensional echocardiography were used to measure dimensions of cardiac chambers, amount of pericardial effusion both anterior and posterior to the heart and to detect any valvular lesions.

II. Video-Assisted Thoracoscopic Pericardiectomy:

*** Anaesthetic management:**

A double lumen endotracheal tube (Robert show tube) was used in all patients and one lung ventilation was used for them with a tidal volume of 10 ml/Kg/min. A radial artery line was placed for continuous blood pressure measure measurement and blood gas sampling. Continuous transcutaneous pulse

oximetry was used for all patients.

*** Position of the patient:**

All the patients were positioned in the right lateral position and draped as in a standard thoracotomy. The entire chest was exposed on the ipsilateral side (left) to allow entry at any intercostal space. A full thoracotomy set was ready in all cases so that conversion to an open thoracotomy could be done at any time.

*** The procedure:**

V.A.T. pericardiectomy was started by choosing an appropriate intercostal site of access for exploratory thoracoscopy. This site was always the sixth intercostal space at the posterior axillary line. Direct digital palpation was used to rule out local pleural adhesions that can impede the introduction of the camera and potentially result in pulmonary parenchymal injury. The camera was then introduced and exploratory thoracoscopy performed. Appropriate sites were then selected for further trocar placement under direct vision through the camera. We used the fifth intercostal space at the anterior axillary line together with the seventh space at the anterior axillary line.

After we had inserted three surgiport trocars, the camera was introduced to identify the phrenic nerve with the pericardiophrenic vessels. Through the other two ports we introduced a holding forceps (endo-forceps) and a scissor (endo-scissor). The endo-forceps was used to hold and exert traction on the pericardium to keep it stretched while the endo-scissor was used to cut a part of the pericardium as big as possible. This was done anterior to the phrenic nerve in all patients and occasionally posterior as well. When the pericardium was not seen to be severely distended we introduced the aspirating needle to verify the pericardial effusion and take a sample. The bleeding edges of the pericardium were then diathermized using endo-grasper while the electric defibrillator was available in case fibrillation of the heart occurred.

After the procedure was over, we inserted an intercostal tube under vision to be positioned in the pleural space through the most dependent of our trocar sites. The other two tropcar sites were closed by one stitch of absorbable vicryl followed by one skin suture. The ipsilateral lung was then inflated. The pericardium resected was sent for histopathology and effusion drained sent for cytological and bacteriological examination.

*** Post-operative period**

The patient was transferred to the intermediate care unit, put on oxygen mask and given analgesia as indicated. After about 12 hours the patient was transferred to the ward and the intercostal tube was removed after its drainage was minimal (less than 50 c.c/day).

III. Postoperative Assessment

History, examination and investigations which were done pre-operatively were all done again post-operatively for follow up over a period of 3 months.

Results

This study encompassed 20 patients who were diagnosed as having pericardial effusion that did not respond to medical treatment.

The age of our patients ranged from 18 to 60 years with a mean of 41.3 years ± 13.75. It included eleven females (55%) and nine males (45%).

The main complaint was shortness of breath which was present in 15 patients (75%), chest pain (atypical) in 3 patients (15%), awareness of heart beats in one patient (5%) and dry cough in one patient (5%).

There was a past history of treatment for malignancy in seven patients (35%), 4 patients were previously operated upon for cancer breast, two patients were under chemotherapy and one was under radiotherapy. 5 patients (25%) had a past history of T.B., 4 patients (20%) were uraemic and were on regular dialysis.

The echocardiographic measurement of pericardial effusion anterior to the heart ranged between 0.9-3.1 cm with a mean of 2.12±0.53 cm, and the posterior effusion ranged from 1.3 cm to 3.5 cm with a mean of 2.03±0.55 cm. 18 patients (90%) had no associated valvular lesions while 2 patients (10%) had coincident valvular lesions.

* Operative Results

Difficulty was encountered in six patients (30%) after introduction of the first thoracoport due to pleural adhesions. These adhesions were carefully dissected after diathermizing them until the lung could be free to collapse away from the pericardium. Of these 6 patients, 4 had left sided cancer breast, one patient had left sided bronchogenic carcinoma and one patient tuberculosis.

The amount of pericardial effusion drained at thoracoscopy ranged between 250-750 cc with a mean SD of 557.50±131.06 cc. There was a direct correlation between the measurements of effusion by preoperative echocardiography and the amount of effusion drained at thoracoscopy.

The operative time ranged between 25 minutes and 110 minutes with a mean of 61 minutes ± 21.5.

The colour of the drained effusion was serous (yellow) in 7 patients (35%), serosanguinous (bright red) in 6 patients (30%) and haemorrhagic (dark blood) in 7 patients (35%).

Aetiology

According to the medical history, clinical examination, laboratory investigations, analysis of pericardial fluid, and pathological examination of the pericardial biopsy, the aetiology of the pericardial effusion could be categorized into:

I. Benign causes: 13 cases (65%)

- Tuberculosis: 5 cases (25%).
- Uraemia: 4 cases (20%).
- Myxoedema: 2 cases (10%).
- Idiopathic: 2 cases (10%).

II. Malignancy causes: 7 cases (35%)

- Cancer breast: 4 cases (20%).
- Bronchogenic carcinoma: 2 cases (10%).
- Pleural mesothelioma 1 case (5%).

*** Post-operative Results:**

As regards shortness of breath which was the main complaint in our patients, there was a marked improvement in the functional class according to the NYHA classification in 17 out of the 20 patients, which was proportionate with the amount of drained effusion irrespective of their original disease.

There was a dramatic change in chest X-ray and echocardiographic data after thoracoscopic drainage of pericardial effusion.

The average hospital stay for the group of patients with benign effusion was 4.3 days (ranging from 2.5 to 18 days). In patients with malignant effusions, there was a long in hospital stay (8 to 40 days) due to debility and the need for further management of their malignant disease.

Discussion

The age of our patients included in this study ranged from 18 to 60 years with a mean of 41.3 years, which differs from Hazelrigg et al. (1993)(5), who reported the average age as 52 years, and Lewis et al. who reported an average of 61 years. The difference in age between our study and the others may be because of the large number of non-malignant pericardial effusions in our study (65%), while in the other groups the pathology was mainly malignant which usually occurs in older age.

The commonest complaint in our patients was shortness of breath (75%) while (45%) complained of atypical chest pain. This goes with the study of Mack et al. (1992) (4) and Hazelrigg et al. (1993)(5).

Dyspnea which was present pre-operatively in all our 20 patients improved in 17 of them (85%). Dyspnea did not improve in three patients. One patient had bilateral bronchopneumonia post-operatively while the other two patients had residual pericardial effusion which was mainly present posteriorly due to intrapericardial loculation. This was in agreement with Mack et al. (1992)(4).

In the plain chest X-ray, the mean cardiothoracic ratio was 72±3.68% preoperatively and 60.4±3.66 post-operatively. This was statistically significant (P value = 0.0001) because the size of the cardiac shadow markedly decreased after drainage of the pericardial fluid.

The echocardiographic measurement of the pericardial effusion both anterior and posterior to the heart showed a significant decrease (P value = 0.0001) reflecting the marked reduction in the amount of pericardial effusion after the V.A.T. pericardiectomy was done.

Thus the pericardial effusion is liable to drainage both anterior and posterior to the heart except in the presence of loculations (Canto et al., 1993)(7).

The average operative time for the V.A.T.S. pericardiectomy done for the 20 patients was 61 minutes ± 21.5. As it is expected with any new procedure or technique, there is a learning curve, and this curve should be more steep as we progress in doing more cases. However, the operative time depends also on the presence or absence of pleural adhesions because the access to the pericardium may be quite difficult in the presence of pleural symphysis.

Our average operative time was however, equal in duration to that reported by Hazelrigg et al. (1993)(5) which was 54 minutes for a total of 35 patients. Mack et al. (1992)(4) did not present their average operative time on reporting their first pioneering 22 patients and so did Canto et al. (1993)(7) when they operated upon 16 patients.

In our study, the mean duration for chest tube removal was 2.4 days for benign cases and 3.3 days for malignant cases. The difference was due to the increased amount of drainage in malignant cases, and besides, the oncology unit occasionally requests keeping the chest tube to be used as an access for instillation of chemotherapy. The average hospital stay for the group of patients with benign effusion was 4.3 days (ranging from 2.5 to 18 days). In patients with malignant effusions, there was a large range in the hospital stay (8 to 40 days) due to debility and the need for further diagnostic tests and treatment of their malignant condition. This goes with the average hospital stay of Hazelrigg et al. (1993) (5) which was 4-6 days for benign cases and ranging from 7-36 days for malignant cases.

In our results, the aetiology of pericardial effusion was as follows: benign cases were 13 (65%) while malignant cases were 7 (35%). These results are similar to those reported by Mack et al. (1992) (4) who had 21 patients of whom 13 (62%) were benign while 8 (38%) had malignant effusions. However, our aetiology is quite different from those of Hazelrigg et al. (1993) (5) who had a total of 35 patients with 18 patients (52%) due to malignancy.

Out of the benign causes, tuberculosis presented 25% of our study mostly because it is endemic in our country while Hazelrigg et al. (1993) (5) had no single tuberculous patient. Post cardiac surgical intervention presented 14% of their cases while we did not have any patients of this category, may be because we are not yet experiencesd enough in the technique to perform such cases with expected extensive adhesions after open heart surgery.

Symptomatic pericardial effusions are common and may result from a variety of causes. When medical treatment has failed to control the effusion or a diagnosis is needed, surgical intervention is required.

The goals of surgery are to relieve the effusion, make a definitive diagnosis, and prevent recurrence of the effusion or development of constrictive pericarditis, with the lowest possible morbidity and mortality. The surgical options include a subxiphoid resec-

tion, median sternotomy, anterolateral thoracotomy or a thoracoscopic approach. Median sternostomy offers distinct advantages for the management of constrictive disease, however, it is used less frequently for effusion, although it may carry less pulmonary morbidity than a thoracotomy. The subxiphoid approach has been popular because it is simple and can be performed with local anaesthesia in a debilitated patient. Studies that have compared subxiphoid drainage with thoracotomy have documented fewer pulmonary complications associated with the former (Naunheim et al. 1991)(3).

Recurrence rates after subxiphoid pericardial resections have varied from 3% to 18% (Sugimoto et al., 1990) (8). Santos and Frater (1977)(9) have suggested that increasing the pericardial resection to include 4 x 4 cm resection leads to a lower incidence of recurrence. Pichler et al. (1985) (2) have advocated complete pericardiectomy instead of subxiphoid resection or anterolateral thoracotomy due to higher recurrence rates with the latter two approaches.

The VATS approach allows a large pericardiectomy to be performed, comparable to that achieved at thoracotomy. A potential advantage of the VATS approach is that it produces less pulmonary morbidity than that seen after anterolateral thoracotomy (Landreneau et al., 1993) (10).

VATS has been remarkable in reducing the severity and duration of post-operative pain and allows patients to move and ambulate without difficulty the night of operation. With VATS, no major muscles are divided, ribs are not spread, dislocated, or broken and ligaments, nerves, and blood vessels are not severely damaged. Hospitalization has been shortened for many of our patients, and most of these patients have resumed normal activity after 10 to 14 days post-operatively.

A more extensive pericardiectomy would be a potential advantage of VATS over the subxiphoid route, and the visualization it affords, dealing with on pulmonary or pleural process, compared with subxiphoid approach, is superior. The disadvantage of VATS compared to the subxiphoid approach is the more complex anaesthetic technique required which may be tolerated poorly by the very ill patients. Excluding those patients with far advanced malignancy, we have not experienced problems with the thoracoscopic approach.

When performing video-assisted thoracic operations, the technique should never compromise the intended procedure. If there is difficulty in performing the operation, there should be no feeling of shame or defect if the chest has to be opened. This is not minor surgery, but rather major, complex intrathoracic surgery using minimally invasive techniques.

Thus thoracoscopic pericardiectomy produces a wide pericardial resection, larger than that achieved by the subxiphoid route and with less attendant pain than that seen with thoracotomy. These potential advantages make thoracoscopic pericardiectomy an attractive alternative. However, the true merits

of this technique will only be determined by time and further experience.

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Pulmonary Resections in Infants and Children: Indications and Complications

Abstract

Although pulmonary resections in infants & children appears to be easy; knowledge of the developmental anatomy is required & surgeons who perform such surgery must understant the management of complex respiratory problems unique to this age group.

Although the accepted indications for lung resection in infants & children have changed dramatically over the past few years; we present a series of 142 infants & children submitted for pulmonary resection and the results did not alter with such change. The commonest indication for pulmonary resection in this age group was inflammatory & infective conditions (62%); of them 40.1% was bronchiectasis, 18.4% was hydatid disease. Pulmonary resections, in this series, done for congenital malformations was in 31% of them cysts (14.7%), infantile lobar emphysema (13.5%), sequestrated lobe (2.1%) and arteriovenous malformation in 0.7% pulmonary umours were present in 2.8%; of them 2.1% were adenoma & 0.7% was a carcinoma. Neglected bronchial rupture was the leading cause for pulmonary resection in 4.2%.

Complications, whether intraoperative constituted 14.7%, in the form of massive intraoperative bleeding (1.4%), cardiac arrest (0.7%), postoperative atelectasis (5.6%), postoperative wound infection or empyema (3.5%), postoperative pleural air pouch (2.1%) & postoperative "Coop" in 1.4%). However all of these complications could be overcome with no mortality.

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Introduction

Pediatric patients had an important role in the development of techniques of pulmonary resection. The first successful staged pneumonectomy was done with mass ligature of hilar structures in a 12 years old girl with bronchiectasis (Nissen, 1931) (1). Two years later, first successful one staged pneumonectomy was reported (Graham & Singer, 1933). (2) The modern era of pulmonary resection began with pneumonectomy with individual ligation of hilar structures in a 3 years old girl with a benign tumour of the left bronchus (Rienhoff, 1933). (3)

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Table I: Age and sex incidence

Sex	No. of cases	Age range
Males	72	3 months-16Y.
Females	70	1.5Y-14Y
Total	142	3m-16Y

Table II: Side

Right	Left	Total
64 (45%)	78 (55%)	142 (100%)

The principles of pulmonary resections are the same in children as they are in adults with little differences; the chest wall of a child allows easier intrathoracic exposure through smaller incisions and rib resection in infants is usually unnecessary (Raffensperger, 1990). (4) Also pulmonary resection in infants and children is simplified because of the elasticity of the pulmonary vessels which are more visible and usually devoid of fat, but an intimate knowledge of the developmental anatomy is required to select the appropriate procedure.

Surgeons who perform major thoracic operations on a neonate or infant must understand the management of complex respiratory problems unique to this age group. A regional referral center with a neonatal and pediatric intensive care unit provides momentary care, appropriate monitoring, ventilatory support parentral nutrition and support staff trained to recognize & treat acute changes in patient's condition.

Aim of the work

Is to re-evaluate the indications and complications of pulmonary resections in infants & children to 16 years of age.

Patients and Methods

This is a collection study of pulmonary resections in infants and children done at Mansoura in the last 15 years. Age of a child was considered to be up to 16 years. 142 patients were included in this study; of them 72 were males and 70 were females. Age ranged from 3 months to 16 years.

The usual investigations prior to pulmonary resection have been done to all patients and all of them were followed up, for variable periods; postoperatively. Out of the total number of patients (142) 64 right thoracotomies & 78 left thoracotomies were done (table II).

The most common pulmonary resection done in our series was lobectomy (77 out of 142); followed by bilobectomy (30). Pneumonectomy was done in only 14 patients (Table III).

Results

Table IV showed the various indications

Table III: Types of pulmonary resections.

Lobectomy	Bilobectomy	Pneumonectomy	Lobectomy + Ligulectomy	Segmentectomy	Total
77 (54%)	30 (21.2%)	19 (13.4%)	10 (6.2%)	6 (4%)	142 (100%)

Table IV: Indications for pulmonary resections in 142 infant and child.

Indication for resection	No. of cases	%
Inflammatory & infective:	88	(62%)
Bronchiectasis	57	40.1%
Collapse	26	18.4%
Hydatid disease	2	1.4%
T.B cavity	3	2.1%
Congenital	44	(31%)
Cyst	21	14.7%
Infantile lobar emphysema	19	13.5%
Arterio-venous malformations	1	0.7%
Sequestrated lobe	3	2.1%
Tumours	4	(2.8%)
Adenoma	3	2.1%
Carcinoma	1	0.7%
Neglected trauma	6	(4.2%)
Total	**142**	**(100)**

Table V: Complications of pulmonary resections in 142 infants & children.

Complication	No. of cases	%
Preoperative		
Massive intraoperative bleeding	2	(1.4%)
Cardiac arrest during operation	1	(0.7%)
Postoperative		
Postoperative atelectasis	8	(5.6%)
Postoperative laryngeal edema	2	(1.4%)
Postoperative air pouches	3	(2.1%)
Postoperative wound infection	4	(2.8%)
Postoperative empyema	1	(0.7%)
Total	**21**	**(14.7%)**

for pulmonary resections in infants and children included in our series. It was done for inflammatory and infective conditions in 88 patients (62%), of them 57 patients (40.1%) had bronchiectasis, 26 (18.4%) had collapsed lobe or lung and not responding to medical treatment & repeated suction; 2 older children (1.4%) had disturbed hydatid disease & 3 patients (2.1%) had tuberculosis, resistant to antituberculous drugs. Pulmonary resections were done in 44 (31%) patients on the basis of congenital pulmonary disease, whether

congenital cysts; 21 patients (14.7%), infantile lobar emphysema, 19 patients (13.5%), arteriovenous malformations, in 4 patients. (2.1%). Pulmonary resections for tumours in infants and children were done for 4 cases only (2.8%) of them 3 patients (2.1%) had bronchial adenoma (2.1%) & one patient had carcinoma (0.7%). Neglected bronchial injury was the indication for pulmonary resections in 6 patients (4.2%).

Complications met with during or after pulmonary resections in infants & children included in this study are listed in table V. The overall incidence was 14.7%. All of these complications were overcome with no mortality.

Discussion

The accepted indications for lung resections in infants and children have changed considerably over the past few years. When Baffe & Pott's (5) reported in 1954; in their study on 47 cases of pulmonary resection treated at children Memorial hospital prior to 1954; the primary indications for lobectomy was bronchiectasis. Currently most major lung resections are performed for congenital malformations and metastatic tumours (Raffensperger, 1990). The results in this series are interesting & needs special attention, in that, most of pulmonary resections (62%) in infants & children were done for inflammatory & infective conditions while congenital malformations and tumours constituted only 31% & 2.8% respectively, which needs reevaluation and awareness of physicians dealing with this age groups of patients. Bronchiectasis was the main indication of such pulmonary resection in our series of 57 patients (40.1%). In 6 patients with bronchiectasis, foreign body inhalation; neglected for long period; was the cause of bronchiectasis. In two of them it was discovered & removed preoperatively via; a bronchoscopy & in the remaining 4 patients, granuloma was found & foreign body discovered after resection. Also, it is important to mention that all of these 6 patients treated asthma which is a good lesion, not to hesitate to do bronchoscope on mere suspicion of foreign body inhalation in infants & children that may avoid a major surgery in such patients. if they are neglected. 26 (18.4%) patients had collapsed lobe or lung and necessitated pulmonary resection. Also pulmonary resection was done in two older children for hydatid disease, although this is not the rule in treatment of such disease. The hydatid cysts were disturbed, infected and ruptured in these patients which explain the basis of lobectomy done for them.

Pulmonary resection in infants and children was done in 44 patients (31%), in our series for congenital etiology; the most common of which was congenital cysts (21 patients, 14.7%) and infantile lobar emphysema (19 patients, 13.5%). The latter have been reported to account for 50% of congenital malformations of the lung by Berlinger et al., 1987 (6). Some of our patients with I.L.E. have been operated upon on an emergency basis and all of the cases were classical on plain radiography and needed no further work up for diagnosis. Only 4 cases needed preoperative bronchoscopy to exclude foreign body inhalation. Left upper lobe was the most frequently affected in our series. Only in one patient in this series, with

I.L.E., an intercostal tube was done as a misdiagnosis of pneumothorax, before being submitted to resection. It must be stressed that, in 11 of our patients with I.L.E, the operation was done under light general anesthesia and rapid thoracotomy was done to expose the distended lobe, delivering it from the pleural cavity before beginning hilar dissection. Excessive positive positive pressure was essentially avoided during intubation.

Although debate arises, whether intralobar sequestration is a congenital or acquired disease (Gebauer & Mason, (7) 1959 and Stocker & Malczak, 1984) (8); three of such cases (2.1%) have been grouped under congenital malformations in our series and have been operated upon. The three cases had intralobar sequestration in left lower lobe and had arterial blood supply from the descending thoracic aorta in two of them and from the abdominal aorta in the third one. A single case (0.7%) of isolated arteriovenous malformation has been operated up, and massive intraoperative bleeding happened.

Bronchial adenomas are probably, the most common primary lung tumours in childhood. Hartman & Shochat, (1983) (9) reviewed 65 cases of bronchial adenoma in the English literature in children aged 4-10 years. We have treated three (2.1%) of such cases in our series. Although, about 5% of bronchial adenoma reported in childhood have shown evidence of malignancy by virtue of local invasion or metastasis to regional lymph nodes (Wellons et al., 1976) (10); non of our cases were malignant.

In contrast to its frequency in adults, carcinoma of the lung is very rare in childhood. In a review of the world literature, Hartman & Schochat, (1983) found 47 cases in children from 5 months to 16 years. A co-existent malformation of the lung may suggest a possible causal relationship. In this series, we have reported one case (0.7%) of pulmonary carcinoma. It was an adenocarcinoma in a girl, 15 years old. Left radical pneumonectomy was done, followed by postoperative chemotherapy. However the survival, was only six months. Prompt & thorough evaluation of children with solitary pulmonary masses or persistent, atypical pulmonary symptoms is mandatory for early diagnosis. Improved prognosis will depend on early diagnosis, prudent surgical resection and refinements in combined regimens of adjunctive therapy.

The relatively high incidence of pulmonary resection done in infants and children for neglected bronchial injuries, in this series (6 patients: 4.2%), raises the importance of early diagnosis and repair of such injuries which is mandatory to prevent stricture and loss of lung function. Rib fractures are always associated with bronchial injuries in adults, but are frequently not seen in pediatric patients. If however, rib fractures are present, their distribution is of some importance. They almost always occur in upper part of the thorax on the side of bronchial rupture (Burnke, 1962). (11) The key to the early diagnosis

of bronchial rupture is in recognizing the bronchial injury itself, not in any pattern of associated injuries or in a specific post injury course. In our six patients with bronchial rupture, the diagnosis was not made until stenosis happened, and called attention to itself through atelectasis and sepsis. This lack of diagnostic accuracy, for the most part, is due to clinical difficulty in distinguishing patients with bronchial rupture from those patients with thoracic trauma without bronchial rupture. The immediate post injury course is of little diagnostic aid, because patients with stabilized bronchial ruptures tend to respond to treatment in the same manner as patients without bronchial injury. Because the diagnosis can not be satisfactorily made in the large majority of patients by clinical appearance or immediate clinical course. Visualization of the trachea and main stem bronchi by appropriate x-ray studies or bronchoscopy is necessary to identify or rule out bronchial rupture in severe thoracic trauma.

