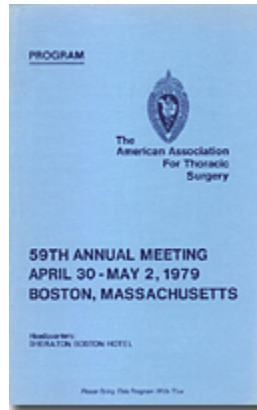


1979 ANNUAL MEETING PROGRAM



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American Association for Thoracic Surgery 59TH ANNUAL MEETING Scientific Program

MONDAY MORNING, APRIL 30, 1979

8:30 A.M. Business Session (Limited to Members)

Ballroom

8:45 A.M. Scientific Session

Ballroom

1. Angina Postacute Myocardial Infarction: A Definite Surgical Indication

*RENE G. FAVALORO, ERNESTO E. WEINSCHELBAUM**

FERNANDO J. BOULLON, VICTOR M. CARAMUTTI*and*

LUIS M. DE LA FUENTE, Buenos Aires, Argentina*

Cine coronary angiography can be performed during the acute and subacute phase of an acute myocardial infarction. A total of 318 patients were studied by selective cine coronary angiography

without mortality and within 30 days of the acute episode. In 203 patients angina pectoris was the indication for the cine angiographic study; 60% showed severe segmental obstructions and only 40% demonstrated total occlusion of the artery responsible for the infarction. Six different angiographic patterns to be discussed were individualized. The analysis of the clinical history, electrocardiographic changes and the utilization of postextra-systolic potentiation, vasodilators and radioisotopes allow us to differentiate ischemia and necrosis. By means of a careful screening of the data obtained we can select proper candidates for immediate revascularization.

The operation can be performed with an acceptable operative risk (7% in 79 patients) and can be done during the acute phase of the episode (half of the patients were operated upon within the first two weeks of the myocardial infarction). To evaluate the medical and surgical treatment of patients with angina postacute myocardial infarction a group of patients were followed during 34 months, 20 were assigned to medical therapy though they were ideal candidates for revascularization and 40 underwent surgical treatment. This comparative study showed that patients with surgical treatment had a total mortality (early and late) of 7.5%; conversely, patients under medical treatment had a 40% mortality rate. Seventy-seven percent of the patients operated upon are asymptomatic, on the other hand, only 20% of the patients under medical therapy are asymptomatic. It is important to remark that 66% of the deaths in the medically treated group occurred suddenly.

Angina postacute myocardial infarction should be included as another form of unstable angina. Our belief is that patients should be studied by cine coronary angiography and operations performed when indicated. Further extension of the infarcted area can be prevented. Cine left ventriculograms and ventricular function studies can demonstrate significant improvement of left ventricular contractility. Pre and postoperative evaluation will be shown.

*By invitation

2. Improvement of Left Ventricular Function by Coronary Bypass Surgery

*M. LAXMANKAMATH**, *CHARLESHELLMAN**,
*DONALD H. SCHMIDT**, and *W. DUDLEY JOHNSON*,
Milwaukee, Wisconsin

There has been considerable controversy regarding the beneficial effects of myocardial revascularization surgery (MRS) on left ventricular function. To assess the effects of MRS on exercise-induced myocardial ischemia, 27 patients (pts) with coronary artery disease (CAD) who had MRS performed were prospectively studied by rest (R) and exercise (E) first-pass nuclear angiography (FPNA). All pts had 30° RAO view R+E FPNA 1 to 3 days pre-MRS and 10 days post-MRS. Mean population age was 52 years; the mean number of grafts placed was 3.2 per pt. In addition, 12 young male volunteers assumed to have normal coronary arteries were tested to R+E FPNA to serve as normal control. In all E FPNA studies, pts had progressive bicycle exercise to symptoms of fatigue, dyspnea, or chest pain. Parameters of ejection fraction (EF), end diastolic volume (EDV), stroke volume (SV), and regional wall motion dysfunction (RWMD) were determined from the FPNA data. Average changes from R to E are shown below:

GROUP	EF(%)	EDV(cc)	SV(cc)	ERWMD
No CAD	.62†'74*	108†'115	65†'88*	0 pts
CAD pre-MRS	.63†'44*	109†'155*	65†'62	20 pts
CAD post-MRS	.65†'73	102†'105	64†'76*	0 pts

*indicates significance with $p < 0.05$

Results: Pre-MRS; 25/27 pts showed significant decrease in EF with exercise, while all 12 pts without CAD showed significant increase in EF. Following MRS; 25/27 CAD pts had significant increase in their EF with exercise.