The fetal myocardium is less compliant than that of adult. (Wallgren et al.), 1967, (12) studied the effects of graded haemorrhage on infants and concluded that the newborn is less able to adapt to loss of intravascular volume than the adult. Because of decreased compliance of the ventricle and increased capacity of the venous system in newborn, cardiac output is augmented principally by an increase in heart rate on the expense of diastolic interval and coronary perfusion and myocardial oxygen delivery. Moreover, shock, in children is frequently associated with glycogen depletion and hypoglycemia and should be treated. Three intraoperative complications were gathered in this series. In two (1.4%) of them, massive intraoperative bleeding happened and fortunately, they were older children and the complication was overcome by blood transfusion. In the third case (0.7%) intraoperative cardiac arrest happened and was resuscitated.

The most common postoperative complication, we have met with in this series, is atelectasis (8 patients, 5.6%). Such a complication needs knowledge of some anatomic and physiologic considerations, to avoid. The total pulmonary resistance of the term infant is approximately 6 times that of the adult; unlike the situation in adults; most of the resistance is the small terminal airway (Hogg et al., 1970). (13) Infants are particularly sensitive to obstruction of these airways with edema or mucous and such obstruction in conjunction with poorly developed pathways of collateral ventilations, accounts for their propensity to develop atelectasis (Griscom et al., 1978). (14) Such complication is managed in our patients by airway suction accompanied by physiotherapy. However judicious use of airway suction and physiotherapy to maintain the patency of the peripheral airways is important. When secretions are suctioned from the endotracheal tube, the catheter should be passed just beyond the end of the tube to avoid perforation of the airways (Anderson & Chonder, 1976). (15) It is, also, important to note that, wide fluctuations in Pa02 occur in term and preterm infants during

suctioning & chest physiotherapy and these patients should be managed less aggressively. Also, management of postoperative pain in infants and children have received little attention; although, after thoracotomy, pain may limit ventilation and clearance of secretions.

One case only in our series with recurrent postoperative atelectasis, needed special monitoring. This child had left lower lobectomy and then presented with atelectasis of the left upper lobe that necessiated bronchoscopic suction, physiotherapy and medication. We noticed that the suture line of the resected left lower lobe, somewhat, encroach on the remaining left upper lobe bronchus with granuloma. This remark must be put in mind during resection of left lower lobe to avoid encroachment on the remaining lobe on that side.

Infants in the first year of life are generally more susceptible to infection than older patients and should be protected with brief course of broad spectrum antibiotics in the postoperative period. Infants and children appear to have an immature inflammatory response. Fever and leucocytosis seen in older children with infection may not occur in infants. Moreover, the polymorphnuclear leucocytosis of the new born have less chemotactic and phagocytic capacity than those of older children (Bower et al., 1982); (16) which in conjunction with a decreased capacity for opsonization makes the new born infant more susceptible to infection with gram negative organisms. 4 of our patients (2.8%) had postoperative wound infection which was mild and easily overcome by proper antibiotics and daily dressings. Only, in one patient (0.7%), postoperative empyema developed and necessitated tubal drainage for time.

Postoperative air pouch in the pleural space, encountered in 3 patients (2.1%) in this series, due to early removal of intercostal tubes after pulmonary resection. It necessitated tubal drainage and these patients did well, after.

Several anatomic peculiarities of the airway of the neonate are important in thoracic surgery to avoid postoperative complications. The narrowest portion of the airway of an adult is at the level of the vocal cords whereas in a child, it is at the level of the cricoid cartilage. Endotracheal tubes that pass through the cords may not pass through the subglottic area or they may be tight. Use of endotracheal tubes of appropriate size is important for intubation of a child. Moreover, the loose areolar tissue of the larynx in a child is susceptible to formation of edema as a result of tube trauma or excessive hydration. Also the trachea of the neonate is short and right and left main bronchi go off at equidistant angles, which makes their intubation equally possible. Finally, the mediastinum is mobile and seemingly insignificant pneumothorax may progress rapidly to tension pneumothorax. Such considerations must be put in mind during anaesthetizing these patients. Postoperative "croop" happened in two patients (1.4%) in

this series due to postinubation laryngeal edema. However they responded to corticosteroid therapy and non of them needed tracheostomy.

Conclusions

(1) Indications for pulmonary resections in infants and children must be reevaluated by physicians dealing with this age group.

(2) Bronchoscopy, on mere suspicion of foreign body inhalation must be done, to avoid neglect & major surgery.

(3) Although, pulmonary carcinoma is very rare in childhood, thorough evaluation of children with solitary pulmonary nodules or persistent atypical pulmonary symptoms is mandatory for early diagnosis.

(4) Early diagnosis & repair of bronchial rupture is essential in pediatric patients with thoracic trauma, even with no fractured ribs, to avoid pulmonary resection.

(5) Knowledge of the anatomical basis in infants & children is essential for both aneasthetist & surgeon to avoid postoperative complications.

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Role of Mediastinoscopy in Preoperative Staging of Bronchogenic Carcinoma

Abstract

To determine more precisely the role of mediastinoscopy in the preoperative staging of bronchogenic carcinoma we studied 35 patients with clinically operable tumours managed at Kasr El-Aini Hospital and compared the results of mediastinoscopy and computed tomography scanning with the findings at thoracotomy. In 14 patients the C.T scan was positive (nodes larger than, 1cm) mediastinoscopy revealed metastatic deposits in mediastinal nodes in 9 patients, while negative mediastinoscopic findings were present in 5 patients. On subsequent thoracotomy one of these patients proved to have metastatic mediastinal nodes. In 21 patients the C.T scanning was negative but mediastinoscopy revealed evidence of mediastinal involvement in 9 patients. The remaining 12 patients with negative mediastinoscopy had thoracotomy that confirmed the preoperative mediastinoscopic findings. Thoracotomy was avoided in patients with positive mediastinoscopy.

The C.T. scan had a sensitivity, specificity and an accuracy of 52.6%, 75% and 62.8% respectively, while for mediastinoscopy it was 94.7%, 100% and 97% respectively. Because of the rather low sensitivity and specificity of C.T scanning, computed tomography cannot replace mediastinoscopy and a more liberal use of mediastinoscopy seems to be justified in the routine preoperative staging of bronchogenic carcinoma.

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Introduction

During the past 50 years carcinoma of the lung has increased in incidence from an obscure and rarely encountered disease to one which is responsible for most cancer deaths in males and the second most common cause in females after cancer breast. This disease is most often encountered in the fifth and sixth decades of life. Recently, bronchogenic carcinoma has been encountered in younger ages (1). The biological behaviour of carcinoma of the lung as well as the form of treatment and the ultimate results are dependent upon a number of factors including cell type, location, extent of the lesion and the immunological response of the patient. The determination of these parameters is called "The Staging Process" (2). The staging system

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presently used to categorize and to classify patients is the new international staging system (3). The status of mediastinal lymph nodes is the most important factor in predicting outcome in those patients who do not have spread outside the chest. Mediastinoscopy was introduced by Carlens in 1959 as a method for exploration and biopsy of the superior mediastinum (4).

The purpose of this work is to assess the value of mediastinoscopy in the staging of bronchogenic carcinoma.

Patients and Methods

This study was carried out on 35 patients in Kasr El-Aini Hospital with clinically operable bronchogenic carcinoma who were diagnosed on Radiological basis. All patients were subjected to full medical history, clinical examination, x-ray chest, sputum cytology, bronchoscopy, chest C.T. scan, mediastinoscopy and exploratory thoracotomy in those only with negative mediastinoscopic results to correlate between the mediastinoscopic findings with that of the operative findings and to try radical resection of the lesion if possible.

Mediastinoscopy was done for all patients and the technique used was the classical anterior cervical mediastinoscopy. The following seven groups of lymph nodes accessible by mediastinoscopy according to the American Thoracic Society (ATS) map of regional pulmonary nodal stations were sampled namely, 2R, 4R, 10R, 7, 2L, 4L and 10L. Neither left anterior mediastinotomy nor any of the modifications of mediastinoscopy were done in the present study. Thoracotomy was done in 18 patients including 17 with negative mediatinoscopic findings plus the first patient in this study with positive mediastinoscopic result for comparison. After thoracotomy microscopic sections were sent from the lymph nodes and the results were compared with those of the preoperative mediastinoscopic biopsy. The sensitivity, specificity and accuracy of mediastinoscopy and C.T scanning were calculated according to the method of Galen using the following formulas:

$$\text{- Sensitivity} = \frac{TP}{TP + FN}$$

$$\text{- Specificity} = \frac{TN}{TN + FP}$$

$$\text{- Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

$$\text{- Positive predictive value} = \frac{TP}{TP + FP}$$

$$\text{- Negative predictive value} = \frac{TN}{TN + FN}$$

TP : True positive, FN: False negative,
FP : False positive TN : True negative

Results

Thirty two patients were males and three were females with the male to female ratio about 10.7 : 1. Their ages ranged from 40 - 80 years with a mean age of 56.3 years. Nine-

teen patients were smokers while 16 were non smokers. Common complaints included cough in 66%, chest pain in 57%, dyspnea in 37%, weight loss in 26% and haemoptysis in 14%. Sputum cytology revealed evidence of malignant cells in 17 cases (49%). Bronchoscopy with bronchial lavage revealed evidence of malignancy in 23 cases (66%). Biopsy was only taken from 7 patients and all were positive for malignant cells.

Computed tomographic scanning was done for all patients and revealed affection of the right upper lobe in 14 cases (40%) followed by the left upper lobe in 6 cases and left lower lobe in 5 cases. 14 patients (40%) had mediastinal lymph node enlargement (i.e nodes larger than 1 cm) while the remaining 21 patients had no mediastinal lymph node enlargment in the C.T. scan. On mediastinoscopy, 9 of the 14 patients with positive C.T scan findings had positive (diseased) mediastinal lymph node biopsy. Assuming that there were no false positive histologic results this constituted true positive results in these 9 patient.

The remaining 5 patients had negative mediastinoscopic findings. One of these 5 patients on subsequent thoracotomy proved

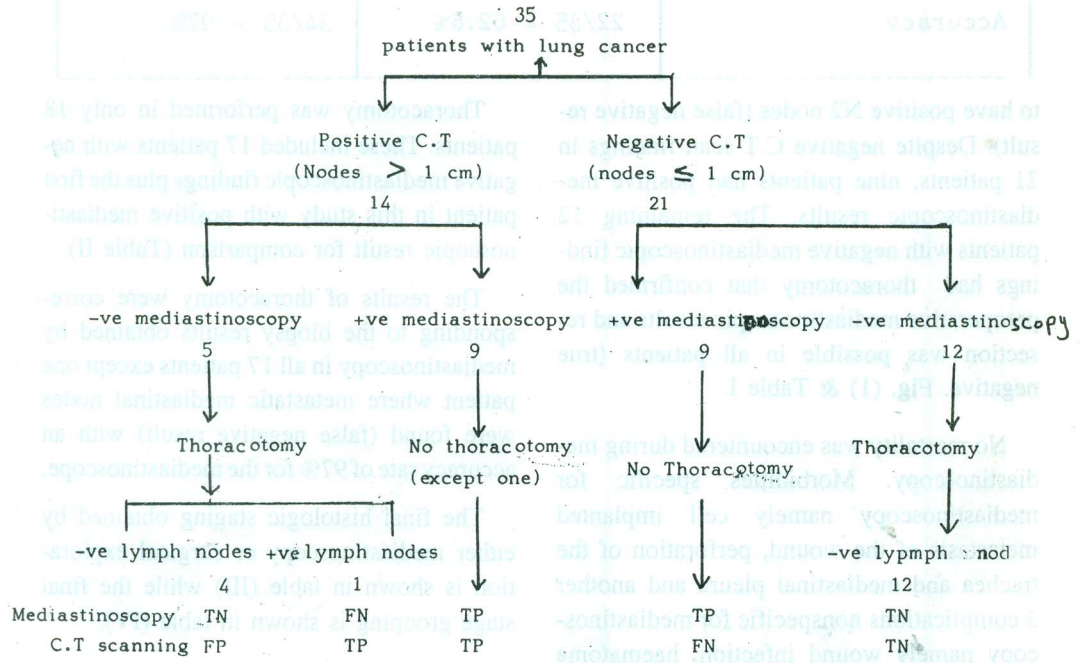

Fig. (1) : Staging flow chart. Results of mediastinoscopy and C.T. scanning (TN : true negative, FN : false negative, TP : true postive, FP : false positive).

Table I: Summary statistics for C.T scanning and Mediastinoscopy (Calculation from Fig. [1])

STATISTIC	C.T. SCANNING	MEDIASTINOSCOPY
True positives	10	18
False positives	4	0
True negatives	12	16
False negatives	9	1
Sensitivity	10/19 = 52.6%	18/19 = 94.7%
Specificity	12/16 = 75%	16/16 = 100%
Accuracy	22/35 = 62.8%	34/35 = 97%

to have positive N2 nodes (false negative result). Despite negative C.T scan findings in 21 patients, nine patients had positive mediastinoscopic results. The remaining 12 patients with negative mediastinoscopic findings had thoracotomy that confirmed the preoperative mediastinoscopic results and resection was possible in all patients (true negative. Fig. (1) & Table I.

No mortality was encountered during mediastinoscopy. Morbidities specific for mediastinoscopy namely cell implanted metastasis of the wound, perforation of the trachea and mediastinal pleura and another 3 complications nonspecific for mediastinoscopy namely wound infection, haematoma and minor bleeding, each was encountered in only one patient.

Thoracotomy was performed in only 18 patients. These included 17 patients with negative mediastinoscopic findings plus the first patient in this study with positive mediastinoscopic result for comparison (Table II).

The results of thoracotomy were corresponding to the biopsy results obtained by mediastinoscopy in all 17 patients except one patient where metastatic mediastinal nodes were found (false negative result) with an accuracy rate of 97% for the mediastinoscope.

The final histologic staging obtained by either mediastinoscopy or surgical exploration is shown in table (III) while the final stage grouping is shown in table (IV).

Discussion

The purpose of mediastinal imaging and

Table II: Types of operative procedures in the operated group

TYPE OF OPERATIVE PROCEDURE	No.OF CASES	%
Left upper lobectomy	5	27.5%
Rt. upper lobectomy	3	17 %
Left pneumonectomy	3	17 %
Rt. lower lobectomy	2	11 %
Thoracotomy + Biopsy	2	11%
Rt. pneumonectomy	1	5.5 %
Rt. upper & middle lobectomies	1	5.5 %
Middle lobectomy	1	5.5 %

Table III: Final histologic staging of 35 patients

Histologic type	No.of Cases	%
Squamous cell carcinoma	12	34%
Adenocarcinoma	12	34%
Small cell carcinoma	4	11%
Undifferentiated carcinoma	2	6%
Large cell carcinoma	1	3%
Adenosquamous carcinoma	1	3%
Anaplastic carcinoma	1	3%
Mucoepidermoid carcinoma	1	3%
Carcinosarcoma	1	3%

Table IV: Final stage grouping of 35 patients

Stage	No. of Cases	%
stage I	8	23%
Stage II	8	23%
Stage IIIa	0	0%
Stage IIIb	17	48%
Stage IV	2	6%

mediastinoscopy is to give the most accurate assessment of mediastinal involvement, thus limiting the number of unnecessary thoracotomies but at the same time to provide the greatest chance of a thoracotomy to a patient with a potentially curable disease (5). At the beginning, mediastinoscopy was used as a routine procedure in the preoperative staging of bronchogenic carcinoma and it showed positive histologic results in 29.6% of patients and so was found a valuable tool to select patients for operation (6).

With the introduction of C.T. scanning a precise visualization of the mediastinum became possible. This led to the assumption that enlarged glands could be considered to be metastatic nodes and that when no glands were discovered a thoracotomy could safely be performed. However, several studies demonstrated that enlarged glands are not necessarily metastatic and histologic proof was mandatory before a patient was judged inoperable (7).

On the other hand, McKenna and Collegues (8) demonstrated that with careful mediastinal dissection during thoracotomy, nodes smaller than 1 cm may be found that indeed prove to contain metastatic disease. These smaller glands are likely to be missed on C.T. scanning inasmuch as slices are routinely taken every 1 cm. They also stated that C.T. scanning could not detect 40% of all nodal metastasis. The sensitivity and specificity of C.T. scanning were found to be 60%.

Again, Rhoads et al (9) reported a sensitivity and specificity for C.T. scanning of 57% and 69% respectively. The sensitivity and specificity of the C.T. scanning in our study (52.6% and 75% respectively) are compatible with the previously mentioned results of both groups of authors.

Again, we agree with them in their conclusion that computed tomography cannot replace mediastinoscopy and because of its low sensitivity cannot even select those patients who should have a mediastinoscopy.

Jolly et al (10) reported their policy in selecting patients with high probability of positive mediastinal nodes for mediastinoscopy. This includes tumour size greater than 2 cm, central location, unfavourable cell type, weight loss of 8 pounds or more and undifferentiated cell type. In our study mediastinoscopy was routinely used in all patients suspected to have operable bronchogenic carcinoma, and it revealed evidence of tumour within the mediastinum in 18 patients out of 35 patients (51%). This is higher than 30% reported by Luke et al (6). These patients with positive mediastinal glands had nonsurgical treatment. This is in agreement with Coughlin et al (11) and Van Schil et al (5) who stated that if positive nodes are found at mediastinoscopy a curative resection is generally not possible and thoracotomy should be avoided especially in cases with extranodal, high paratracheal or contralateral involvement as the overall survival is low. Shields (12) estimates that 5 year survival rate of all patients with positive mediastinal nodes approximates 2%, However. Staples et al (13) reported improved survival in selected patients with limited mediastinal nodal metastasis following surgical resection with a 5 year survival rate of 24%. He stated also that patients in this group who are most likely to benefit from surgery are those with (a) ipsilateral nodal metastasis (b) intracapsular rather than extra capsular nodal involvement (c) positive mediastinal nodes discovered at thoracotomy following negative findings at mediastinoscopy (d) involvement of the mediastinum by squamous cell carcinoma as compared with carcinomas of other cell types.

In our study mediastinoscopy had a sensitivity of 94.7%, a specificity of 100% and an accuracy of 97%, this is in agreement with the results of Van Schil et al (5)who reported 91%, 100% and 95% respectively. The impact of mediastinoscopy has been to decrease operative rates and increase resection rates and to increase survival after resection as well as after operation (4) Although it is an invasive tool, mediastinoscopy has become safer with negligible mortality and very low morbidity.

In conclusion, because of its relative higher sensitivity and specificity over the C.T scanning we can state that mediastinoscopy is recommended as a routine method not only in the preoperative staging of bronchogenic carcinoma but also in its diagnosis even if the C.T scan is negative for hilar and mediastinal lymph node enlargement because metastatic deposists can be found in normal sized lymph nodes. Further more positive mediastinoscopic results are still contra indications for surgical intervention in pa-

tients with bronchogenic carcinoma as the overall survival is very low.

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Talc Slurry Pleurodesis in Hepatic Hydrothorax

Abstract

This prospective study was designed to determine the efficacy and safety of talc slurry pleurodesis in patients with symptomatic hepatic hydrothorax not responding to medical treatment and repeated thoracocentesis. Twenty patients underwent this treatment in Zagazig University Hospital between October 1993 and May 1995, 12 (60 percent) of them were men. The patient ages ranged from 28 to 59 years (mean 45.4 ± 8.7 years). In 80 percent (16 patients) the effusion was right sided. All patients received 3-g talc slurry via tube thoracostomy. Continued high-volume tube output was occured in 3 (15 percent) patients, reinstillation of other 3-g talc slurry was done in these cases with successful pleurodesis. The mean duration of follow-up was 12.1±5.6 months (range 1-20 months). Three patients (15 percent) have died during the follow-up period and the cause of death was not related to the procedure (2 due to hematemesis and one due to acute myocardial infarction). No statistically significant changes had occured in liver function tests and electroytes (Na+ and K+) after the pleurodesis. Pleurodesis was successful in 17 of 20 patients (85 percent). Only three patients (15 percent) had recurrence of the effusion. Contralateral pleural effusion had occured in one patient (5 percent).

Adverse effects associated with pleurodesis included mild pain (100 percent), fever (12 of 20, 60 percent), empyema (1 of 20, 5 percent), and atrial flutter (1 of 20, 5 percent).

We can conclude that 3-g talc slurry pleurodesis via a chest tube is an effective and safe procedure for controlling pleural effusion in patients with symptomatic hepatic hydrothorax not responding to medical treatment and repeated thoracocentesis.

Ahmed M. Deebes*, M.D., and Osman M. Abdou

J. of Egypt. Society of Cardio thorac. Surg. 1996, Vol. IV April No 2

Introduction

The treatment of patients with recurrent, symptomatic malignant plural effusions with chemical pleurodesis is a common place (1). However, the treatment of patients with recurrent nonmalignant pleural effusions remains a difficult clinical problem (2). The major mechanism of pleural fluid accumulation in patients with cirrhosis is through transdiaphragmatic movement of ascitic fluid via diaphragmatic lymphatics or small diaphragmatic defects along a

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peritoneal-pleural pressure gradient. Decreased intravascular oncotic pressure from diminished protein synthetic capacity of the diseased liver is an another cause for pleural fluid accumulation in these patients (3).

Intial managment of pleural effusion related to cirrhosis should be directed to decrease formation of ascites with adequate nutrition, adminstration of a diuretic, and salt restriction. Thoracocentesis and paracentesis, as appropriate, may be also helpful. If the effusion is persistently symptomatic, the patient may be a candidate for chemical pleurodesis (2). Talc is a highly effective pleurodesis agent when adminsterated either via poudrage or slurry in patients with pleural effusion or pneumothorax (4,5). In a recent canine study, Bresticker, et al, 1993 (6) reported that pleural symphysis from talc was comparable to that obtained by mechanical abrasion. Talc slurry instilled through a chest tube is an effective and safe bedside method of pleurodesis (7).

The aim of this prospective study is to detemine the efficacy and safety of talc slurry pleurodesis in patients with symptomatic hepatic hydrothorax not responding to medical treatment and thoracocentesis.

Patients and Methods

This series consisted of 20 patients, 12 (60 percent) of them were men, with a mean age of 45.4±8.7 (range 28 to 59) years, who were admitted to the Department of Cardiothoracic Surgery, Zagazig Univeristy Hospitals with recurrent hepatic hydrothorax not responding to medical treatment and repeated thoracocentesis between October 1993 and May 1995.

Selection of patients

Patients with hepatic hydrothorax who underwent talc slurry pleurodesis, were required to be not responding to medical treatment and repeated thoracocentesis, and still persistently symptomatic.

Technique

Asbestos-free purified talc powder sterilized by dry heat at 132°c for 6h was used. Chest tubes were placed through the 6th intercostal space in midaxillary line, when the drainage fell bellow 150 ml/24h, pleurodesis was attempted. Three grams of talc mixed in 50 ml of normal saline solution, under sterile conditions, was injected through the chest tube followed by an additional 25 to 50 ml of saline solution to clear the tube. The chest tube was clamped for 2h. The patients underwent rotational maneuvers (15 min.) each in the right lateral, left lateral, supine, and prone positions) during the time that the chest tube was clamped. The tube was then reattached to the underwater seal.

Chest tubes were removed when the drainage was less than 100 ml/day. Subsequent 3-g talc instillation were done, within one week of intial pleurodesis, in cases with continued high-volume chest tube output and this was not considered as treatment failure. Chest radiographs were performed prior to chest tube placements, shortly after tube placements, shortly before intracavitary therapy,

shortly after intracavitary therapy, repeated on the second postoperative day, just before tube removal, and on all subsequent visits.

Liver function tests (S. Bilirubin, S. Albmin, S. Globulin, S. ALT, and S. AST), and electrolytes (Na+ and K+) were done to all patients before tube insertion and repeated within a week after pleurodesis was attempted.

Successful pleurodesis was defind as the abscence of any pleural fluid reaccumulation in all follow up radiographs. Any reaccumulation was regarded as treatment failure.

Statistics

All values were presented as mean ± standard deviation. Age, chest tube duration, and length of follow-up were compared between success and failure groups with unpaired two-tailed Student "t" test (8). Also, chest tube durations were compared between the group of patients with continued high-volume tube output needing reinstillation of talc slurry and the group of other patients with unpaired two-tailed Student "t" test (8).

Liver function tests and electrolytes were compared, before and after pleurodesis, with paired two-tailed Student "t" test (8).

P values were considered significant when less than or equal to 0.05.

Results

There were 16 (80 percent) patients with right sided effusion, and 4 (20 percent) patients with left sided effusion.

Reinstillation of 3-g talc slurry was done, within one week of the initial pleurodesis, in 3 (15 percent) patients due to continued high-volume tube output. The duration of chest tube, in these cases, was prolonged

Table 1: Duration of drainage for patients with high-volume tube output needing reinistillation of talc slury and other patients.

No of days	1st group N = 3	2nd group N = 17	t	P value	Signif.
Mean ± SD Range	15 ± 4.6 (10 - 19)	7 ± 2.2 (5 - 14)	4.956	< 0.001	H . S .

1st group = patients with high-volume tube outpout needing reinstilation of talce slurry
2nd group = the other group of patients
t = t value of unpaired two tailed Student t test.
H.S = Highly significant.

Table 2 - Comparison of patients with successfull and failed talc pleurodesis

Item	All patients N=20	successful pleurodesis N=17	Failed pleurodesis N=3	t	P value	signifi
Age, yr (range)	45.4±8.7* (28-59)	45.6±9.1 (28-59)	44±7.2 (38-52)	0.287	>0.50 &<0.90	N.S.
chest tube duration,d (range)	8.2±3.85 (5-19)	8.17±3.8 (5-19)	8.33±4.9 (6-14)	0.40	>0.90	N.S.
Follow-up,m (range)	12.1±5.6 (1-20)	11.6±5.9 (1-20)	14.3±3.1 (11-17)	0.762	>0.20 &<0.50	N.S.

* Mean ± S.D.

compared to chest tube duration in other cases (P<0.001) (table 1) During the period of the study, 3 (15 percent) of the 20 patients died. The cause of death in the three cases was not related to the procedure, two (67 percent) of the three patients died due to severe hematemesis one and 8 months after the procedure. The third case died, 4 months after the procedure, due to acute myocardial infarction.

Patient age, chest tube duration, and follow-up are summarized in table 2. There was no difference between successful and failed procedures when comparing chest tube duration (p>0.90). Also, there was no difference when comparing patient age between both groups (0.90 > p > 0.50). The mean duration of follow-up was not statistically different between both groups (0.50 > p > 0.20).

Liver function tests (S. Bilirubin, S. Albumin, S. Globulin, S. ALT, and S. AST) and electrolytes (Na+, and K+), before and after talc pleurodesis, are summarized in table 3. There were no statistically significant difference when comparing liver function and

Table 3: Liver function tests and Electrolytes (Na+and K+) before and after talce pleuradesis.

Item	Reference range	Before pleurodesis	After pleurodesis	t	p value	signif.
S.bilirubin						
. total	0.2-1 mg/dL	1.06±0.35*	1.1±0.39	0.875	>0.20 &<0.50	N.S.
. direct	0.00-0.2mg/dL	0.44±0.17	0.46±0.18	0.108	>0.90	N.S.
S.Albumin	3.4-5.0g/dL	2.55±0.42	2.53±0.36	0.465	>0.50 &<0.90	N.S.
S.Globulin	1.5-3.5g/dL	3.88±0.32	3.86±0.36	0.387	>0.50 &<0.90	N.S.
S.ALT(SGPT)	30-65U/L	52.7±15.08	51.8±12.87	0.814	>0.20 &<0.50	N.S.
S.AST(SGOT)	15-37 U/L	32.25±8.4	31.65±8.4	0.870	>0.20 &<0.50	N.S.
Na +	140-148 mmol/L	134.7±6.6	135.6±5.6	1.15	>0.20 &<0.50	N.S.
K+	3.6-5.2 mmol/L	4.32±0.6	4.24±0.57	1.45	>0.10 &<0.20	N.S.

* Mean ± S.D.
t = t value of the paired student "t" test
N.S = Not Significant.

electrolytes before and after pleurodesis. Success occured in 17 (85 percent) of our 20 patients. Recurrence occured in 3 (15 percent) cases, 3, 10, and 12 weeks postoperative. At that times, they were retreated with talc slurry instillation and they had no recurrence during the time of follow-up.

Contralateral pleural effusion (contralateral recurrence) occured in one (5 percent) case, 4 months after the procedure, and this recurrence was not considered as treatment failure. She was retreated with talc slurry instillation through a chest tube with no recurrence for the next 12 months. All patients complained of mild pain after the procedure was completed. Twelve of the 20 patients (60 percent) had a mild temperture elevation (T max <38°c).

A Staphylococcus empyema had developed 30 days after the procedure in one (55% perecnt) of our 20 patients. The patient recovered from her empyema following drainage without requiring surgical intervention.

Atrial flutter occured in one (5 percent) of 20 patients at 24h postprocedure. The patient was treated with digoxin for rate control and spontaneously converted to normal sinus rhythm.

No episodes of respiratory distress syndrome or pneumonitis were observed after all procedures.

Discussion

Many studies have demonstrated that talc pleurodesis is a safe and effective means of achieving apposition of the pleural surfaces Success rates are reportedly greater than 85 percent (9,10,11,12,13). Most of literatures has dealt almost exclusively with the application of dry talc at the time of thoracotomy (dusting), thoracoscopy (insufflation), or through a series of chest tubes (Venturi propulsion) (14). The experience of Webb and colleagues, 1992 (13) has sparked a resurgence of interest in the use of talc slurries, which may be especially applicable to those patients in whom a thoracoscopy poses an increased risk. In our study we preferred the use of talc slurry to avoid any risk to the diseased liver. Kennedy et al (1994) (4) in their review on talc pleurodesis concluded that the overall success rate was 91 percent in the treatment of pleural effusions (659 of 723) and this is consistent with 85 percent success rate in our study.

The optimal dose of talc required for effective pleurodesis is unknown, as little as 2-g has been used with success (12,15,16,17) while 5- and 10-g doses have been used more commonly (7,11,13,14,18,19,20). Kennedy, et al, 1994 (7) postulated that respiratory complications may be associated with high-dose talc. In our study, we have used 3-g doses in a trial to avoid respiratory complications that may associate high-doses. But renistillation of another 3-gm was needed in 15 percent (3 of 20) of cases due to continued high-volume tube output. No respiratory complications occured in our study. Little published studies reported the use of pleurodesis in controlling pleural effusion in cases

of hepatic hydrothorax. In the study of vargas, et al, 1994 (16) intrapleural insufflation of 2-g talc through thoracoscopy has been used in 6 patients with hepatic hydrothorax with only one case of recurrence (16 percent). This case was retreated with talc with no recurence for the next 2 months. In our study the recurrence rate was 15 percent (3 of 20 cases) and this is consistent with the previous study. Previous reports on attempts at pleurodesis in patients with hepatic hydrothorax have used tetracycline the most part and the results have been mixed. Falchuk, et al, 1977 (21) reported successful pleurodesis in two patients treated with tetracycline, while Ikard et al, 1980 (22) reported two failures with tetracycline. In our study, there was one case (5 percent) of contralateral recurrence. To our knowledge, there have been no previous studies reported contralateral recurrence in cases of hepatic hydrothorax treated with pleurodesis However Davidoff, et al 1993 (24) reported a contralateral recurrence in a patient of pleural effusion secondary to congestive heart failure treated with pleurodesis using quinacrine. In our study, 3 patients (15 percent) have died during the follow-up period. The cause of death was not related to the procedure, two cases died due to severe hematemesis and one case due to acute myocardial infarction. In the study of Vargas, et al,1994 (16), there was three mortalities (50 percent) of the six patients had cirrhosis. All of them died because of causes not related to the pleurodesis, two of them died because of causes not related to the pleurodesis, two of them died because of sepsis and the third died after a severe attack of hematemesis.

Most pleurodesis agents are associated with pain at the time of instillation into the pleural space. The degree of pain associated with talc has been variously reported from non-existent to sever (4). In our study all patients were complained of mild pain. Fever following talc pleurodesis is common. Aelony et al, 1991 (23) noted temperature elevation in 54 percent of their patients, also, Kennedy et al, 1994 (7) reported temperature elevation in 63 percent of the procedures. In our study, this occured in 60 percent of our patients which comparable with the previous results.

Empyema and locol site infections are recognised complications of thoracocentesis and thoracostomy. Todd et al, 1980 (25) reported an incidence of empyema of 3 percent (5 of 163) following poudrage, and Kennedy, et al, 1994 (7) reported an incidence of 5 percent (4 of 73) using talce slurry. This comparable with our results as empyema was complicated 5 percent (1 of 20) of our cases. No empyema were recorded in the two large studies of Webb et al, 1992 (13) and Adler et al, 1976 (18).

Respiratory insufficiency has been reported with both talc poudrage and talc slurry. Bouchama, et al, 1984 (26) reported a case of acute pneumonitis that followed closed pleural biopsy and talc slurry pleurodesis. They postulated that the respiratory failure occured from talc emboli to the lung as talc as talc particles was obtained by bronchoalveolar lavage. The patient improved with

corticosteroid theropy. Rinaldo, et al, 1983 (27) reported development of adult respiratory distress syndrome in three patients who received a 10-g talc slurry via a chest tube, two patients recovered. Todd, et al, 1980 (25) reported respiratory failure in seven patients underwent talc poudrage. Kennedy, et al, 1994 (7), also, reported three cases of respiratory failure attributed to 10-g talc slurry pleurodesis, one patient, who underwented bilateral, simultaneous talc pleurodesis required mechanical ventillation, while the two other patients were treated with oxygen and corticosteroids. In our study, no episodes of respiratory failure or pneumonitis occured, also Vargas et al, 1994 (16) reported no cases with respiratory problems in their study with 2-g talc poudrage. We think that development of respiratory failure may be dose-related. This is supported, recently, by the study of Kennedy et al, 1995 (28) on New Zealand white rabbits as they postulated that in the abscence of overwhelming exposure, it is unlikely that the entery of small particles of talc into systemic circulation has clinical significance.

In our study there was no statistically significant changes in the liver function tests and electrolytes after talc pleurodesis. To our knowledge there was no previous studies regarding liver function and electrolytes after talc pleurodesis.

In the past, there was concern about the possibility that asbestos in talc could lead to the development of malignant mesothelioma. However, Lange et al, 1988 (29) studied 114 patients 22-35 years after talc pleurodesis for spontaneous pneumothorax and found no patients with mesothelioma and they concluded that no evidence to suggest that an increase risk of cancer exists in those who undergo talc pleurodesis.

The present study shows that the intrapleural injection of 3-g talc slurry through a chest tube is an effective and safe treatment for patients of symptomatic hepatic hydrothorax, not responding to medical treatment and repeated thoracocentesis, but not without some adverse effects. Fever is to be expected. Pain is a common adverse effect but almost of mild degree. Also there is a risk of development of empyema as it is a recognised complication of thoracocentesis and thoracostomy. We believe that the problem of respiratory failure can be avoided by the use of low-dose talc.

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Colon Interposition for Operable Cancer Oesophagus

Abstract

From the beginning of 1993 till the end of 1995, 16 patients with operable cancer oesophagus underwent total transhiatal oesophagectomy (THE) followed by retrosternal colon interposition (RCI). Their age ranged from 31-65 years with male to female ratio of 3:1.

Six patients (37.5%) had previous history of splenectomy. The left colon was used in all patients being isoperistalic in 14 patients (87.5%) and antiperistaltic in two (12.5%). Hospital mortality was 18.75% (3 patients). Morbidity included pneumothorax (18.75%), cervical leakage (37.5%), wound sepsis (18.7%), burst abdomen (6%) and pulmonary complications (37.5%). No case of undue bleeding or recurrent laryngeal nerve paralysis were encountered. 76.9% of the survivors regained good swallowing function and 23.1% had fair results.

It was concluded that THE followed by RCI is suitable and safe oespohageal substitute after resections for patients with operable cancer oesophagus.

Khaled Karara, MD and Ahmed Saleh, MD

J. of Egypt. Society of Cardio thorac. Surg. 1996, Vol. IV April No 2

Introduction

Following resection of operable cancer oesophagus reconstruction of the swallowing ability could be done using stomach, colon or jejunum. The first use of the transverse colon as oesophageal substitute is credited to Kelling in 1911.(1) However the result of colon interposition were not encouraging till the late 70's when low mortality rate and low incidence of colon necrosis were reported. (2,3) Since then, the enthusiasm to the use of colon is increasing to be the substitute of first choice in non-malignant conditions as lye burns of the oesophagus.(4)

In the present status, in malignant conditions, the colon is the substitte of choice when the stomach could not be used. (4,5). Yet, there are reports of its use as first choice substitute in patients with operable cancer oesophagus including this study. (6,7,8)

Material and Methods

In this study, 16 patients with operable cancer oesophagus underwent from January 1993 till December 1995 total transhiatal blunt oesophagectomy (THE) followed by retrosternal colon interposition (RCI).

For each patient thorough history taking, clinical examination, necessary laboratory in-

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vestigations, oesophagograms and oesophagoscopy with biopsy were done. Bronchoscopy, ultrasonography abdomen and CT scan chest were done as indicated to stage the disease and exclude manifestations of inoperability. The criteria of inoperability used in this study are summarized in Table I. Inoperability was sometimes not detected except after exploratory laparotomy performed in the start of operation or during THE and such patients were excluded from this study.

Preoperative preparation of the patient included correction of malnutrition and dehydration by tube feeding or hyperalimentation. Hyperalimentation was found to reduce mortality and morbidity for patients with cancer oesophagus. (9,10) Colon preparation was started two days prior to surgery by giving liquid low residue diet. Repeated high cleansing enemata were done the day prior to surgery. Antibiotic prophylaxis using 1 gr oral neomycin was given t.d.s. the day before operation. A broad spectrum antibiotic a cephalosporin, was given one hour before surgery and every six hours for 24 hours. Continuing antibiotics for longer periods was done when indicated e.g. associated pulmonary problems. Chest physiotherapy and correction of associated medical problems were done routinely.

General endotracheal anesthesia using a cuffed tube was done. The patients were connected to the monitoring lines which included non-invasive blood pressure and pulse oximetry.

An abdominal midline incision from the xiphoid till the umbilicus was done. Abdominal exploration was started to assess operability and to inspect the colon and its vasculature. If signs of inoperability were detected, either intubation or palliative retrosternal colon bypass (RCB) without THE was done. (11) If operability was decided, the cervical incision along the anterior border of left sternomastoid muscle was started for mobilization of the oesophagus. THE was started. (12-15) The oesophageal diaphragmatic hiatus was enlarged and the oesophagus was dissected from below then from above. With the surgeon's hand in the mediastinum, the anaesthetist and the surgeon should keep an eye on the patient's pulse and blood pressure. This step was sometimes associated with marked drop in the pressure due to cardiac compression against the sternum and should be done intermittently. The oesophagus was then cut from above and withdrawn downwards. It was then cut from below with a safety margin that may necessitate upper partial gastrectomy. The colon was then mobilized and the segment was selected to be based on left colic or middle colic vessels. A suitable length of colon was chosen. The retrosternal tunnel was dissected and a silk suture was passed through it. The colonic segment was passed posterior to the stomach and withdrawn up into the tunnel. The oesophago-colic anastomosis was done by outer seromusclar interrupted 3/0 silk and inner 3/0 continuous chromic catgut or vicryl sutures. The cologastric anastomosis was done to the

Table 1: Criteria of Inoperability.

General	Advanced age, cardiopulmonary problems, chronic illness, marked cachexia.
Local	Tracheo-oesophageal fistula, marked local infiltration. Primary tumours more than 10 cm.
Metastatic	Lymphatic or blood stream

anterior aspect of mid-stomach by outer continuous seromuscular 3/0 silk and inner continuous 3/0 chronic catgut or vicryl sutures.

The colo-colic anastomosis was then started by outer seromuscular 3/0 silk continuous sutures and inner 3/0 chronic catgut or vicryl continuous mucosal sutures. The colonic mesentery was closed to avoid occurrence of internal herniation. Pyloroplasty or pyloromyotomy and gastrostomy were routinely done. The cervical incision was closed with a drain and the abdominal incision without. The chest was thoroughly auscultated for pneumothorax and intercostal tube drainage was done if pneumothorax was found.

Postoperatively, the patients were monitored and fluid charts for intake and output were followed. X-ray chest was done routinely on arrival to the ICU and later on when required. Gastrostomy feeding was started from the fourth postoperative day. The cervical drain was removed about the same time. About the tenth postoperative day, gastrographin study was done to detect any cervical leakage. If no leakage was present, fluids were allowed orally, otherwise gastrostomy feeding was continued till complete closure of the salivary fistula.

Results

The age of the 16 patients studied ranged from 31-65 years. Those between 50-60 years represented 50% of the cases. The male to female ratio was 3:1.

Dysphagia was present in all patients. The duration of dysphagia ranged from 1-6 months and the commonest was three months.

Following barium study and oesophagoscopy, two patients (12.5%) had upper third tumours, six patients (37.5%) had middle third tumours and eight patients (50%) had

lower third tumours. The lesion was in the form of a mass in eight patients (50%), malignant ulcer four patients (25%) or stenotic lesion four patients (25%). Histopathologically, ten cases (62.5%) were squamous cell carcinomas, five cases (31.5%) were adenocarcinomas and one case (6%) anaplastic carcinoma (Fig. 1,2,3,4).

Clinical examination and investigations including ultrasonography abdomen, CT scan and bronchoscopy were used to detect signs of inoperability in the patients studied. Patients found to be inoperable on exploratory laparotomy performed in the initial steps of operation or during THE were excluded from the study.

Previous history of splenectomy with or without devascularisation for portal hypertension was present in six patients (37.5%).

Operative technique:

For all the patients, THE was done followed by RCI using the left colon. In 14 patients (87.5%) the colon was isoperistaltic based on left colic vessels, and in two patients (12.5%), it was antiperistaltic based on middle colic vessels. During THE, two cases were encountered with local fixed infiltration of the tumour to the surrounding prevertebral muscles, aorta, trachea or pericardium. For these cases, palliative RCB was done without THE and the two cases were excluded from this study. Intraoperatively, no undue bleeding was encountered from the THE. No case required splenectomy due to accidental injury.

The proximal colonic anastomosis was to the oesophagus in 15 cases and to the pharynx in one case. The distal anastomosis was to the anterior mid-stomach in all the cases. Pyloroplasty was done for 13 patients and pyloromyotomy for 3 patients. The mean operative time was 3.5 hours (range 3-4 hours).

Post-operative period:

Morbidity:

1. Pneumothorax: Two on the left and one on the right (18.75%) were diagnosed in the operating room at the end of the procedure in two cases and on arrival to the recovery room in one patient. It was managed by intercostal tube drainage for two to three days.

2. Cervical anastomotic leakage (salivary fistula): Occurred in five cases (37.5%). Gastrostomy feeding, and stoppage of oral intake with frequent dressing resulted in a spontaneous closure of the fistula in all cases. The time of fistula closure ranged from 2-8 weeks with a mean of 25 days.

3. Wound complications as wound sepsis in three patients (18.7%) and burst abdomen in one patient (6%).

4. pulmonary complications including aspiration, bronchopnemonia, atelectasis and wheezy chest occurred in five cases (37.5%).

5. Other complications common with major operations included:

- One patient with history of previous bilateral renal operations developed progressively increasing blood urea and

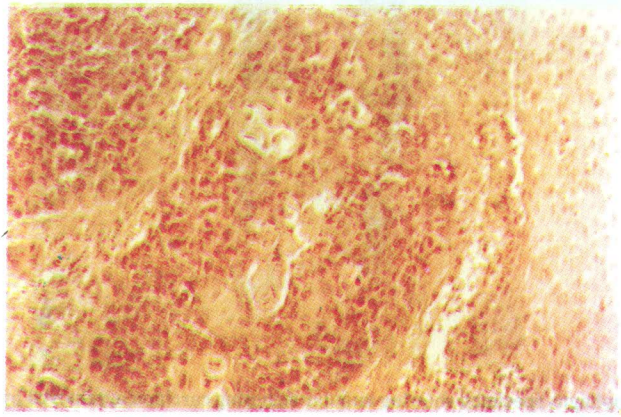

Fig. 1: A well differentiated squamous cell carcinoma of the oesophagus with well organized nests with Keratin whorls (H & E stain).

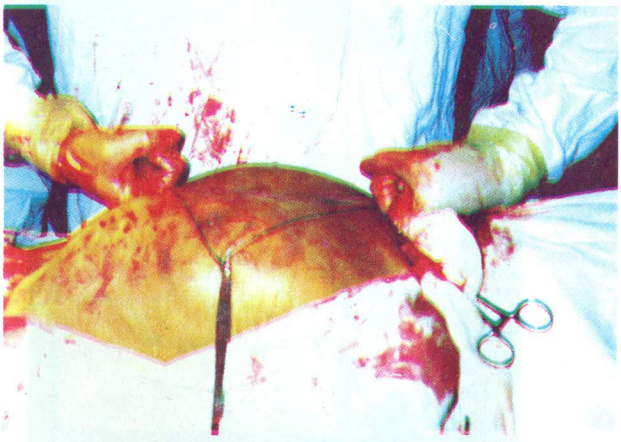

Fig. 2: The retrosternel tunnel dissected and ready to pass the mobilized colon through it.

Fig. 3: Total oesophagns specimen showing annular stenosing carcinoma, removed by blunt total oesophagectomy technique. (Formalin-fixed Specimen).

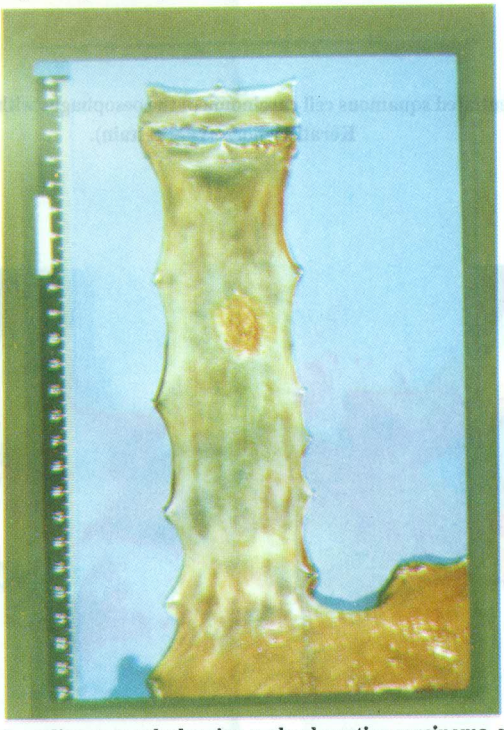

Fig. 4: Total oesophagus and cardiac stomach showing early ulcerative carcinoma, removed by blunt total oesophagectomy technique (Fiesh specimen).

serum creatinine and was maintained on regular dialysis.