In conclusion, MRS in pts with significant CAD can improve myocardial performance during exercise by abolishing evidence of ischemia (decreased EF, increased EDV, and E RWMD) as assessed by FPNA testing. In fact, it is suggested that failure to abolish such an abnormal response by such testing may reflect incomplete revascularization.

*By invitation

3. The Transluminal Dilatation of Coronary Arteries and Partially Obstructed Saphenous Vein Grafts

W. B. FORD, M. H. WHOLEY, E. A. ZIKRIA*, W. H. MILLER*,
S. R. SAMADANI*, and A. G. KOIMATTUR *, Pittsburgh, Pennsylvania*

Since January 1978 we have evaluated 12 patients in whom segmental occlusive disease of the aorto-coronary saphenous vein graft or the native coronary circulation was present. The significantly occluded vessels were restored to relatively normal circulation by means of percutaneous transluminal dilatation in 8 of these patients, with technical failures in 3 patients and the occurrence of a thrombosis during the dilatation procedure in one other.

All dilatation procedures are performed under local anesthesia with an open heart team standing by. In the event of technical failure or incipient thrombosis with developing infarction, the patient is transferred for immediate bypass surgery.

This paper will include detailed technical description of the procedure as well as the catheters we have used. Catheter designs utilized thus far include a series of coaxial dilating catheters as well as the balloon-type catheter.

Details of the clinical and laboratory evaluation of selected cases are described, as well as the clinical results. Follow-up of these patients will continue at least 12 months, and our follow-up findings to date will be reported.

Based on these early results, we have developed categorized guidelines of the indications for percutaneous transluminal dilatation of the coronary arteries and the anastomotic sites of their saphenous vein grafts. Percutaneous transluminal dilatation procedures have been performed successfully for occlusive changes in the iliac and femoral vessels, but the technique has only recently been described for the coronary circulation. Certain inherent complications will be mentioned, but our preliminary experiences are encouraging. Our work with transluminal coronary dilatation is progressing, and it is expected that more experience will be available for presentation at the April meeting.

Slides and a 16 mm. movie depicting the catheters and their use will be included in the presentation.

INTERMISSION - VISIT EXHIBITS

*By invitation

SESSION ON CONTROVERSIES

Internal Mammary Artery versus Saphenous Vein Grafts

4. Isoproterenol Induced Flow Responses in Mammary and Vein Bypass Grafts

*DONALD H. SCHMIDT**, *FRED BLAU**, *CHARLES HELLMAN**
and *W. DUDLEY JOHNSON*, Milwaukee, Wisconsin

Clarification of the relative flow potentials of direct mammary grafts and aorta-to-coronary artery vein grafts is clearly desirable. For this purpose regional myocardial perfusion (RMP) was measured at rest and following isoproterenol (ISO) infusion (4-8/ μ g/min) to a mean HR of 119 in 38 patients. After injection of 15mCi ^{133}Xe into the coronary artery (CA) or graft, washout of the ^{133}Xe from the distribution of the artery or graft was measured with a multi-crystal scintillation camera. RMP(ml/100g/min) was calculated using the Kety formula. The double product (DP) of HR and systolic BP was used as an index of myocardial oxygen demand. A response index (RI) was calculated ($\text{RI} = 10^3 \times \frac{\text{RMP}}{\text{DP}}$) to normalize the data. The following mean results were obtained:

	Normal (7)			Veins (17)			Mammarys (14)		
	HR	BP	RMP	HR	BP	RMP	HR	BP	RMP
Rest	74	147	70	78	153	74	88	135	80
ISO	116	149	121	118	150	122	121	137	117
RI	8.3 \pm 3.7			10.2 \pm 5.6			8.7 \pm 3.2		

Hence there were no significant differences between the response index of the direct mammary grafts (8.7) or vein grafts (10.2) to an occluded left anterior descending CA, as compared to the normal circulation (7.4). The data indicates that mammary grafts produce the same flow response to the increased demand of ISO as do vein bypasses and the normal circulation. Because of the other advantages of the mammary graft (higher patency and total absence so far of late closure), this refutes the often expressed fear that mammary flow is too low for adequate perfusion.

*By invitation

5. Left Anterior Descending Coronary Artery Bypass Grafts: Saphenous Vein Versus Internal Mammary Artery

*DENISH. TYRAS**, *HENDRICK B. BARNER*,
GEORGE C. KAISER, *JOHNE. CODD**, *D. GLENNPENNINGTON**,
and *VALLEEL. WILLMAN*, St. Louis, Missouri

During the interval 1972-1977, of 1521 patients undergoing isolated coronary artery bypass grafting, 1458 received grafts to the left anterior descending (LAD). The internal mammary artery (IMA) was used in 765 patients, reversed saphenous vein (SVG) in 693 patients. Choice of bypass conduit was nonrandom. Clinical follow-up is available in 98% of patients. Angiography has been obtained in 67% of eligible patients at 1 month, 60% at 1 year, 60% at 3 years, and 62% at 5 years.