- Deep vein thrombosis occurred in one patient and required heparinization.

- Cardiac arrhythmias in two patients.

NB: No case of recurrent laryngeal nerve paralysis was encountered.

Mortality:

Three patients died (18.75%), two in the first two postoperative days from sudden cardiopulmonary insult and one on the fifth day. The latter had severe chest infection and developed burst abdomen. He died after the operation of closure of the burst.

Functional results:

Of the surviving patients, ten patients (76.9%) regained good swallowing function and three patients (23.1%) had fair function.

Discussion

On facing a case of cancer oesophagus, a trial is made to define operability and to stage the disease. (12) For inoperable cases, different modalities are used aiming at palliative restoration of swallowing ability among which are palliative resection and palliative bypass. For the operable cases, curative extirpation of the oesophageal tumour is done followed by the use of suitable oesophageal substitute. Stomach, colon and jejunum pedicled or as free revascularised flaps are the available substitutes for operable or inoperable cases. (4)

Using the colon as an oesophageal substitute have several advantages. The colon, being a tubular structure, does not need to be formed into a tube as the stomach. It is less bulky and has a well defined blood supply. So a low incidence of graft necrosis can be achieved in experienced hands. (4) The colon is also the first choice substitute when the stomach could not be used being removed, the site of disease or when its vasculature is found poor or was accidentally injured during dissection. (4,8) In Egypt where schistosomiasis is prevalent, many of our patients presenting with cancer oesophagus had previously undergone splenectomy with or without a devascularization procedure of the stomach. The stomach will be found fixed by adhesions in its bed and its vasculature is not dependable. This abandoned the use of the stomach after previous splenectomy. (16) More than one third of the cases included in this study had previous splenectomy.

Whether to use the stomach or colon as the first choice substitute is also a matter of surgeons preference. In some centers, as ours, RCI is a frequently practiced procedure after failure of dilatation of lye strictures of the oesophagus. The latter is frequently encountered in our country, for the frequent use of potash for cleansing. (17) So in these centers, surgeons are very well trained on using the colon early in their career and find it easy and safe to apply for patients with cancer oesophagus.

Surgeons preferring colon rather than stomach as a substitute believe in better preservation of the digestive function if the

stomach is left undisturbed. (6) They accuse also the stomach of long-term gastro-oesophageal reflux, possible ulceration and progressive dysfunctional propulsion compared with the colon. (8)

The procedure used in this study adds also the advantages of doing THE. Cancer oesophagus is characterised by submucosal lymphatic spread and for the possibility of multicentricity of the lesion. (18) Doing THE has accordingly an oncologic advantage and ensures that a good safety margin is taken. (19)

In addition, it avoids thoracotomy with its accompanying decrease in operative time, trauma and decrease of post-thoracotomy pain that lasts for months postoperatively. (19) Also, it avoids doing anastomoses in the chest with almost a fatal outcome when leakage occurs. (12,19) In this study for example, all the cervical leakages closed spontaneously with zero mortality. Doing gastrostomy as a routine in this study allowed early resumption of tube feeding post-operatively even if cervical leakage occurs. This obviates the use of the more expensive hyperalimentation in case of leakage.

Placing the colon in the retrosternal route rather than the transpleural or posterior mediastinal route adds another advantage. It leaves the posterior mediastinal space free for irradiation for any residual tumour cells that may be left. (12) This obviates the risk of exposing the interposed colon to the risk of irradiation colitis, stricture formation and colo-respiratory fistulae. (20) Also, placing the colon away from the original tumour bed avoids the possible risk of regrowth of residual tumour tissue to invade and obstruct the colon. (12)

On the other hand, RCI has the disadvantage of performing three anastomoses. (5,6) If this is viewed from the point that it is time consuming, it should not be forgotten that it conserves the time for opening and closing the chest and the time for refashioning the stomach into a tube. The time factor is also minimised in experienced hands. (7) However, if it is viewed from the point that each anastomosis of the three is liable to early leakage and later stenosis, the following should be considered. In this study and our previous experience and that of others, no single case of leakage from the cologastric or colocolic anastomosis was reported. (5-8, 11) Leakage in the oesophago-colic anastomosis, if it occurs, is rather benign compared with oesophago-gastric leakage in the chest after classical oesophagogastrectomy. If strictures occur in the oesophagocolic or cologastric anastomosis, they are amenable to dilatation. (8) If the latter failed, the position of the two anastomoses is more easily accessible for refashening compared with an intra-thoracic oesophago-gastric anastomosis. Also, no single report of stricture of the colocolic anastomosis was found in our experience and many others. (5-8,11)

The critics of THE have argued the following disadvantages to the procedure: (1) Avoidance of adequate exposure, with improper haemostasis being a blind procedure

and (2) Avoidance of complete mediastinal lymph node dissection, hence the patient is denied both the benefits of accurate tumour staging and en block cancer dissection. (12,13) So, it is considered as offering the best "palliation" with the least morbidity for patients with "resectable" tumours. (12)

Concerning the first criticism, many surgeons are believing now that THE is a safer alternative to transthoracic resection. (13,14) This is especially so with improvement of the learing curve of the team. The average blood loss in the big series was less than one litre. (13,14) To avoid serious bleeding, it is advisable to abandon the blind procedure if excessive fixation of the tumour to the nearby structures was found and to do thoracotomy for such cases (13), or palliative RCB without THE as done in this study.

Concerning the second criticism of oncologic disadvantage of not performing en block dissection of the lymph nodes, several points should be considered. Most of the cases requiring oesophagectomy, about 90% in some series, are advanced in stages III and IV when first seen. (13) The procedure is performed to offer the best palliation for the resectable tumour. (12)

For the remaining earlier cases, better dissection and exposure of upper third tumours with the surrounding lymph nodes can be performed through a partial median sternotomy. (21) Also, in lower third tumours lower mediastinal lymph nodes could be dissected by incising the diaphragm. (22) The point of controversy lies in middle third tumours, where thoracotomy is required for block dissection of mediastinal lymph nodes. However, some authors accuse such dissection of being incomplete because it is quite difficult to approach areas as left para-tracheal region from a right thoracotomy, needing accordingly bilateral thoracotomy which is not feasible. (23,24) Also, to be complete a bilateral lower neck dissection and upper perigastric node dissection should be included in each case which complicate much the procedure (25). In addition, many surgeons regard an oesophageal cancer that infiltrates regional lymph nodes as being a systemic disease, and the patient dies more of systemic metastases rather than local recurrences. (26) A possible alternative was the administration of chemotherapy and irradiation before THE. (27) After such course the tumour gets more limited to the oesophagus and in some cases even not detectable during oesophagectomy. (13,27) Finally, no difference in long-term survival was found between patients with THE and those after thoracotomy. (28)

Some technical points are of importance to decrease post-operative morbidity and mortality after this procedure. Hyperalimentation in preoperative preparation of the patients was found important. (9,10) Meticulous care should be directed to closure of the mesenteric rent of the colon to avoid internal herniation and intestinal obstruction postoperatively. More liberal use of prophylactic tension sutures for closure of the laparotomy

is recommended especially in malnourished patientss with weak musculature especially in the presence of chest troubles exposing the patient to frequent coughing episodes post-operatively. This helps to decrease the liability of burst abdomen with its associated morbidity and mortality as reported in this study. Finally, some authors to avoid problems of pneumothorax that may amount to mortality perform bilateral prophylactic intercostal tubes. (16) However, in this study, it is recommended just to put the patient under strict observation for this problem on the operating table and postoperatively and to put a tube only when and on the side it develops. Those preferring the use of stomach have accused the colon for long-term functional problems namely; redundancy of the graft, delayed emptying, nocturnal regurgitation and aspiration. (13) These are avoided by proper measuring of the required length of the colon avoiding redundancy and all these functional disadvantages decrease with improvement of the learning curve of the operating team.

In this study, pyloromyotomy or pyloroplasty was performed for all patients to improve gastric emptying since vagotomy is performed with THE. To perform a drainage procedure is also the opinion of other authors. (29)

From the foregoing, it was concluded that RCI using the left colon is a suitable oesophageal substitute after resection in patients with operable cancer oesophagus. It can be used when the stomach can not be used or as a primary choice.

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G. Total oesophagectomy without thoracotomy for cancer. Am Surgeon 1987; 53: 587-91.

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INTERNET

REVIEW ABSTRACTS

THORACOSCOPY "1990-1995"

Video-assisted thoracic surgical repair of a foramen of Bochdalek hernia.

Silen-ML: Canvasser-DA; Kurkchubasche-AG; Andrus-CH; Naunheim-KS

Ann-Thorac Surg. 1995 Aug; 60(2): 448-50

A case report of a congenital posterolateral diaphragmatic hernia in an adolescent is presented and a technique for thoracoscopic repair of bochdalek hernia is described. postoperative discomfort was minimal and the hospital stay was less than 24 hours. Video-assisted thoracic surgery may be the technique of choice for repair of certain congenital diaphragmatic hernias when identified after infancy.

Legionella pericarditis diagnosed by direct fluorescent antibody statining.

Puleo--JA; Matar-FA; McKeown-PP; Conant-P; Basta-LL

Ann-Thorac-Surg. 1995 Aug; (60(2): 444-6

Legionella pericarditis is a rare and serious manifestation of Legionnaire's disease. A case is presented in which the diagnosis was established by direct fluorescent antibody staining on a pericardial tissue specimen. Video-assicted thoracopy was used safely and effectively in diagnosis and management in this case.

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Vol. IV, No 2
April 1996

Thoracoscopic excision of a posterior mediastinal "dumbbell" tumor using a combined approach.

Heltzer-JM; Krasna-MJ; Aldrich-F; McLaghlin-JS

Ann-Thorac-Surg. 1995 Aug; 60(2): 431-3

Up to 10% of neurogenic tumors in the posterior mediastinum demonstrate intraspinal extension. Historically, these lesions have been considered resectable only by a combined thoracic and neurosurgical approach using thoracotomy. Herein, a thoracoscopic excision of a "dumbbell" lesion within the framework of a combined approach is described.

Thoracoscopic resection of pulmonary metastases [letter]

Yim-AP

(BIBLOGRAPHIC CITATION): Chest. 1995 Aug; 108(2): 587

Thoracoscopic pericardiectomy.

Krasna-M; Fiocco-M

Surg-Laparosc. 1995 Jun; 5(3): 202-4

A new technique for pericardial resection is described using thoracoscopy. With the advent of newer videolaparscopic techniques allowing better visualization and the use of new endoscopic staplers, a whole spectrum of surgical procedures can now be performed through the thoracoscope.

Thoracoscopy: anesthetic considerations.

Walker-T; Bensky-KP
AANA-J. 1995 Jun; 63(3): 217-24

Thoracoscopy is a surgical procedure which was performed in the early 1900s primarily for the treatment of tuberculosis until antibiotics became the treatment of choice. Over the last two decades, thoracoscopy has experienced a rebirth as the biotics as the indications for this endoscopic procedure have became numerous. Although less invasive than the thoracotomy, thoracoscopy is not without potential complications. The anesthesia provider must be alert for problems related to one-lung ventilation, lateral positioning, and pleural cavity insufflation. The anesthetic technique must be planned with the physiological changes which occur during thoracoscopy in mind.

A Survey of South African Endoscopic Surgical Practice.

Warren-BL; Bornman-PC
S-Afr-J-Surg. 1995 Mar; 33(1): 6-9

To coincide with the first annual meeting of the South African Society of Endoscopic Surgeons (SASES), a postal survey of the endoscopic surgical practices of 98 registered specialist surgeons was undertaken. A response rate of 73.5% was achieved, and 94.5% of respondents had personally performed endoscopic surgical procedures.

Cholecystectomy (4, 557) was the most commonly performed endoscopic surgical procedure and was associated with postoperative mortality rate of 0.13% and morbidity of 3.5%. Twelve bile duct injuries were reported (0.26%). In descending order of frequency, other procedures reported were diagnostic laparoscopy (1,404), dorsal sympathectomy (412), appendicectomy (396), injuinal hernia repair (146), anti-reflux procedures (83) and diagnostic thorascopy (51). No postoperative deaths were recorded and complication rates varied from zero for diagnostic thoracoscopy to 4.8% for injuinal repair and anti-reflux procedures. The selected sample of South African surgeons canvassed appears to have adopted endoscopic surgical techniques with enthusiasm and with complication rates that compare favourably with those reported elsewhere.

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Video-Assisted Thoracic Surgery [letter]

Allen-MS; Deschamps-C; Trastek-VF; Pairolero-PC

Mayo-Clin-Proc. 1995 Aug; 70(8): 811-2

Early experience with videothoracoscopic hydrodissection pleurectomy in the treatment of malignant pleural effusion.

Harvey-JC; Erdman-CB; Beattie-EJ

J-Surg-Oncol. 1995 Aug; 59(4): 243-5

Parietal pleurectomy is our preferred procedure for management of malignant pleural effusion. However, the morbidity of a major thoracotomy has precluded all but highly selected patients from the conventional (open) procedure. Recently, we have been able to perform parietal pleurectomy by means of a video-assisted, thoracoscopic technique. We have retrospectively analyzed the results of this procedure performed on 11 patients between March 1993 and February 1995. These patients ranged in age from 40 to 87 years of age, with a mean age of 61.5 years. Primary tumors were non-small cell lung cancer (5), breast cancer (4), mesothelioma (1), and unknown (1). There was one operative mortality (9.1%). All were relieved of symptoms of pleural effusion. Median survival was 128 days. Early experience indicates we are accomplishing an operation equivalent to that formerly performed by "open" technique. If continued results are similar to our initial experience, we will be able to offer this superior palliation of malignant pleural effusion to a wider range of patients.

VATS: quo vadis? [editorial; comment]

Rusch-VW

J-Am-Coll-Surg. 1995 Aug; 181(2): 165-7

The safety and versatility of video-thoracoscopy: a prospective analysis of 895 consecutive cases [see comments]

DeCamp-MM Jr; Jaklitsch-MT; Mentzer-SJ; Harpole-DH Jr; Sugarbaker-DJ

J-Am-Coll-Surg. 1995 Aug; 181(2): 113-20

The application of video-endoscopy to general thoracic surgery is radically changing the approch to many benign and malignant diseases of the chest. Since July 1991, we have performed 794 purely thoracoscopic and 101 video-assisted thoracic surgical (VATS) procedures on 860 patients. STUDY DESIGN: Comprehensive, prospectively acquired data examining the specific indications for and outcomes of this new technique were prospectively entered into a thoracic surgical database. Preoperative, intraoperative, postoperative, and outcome variables were studied for the entire group as well as three high-risk cohorts: age over 70 years (n=198), forced expiratory volume in one second (FEV1) of less than 1 L (n=46), and Karnofsky performance index of less than 8 (n=61).

RESULTS: The 895 cases involved 449 men and 446 women of ages 15 to 89 years (mean 56 ± 16 years standard deviation). The indications for surgery were diagnostic in 501 cases (56 percent), therapeutic in 244 cases (27 percent), and both diagnostic and therapeutic in an additional 150 cases (17 percent). The specific procedures performed were operations on the lung (569 cases), pleura (196 cases), esophagus (42 cases), mediastinum (51 cases), and pericardium (37 cases). Fifty-seven percent of the procedures were for a malignant process and 43 percent were for benign or infectious pathology. There were nine deaths for a series, operative mortality rate of 1.0 percent. Thirteen patients (1.4 percent) required conversion to a limited thoracotomy for technical reasons. There were 127 complications in 121 patients yielding a morbidity rate in all patients of 14 percent. Mortality rates in the elderly, poor lung function, and depressed performance index cohorts were 1.5, 2.1, and 9.8 percent, respectively. Morbidity rates in these high-risk populations were 19, 30, and 18 percent, respectively. The median postoperative length of stay was three days after closed thoracoscopy and five days after VATS resection. CONCLUSIONS: These data underscore the flexibility, safety, efficacy, and potential for cost savings of videoscopic surgery in patients with thoracic diseases. The ability to perform excisional biopsy improves diagnostic specificity and sensitivity to nearly 100 percent. Video-assisted thoracic surgical techniques also offer a minimally invasive procedure with acceptable risk to patients heretofore inoperable by standard thoracotomy.

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Neck radionuclide scanning: a pitfall in parathyroid localization.

Rantis-PC Jr; Prinz-RA; Wagner-RH
Am-Surg. 1995 Aug; 61(8): 641-5; discussion 645-6

Radionuclide parathyroid scans are widely used to localize abnormal parathyroid glands. They are especially valuable for identifying ectopic glands, including those in the mediastinum. Two patients with hyperparathyroidism who had mediastinal glands that were not identified because only the neck was scanned prompted our review of the technique of parathyroid scanning at hospitals in our region and of the frequency of mediastinal parathyroid glands identified by scanning at our own institution. The nuclear medicine departments at 72 area hospitals were surveyed. Parathyroid scans were performed at 51 of these hospitals but only 13 (25%) routinely scanned the mediastinum and chest. At our institution 480 parathyroid scans were performed during a 9-year period. Twenty-six mediastinal parathyroid glands were identified by routine scanning of both the neck and mediastinum. Most of these glands could be removed through a cervical incision. However, four required formal thoracotomy and two thoracoscopy. CONCLUSIONS: A radionuclide parathyroid scan limited to the neck is an incomplete study. Scans that do not include the thorax will miss mediastinal glands that occurred in 5 per cent of the patients in our series. Despite this, radionuclide parathyroid scanning was limited to the neck in 75 per cent of surveyed hospitals.

This practice increases the chance for failed surgical exploration and increases potential patient morbidity.

Prolonged interval jet ventilation. An alternative ventilation technique for patients with problematic cardiopulmonary pathophysiology.

Conacher-ID
Anaesthesia. 1995 Jun; 50(6): 518-22

The initial clinical experience of using a technique of prolonged interval jet ventilation is reported. Periodic pulses, of from three to nine breaths, were delivered in rapid sequence from a jet ventilator during one-lung ventilation. The expiration phase was free to atmosphere, without added artificial expiratory assist or resistance, and of from 30 to 50 s duration before delivery of the next pulse of jet ventilation. The aim of the technique

was to evaluate during anaesthesia the practicalities of securing a prolonged period during which intrathoracic pressure is low and hence optimal for venous return and deflation of pathological pulmonary regions with long time constants. The system used is flexible enough to allow for conventional positive pressure techniques to be applied if necessary. As the gas delivery was of high concentration, episodes of hypoxaemia were minimal in this group of high risk patients and due to technical rather than physiological causes. The delivery of a minute volume adequate to prevent hypercapnia was not always possible and the technique may be contraindicated in those conditions in which a raised carbon dioxide concentration is disadvantageous.

Vats lobectomy with mediastinal lymph node sampling or dissection.

MacKenna-R Jr
Chest-Surg-Clin-N-Am. 1995 May; 5(2): 223-32

With a thoracoscope for visualization, a lobectomy with mediastinal node dissection can be accomplished with standard thoracotomy instruments through a 6-cm incision without spreading the ribs. This article describes the indications, contraindications and technical details of this procedure.

Thoracic incisions.

Fry-WA
Chest-Surg-Clin-N-Am. 1995 May; 5(2): 177-88

There are many ways to gain access to the chest. In recent years, there has been a rediscovery of the clamshell incision, an evolving concent of the utility incision for video-assisted thoracic surgery (VATS), and a continued emphasis on the importance and usefulness of the muscle-sparing axillary thoracotomy, which continues to be the author's most frequently used incision.

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Video-assisted thoracoscopy in the management of recurrent spontaneous pneumothorax.

De-Giacomo-T; Rendina-EA; Venuta-F; Ciriaco-P; Lena-A; Ricci-C

Eur-J-Surg-. 1995 Apr; 161(4): 227-30

To present our experience of video-assisted thoracoscopy in the historical control group treated by lateral thoracotomy. DESIGNGN: prospective evaluation with historical controls. SETTING: Teaching hospital, SUBJECTS: 41 Patients with recurrent spontaneous pneumothorax, 20 of whom were treated by video-assisted thoracoscopy and 21 of whom underwent lateral thoracotomy (historical control group). MAIN OUTCOME.

MEASURES: Duration of chest drainage, length of hospital stay, amount of narcotic analgesia required, postoperative complications, and recurrence during follow up. RESULTS: The mean (range) duration of chest drainage in the group who underwent video-assisted thoracoscopy was 5 days (4-7) compared with 7 days (4-13) in the control group; the corresponding figures for length of hospital stay were 6 days (4-8) compared with 10 days (5-16). 3 Patients (15%) in the thoracoscopy group, and 2 (10%) developed minor complications compared with 5 (24%). The mean length of follow up was 9 months (range 1-18) compared with 26 months (19-34), and no patient in either group developed a recurrence. CONCLUSION: Our early results of treating recurrent spontaneous pneumothorax with video-assisted thoracoscopy have been encouraging, and we have adopted it in preference to lateral thoracotomy.

"Homemade" knot pusher for extracorporeal ties.

Yim-AP; Lee-TW

Aust-N-Z-J-Surg. 1995 Jul; 65(7): 510-1

We describe a 'homemade' knot pusher modified from a conventional right angle dissector for extracorporeal ties. The knot pusher has the advantage of allowing the operator to control the tension applied to the structure to be ligated. The instrument can be made with simple tools and its use can be easily learnt. We have used this device in 10 video assisted thoracoscopic lobectomies (over 100 applications on pulmonary vascular structures) without complications. This device can also be used in 'open' surgery when knot tying is needed through a deep wound.

Intrapulmonary lymph nodes in the differential diagnosis of solitary pulmonary nodules: case report and review of the literature.

Hendriks-J; Van-Schil-P; Corthous-B; Van -Meerbeeck-J; Ramael-M; Vanmaele-R; Van-Marck-E; Eyskens-E

Acta-Chir-Belg. 1995 May-Jun; 95(3): 130-2

A 49-year-old man was admitted for further investigation of a coin lesion with a diameter of 1 cm. He was a heavy smokee with no professional exposure. Since the percutaneous needle biopsy did not yield a definitive diagnosis, a thoracoscopy was performed. The solitary pulmonary nodule was found to be an intrapulmonary lymph node with anthracosilicotic pigment and and a thoracoscopic wedge resection was performed. A review of the case reports in the period 1961-1993 shows that intrapulmonary lymph nodes could be more frequent than originally thought. All patients were smokers but professional exposure was not a constant finding. The differentional diagnosis and management of the indeterminate solitary pulmonary nodule are discussed.

A new technique for one-lung ventilation during video-assisted thoracoscopic surgical interruption of patent ductus arteriosus in children.

Vakamudi-M; Shenoy-V; Haldar-J; Dixit-M; Bagchi-S; Shetty-D

J-Thorac-Cardiovasc-Surg. 1995 Jul; 110(1): 273-4

From the neck to the lung: pneumothorax caused by a lost needle.

Reinmuth-N; Forster-R; Scheld-HH

Eur-J-Cardiothorac-Surg. 1995; 9(4): 216-7

The case of a 29-year-old man with a left-sided pneumothorax caused by an injection needle in the lung is presented. The needle had been lost 3 months previously during an attempt to inject heroin into the left jugular vein. With axillary limited thoracotomy after attempted thoracoscopy, the needle was finally found in the left upper lobe of the lung, most probably causing the pneumothorax. At least no other pathologies of the lung

were detected and, after surgery, no further pneumothorax occurred. The case is discussed in relation to similar cases described in the medical literature.

Primary spontaneous pneumothorax treated by video assisted thoracoscopic surgery-results of intermediate follow up.

Yim-AP; Ho-JK; Lai-CK; Chan-HS
Aust-N-Z-J-Med. 1995 Apr; 25(2): 146-50

BACKGROUND: Primary spontaneous pneumothorax (PSP) is a common clinical condition associated with high recurrence if no definitive treatment is given and could be life threatening if left untreated. The best treatment for this condition, however, remains controversial. AIMS: A prospective study of patients with PSP treated by video assisted thoracoscopic surgery (VATS) after a mean follow up of 16 months. METHODS: Between September 1992 and April 1994, 114 VATS procedures were performed on 110 patients with PSP (including four patients with bilateral presentation) by one surgical team from a single institution. Mechanical pleurodesis with Marlex mesh was performed on all patients. In addition, apical bullae were identified in 100 cases (88%) and these were resected. RESULTS: There was no mortality. The median hospital stay was three days. The procedure was well accepted by patients and this was reflected subjectively in a visual analogue scale and objectively in the requirement of postoperative analgesia. Complications included one wound infection, one bleeding, eight persistent air leaks over ten days. We had two failures with recurrence of pneumothorax occurring one week and two months postoperatively (mean follow up of 16 months). Late morbidity with intercostal neuropathy was identified in nine patients but only two of them required oral analgesics. CONCLUSION: VATS is a quick and effective treatment for PSP. We currently recommend VATS for patients with recurrent spontaneous pneumothorax, as well as first time pneumothoraces associated with tension, bilaterality, frequent travelling, unreliable follow up and persistent air leak over three days.

Diagnosis by video-assisted thoracoscopy of traumatic pericardial rupture with delayed luxation of the heart: case report.

Thomas-P: Saux-P; Lonjon-T; Viggiano-M; Denis-JP; Giudicelli-R; Ragni-J; Gouin-F; Fuentes-P

J-Trauma. 1995 Jun; 38(6): 967-70

Isolated pericardial rupture is probably a frequently overlooked injury. We present a case of delayed heart herniation through a left pericardial tear resulting from blunt trauma. Diagnosis was achieved by video-assisted thoracoscopy, which was also helpful in the selection of the appropriate site and extent for the thoracotomy incision.

Endoscopic transthoracic sympathectomy: an efficient and safe method for the treatment of hyperhidrosis.

Drott-C; Gothberg-G; Claes-G

J-Am-Acad-Dermatol. 1995 Jul: 33(1): 78-81

BACKGROUND: Hyperhidrosis of the palms, axillae, and face has a strong negative impact on the quality of life for many persons. Existing nonsurgical therapeutic options are far from ideal. Definitive cure can be obtained by upper thoracic sympathectomy. The traditional open surgical technique is a major procedure; few patients and doctors have found that risk-benefit considerations favor surgery. Endoscopic minimal invasive surgical techniques are now available. OBJECTIVE: We investigated whether endoscopic ablation of the upper thoracic sympathetic chain is efficient and safe in the treatment of hyperhidrosis. METHODS: We treated 850 patients with bilateral endoscopic transthoracic sympathectomy. RESULTS: There was no mortality or life-threatening complication. Nine patients (1%) required intercostal drainage because of hemothorax or pneumothorax. Treatment failure occurred in 18 cases (2%) and symptoms recurred in 17 patients (2%). At the end of follow-up (median, 31 months) 98% of the patients reported satisfactory results. CONCLUSION: Endoscopic transthoracic sympathectomy is an efficient, safe, and minimally invasive surgical method for the treatment of palmar, axillary, and facial hyperhidrosis.

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Inadequacy, mortality, and thoracoscopy [letter]

Walsh-GL; Nesbitt-JC

Ann-Thorac-Surg. 1995 Jul; 60(1): 233

One hundred consecutive cases of video-assisted thoracoscopic surgery for primary spontaneous pneumothorax.

Yim-AP;Ho-JK

Surg-Endosc. 1995 Mar; 9(3): 332-6

We reviewed our experience on video-assisted thoracoscopic surgery (VATS) from our first 100 cases of primary spontaneous pneumothorax (PSP) performed at our institution from September 1992 to January 1994. Apical bullae were identified in 87% of cases. Mechanical pleurodesis with Marlex mesh was performed on all patients. Excision with endoscopic staple cutter was performed in 69 cases; an endoloop was used in five cases; ablation with an argon beam coagulator (ABC) was done in six cases; excision with endoscopic suturing occurred in seven cases and mechanical pleurodesis alone was used in 13 cases. The overall median postoperative chest tube duration was 2 days (range 1-25 days) and hospital stay 4 days (range 1-30 days). Complications occurred in 8 cases (8%): 1 wound infection; 1 chest wall bleeding; and 6 persistent air leaks which lasted for more than 10 days (one of which eventually required an axillary thoracotomy for control) Procedure failure with recurrence occurred in three cases (3%) at a mean follow-up of 17 months (range 8-24 months). The ABC group alone was responsible for one recurrence and two persistent leaks. We conclude that with the VATS approach in the treatment of PSP, staple resection of apical bullae is quick and most reliable but costly. Endoloop and hand suturing are applicable to selected patients with small and localized bullae and should be further studied, while our limited experience does not favor ABC as the primary treatment modality.

The role of cavitary endoscopy in trauma

Ivatury-RR; Simon-RJ

Surg-Annu. 1995; 27: 81-97

A non-muscle-relaxant technique for video-assisted thoracoscopic thymectomy in myasthenia gravis [letter]

Chan-MT; Ng-SK; Low-JM

Anaesth-intensive-care. 1995 Apr; 23(2): 256-7

Diagnosis and management of malignant pleural effusions.

Fenton-KN; Richardson-JD

Am-J-Surg. 1995 Jul; 170(1): 69-74.

Approximately half of all patients with metastatic cancer develop malignant pleural effusions. Because the patients are already terminally ill, these effusons can present significant diagnostic and therapeutic challenges. Symptoms are either present at the time of diagnosis or develop subsequently in virtually all cases. The diagnosis is based on chest radiography followed by thoracentesis or thoracoscopy. Most malignant effusions are exudative and about one third are bloody. Cytology is positive for cancer cells in the intial pleural fluid specimens from 60% of patients who are ultimately shown to have malignant effusions. The remaining 40% require a repeat thoracentesis, pleural biopsy, thoracoscopy, or multiple procedures to prove the presence of cancer. Because the average life expectancy of a patient with a malignant pleural effusion is about 6 months, it is important to obtain a diagnosis expeditiously and formulate a treatment plan that optimizes quality of life. Tube thoracostomy with chemical pleurodesis using doxycycline or bleomycin is the mainstay of current treatment and is about 85% effective.

Videothoracoscopic wedge resection of the lung for the diagnosis of acute rejection in lung transplant recepients.

Hoffmann-H; Bittmann-I; Moroder-E; Reichenspurner-H; Dienemann-H

Transplant-Proc. 1995 Jun; 27(3): 2002-3

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Use of thoracoscopy and a minimal thoracotomy, in mammary-coronary bypass to left anterior descending artery, without extracorporeal circulation. Experience in 2 cases.

Benetti-FJ; Ballester-C

J-Cardiovasc-Surg-Torino. 1995 Apr; 36(2): 159-61

A new surgical approach to mammary-coronary bypasses, to the left anterior descending artery, without the use of extracorporeal circulation, is described here. A minimal left anterior thoracotomy and the use of thoracoscopy are combined in this procedure performed in two patients (54-year-old male and 56-year-old male). Results were excellent: both patients were soon discharged from hospital (3 days patient 1 and 36 hours patient 2). Neither blood nor inotropic drugs were required. New angiographies previous to discharge were done, showing 100% patency of the mammary grafts. Both patients are angina-free. due to its simplicity, and with more experience, this technique could be a good alternative for patients with severe lesions of the left anterior descending artery.

Use of a single lumen endotracheal tube and continuous CO2 insufflation in transthoracic endoscopic sympathectomy.

Wong-RY; Fung-ST; Jawan-B; Chen-HJ; Lee-JH

Acta-Anaesthesiol-Sin. 1995 Mar; 33(1): 21-6

BACKGROUND: Transthoracic endoscopic sympathectomy (TES) is an accepted standard surgical treatment for palmar hyperhidrosis. For anesthetic management, a double lumen endobronchial tube is usually used to deflate the lung on the operative side. Recently we have applied continuous insufflation of carbon dioxide (CO2) into the pleural cavity to merely compress one lung while ventilating both lungs with a conventional single lumen endotracheal tube. METHODS: We have studied 45 patients (ASA I and II) who underwent bilateral TES, Thirty-three were ventilated by single lumen tube and the other 12 by double lumen endobronchial tube with one lung ventilation. In both groups I and II, CO2 was insufflated slowly through the scope to an intrapleural pressure of 20 cm H2O. Both lungs were ventilated with peak pressure of less than 20 cmH2O at tidal volume of 5-12 ml/kg at 10-16 beats/min. RESULTS: In these patients,

no CO2 retention was noted. Oxygenation and cardiovascular stability were maintained and there were no complications. In the double lumen series, we found that oxygen satuation was less uniform and less stable than those in the single lumen series. CONCLUSIONS: It is concluded that the use of single lumen endotracheal tube with continuous insufflation of CO2 in TES is easy, simple and safe.

Video -assisted thoracoscopic lobectomy: a word of caution.

Yim-AP; Ho-JK

Aust-N-Z-J-Surg. 1995 Jun; 66(6): 438-41

Advances in video-assisted thoracoscopic (VAT) surgery allow it to assume an increasingly important therapeutic role. Two successful VAT lobectomies (left upper lobe and right lower lobe) were performed in patients with stage I adenocarcinoma. An 8 cm access minithoracotomy for hilar dissection and subsequent specimen delivery was used. Routine mediastinal node sampling was performed thoracoscopically as would be done conventionally. Video-assisted thoracoscopic lobectomy of the right upper lobe was attempted in another patient but he required emergency conversion to open thoracotomy because of bleeding from mechanical failure of the vascular staple-cutter. Although VAT lobectomy is feasible technically, attention to detail is important when mechanical devices are used to minimize the chance of malfunctioning. Once disaster occurs the surgeon should be capable of dealing with the consequences.

Video-assisted thoracoscopy for closure of a bronchial stump fistula.

Galikowski-M; Kozak-J; Barcikowski-S

Thorac-Cardiovasc-Surg. 1995 Feb; 43(1): 60-1

It is thought that thoracoscopic closure of a bronchial stump fistula is beyond the capabilities of current thoracoscopic techniques. We describe the successful use of thoracoscopy in the therapy of a late right main bronchial stump dehiscence after pneumonectomy and chemotherapy of a stage IIIA adenocarcinoma. We clipped the fistula with a Multifire Endo Hernia Stapler (Auto Suture) and we obtained intraoperative airtight closure of the fistula.

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Initial experience of video assisted thoracoscopic pneumonectomy.

Craig-SR; Walker-WS

Thorax. 1995 Apr; 50(4): 392-5

Preliminary experience of video assisted thoracoscopic pneumonectomy in six patients with bronchogenic carcinoma is described. METHODS--Four left and two right pneumonectomies were performed under video thoracoscopic imaging. Thoracoscopic instruments were passed through two separate stab incisions on the lateral chest wall and a separate 6 cm submammary incision was also created to allow further access for instrumentation and removal of the resected lung. In this initial experience resection was restricted to patients with bronchogenic carcinomas of less than 6 cm in diameter who had no involvement of the mediastinum. RESULTS--There were no operative deaths and no complications attributable to the technique. One patient developed postoperative atrial fibrillation and a small sacral sore and one patient was readmitted with abdominal pain and pyrexia which settled following exclusion of post pneumonectomy empyema. The remaining four patients made a rapid uncomplicated postoperative recovery with less pain and discomfort than that normally associated with a standard posterolateral thoracotomy. Postoperatively the mean (SD) patient controlled morphine consumption was 1.36 (1.90) mg per hour in the first 36 hours compared with the unit mean for open thoracotomy of 1.73 (1.68) mg per hour. The mean linear visual analogue pain score was 15.4 (15.6) in the first 24 hours compared with the unit mean for open thoracotomy of 34.5 (8.5). CONCLUSIONS-Video assisted thoracoscopic pneumonectomy can be performed safely in patients who have stage I and stage II bronchogenic carcinomas, up to 6 cm in diameter, with no mediastinal involvement on mediastinoscopy and thoracic computed tomographic assessment. This technique may result in less postoperative pain and discomfort and should allow a quicker return to normal activities.

Thoracoscopy and video-assisted thoracic surgery in the treatment of lung cancer.

Mentzer-SJ; DeCamp-MM; Harpole-DH Jr; Sugarbaker-DJ

Chest. 1995 Jun; 107(6 Suppl): 298S-301S

The contemporary surgical repertoire for the evaluation and treatment of patients with lung cancer includes the bronchoscope, mediastinoscope, thoracoscope, and standard surgical instrumentation. The recent advances in video optics and the development of endoscopic instruments have significantly expanded the surgical options for patients with lung cancer. Thoracoscopy, or the more inclusive term of video-assisted thoracic surgery (VATS), has been characterized as "minimally invasive" surgery. Thoracoscopy and VATS have decreased operative traumma and facilitated surgical staging prior to neoadjuvant therapy. An ancillary benefit to diminished surgical morbidity is shorter hospital stays with a concomitant reduction in costs to the patient and health-care system. These advantages make VATS ideal for elderly patients or patients with significant comorbidity.

Thoracoscopic staging and surgical therapy for esophageal cancer.

Sugarbaker-DJ; Jaklitsch-MT; Liptay-MJ

Chest. 1995 Jun; 107(6 Suppl): 218S-223S

Esophageal cancer continues to be a major health problem with an associated poor prognosis. New technology is being applied to the staging of this cancer. The new staging system requires assessment of depth of wall penetration and lymph node status prior to resection. To determine penetration and node status with a high degree of accuracy generally requires some combination of chemotherapy, magnetic resonance imaging, endoesophageal ultrasound, and/or surgical staging. Several variables need to be considered in planning the surgical approach to the patient with esophageal cancer: the intent of the surgeon to either cure or palliate, the anatomic location of the tumor, and the method of reconstruction. Surgery is optimal for localized esophageal cancer. Neoadjuvant chemoradiation has increased survival in specific subgroups. Phase 2 trials have shown the safety and efficacy of chemoradiation. Randomized multi-institutional trials are needed to verify the encouraging results of recent phase 2 trials.

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Laparoscopy and thoracoscopy in infants and children.

Pesetski-JR

Semin-Perioper-Nurs. 1995 Apr; 4(2): 146-50

The recent revolution in adult laparoscopic and thoracoscopic surgery is gaining momentum in the pediatric surgery arena. Pediatric general surgeons, urologists, and thoracic surgeons have all reported successes in performing minimally invasive surgery. This article presents a review of the current literature and a status report on current pediatric laparoscopic and thoracoscopic proceures.

Minimizing chest wall trauma in video-assisted thoracic surgery.

Yim-AP

J-Thorac-Cardiovasc-Surg. 1995 Jun; 109(6): 1255-6

Malfunctioning of vascular staple cutter during thoracoscopic lobectomy.

Yim-AP; Ho-JK

J-Thorac-Cardiovasc-Surg. 1995 Jun; 109(6): 1252

Safety and efficacy of video-assisted thoracic surgical techniques for the treatment of spontaneous pneumothorax.

Naunheim-KS; Mack-NJ; Hazelrigg-SR; Ferguson-MK; Ferson-PF; Boley-TM; Landreneau-RJ

J-Thorac-Cardiovasc-Surg. 1995 Jun; 109(6): 1198-203; discussion 1203-4

Video-assisted thoracic surgery has been widely used in the treatment of spontaneous pneumothorax despite a paucity of data regarding the relative safety and long-term efficacy for this procedure. We reviewed 113 consecutive patients (68 male and 45 female

patients, aged 15 to 92 years, mean 35.1) who underwent 121 video-assisted thoracic surgical procedures during 119 hospitalizations from 1991 through 1993. Recurrent ipsilateral pneumothorax was the most frequent indication for surgery and occurred in 77 patients (65%). The most common method of management was stapling of an identified bleb in the lung, which was undertaken in 105 (87%)patients. No operative deaths occurred. Complications included an air leak lasting longer than 5 days in 10 (8%) patients two of whom required second procedures for definitive management. No episodes of postoperative bleeding or empyema occurred. The postoperative stay ranged from 1 day to 39 days (median 3 days, average 4.3 days) and 99 patients (84%) were discharged within 5 days. Mean follow-up was 13.1 months and ranged from 1 to 34 months. Eleven patients (10%) were lost to follow-up. Ipsilateral pneumothorax recurred after five of 121 procedures (4.1%). Twelve perioperative parameters (age, gender, race, smoking history, site of pneumothorax, severity of pneumothorax, operative indications, number of blebs, site of blebs, bleb ablation, method of pleurodesis, and prolonged postoperative air leak) were entered into univariate and multivariate analysis to identify significant independent predictors of recurrence. The only independent predictor of recurrence was the failure to identify and ablate a bleb at operation, which resulted in a 23% recurrence rate versus a 1.8% rate in those with ablated blebs ($p<0.001$). These data suggest that video-assisted thoracic surgery is a viable alternative to thoracotomy for the treatment of recurrent spontaneous pneumothorax. It results in a short hospital stay, low morbidity, high patient acceptance, and a low rate of recurrence.

Localization of small pulmonary nodules for thoracoscopic resection: use of a newly developed hookwire system.

Kanazawa-S; Ando-A; Yasui-K; Tanaka-A; Hiraki-Y

Cardiovasc-Intervent-radiol. 1995 Mar-Apr; 18(2): 122-4

We developed a stainless steel spring hookwire, 0.28 mm in diameter and 10 mm in length, with a 30-cm-long, 5-0 nylon monofilament suture firmly attached to its funnel-shaped end. A 21-gauge, 10-cm long cannula was used as an introducer, and a 24-gauge, 10-cm-long blunt-pointed needle as a pusher. The hookwire was successfully placed into the target pulmonary parenchyma under computed tomography guidance in two patients with a small pulmonay nodule. The attached string served as a clear guide at thoracoscopy. Flexibility of the exposed suture through the skin eased wire management after

placement. No wire dislodgement occurred.

Videoendoscopic procedures in thoracic surgery: technical aspects and report of removal of a mediastinal cyst.

Schwarz-CD; Puschmann-R; Eckmayr-J; Hartl-P; Mayer-KH; Zisch-Rj

Surg-laparosc-Endosc. 1995 Apr; 5(2): 94-9

Current videoendoscopic technology and percutaneous techniques of exposure and dissection have been successfully applied to abdominal surgery with favorable results. Application of this technology to our practice of thoracic surgery is the basis of this report. Video-assisted thoracic surgery was performed in 36 patients for the following indications: Raynaud's syndrome, undefined pulmonary nodule, persisting spontaneous pneumothorax, T1 bronchial carcinoma, and mediastinal cyst. Videoendoscopic surgical procedures were accomplished using double-lumen endotracheal anaesthesia and a percutaneous stapling device. Procedures performed using this technique include thoracic sympathectomy, wedge or keel excision, blebectomy, lung apex stapling, parietal pleurectomy, and dissection of the mediastinal cyst. Median operating time was 45 min (range, 15 to 90 min). Tissue diagnosis was obtained in all patients. Median diameter of excised nodules was 10 mm (range, 7 to 70 mm). There were no operative deaths. The single complication was a prolonged air leak. This new method of thoracic surgery appears to benefit the patients. For us it proved a secure way to perform thoracic surgery. Our case of removal of a benign cyst in the posterior mediastinum shows that video-assisted thoracic surgery has expanding applications in the field of general thoracic surgery.

A comparative retrospective study of thoracoscopy versus thoracotomy for the treatment of spontaneous pneumothorax.

Radberg-G; Dernevik-L; Svanvik-J; Thune-A

Surg-Laparosc-Endosc. 1995 Apr; 5(2): 90-3

Thoracoscopic surgery has been claimed to reduce patient disability, recovery time, and hospital costs compared with open surgery. We analyzed 25 patients who had

undergone thoracoscopic surgery and compared the outcome to 24 patients who had undergone conventional surgery for spontaneous pneumothorax. The thoracoscopic group was able to return to work and daily activities earlier and had less impairment of shoulder movement. There was a loss of sensation corresponding to the dermatomes where the thoracoscopic ports were placed which could have resulted from compression of the intercostal nerves by the instruments. However, a similar loss of sensation was found in the thoracotomy group. We conclude that thoracoscopy may be the method of choice for the treatment of spontaneous pneumothorax, although further methodological development should be done.

Videothoracoscopic resection of a posterior mediastinal tumor.

Saito-A; Yagi-N; Miura-K; Takano-Y

Surg-laparosc-Endosc. 1995 Apr; 5(2): 142-3

We report a complete videothoracoscopic resection of a posterior mediastinal tumor (neurilemmoma) in a 43-year-old man. The tumor was located in the right cupula of pleura and well demarcated. The tumor was mobilized under videothoracoscopic guidance and extracted from the thoracic cavity through a trocar site. The postoperative course was uneventful, and the postoperative pain could be reduced.

Thoracoscopic sympathectomy for Buerger's disease: a report on the successful treatment of four patients.

Ishibashi-H; Hayakawa-N; Yamamoto-H; Nishikimi-N; Yano-T; Nimura-Y

Surg-Today. 1995; 25(2): 180-3

We describe herein the successful treatment of four patients with ischemic ulcers or gangrene of the fingers due to Buerger's disease by thoracoscopic sympathectomy, a new method of surgery which eliminates the difficulties associated with the traditional "open' approaches to the thoracic sympathetic chain such as poor exposure, risk of damage to the adjacent structures, and postoperative pain. After the patients were placed in the lateral decubitus position with unilateral pulmonary ventilation, the thoracic

sympathetic ganglia (T) from the lower third of T1 to T3 were resected endoscopically. The operative results were excellent, with improvement or complete resolution of the ulcer being achieved in all four patients. All of the patients were satisfied with the results in terms of ulcer healing, postoperative pain, and cosmetic appearance. Although a postoperative air leakage developed in one patient with a history of pulmonary tuberculosis, it was successfully treated with an adhesive agent. None of the patients developed Horner's syndrome. Thus, because thoracoscopic sympathectomy is easier to perform with a lower risk of complications than conventional thoracic sympathectomy, we recommend this operative approach as the procedure of choice for surgical thoracic sympathectomy.

Early thoracoscopic debridement and drainage as definite treatment for pleural empyema.

Sendt-W; Forster-E; Hau-T

Eur-J-Surg. 1995 Feb; 161(2): 73-6

To report our experience with early thoracoscopic debridement and drainage in the treatment of pleural empyema in the fibrinopurulent or early organising phase. DESIGN: Prospective open study. SETTING: District hospital, Germany. SUBJECTS: 10 Patients operated on between August 1991 and April 1993. INTERVENTIONS: Double lumen intubation, followed by thoracoscopic opening of the empyema, evacuation of all pus under vision, debridement of the lung, irrigation of the thoracic cavity and insertion of a chest drain. MAIN OUTCOME MEASURES: Morbidity and mortality. RESULTS: Cultures taken during the operation grew no pathogens in five cases; Streptococcus pneumoniae, and haemolytic streptococci (once in combination with Staphylococcus aureus), were cultured in two cases each; and Mycobacterium tuberculosis in one. Chest drains were removed a mean of 8.5 days after operation. All patients were well without signs of infection 1-21 months later, and in no case was conversion to open operation necessary. CONCLUSION: Early thoracoscopic debridement and drainage is a safe and effective alternative to open treatment of patients with pleural empyema in the fibrinopurulent or early organising phase.

Thoracoscopic excision of a malignant schwannoma of the intrathoracic vagus nerve.

Singer-RL

Ann-Thorac-Surg. 1995 Jun; 59(6): 1586-7

Malignant schwannomas of the intrathoracic vagus nerve are rare tumors. A patient underwent resection of a mediastinal malignant schannoma of the vagus nerve using video-assisted thoracoscopy, with no recurrence at 18 months.

Lung reduction as birdge to lung transplantation in pulmonary emphysema.

Zenati-M; Keenan-RJ; Landreneau-RJ; Paradis-IL; Ferson-PF; Griffith-BP

Ann-Thorac-Surg. 1995 Jun; 59(6): 1581-3

We present a case of bridging to lung transplantation by means of laser ablation of emphysematous bullae in a lung transplant candidate. The patient underwent successful left single-lung transplantation 17 months after lung reduction. He is now well 3 months after transplantation.

Detection of residual flow by transesophageal echocardiography during video-assisted thoracoscopic patent ductus arteriosus interruption.

Lavoie-J; Javorski-JJ; Donahue-K; Sanders-SP; Burke-RP; Burrows-FA

Anesth-Analg. 1995 Jun; 80(6): 1071-5

The purpose of this study is to examine prospectively the efficacy of intraoperative transesophageal echocardiography (TEE) monitoring in reducing the incidence of residual ductal flow during video-assisted thoracoscopic (VATS) patent ducts arteriosus (PDA) interruption. Thirty consecutive patients undergoing PDA interruption via the VATS procedure were monitored with an appropriately sized Hewlett-Packard color-Doppler TEE probe. All examinations were performed by the same individual and inter-

preted with a cardiologist. Real time TEE monitoring was used, but the results were not disclosed to the surgeon until he was prepared to close the wound. The mean age was 2.4 yr and the average weight 11.2 kg. Two patients had residual flow after placement of the vascular clip. One patient had residual flow detected intraoperatively after placement of the vascular clip and residual flow was quickly abolished by the placement of a second clip, thus avoiding a reintervention. A follow-up transthoracic echocardiography was performed on 18 patients 1 month postoperatively. Three patients presented residual ductal flow. This study using a novel application of TEE, demonstrates that TEE monitoring during PDA interruption may improve the surgical result, thus avoiding reintervention and the complications associated with residual ductal flow. However, late recurrrence due to recanalization may occur and not be detected by intraoperative TEE monitoring.

Thoracoscopic upper thoracic sympathectomy for primary palmar hyperhidrosis in children and adolescents.

Shinar-D; Levi-I; Mares-AJ

J-Pediatr-Surg. 1995 Mar; 30(3): 471-3

After 20 years of experience with the "open" transaxillary approach, the authors are presently performing the thoracoscopic technique for upper thoracic sympathectomy in severe primary hyperhidrosis. During a period of 14 months, 23 operations were performed and 22 patients had immediate and permanent relief of palmar sweating. The immediate postoperative course was uneventful in all cases. Hospitalization was short, and all patients returned to school and full activity 3 to 5 days after operation. These initial results compare favorably to the "open" method and, pending further experience, are actually better in terms of less pain, early discharge, quicker return to normal activity, and a smaller, less conspicuous scar.

Who should perform thoracoscopy? The controversy continues [letter]

Esteva-H

Chest. 1995 May; 107(5): 1480

Video-assisted thoracoscopic pleurectomy in the management of malignant pleural

Waller-DA; Morritt-GN; Forty-J
Chest. 1995 May; 107(5): 1454-6

To evaluate the outcome of pleurectomy using videoassisted thoracic surgery (VATS) for pleurodesis in patients with malignant pleural effusion. DESIGN: Cohort prospective study. Follow-up of patients from referral for thoracoscopy to death. SETTING: Regional Cardiothoracic Surgical Centre. PATIENTS: Nineteen patients (median age 63 years, range 51 to 84 years) with malignant pleural effusion, secondary to mesothelioma in 13 and metastatic adenocarcinoma in 6. INTERVENTION: Video-assisted parietal pleurectomy. MEASUREMENTS AND RESULTS: Median operating time was 35 min (range 15 to 60 min). The median fall in hemoglobin concentration in the first 24 h postsurgery was 1.1 g/dL (0.3-2.5 g/dL). The median postoperative morphine requirement was 1.25 mg/h (0-6.2 mg/h) in the first 12 h postoperatively. All patients were successfully extubated in the operating room without the need for reventilation, and all patients were successfully discharged from the hospital with a median postoperative stay of 5 days (range 2 to 20 days) At current median follow-up of 12 months (range 4 to 17 mon) 6 patients died of their underlying disease. In the remaining 13 patients, two have developed recurrent effusins. CONCLUSIONS: Using VATS to perform parietal pleurectomy is a safe, effective method of obtaining palliative pleurodesis in patients with malignant effusions.

Role of videoendoscopy in pulmonary surgery: present experience.

Solaini-L; Bagioni-P; Grandi-U
Eur-J-Cardiothorac-Surg. 1995; 9(2): 65-8

Videothoracoscopic techniques were utilized in managing 88 consecutive patients. The series was composed of 36 patients with pneumothorax, 44 cases of single and 9 of multiple pulmonary nodules and 1 patient with diffuse lung disease. In 14 cases (15.9%) conversion to open thoracotomy was necessary while in the remaining 74 patients the procedure (30 blebectomies, 2 bullectomies, 37 wedge resections, 6 lobectomies and one multiple biopsies) were carried out as planned. In each lobectomy and in six wedge

resections an accessory small incision was necessary; we consider only this video-assisted thoracic surgery (VATS). Benign disease, aside from the blebs and bullae, was found in 12 cases of solitary pulmonary nodules and in 1 case of multiple lesions, while malignant lesions were detected in 31 patients. Primary carcinoma was diagnosed in nine cases after a wedge resection had been performed on a suspicious solitary nodule. In two of these wedge resection had to suffice because of poor lung function while in the remaining seven cases, a lobectomy was carried out through an open thoracotomy in two patients, and in five cases VATS was attempted successfully in four while in one case a formal thoracotomy was necessary due to bleeding. Solitary metastases were found in 14 patients and were managed by 12 wedge resections and 2 lobectomies. Seventy-one patients (97.3%) had an uneventful postoperative course while 2 (2.7%) had only minor complications. No recurrences were observed, however follow-up is limited. Videothoracoscopy techniques are very useful and are good alternatives to conventional thoracotomy in managing cases of pneumothorax, benign pulmonary lesions and in taking biopsies.

Intrapleural talc for the treatment of malignant pleural effusions secondary to breast cancer.

Milanez-RC; Vargas-FS; Filomeno-LB; Teixeira-LR; Fernandez-A; Jatene-F; Light-RW
Cancer. 1995 Jun 1; 75(11): 2688-92

The management of malignant pleural effusions secondary to breast cancer is a difficult problem. In the 1980 s tetracycline was probably the most commonly used sclerosing agent but parenteral tetracycline is no longer available. Therefore, it is important to evaluate alternative sclerosing agents. This prospective study was designed to determine the efficacy of insufflated talc in producing pleurodesis in patients with pleural effusions secondary to breast cancer. METHODS. Fifty-two patients admitted between May 1985 and November 1992 to the Department of Thoracic Surgery underwent thoracoscopy and had 2 gm sterile asbestos free talc insufflated throughout the pleural space at the time of the procedure. One or two chest tubes were inserted and left in place until fluid drainage was less than 100 ml per day. RESULTS. Of the 52 patients, 5 were not evaluable. Two patients died within 30 days of the procedure. In three additional patients the lung did not expand after thoracoscopy. The intrapleural insufflation of talc was effective in preventing recurrence of pleural effusion. At 30 days there was no recurrence

of the pleural fluid in 45 of the 47 (95.7%) patients. One of these patients had a recurrence of the effusion 2 months after the procedure but the remaining 44 (93.6%) had no recurrence for the duration of the study. Aerosolized talc was associated with a moderate morbidity. Six (11.5%) patients had re-expansion edema, but all recovered. Empyema developed in one patient after the procedure. No episodes of respiratory distress syndrome were observed after talc pleurodesis. CONCLUSION. The insufflation of 2 gm talc into the pleural space is an effective method to control pleural effusions secondary to breast cancer.

Thoracoscopic management of pleural effusions revisited.

Yim-AP; Ho-JK; Lee-TW; Chung-SS

Aust-N-Z-J-Surg. 1995 May; 65(5): 308-11

Pleural effusion is a commonly encountered clinical condition. We report our experience with video assisted thoracoscopic surgery (VATS) in the management of pleural effusions in three groups of patients: (1) Patients with cryptogenic pleural effusions for diagnosis; (2) patients with established malignant effusions for talc insufflation and limited decortications; and (3) patients with early empyema for debridement and drainage. From September 1992 to March 1994, we have successfully managed 28 patients with pleural effusions (12 males, 16 females; age ranged from 22 days to 73 years). Management consisted of 16 diagnostic thoracoscopies with guided pleural biopsies, seven limited decortications for trapped lungs, 12 talc insufflation for recurrent symptomatic malignant effusions and debridement and drainage of five empyemata. There was no mortality or intra-operative complications. The procedure was tolerated well by all patients. The mean duration of chest drainage and hospital stay were 1.2 and 2.8 days for group 1 patients, 4.5 and 6.4 days for group 2, and 5.6 and 7.1 days for group 3. Specific histological diagnosis was obtained in all but two patients (88%). Thoracoscopic talc insufflation was successful in 92% of cases at mean follow up of 8 months. Thoracoscopic debridement and drainage of empyema resulted in rapid resolution of sepsis in all cases. Advances in video camera technology and instrumentation have allowed more therapeutic manoeuvers to be carried out. We conclude that VATS is a safe and effective way of managing selected patients with pleural effusions.

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Bronchogenic cysts of the mediastinum.

Ribet-ME; Copin-MC; Gosselin-B

J-Thorac-Cardiovasc-Surg. 1995 May; 109(5): 1003-10

During a 25-year period 69 patients whose ages ranged from 1 day to 64 years were treated for bronchogenic cyst of the mediastinum. The male-to-female sex ratio was 1:0.76. The cysts were symptomatic in 63.7%, compressive in 43.4%, and life threatening in 2.8% of cases. Symptoms and signs of compression were more frequent in infants and children than in adults. Such symptoms and signs were more dependent on the location of the cyst than on its volume. The preoperative diagnosis was wrong in 16% of cases. The cysts were approached through thoracotomy in 67 cases, including one conversion from thoracoscopy, and through cervicotomy and mediastinoscopy in one case each. The cysts opened into the respiratory tract in five cases. No communication with the esophageal lumen was observed. The cystic contents were apparently infected in three cases, but samples remained sterile at culture. There was one hospital death caused by a centrally located compressive cyst that was undiagnosed at thoracotomy. The postoperative morbidity rate was 13.4%. There were no further symptoms after operation in children, but five adults reported continuing pain or dyspnea. Resection of bronchogenic cysts is recommended because of uncertainities in diagnosis and in evolution.

Video-thoracoscopic lung biopsy in diagnosis of interstitial lung disease.

Nasim-A; Akhtar-RP; Spyt-TJ

J-R-Coll-Surg-Edinb. 1995 Feb; 40(1): 22-4

Lung biopsy remains an important investigation in the diagnosis of diffuse interstitial lung disease despite improved diagnostic yield of high resolution computed tomography scanning. We describe 19 pulmonary wedge biopsies (13 men and 6 women) performed using videothoracoscopic technique. The median age of the patients was 56 years (range 32-72 years). All our patients were suspected to have diffuse interstitial lung disease and were referred for lung biopsy to obtain a histological diagnosis. Thoracoscopic wedge excisions were accomplished under general anaesthesia using high frequency jet ventilation and a percutaneous stapling device. A tissue diagnosis was ob-

tained in all patients: 8 had cryptogenic fibrosing alveolitis, 3 had interstitial pulmonary fibrosis, 2 had emphysema, 2 had extrinsic allergic alveolitis, 2 had sarcoidosis, 1 had non-specific chronic inflammation, and 1 had pulmonary haemosiderosis. There were no operative deaths. There was one failure resulting in conversion to an open procedure. There were three complications: two air leaks and one effusion. Median postoperative hospital stay was 2 days (range 2-7 days). We conclude that videothoracoscopic wedge biopsy is a safe and effective procedure and should be recommended in patients who require a histological diagnosis of diffuse interstitial lung disease.

Video-assisted right lower lobectomy for a lung cancer with mini-thoracotomy.

Saito-A; Yagi-N; Miura-K; Takano-Y

Surg-Laparosc-Endosc. 1995 Feb; 5(1): 56-8

We report a case of T1 NO MO lung cancer in which we successfully performed video-assisted right lower lobectomy and mediastinal lymph node dissection. The lobectomy was done on a 64-year-old woman who had a 2-cm adenocarcinoma in the right lower lobe. The procedure could be done safely and adequately using three trocars and a 5-cm mini-thoracotomy. The patient had an uncomplicated postoperative course and was satisfied with minimal postoperative pain, quick recovery, and minute skin scars. Video-assisted lobectomy may be reasondable approach in selected patients of primary lung carcinoma.

Thoracoscopic assisted lobectomy.

De-Letter-J; Proot-L

Surg-Laparosc-Endosc. 1995 Feb; 5(1): 12-6

The advances in endoscopic capabilities expanded the potential role of laparoscopic and thoracoscopic surgery. The introduction of safe linear stapling devices made thoracoscopic assisted segmental lung resections possible. Because of the postoperative advantages of a thoracoscopic operation, a technique for thoracoscopic lobectomies was developed. Three case reports are presented using the same technique. The first two cases

report a righ lower lobectomy and the third case a bilobectomy, right middle and lower lobe.

Thoracoscopic debridement of loculated empyema thoracis in children.

Silen-ML; Weber-TR

Ann-Thorac-Surg. 1995 May; 59(5): 1166-8

The appropriate management of multiloculated empyema thoracis remains controversial. During a 7-month period, we have managed multiloculated empyema with early thoracoscopic debridement in three consecutive pediatric patients. Chest tubes were removed 7 ± 1 (mean ± standard deviation) days after thoracoscopy and discharge from hospital was on postoperative day 8 ±. We suggest that early thoracoscopic debridement of multiloculated empyema thoracis in children is safe and efficacious.

Video-assisted thoracic surgery for the anterior approach to the thoracic spine.

Mack-MJ; Regan-JJ; McAfee-PC; Picetti-G; Ben-Yishay-A; Acuff-TE

Ann-Thorac-Surg. 1995 May; 59(5): 1100-6

Standard anterior approach to the thoracic spine is by a posterolateral thoracotomy. Because of the morbidity associated with this incision, video-assisted thoracic surgery (VATS) has been used as a less invasive approach for many intrathoracic disease processes. We have applied VATS for anterior access to the thoracic spine. From April 1991 to September 1994, 95 patients underwent thoracic spine procedures using thoracoscopy as the sole method of anterior approach. Procedures performed include discectomy for herniation (n=57), multilevel discetomy for correction of spinal deformity (27), corpectomy (9), and drainage of intervertebral disc space abscess (2). All levels of the thoracic spine from the T2-T3 level to the T12-L1 interspace were approached. Forty-four procedures were performed through the left side of the chest and 41 through the right. The planned procedure was accomplished by VATS in all but 1 patient who required conversion to an open procedure because of scarring from a previous spine procedure. Mean operative time was 2 hours 24 minutes (range, 45 minutes to 5 hours 10 minutes). Average chest tube duration was 1.4 days, and mean length of stay

was 4.82 days (range, 2 to 21 days). Complications included intercostal neuralgia (6), atelectasis (5), excessive epidural blood loss (2,500 mL; 2) and temporary paraparesis in a scoliosis patient related to operative positioning. We conclude that VATS offers a new, less morbid anterior approach to the thoracic spine. Although there is a significant learning period, most procedures requiring an anterior access can be performed safely by this technique. The VATS approach mandates an expanded role for the thoracic surgeon in operative spine disease.

Minimal access surgery and the "golden period" for conversion [editorial]

Greene-FL

Surg-Endosc. 1995 Jan; 9(1); 11

Endoscopic transthoracic sympathectomy: successful in hyperhidrosis but can the indications be extended? [letter]

Cameron-A

Ann-R-Coll-Surg-Engl. 1995 Jan; 77(1): 70

Thoracoscopic cardiomyotomy for achalasia of the cardia: early results.

Foley-R; Brough-W

Ann-R-Coll-Surg-Engl. 1995 Jan; 77(1): 60-2

A thoracoscopic technique of Heller's procedure for achalasia of the cardia is described. The operation has been performed on five patients with excellent symptomatic results. There were no complications. All patients went home on the 3rd postoperative day and returned to work within 2 weeks of the procedure.

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Simultaneously stapled lobectomy: a safe technique for video-assisted thoracic surgery.

Lewis-RJ

J-Thorac-Cardiovasc-Surg. 1995 Apr; 109(4): 619-25

Currently, techniques for video-assisted thoracic surgery are being borrowed from the open conventional thoracotomy. However, these same techniques have made video-assisted lobectomy difficult, burdensome, and even dangerous. Simultaneously stapled lobectomy (simultaneous stapling of all hilar structures in their natural anatomic configuration) has been performed successfully in 16 patients. Every attempted simultaneously stapled lobectomy is included. The lesions included 14 malignant tumors, one giant benign pulmonary cyst, and one large necrotizing granuloma. Three right upper lobes, one right middle lobe, six right lower lobes, four left upper lobes, and two left lower lobes were resected uneventfully. Nine adenocarcinomas, two large cell carcinomas, and three squamous cell carcinomas ranging in size from 2.5 to 5 cm were removed. Lung fissures, the hilum, and the mediastinum were explored for lymph nodes in each patient. Median operative time was 110 minutes. Average blood loss was less than 100 ml. Median hospitalization was 6 days, although eight patientts were discharged between 3 and 5 days. Three patients had air leaks for an average of 14 days and one patient had mild subcutaneous emphysema for 5 days. There was no surgical mortality. Median follow-up is 15 months (range 8 to 20 months). Simultaneously stapled lobectomy is not meant to replace conventional lobectomy by open thoracotomy. Indications are cardiac or renal problems, contralateral chest wall paralysis, neurogenic deficiencies, adamant refusal to undergo open lobectomy, psychologic aberrations, and pain from a previous thoracotomy. Contraindications include absent fissures, enlarged matted invasive nodes, fibrotic hilum, central or bulky lesions, calcific bronchi, chest wall invasion, and lesions crossing a fissure. Precedent for this technique will be discussed. When used with discretion in carefully selected patients, in whom an open lobectomy would be contraindicated, simultaneously stapled lobectomy might eventually prove to be another available option. Time and further experience will be necessary to determine its true merits.

Exploratory thoracotomy for nonresectable lung cancer.

Steinbaum-SS; Uretzky-ID; McAdams-HP; Torrington-KG; Cohen-AJ
Chest. 1995 Apr; 1077(4): 1058-61

We sought to evaluate the effect of new diagnostic modalities on patients explored surgically for inoperable lung cancer. From July 1983 to February 1992, 335 patients underwent thoracotomy for lung cancer. Thirty-three of the 35 patients with nonresectable disease had sufficient data for analysis and underwent chest radiography (CXR), CT scan, and bronchoscopy. The study was terminated when video-assisted thoracoscopy (VAT) was introduced at the institution. Causes of nonresectability included significant N2 disease not diagnosed preoperatively (n=11), tumor invasion of contiguous mediastinal structures (n=8), and insufficient pulmonary function (n=4). Four patients were left with unresected disease because of thoracic metastasis. Two patients had technically unresectable disease; three patients were explored surgically because diagnoses could be obtained by no other means. One patient was found to have small cell cancer. Data analysis demonstrated that 19 of 33 thoracotomies could potentially have been avoided or resulted in resection with current techniques. Refinement of imaging criteria, a judicious surgical approach to N2 disease, and VAT may significantly reduce thoracotomies for nonresectable lung cancer.

A technical report on video-assisted thoracoscopy in thoracic spinal surgery.

Preliminary description. Mack-MJ; Picetti-GD-3rd
Spine. 1995 Apr 1; 20(7): 831-7

This report is a preliminary description of the efficacy of video-assisted thoracoscopic surgery in thoracic spinal procedures that otherwise require open thoracotomy. OBJECTIVE. This report sought to describe the efficacy of video-assisted thoracoscopic surgery in thoracic spinal procedures that otherwise require open thoracotomy. SUMMARY OF BACKGROUND DATA. In a landmark study compared video-assisted thoracoscopic surgery for peripheral lung lesions with thoracotomy, video-assisted thoracoscopic surgery reduced postoperative pain, improved early shoulder girdle function, and shortened hospital stay. METHODS. Video-assisted thoracoscopic surgery was performed

in 12 thoracic spinal patients (herniated nucleus pulposus, infection, tumor, or spinal deformity) and is described in detail in this report. RESULTS. Video-assisted thoracoscopic surgery in thoracic spinal surgery resulted in little postoperative pain, short intensive care unit and hospital stays, and little or no morbidity. In the short follow-up period, there was no post thoracotomy pain syndrome or neurologic sequelae in these patients. Operative time decreased dramatically as experience was gained with the procedure. CONCLUSION. Given consistently improving surgical skills, a number of thoracic spinal procedures using video-assisted thoracoscopic surgery, including thoracic discectomy, internal rib thoracoplasty, anterior osteotomy, corpectomy, and fusion, can be performed safely with no additional surgical time or risk to the patient.

Biopsy of lesions of the thorax.

Fry-WA

Surg-Oncol-Clin-N-Am. 1995 Jan; 4(1): 29-46

Bronchoscopy, thoracocentesis, and fine needle aspiration are the three most useful biopsy techniques for thoracic lesions. Minimally invasive procedures, such as mediastinoscopy and thoracoscopy, must readily be available. As biopsy techniques and the lesions to be biopsied become more complex, the surgeon should make the decision regarding the particular technique. Exploratory thoracotomy remains the ultimate thoracic biopsy.

Videothoracoscopic staging and treatment of lung cancer.

Roviaro-G; Varoli-F; Rebuffat-C; Vergani-C; Maciocco-M; Scalambra-SM; Sonnino-D; Gozi-G

Ann-Thorac-Surg. 1995 Apr; 59(4): 971-4

Videothoracoscopy, routinely performed as the intial step of an operation opens interesting opportunities for both the operative staging and treatment of lung cancer. Videosurgical maneuvers ensure thorough exploration of the cavity, thus avoiding unnecessary exploratory thoracotomies, confirming resectability of the lesion by open or, in selected cases, by a direct video-assisted approach. We report our experience of 155

patients submitted to videothoracoscopic operative staging between October 1991 and January 1994. Videothoracoscopic operative staging showed unresectability in 13 patients (8.3%) due to preoperatively unexpected (10 patients) or suspected conditions (3 patients). The remaining 142 patients were divided by staging of the lesion and general conditions into three groups. Group A consisted of 13 elderly patients with small peripheral tumor who could not tolerate lobectomy and who underwent thoracoscopic wedge resection. Group B consisted of 63 patients with peripheral clinical T1 NO or T2 NO tumor. Fifty-two lobectomies and 4 pneumonectomies were carried out thoracoscopically. Seven conversions to thoracotomy were necessary due to technical problems. The postoperative course was uneventful in 51, 5 had prolonged air leakage, and a bronchial fistula developed in 1 because of positive-pressure postoperative ventilation. Group C consisted of 66 patients with stage II or IIIa neoplasm. Thoracotomy after thoracoscopy proved unresectability in 4, whereas 62 were submitted to a radical pulmonary resection. In the literature the incidence of exploratory thoracotomies for conditions missed by preoperative staging still remains high. After adoption of videothoracoscopic operative staging we reported a 2.6 % exploratory thoracotomy rate.

Videothoracoscopy versus thoracotomy for the diagnosis of the indeterminate solitary pulmonary nodule.

Santambrogio-L; Nosotti-M; Bellaviti-N; Mezzetti-M

Ann-Thorac-Surg. 1995 Apr; 59(4): 868-70; discussion 870-1

The solitary pulmonary nodule often presents a diagnostic challenge to the specialist because the nature of the nodule is often indeterminate at the end of the usual diagnostic process, and operation frequently is required before a definite diagnosis can be made. We have conducted a rendomized, prospective trial to evaluate the diagnostic efficacy of video-assisted thoracic surgery versus muscle-sparing lateral thoracotomy. Between January 1991 and May 1994, 44 patients suffering from solitary pulmonary nodule were divided at random into groups: the nodule was removed in 22 cases by video-assisted thoracic surgery and in 22 cases by lateral thoracotomy. Nineteen wedge resections, 1 segmentectomy, and 2 lobectomies were performed in the first group and 13 wedge resections, 8 segmentectomies, and 1 lobectomy in the second group. An "access" thoracotomy had to be performed in 5 patients in the video-assisted thoracic surgery group. The operating room time was 97.2±32.9 minutes in the video-assisted thoracic surgery group and 130.5± 14 minutes in the lateral thoracotomy group ($p>0.05$). In both groups a final diagnosis was made in 100% of cases. The postoperative hospital stay was 4.6± 1.08

days in the video-assisted thoracic surgery group and 7.8±0.89 days in the lateral thoracotomy group ($p<0.01$). Pain was evaluated on a visual analogue scale; the scores were 26.5±11.6 in the video-assisted thoracic surgery group and 48.3±12.8 in the lateral thoracotomy group ($p<0.05$).

Current concepts in the use of cavitary endoscopy in the evaluation and treatment of blunt and penetrating truncal injuries.

Simon-RJ; Ivatury-RR

Surg-Clin-North-Am. 1995 Apr; 75(2): 157-74

The use of thoracoscopy in the patient with penetrating injury to the thorax is in its infancy. Although it is used mainly for diagnosis, evidence suggests that it will become a therapeutic tool during the intial management of the traumatized patient and in the post-injury period (early evacuation of retained hemothorax and the treatment of empyema). Although its role in injuries to the superior chest is clear, its role has not been established in the evaluation of the diaphragm. Both laparoscopy and thoracoscopy offer advantages in this area that must be considered when contemplating diagnosis and treatment. Further studies help define the place of these procedures for injuries in the thoracoabdominal area. The indications for cavitary endoscopy after truncal injury are summarized in Table 2. It must be remembered that experience in this field is rapidly increasing, and indications will change with new studies and new technology.

Thoracoscopic intercostal nerve blocks [letter]

Temes-RT; Won-RS; Kessler-RM; Wernly-JA

Ann-Thorac-Surg. 1995 Mar; 59(3): 787-8

Video-assisted thoracic surgery.

Maziak-DE; McKneally-MF

Ann-Thorac-Surg. 1995 Mar; 59(3): 780-1

Potential complications of vascular stapling in thoracoscopic pulmonary resection.

Craig-SR; Walker-WS

Ann-Thorac-Surg. 1995 Mar; 59(3): 736-7; discussion 737-8

In a series of 57 patients undergoing thoracoscopic pulmonary lobectomy, 2 required expeditions conversion to open thoracotomy when a stapling device (Endo-GIA 30 V3; Autosuture, Ascot, UK) used on the main right lower pulmonary artery in 1 case and on the left superior pulmonary vein in the other cut but failed to staple the vessel involved. In both instances the vessel was successfully controlled while a thoracotomy was performed and the involved vessel was oversewn. Both patients made an uncomplicated postoperative recovery. As the number of thoracoscopic pulmonary resections increases, it is likely that similar episodes will occur in the future. These cases strongly emphasize the fact that patients undergoing this procedure should do so in a center specializing in thoracic surgery where there is the necessary surgical expertise and equipment to deal with such potentially life-threatening vascular complications.

Outpatient thoracoscopy: a case report and discussion.

Garcha-I; Conn-J

Am-Surg. 1995 Mar; 61(3); 229-30

Thoracoscopy has long been recognized as having significant diagnostic and therapeutic value. We present a new, less invasive method of obtaining good biopsy specimens of pleural based lesions using a single incision and on an outpatient basis. JW. who has a history of Hodgkin's Lymphoma, presents with a suspicious pleural mass adjacent to the AP window and not amenable to percutaneous biopsy. She was admitted to the ambulatory surgery unit and underwent video thoracoscopic biopsy of the lesion through a single 12 mm incision. Surgery time was 25 minutes, and frozen section revealed Hodghin's lymphoma. No chest tube was inserted, and post-op chest film revealed a small pneumothorax that resolved in 4 hours. The patient was ready for discharge at that time. The technique we used involved placing a standard 10 mm trocar and scope in the midaxillary line with the patient in the lateral decubitus position. Once the scope is in, the trocar is

pulled back so that a mediastinal biopsy forceps can be placed alongside the camera through the same hole. The biopsy is taken, and irrigation and cautery instruments can then also be placed and used in a similar manner. Before removing the camera, a prolene purse string suture is placed around the incision. While the anesthesiologist inflates the lung, the camera is slowly removed, watching all lobes inflate. The purse string is then tied and the patient awakened. We have performed seven of the above procedures thus far with good results. We feel the following are essential in patient selection for outpatient thoracoscopy: 1) The lesion to be biopsied is pleural based.

Video-assisted thoracoscopic vascular ring division in infants and children.

Burke-RP; Rosenfeld-HM; Wernovsky-G; Jonas-RA

J-Am-Coll-Cardiol. 1995 Mar 15; 25(4): 943-7

This study evaluated our early experience with video-assisted thoracoscopic vascular ring division and compared this approach with division by means of a conventional open thoracotomy. BACKGROUND. Video-assisted thoracoscopic techniques reduce surgical trauma and have been applied to several adult thoracic procedures; however, pediatric applications have been limited. We developed instruments and techniques for video-assisted thoracoscopic vascular ring division in the pediatric population. METHODS. We compared patient characteristics, operative results and postoperative hospital courses of all patients undergoing vascular ring division by a video-assisted approach with a historical control group of all patients undergoing division by an open thoracotomy between January 1991 and December 1992. RESULTS. Eight patients (median age 5 months, range 40 days to 5.5 years; median weight 6.2 kg, range 1.8 to 17.1) underwent video-assisted thoracoscopic vascular ring division. Four had a double aortic arch with an atretic left arch and a left ligamentum, and four had a right aortic arch with aberrant left subclavian artery and a left ligamentum. All eight had successful ring division with symptomatic relief and no mortality. A limited thoracotomy was performed in three patients to divide patent vascular structures, and the hospital period was prolonged in one because of chylothorax. These eight patients were compared with a historical cohort of eight pediatric patient having vascular ring division performed by a conventional thoracotomy. The two groups did not differ in age, weight, intensive care unit or postoperative hospital stay, duration of intubation or thoracostomy tube or hospital charges. Total operating room time was longer for the group undergoing video-as-

sisted operation. CONCLUSIONS. Early results for video-assisted thoracoscopic vascular ring division are comparable to those of the conventional surgical approach. With further refinement in technique and instrumentation, video-assisted surgical intervention may become a viable alternative to open thoracotomy for management of the symptomatic vascular ring.

Resection of paravertebral neurofibroma by video-assisted thoracoscopy.

Rieger-R; Zauner-E; Wayand-W

Br-J-Surg. 1995 Jan; 82(1): 63

Interstitial lung disease: a diagnostic approach. Are CT scan and lung biopsy indicated in every patient?

Raghu-G

Am-J-Respir-Crit-Care-Med. 1995 Mar; 151(3 Pt 1): 909-14

Video-assisted thoracoscopic surgery for congenital heart disease.

Burke-RP; Wenovsky-G; van-der-Velde-M; Hansen-D; Castaneda-AR

J-Thorac-Cardiovasc-Surg. 1995 Mar; 109(3): 499-507; discussion 508

Video-assisted endoscopic techniques have reduced operative trauma in adult thoracic and general surgery, but applications in children with congenital heart disease have been limited. We report the development of video-assisted thoracic surgery procedures for neonates and infants with cardiovascular disease. Endoscopic instruments and techniques for pediatric cardiovascular procedures were designed and tested in the animal laboratory. Forty-eight operations were subsequently performed in 46 pediatric patients ranging in age from 2 hours to 14 years (median 9 months), weighing from 575 grams to 54 kg (median 8.5 kg). Clinical applications included seven different surgical procedures: patent ductus arteriosus interruption in infants (n=26) and premature neonates (n=5), vascular ring division (n=8), pericardial drainage and resection (n=3), arterial and

venous collateral interruption (n=2), thoracic duct ligation (n=2), epicardial pacemaker lead insertion (n=1), and diagnostic thoracoscopy (n=1). There was no operative mortality. Technical success, defined as a video-assisted procedure completed without incising chest wall muscle or spreading the ribs, was achieved in 39 of 48 procedures (82%), with thoracotomy required to complete nine procedures. Most patients (22/25, 88%) undergoing elective ductus ligation were extubated in the operating room and discharged from the hospital within 48 hours of the operation. Eight of the last 10 patients having ductus ligation were discharged on the first postoperative day. Residual ductal flow was assessed by (1) transesophageal echocardiography in the operating room (incidence: 0/25, 0%, 70% CL 0% to 7.3%); (2) discharge auscultation (incidence: 1/30, 3%, 70% CL 0.5% to 10.8%); and (3) follow-up Doppler echocardiography (incidence: 3/25, 12%, 70% CL 5.4% to 22.6%). Video-assisted thoracoscopic techniques can be safely applied to pediatric patients with patent ductus arteriosus and vascular rings and may become an effective addition to the staged management of more complex forms of congenital heart disease.

Pathologic comparison of video-assisted thoracic surgical lung biopsy with traditional open lung biopsy.

Kadokura-M; Colby-TV; Myers-JL; Allen-MS; Deschamps-C; Trastek-VF; Pairolero-PC
J-Thorac-Cardiovasc-Surg. 1995 Mar; 109(3): 494-8

Video-assisted thoracic surgical lung biopsy is an alternative to traditional open lung biopsy for diagnosis in patients with pleuropulmonary diseases. Between January 7, 1991, and August 3, 1993, 71 consecutive patients had video-assisted thoracic surgical lung biopsy and 42 patients had traditional open lung biopsy. A specific histologic diagnosis that correlated with the clinical findings was sought in each case and the yield was compared between the two groups. Procedure-related artifactual changes were also evaluated; the extent of traumatic hemorrhage and neutrophil margination as a result of tissue manipulation was significantly greater for patients in the video-assisted thoracic surgical lung biopsy group than for those in the open lung biopsy group, but the changes were generally minor and did not affect diagnostic yield. Complications developed in 11 (15%) of 71 patients in the video-assisted thoracic surgical lung biopsy group including 5 patients with prolonged air leakage (more than 10 days); 2 with pneumonia; and 1 each with

bleeding, late pneumothorax necessitating readmission, mucus plug necessitating bronchoscopy, and a hypoxic episode necessitating mechanical ventilation. On the other hand, 7 (17%) of 42 patients in the open lung biopsy group had complications including 4 patients with prolonged air leakage (more than 10 days) and 3 with pneumonia. There were 6 (8%) operative deaths in patients who had video-assisted thoracic surgical lung biopsy and 7 (17%) in the open lung biopsy group; all had preoperative respiratory failure. We conclude that video-assisted thoracic surgical lung biopsy is an acceptable alternative to open lung biopsy for diagnosis of pulmonary infiltrates or indeterminate nodules.

Digital localization of peripheral lung nodules with video-assisted thoracic surgery [letter]

Yim-AP; Ho-JK

Chest. 1995 Mar; 107(3): 886-7

Thoracoscopic-assisted lobectomy. Preliminary experience and results.

Liu-HP; Change-CH; Lin-PJ; Change-JP; Hsieh-MJ

Chest. 1995 Mar; 107(3): 853-5

A preliminary report is made on the use of videothoracoscopy to achieve pulmonary lobectomy in 16 patients, including 12 with centrally located pulmonary metastases and 4 with benign lesions (3 bronchiectases and 1 endobronchial hamartoma).

Videothoracoscopy was performed on eight right-lower lobes, one middle lobe, two right upper lobes, four left-lower lower lobes, and one left-upper lobe with a thoracoscope and conventional thoracic instruments. All patients received standard pulmonary lobe resection with lymph node clearance similar to that achieved with open thoracotomy. The mean operative time was 3 h (range, 2.5 to 4 h). Average blood loss was 100 mL and mean length of hospital stay was 6 days (range, 4 to 8 days). A combination of videothoracoscopy with use of conventional instruments resulted in similar performance but less chest wall interruption than in coventional pulmonary lobectomy. Videothoracoscopy showed safer and faster lung resection, which subsequently minimized the perioperative morbidity. Pain intensity was lessened, functional recovery was quicker, and hospital stays were shorter in the patients we reviewed.

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Mechanical treatment of atrial fibrillation: removal of pericardial cyst by thoracoscopy.

Vlay-SC; Hartman-AR

Am-Heart-J. 1995 Mar; 129(3): 616-8

Thoracoscopy for spontaneous pnemothorax 2.10 version with bleb stapling and pleurectomy.

Ellman-BR; Ferrante-JW; Tiedemann-RN

Am-Surg. 1995 Feb; 61(2): 102-5

A series of 25 Thoracoscopy procedures were performed for spontaneous pneumothorax over the past 2 1/2 years. The indications for the procedure were recurrent pneumothorax or choice of patient for definitive care. The procedure developed over the period of 2 1/2 years, and the procedure included a thoracoscopy, stapling of apical blebs, and apical pleurectomy. The complication rate was 3% and limited to local wound problems. There was one recurrent pneumothrax in a patient who did not have the pleurectomy as a part of the procedure. This was early on in the experience, when it was felt that pleural abrasion would be adequate. Since that time, a formal apical pleurectomy has been done with each of these procedures. No further recurrences have been noted over the 2 1/2 year period of time. The procedure includes one port at the anterior axillary line, fifth intercostal space, one port in the axilla, third intercostal space, and one port in the midclavicular line, fourth intercostal space. A 30 degree and angled scope is sometimesused for better visualization. The Endo GIA (US Surgical or equivalent Ethicon stapler) is used to staple the blebs, and the pleurectomy is done through the two non-video ports.

Intraoperative visualization of the aortic valve from the left ventricle.

Furuse-A; Kohno-T; Ohtsuka-T

J-Thorac-Cardiovasc-Surg. 1995 Feb; 109(2): 395.

Video-assisted thoracoscopic T2 sympathectomy for hyperhidrosis palmaris [letter]

Kopelman-D; Assalia-A; Hashmonai-M

J-Am-Coll-Surg. 1995 Feb; 180(2): 253-4

Combined microneurosurgical and thoracoscopic removal of neurogenic dumbbell tumors.

Vallieres-E; Findlay-JM; Fraser-RE

Ann-Thorac-Surg. 1995 Feb; 59(2): 469-72

The resection of posterior mediastinal dumbbell tumors has until now required laminectomy and some form of open access to the thoracic cavity. Over a 1-year period, a novel surgical approach combining posterior microneurosurgical and anterior video-assisted thoracoscopy techniques was used in 4 patients. In 3 patients, the tumor was removed successfully with minimal postoperative discomfort and rapid recovery. In the fourth patient, limited thoracotomy became necessary to control bleeding. This new approach, which combines modern-day neurosurgical and general thoracic surgical techniques, appears safe and could become the preferred method for removing most benign posterior mediastinal dumbbell tumors.

The role of thoracoscopy in the diagnosis of interstitial lung disease.

Krasna-MJ; White-CS; Aisner-SC; Templeton-PA; McLaughlin-JS

Ann-Thorac-Surg. 1995 Feb; 59(2): 348-51

A study was undertaken to evaluate the safety and efficacy of thoracoscopic lung biopsy for interstitial lung disease. The relation between operative findings, pathologic findings, and preoperative computed tomographic scan findings was examined. Twenty-six patients, 10 male and 16 female, underwent thoracoscopic lung resection to diagnose interstitial lung disease. Sixteen patients were outpatients for an elective procedure; 10 were inpatients including 2 who were ventilar dependent. The mean length of operation was 54 minutes and the mean length of chest tube duration, 1.3 days. There were no deaths.Sta-

phylococcal pneumonia developed in 1 patient postoperatively. One patient with systemic pulmonary hypertension was ventilator dependent for 48 hours. A double-lumen endotracheal tube was used in all but 2 patients. Twelve-millimeter trocar ports were used to allow easy interchange of staplers and endoscopic instruments. Biopsy of at least two lobes was performed in each patient with resection of a piece of grossly abnormal lung. A single chest tube was left routinely. The pathologic diagnosis was usual interstitial pneumonitis in 7 patients. Four patients had interstitial fibrosis and 4, granulomas. Three patients had diffuse alveolar damage and 3, Wegener's granulomatosis. Two patients had bronchiolitis obliterans with organizing pneumonia. One patient each had lymphangioleiomyomatosis, eosinophilic granuloma, and cytomegalovirus. Sixteen patients underwent preoperative computed tomographic scanning. The scans were assessed by 2 radiologists who were blinded to the surgical results. Computed tomography accurately predicted the site of disease in most instances. Four patients had at least one lobe with no evidence of disease on computed tomography but with interstitial lung disease found thoracoscopy.

Thoracoscopic surgery as a routine procedure for spontaneous pneumothorax. Results from 82 patients.

Liu-HP; Lin-PJ; Hsieh-MJ; Change-JP; Chang-Ch

Chest. 1995 Feb; 107(2): 559-62

A Total of 82 consecutive patients with recurrent or persistent spontaneous pneumothorax were considered for thoracoscopic blebectomy or bullectomy and pleurodesis. The median age was 47 years, and 70% were men. All the patients were successfully treated using a video-assisted thoracoscopic technique. There were no deaths attributable to the procedure. Complications occured in 6 patients (7.3%). Three patients (4%) with diffuse bullous lung disease had prolonged intubation (9, 11, and 12 days, respectively). Persistent air leaks lasting from 10 to 14 days occurred in 2 patients (3%). One patient had an endoloop slip from the lung parenchyma after a forceful sneeze 2 days after the operation. Air leak subsided after the second operation using a conventional suturing technique. Blebs or bullae were present in 69 patients (83%). These were ablated by endoscopic stapling (37 patients) and through thoracoscopic ligation using an endoloop technique (32 patients). In this group of patients, the median postoperative hospital stay

was 5 days. Thirteen patients with air leaks and diffuse bullous lung disease received only talc insufflation thoracoscopically. All of them showed good lung expansion after the operation. There are no recurrences, with a mean follow-up of 22 months. These results suggest that thoracoscopic ablation of blebs or bullae and pleurodesis may be applicable to patients with spontaneous pneumothorax who require surgical intervention.

Laparoscopy and thoracoscopy in evaluation of abdominal trauma.

Carey-JE; Koo-R; Miller-R; Stein-M

Am-Surg. 1995 Jan; 61(1): 92-5

The role of laparoscopy and thoracostic modalities in blunt and penetrating abdominal trauma was studies in 35 hemodynamically stable patients who otherwise would have undergone exploratory laparotomy because of equivocal diagnostic findings. Minimally invasive laparoscopic techniques (single 5 millimeter port) and minimal abdominal insufflation (8-10 millimeters mercury) were used with general anesthesia. Both laparoscopy and thoracoscopy appear to be safe (no complications), highly sensitive (100%), specific (88%), and accurate (91%) tools for determining the presence of surgically significant abdominal pathology and the need for therapeutic laparotomy. The appropriate application of these techniques, possibly under local anesthesia, offers potential cost savings.

Thoracoscopy versus thoracotomy: indications and advantages.

Weatherford-DA; Stephenson-JE; Taylor-SM; bLACKHURST-d

Am-surg. 1995 Jan; 61(1): 83-6

Although the diagnosis and treatment of intrathoracic diseases have been affected by the use of thoracoscopy, the indications and advantages of this procedure are poorly defined. To review the indications and results in a community practice, 52 consecutive cases of thoracoscopy were reviewed and the postoperative courses were compared to a control group of 43 simultaneous thoracotomies. Operative indications for thoracoscopy included investigation or treatment of a lung mass (n=33), spontaneous pneumothorax (n=10), mediastinal mass (n=4), pleural effusion (n=2), mesothelioma

(n=2), and a ruptured hemidiaphragm (n=1). General endotracheal anesthesia was used in each case. Overall, thoracoscopy was successful in 40 cases (77%). Conversion to formal thoracotomy was required in 14 cases (27%) secondary to poor visualization or to aid in further dissection Compared to thoracotomy, complication rates were less (7.6 vs 16.2%), hospital stay shorter (5.5 vs 8 days), ICU stay shorter (0 vs 2 days) and pleural drainage time less (2 vs 5 days) in the thoracoscopy group. In summary, 73% of the patients in this study who formerly would have undergone thoracotomy were successfully managed with thoracoscopy alone, with acceptable morbidity and mortality. These data define the indications, morbidity, and mortality of thoracoscopy and suggest that thoracoscopy may emerge as the procedure of choice in the diagnosis and management of many thoracic diseases.

Management of recurrent malignant pleural effusions. The complementary role talc pleurodesis and pleuroperitoneal shunting.

Petrou-M; Kaplan-D; Goldstraw-P

Cancer. 1995 Feb 1; 75(3): 801-5

Recurrent pleural effusions in patients with advanced cancer is a common problem that causes significant morbidity and can negatively affect patients' quality of life for their remaining months. Several palliative treatment options are available. METHOdS. The results of a 10-year experince with 180 patients referred for the surgical palliation of their condition were retrospectively reviewed. Their mean age was 60 year (range, 20-90 years). One hundred and thirty-four patients (74%) had been treated before referral with one or more of the following modalities: repeated needle thoracocentesis (87 patients), tube thoracostomy (24 patients), chemical or biologic pleurodesis (22 patients), and pleurectomy (1 patient). One hundred and seventeen patients demonstrated full lung expansion at thoracoscopy/mini-thoracotomy and underwent talc pleurodesis, whereas the other 63 patients had the "trapped lung syndrome" and required the insertion of a pleuroperitoneal shunt (Denver, Biomedical, Inc). RESULTS. There were no intraoperative deaths and the early death rate was 5.9% for the talc pleurodesis group and 3.2% for the group that received shunts. The mean hospital stay for the patients receiving talc and shunts was 7.3 days (range, 3-15 days) and 5.9 days (range, 2-12 days), respectively. Follow-up data were available in 60% of the patients and showed that effective palliation was achieved in more than 95% of patients in each group. There were eight patients re-

quiring (12%) with blocked shunts (five requiring replacement or renovation and three requiring removal and open drainage) at 1 week to 4 months after insertion. Two patients (one from each group) required one further episode of treatment by thoracocentesis. The median survival for the talc and shunt groups was 4.9 months (range, 1-63 months) and 5.4 months (range, 1-53 months). Patients with effusions because of secondary breast carcinoma or lymphomas survived the longest. CONCLUSION. In patients with malignant pleural effusions in whom pleurodesis is precluded by limited lung expansion, effective palliation can be achieved by pleuro-peritoneal shunt insertion.

Indadequacy, mortality, and thoracoscopy (editorial; comment)

Allen-MS; Pairolero-PC

Ann-Thorac-Surg. 1995 Jan; 59(1): 6

Thoracoscopic implantation of cancer with a fatal outcome [see comments]

Fry-WA; Siddiqui-A; Pensler-JM; Mostafavi-H

Ann-Thorac-Surg. 1995 Jan; 59(1): 42-5

A case is presented in which an indeterminate lung lesion was extracted through an accessory incision during a video-assisted thoracic surgical lung biopsy. The lesion was malignant, and a completion lobectomy was performed. An incisional recurrence developed 5 months later, and this was treated with a wide chest wall resection and reconstruction. However, there was a second massive chest wall recurrence that proved fatal. We believe that tumor seeding to the chest wall occurred at thoracoscopy. To prevent such tumor seeding, thoracoscopic biopsy specimens should be removed in some sort of receptacle when cancer is suspected.

Videothoracoscopy and spontaneous pneumothorax [letter]

Graham-AN; McManus-KG; McGuigan-JA

Ann-Thorac-Surg. 1995 Jan; 59(1): 266-7

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A solution to prolonged air leak after video-assisted thoracoscopic lobectomy

Bhatnagar-NK; Berndt-S

Ann-Thorac-Surg. 1995 Jan; 59(1): 260-1

Thoracoscopic removal of mediastinal parathyroid adenoma.

Smythe W.R. Bavaria-JE; Hall-RA; Kline-GM; Kaiser-LR

Ann-Thorac-Surg. 1995 Jan; 59(1): 236-8

Mediastinal parathyroid tissue hyperfunctions in as much as 25% of the patients with primary hyperparathyroidism, and this may be responsible for causing conventional operative procedures to fall in as much as one-third of the cases. When lesions prove to be not accessible through a cervical incision, or when a mediastinal adenoma is diagnosed before cervical procedures, median sternotomy and angiographic ablation have been considered the only options for removal. However, thoracoscopy has theoretic advantages over both. Two patients underwent successful thorascopic removal of a hyperfunctioning ectopic mediastinal parathyroid adenoma and their cases presented here.

Tumor implants after thoracoscopic resection of a metastatic sarcoma

Nesbitt-JC

Ann-Thorac-Surg. 1995 Jan; 59(1): 215-6

Tumor implantation after video-assisted thoracic operations is rare. We describe the case of a 61-year-old woman who underwent an apparently uneventful thoracoscopic resection of a solitary pulmonary metastasis from a primary limb sarcoma. Within 3 months, extensive trocar and diaphragmatic implants developed that required an extensive en bloc resection of her chest wall, diaphragm, and lung. Because of the aggressive biologic behavior of sarcomas and their potential to grow in surgical tracts concern is raised about the advisability of using video-assisted thoracic surgical techniques in the management of these tumors.

Applications of thoracoscopy for lung metastases.

Liu-HP; Lin-PJ; Hssieh-MJ; Chang-CH
Chest. 1995 Jan; 107(1): 266-8

Lung nodules in patients with a history of malignancy usually require tissue diagnosis that will provide prognostic information and dictate further therapy. Patients with a favorable tumor histologic condition and limited tumor burden were often considered for resection. This is usually accomplished by wedge resection through open thoracotomy when the lesions were peripheral. However, complications related to open thoracotomy often exclude poor-risk patients, especially those with impaired pulmonary function. Currently, technique of thoracoscopic resection is opening up new vistas and unimagined options for the thoracic surgeon in the management of pulmonary diseases. With the applications of thoracoscopy and small incisions, it is now possible for the thoracic cavity and its contained organs to be thoroughly explored. Our recent experience with the thoracoscopic resection as a primary treatment for lung metastases is the focus of this report. Forty-seven patients with a history of malignancy and new lung metastases underwent this type of resection. Postoperatively, there is less pain, quick functional recovery, and excellent cosmetic healing. It is a safe and promising approach.

ANNOUNCEMENTS OF THE SOCIETY

Vol. IV, No 2 April 1996

The Egyptian Society of Cardiothoracic Sugery (Registered No 346 in 1996) announces

1- The Different Symposia held in :

1- **Imbaba National Institute on 29.6.1996**
(Dr. Sherif Abdel Hady)

2- **Azhar University on 24.7.1996**
(Dr. Ezz El Din Abdel Raouf)

3- **Kasr El Aini on 30.9.1996**
(Prof. Dr. Moustafa Radwan)

4- **Zagazig University on 7.11.1996**
(Dr. Essam Abdel Wahid)

5- **Shebeen ELKom on 28.12.1996**
(Prof. Reda Mostafa)

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(1)-Neaton JD, et al. Treatment of Mild Hypertension Study (TOMHS). JAMA 1993; 270 (6) : 713-724.
(2)-Deanfield J, et al. Circadian Anti - Ischemia Program in Europe (CAPE). JACC 1994; 53A : 710-1.

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1- Gibbs, D.L Cefoperazone a mircobiological, pharmacological, and clinical review . Internal Medicine ; 2 (3), 1983: 1-6
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PRECAUTIONS
General
CEFOBID is extensively excreted in bile. The serum half-life of CEFOBID is usually prolonged and urinary excretion of the drug increased in patients with hepatic diseases and/or biliary obstruction. Even with severe hepatic dysfunction, therapeutic concentrations of cefoperazone are obtained in bile and only a 2 to 4 fold increase in half-life is seen.

Dose modification may be necessary in cases of severe biliary obstruction, severe hepatic disease or coexistent renal dysfunction.

In patients with both hepatic dysfunction and concomitant renal impairment, CEFOBID serum concentrations should be monitored and dosage adjusted as necessary. In these cases dosage should not exceed 2 g/day without close monitoring of serum concentrations.

The serum half-life of CEFOBID is reduced slightly during hemodialysis. Thus dosing should be scheduled to follow a dialysis period.

As with other antibiotics, Vitamin K deficiency has occurred in a few patients treated with CEFOBID. The mechanism is most probably related to the suppression of gut flora which normally synthesize this vitamin. Those at risk include patients with poor diet, malabsorption states (e.g. cystic fibrosis) and patients on prolonged intravenous alimentation regimens. Prothrombin time should be monitored in these patients and exogenous vitamin K administered as indicated.

A reaction characterized by flushing, sweating, headache, and tachycardia has been reported when alcohol was ingested during and as late as the fifth day after administration of CEFOBID. A similar reaction has been reported with certain other cephalosporins and patients should be cautioned concerning ingestion of alcoholic beverages in conjunction with administration of CEFOBID. For patients requiring artificial feeding orally or parenterally, solutions containing ethanol should be avoided.

As with other antibiotics, overgrowth of nonsusceptible organisms may occur during prolonged use of CEFOBID. Patients should be observed carefully during treatment.

Drug Laboratory Test Interactions
A false-positive reaction for glucose in the urine may occur with Benedict's or Fehling's solution.

Usage During Pregnancy
Reproduction studies have been performed in mice, rats and monkeys at doses up to 10 times the human dose and have revealed no evidence of impaired fertility and did not show any teratological findings. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, this drug should be used during pregnancy only if clearly needed.

Usage in Nursing Mothers
Only small quantities of CEFOBID are excreted in human milk. Although cefoperazone passes poorly into breast milk of nursing mothers, caution should be exercised when CEFOBID is administered to a nursing mother.

Usage in Paediatrics
CEFOBID had adverse effects on the testes or prepubertal rats at all doses tested. Subcutaneous administration of 1000 mg. per kg. per day (approximately 16 times the average adult human dose) resulted in reduced testicular weight, arrested spermatogenesis, reduced germinal cell population and vacuolation of Sertoli cell cytoplasm. The severity of lesions was dose dependent in the 100 to 1000 mg/kg per day range; the low dose caused a minor decrease in spermatocytes. This effect has not been observed in adult rats. Histologically the lesions were reversible at all but the highest dosage levels. However, these studies did not evaluate subsequent development of reproductive function in the rats. The relationship of these findings to humans is unknown.

Usage in Infancy:
CEFOBID has been effective', used in infants. It has not been extensively studied in premature infants and neonates. Therefore in treating premature infants and neonates potential benefits and possible risks involved should be considered before instituting therapy (See Usage in Paediatrics).

CEFOBID does not displaced bilirubin from plasma protein binding sites.

ADVERSE REACTIONS
Hypersensitivity: As with all cephalosporins, hypersensitivity manifested by maculopapular rash, urticaria, eosinophilia and drug fever has been reported. These reactions are more likely to occur in patients with a history of allergies, particularly to penicillin.

Hematology: Slight decreases in neutrophils have been reported. As with other beta-lactam antibiotics, reversible neutropenia may occur with prolonged administration. Some individuals have developed a positive direct Coombs test during treatment with cephalosporin antibiotics. Decreased hemoglobins or hematocrits have been reported, which is consistent with published literature on other cephalosporins. Transient eosinophilia has occured, and hypoprothrombinemia has been reported (See Precautions section on vitamin K deficiency).

Liver: Transient elevation of SGOT, SGPT and alkaline phosphatase levels have been noted.

Gastrointestinal: Altered bowel habits (loose stools or diarrhea) have been reported. Most of these events have been mild or moderate in severity. In all cases, these symptoms responded to symptomatic therapy when therapy was stopped.

Local reactions: CEFOBID is well tolerated following intramuscular administration. Occasionally, transient pain may follow administration by this route. As with other cephalosporins, when CEFOBID is administred by an intravenous catheter some patients develop phlebitis at the infusion site.

DOSAGE AND ADMINISTRATION
The usual adult daily dosage of CEFOBID is 2 to 4 grams per day administered in equally divided doses every 12 hours. In severe infections the dosage may be increased to a total of 8 grams per day in equally divided doses every 12 hours. Twelve grams per day have been administered in equally divided doses every 8 hours and usage of up to 16 grams per day in divided doses has been reported without complications. Treatment may be started before results of susceptibility testing are available.

The recommended dosage for uncomplicated gonococcal urethritis is 500 mg intramuscularly as a single dose.

Because renal excretion is not the main route of elimination of CEFOBID, patients with renal failure require no adjustment in dosing when usual dosages (2-4 g daily) are administered. For patients whose glomerular filtration rate is less than 18 ml/min or whose serum creatinine level is greater than 3.5 mg/dl, the maximum dosage of CEFOBID should be 4 grams per day.

Solutions of CEFOBID and aminoglycoside should not be directly mixed, since there is a physical incompatibility between them. If combination therapy with CEFOBID and an aminoglycoside is contemplated (See INDICATIONS section) this can be accomplished by sequential intermittent intravenous infusion provided that separate secondary intravenous tubing is used, and that the primary intravenous tubing is adequately irrigated with an approved diluent between doses. It is also suggested that CEFOBID be administered prior to the aminoglycoside.

In infants and children a 50 to 200 mg/kg/day dosage of CEFOBID should be given in two administrations (every 12 hours) or more if necessary. For neonates aged less than 8 days, the drug should be given every 12 hours. A dosage of up to 300 mg/kg/day has been used to treat some infants and children with severe infections, including several with bacterial meningitis, without complication.

Intravenous Administration:
Vials of CEFOBID sterile powder may be initially reconstituted with a minimum of 2.8 ml per gram of cefoperazone of any compatible reconstituting solution appropriate for intravenous administration. For ease of reconstitution the use of 5 ml of compatible solution per gram of CEFOBID is recommended.

For intermittent intravenous infusion each one-or two-gram vial of CEFOBID should be dissolved in 20 to 100 ml of a compatible sterile intravenous solution and infused over a period of 15 minutes to one hour. If sterile water for injection is the preferred diluent, no more than 20 ml should be added to the vial.

For continuous intravenous infusion, each gram of CEFOBID should be dissolved in either 5 ml of Sterile Water for Injection or Bacteriostatic Water for Injection and the solution added to an appropriate intravenous diluent.

For direct intravenous injection, the maximum dose of CEFOBID should be two grams per administration for adults and 50 mg/kg per administration for children. The drug should be dissolved in an appropriate diluent to give a final concentration of 100 mg/ml and administered over a period of no less than three minutes to five minutes.

Intramuscular Administration
Sterile Water for Injection of Bacteriostatic Water for Injection may be used to prepare CEFOBID for intramuscular injection. When concentrations of 250 mg/ml or more are to be administered, a lidocaine solution should be used. These solutions should be prepared using a combination of Sterile Water for Injection and 2% Lidocaine Hydrochloride Injection that approximates a 0.5% Lidocaine Hydrochloride Solution. A two-step dilution process as follows is recommended: First, add the required amount of Sterile Water for Injection and agitate until CEFOBID powder is completely dissolved. Second, add the required amount of 2% lidocaine and mix.

The drug should be given by deep intramuscular injection into the large muscle mass of the gluteus maximum or anterior thigh.

Reconstituted CEFOBID solutions may be stored in plastic syringes, or in flexible plastic parenteral solution containers.

Frozen samples should be thawed at room temperature before use. After thawing, unused portions should be discarded. Do not refreeze.

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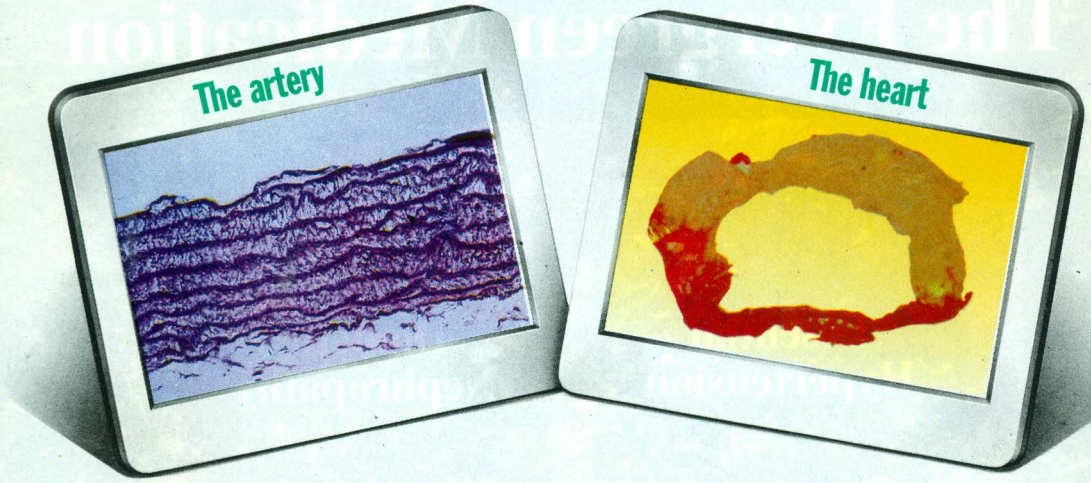
Scoring an ACE in cardiovascular remodeling



1 tablet daily

COVERSYL® 4 mg

PERINDOPRIL

in hypertension and heart failure...

...cardiovascular remodeling is a key pathogenic feature. Coversyl 4 mg actively combats cardiovascular remodeling by correcting the structural and functional alterations of the heart and artery.[1-4]

Coversyl 4 mg is a true once daily ACE inhibitor with guaranteed antihypertensive efficacy right up to 24 hours post dose.[5]

In heart failure, Coversyl 4 mg (half-a-tablet) offers a safer start to treatment thanks to an absence of significant hypotensive first-dose response.[6]

With its original properties, Coversyl 4 mg is a high-performance ACE inhibitor in both its indications.

1. SIHM I et al. *Eur Heart J.* 1993; 14(suppl) : 63 - 2. LEVY BI et al. *Circ Res.* 1988; 63 : 227-239 - 3. ASMAR RG et al. *J Hypertens.* 1988; (suppl 3) : S33-S39 - 4. MICHEL JB et al. *Circ Res.* 1988; 62 : 641-650
5. MORGAN TO et al. *Am J Hypertens.* 1993; 6 : 116 A - 6. MAC FADYEN RJ et al. *Br Heart J.* 1991; 66 : 206-211.

Coversyl is a long-acting ACE inhibitor. **International nonproprietary name** : Perindopril. **Indications :** Essential hypertension. Congestive heart failure (adjunctive therapy). **Dosage and administration :** *Hypertension :* 4 mg once a day in the morning. If necessary, the dose may be increased to 8 mg after one month of treatment. Coversyl should be taken before food. *Congestive heart failure :* Coversyl should be started under close medical supervision at a starting dose of 2 mg in the morning. This may be increased to 4 mg once blood pressure acceptability has been demonstrated. *Elderly patients :* start treatment at 2 mg daily. **Contraindications :** Children. Pregnancy. Lactation. Patients with a history of hypersensitivity to Coversyl. **Precautions :** Assess renal function before and during treatment where appropriate. Renovascular hypertension. Surgery/Anesthesia. Renal insufficiency : the dose should be cautiously adjusted in accordance with the creatinine clearance *(refer to complete data sheet).* Symptomatic hypotension is rarely seen, but is more likely in volume-depleted patients, those receiving diuretics, or with the first two doses. In diuretic-treated patients, stop the diuretic 3 days before starting Coversyl. A diuretic may later be given in combination if necessary; potassium-sparing diuretics are not recommended. Combination with neuroleptics or imipramine-type drugs may increase the hypotensive effect. Serum lithium concentrations may rise during lithium therapy. **Side effects :** Rare and mild, usually at the start of treatment. Cough, fatigue, asthenia, headache, disturbances of mood and/or sleep have been reported. Less often, taste impairment, epigastric discomfort, nausea, abdominal pain, and rash. Reversible increases in blood urea and creatinine may be observed. Proteinuria has occurred in some patients. Rarely, angioneurotic edema and decreases in hemoglobin, red cells, and platelets have been reported. **Composition :** Each tablet contains 4 mg of the tert-butylamine salt of perindopril. **Presentation :** Packs of 30 tablets of Coversyl 4 mg (scored). *Refer to data sheet for complete prescribing information.*

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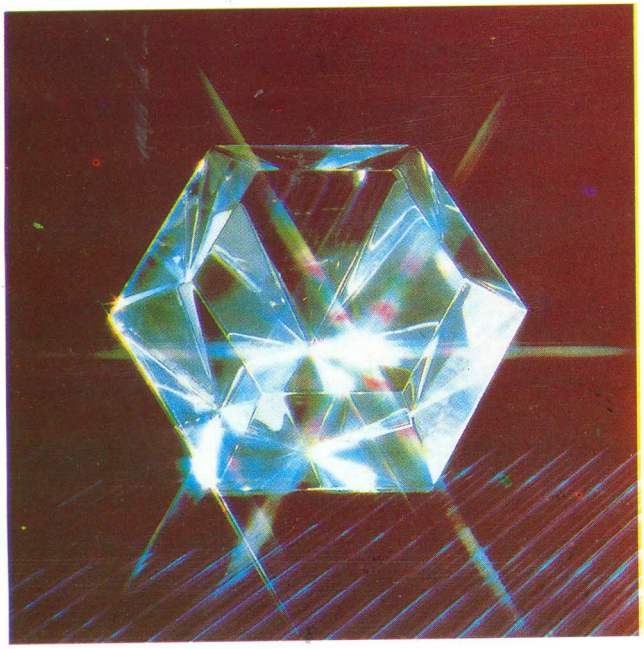
HYPERTENSION

Well-being

the key to success



- Well-being with Natrilix is a spontaneously reported subjective sensation demonstrated by large multicentre studies (1, 2).
- Well-being with Natrilix is also related to its simple and once-daily dosage, and its excellent clinical and biological tolerance.
- Well-being with Natrilix is thus the guarantee of a better adherence of the patient to treatment and the guarantee of a high therapeutic success rate maintained over the long term (3).

(1) Wheeley M. St G. et al. (1982) Pharmatherapeutica, 3 (2): 143-152. (2) Watters K., Campbell D.B. (1986), Concilia Medica, 1 (3): 33-41. (3) Vukovich R.A. et al. (1983), CMRO, 8 (suppl. 3): 109-122.

NATRILIX

INDAPAMIDE

1 tablet daily

Indication: Essential hypertension. **Contra-indications:** Severe hepatic insufficiency, recent cerebrovascular accidents. **Associated treatments:** In view of its mode of action, Natrilix may be combined with any non-thiazide anti-hypertensive agent. Drug combinations to be avoided: tienilic acid, lithium, fenoxidil, lidoflazine, prenylamine, vincamine. **Precautions:** Monitoring of potassium and uric acid serum levels is recommended especially in subjects with a predisposition or a sensitivity to hypokalemia, and in patients with gout. **Side-effects:** Hypokalemia, fatigue, orthostatic hypotension, allergic manifestations. **Dosage and administration:** One tablet daily. **Composition:** Each coated tablet contains 2.5 mg of 1-(4 chloro-3-sulfamyl-benzamido)-2-methyl-indoline (or indapamide). **Presentation:** Box of 30, 60 or 100 coated tablets.

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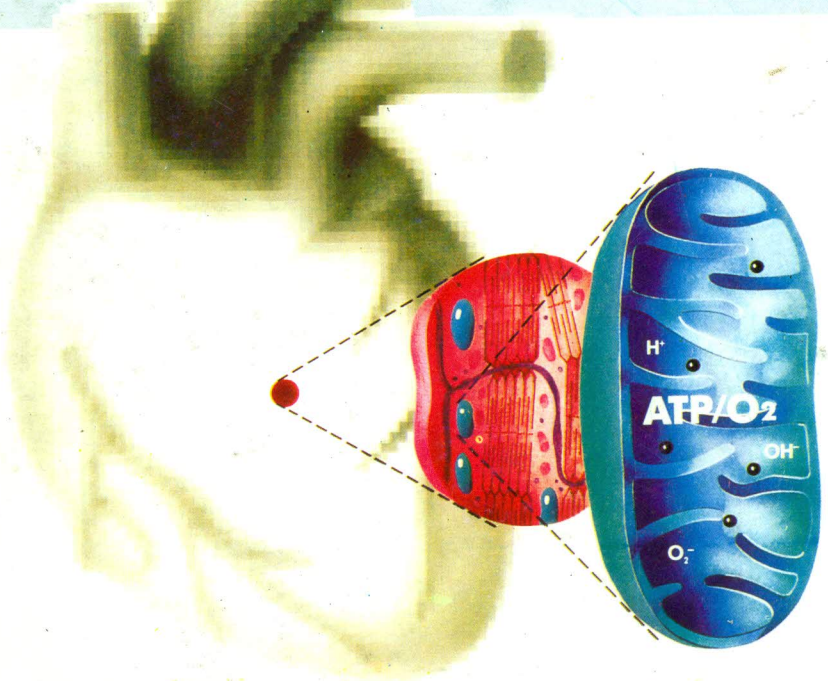
VASTAREL® 20

Trimetazidine

OPTIMIZES MITOCHONDRIAL ENERGY METABOLISM[1-3]

3 tablets daily



providing all coronary patients with

- **permanent myocardial cytoprotection**[4]
- **major antianginal efficacy**[4-6]

Indications: Ischemic heart disease (angina pectoris, sequelae of infarction).
How supplied: Box of 60 tablets, each containing 0.02 g trimetazidine dihydrochloride.
Dosage: 3 tablets per day in three divided doses, with meals.
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VASTAREL® 20
Trimetazidine
3 tablets daily