Results:	IMA	SVG	p-value
Age	52.2 ± 0.3	53.1 ± 0.3	<0.05
Women	17.4%	13.0%	<0.025
No. of grafts/patient	2.5	2.5	N.S.
Left main coronary stenosis %≥50% (LMCA)	9.3%	16.9%	<0.005
Pre -infarction angina (PI A)	10.6%	15.0%	<0.025
Operative mortality	1.4%	1.9%	N.S.
Cumulative 5 year survival	88.6%	89.5%	N.S.
Patency of LAD graft (cumulative):			
1 month	97.5%	94.1%	<0.005
1 year	92.8%	87.5%	<0.002
3 years	92.0%	85.5%	<0.0005
5 years	89.9%	82.8%	<0.005
Normal preoperative LV function	49.0%	49.0%	N.S.
Normal postoperative LV function:			
operation 72-73	54.0%	46.0%	N.S.
operation 74-77	70.0%	59.0%	<0.05
1 year graft patency: operation 72-73	87.1%	82.2%	N.S.
operation 74-77	+ { 94.7%	++ { 89.8%	<0.01
+ p<0.0125	++ p<0.04		

Although the choice of bypass graft conduit was nonrandom and SVG was used more often in the event of LMCA and PIA, perioperative myocardial infarction (MI) was significantly lower in the IMA group (6.3%) vs. the SVG group (10.6%), even when LMCA and PIA patients were excluded (p<0.005).

These data show higher patency rates, lower perioperative MI occurrence, and better preservation of ventricular function with IMA grafts to the LAD. However, these benefits with IMA over SVG were only obtained after two years of experience (approximately 100 patients), and this apparent "learning period" may be a significant deterrent to use of the IMA as a new approach.

*By invitation

6. Clinical Comparison Between Patients with Saphenous Vein and Internal Mammary Artery as a Coronary Graft

JAMES W. JONES, JOHN L. OCHSNER, NOEL L. MILLS,
and LARRY HUGHES*, New Orleans, Louisiana*

Among the few available reports that compare the effects on surgical success, we found that patients having internal mammary artery (IMA) grafts had superior hospital and extended courses. In recent years, improved technique, better myocardial protection, and more extensive revascularization have led to better patency rate of saphenous vein grafts (SVG). Our previous study was extended to include patients from January, 1971 through May, 1978. Of this group, one thousand, two hundred and thirty-nine (1,239) patients had comparable patterns of bypasses. Seven hundred twenty-six (726) patients had SVG's alone and 513 patients had IMA bypasses exclusively or in combination with SVG bypasses. Follow-up ranged from 7.5 years to 6 months and was complete in 99%. In the total group, 493 (96.1%) patients with IMA grafts are alive and 679 (93.5%) patients with SVG are alive ($P=0.00378$). Rates of anginal relief were not significantly different ($P=0.413339$). Distribution of the two groups among 193 other variables was examined. After maldistributed subsets were removed, 415 patients having SVG's and 363 patients with IMA's remained for study. Although overall survival rates were better in the unbiased group having IMA bypasses (97.5% vs. 95.7%), the differences were not significant ($P=0.38402$). Logrank test analyses were done on all survival data and confirmed these findings.

Conclusion - Using present-day techniques of coronary artery surgery, there is little effect on the clinical outcome, whether the internal mammary or saphenous vein graft is used as a conduit. Consequently, the internal mammary artery is indicated (1) as a conduit to small arteries; (2) as a conduit to arteries supplying limited muscle mass; (3) where a vein is unavailable; and (4) where not competitive with the native circulation or a larger vein graft.

11:15 A .M. Presidential Address

A LETTER TO HELEN John W. Kirklin

*By invitation

MONDAY AFTERNOON, APRIL 30, 1979

2:00 P.M. Scientific Session Ballroom

7. A Comparison of Bubble and Membrane Oxygenators in Short and Long Perfusions

*RICHARD E. CLARK, THOMAS B. FERGUSON and
CLARENCE S. WELDON, St. Louis, Missouri*

This study was conducted over a 3-year period to ascertain the physiologic and biochemical alterations invoked by the use of bubble (N=20) and membrane oxygenators (N=20) in 40 selected high risk patients where perfusion times were anticipated to be ≈ 3 hrs. Similar matched sets of 40 patients each who had perfusion times of 2 hours or less were chosen to examine dependency of the results on perfusion time. The membrane oxygenator was a folded system using microporous expanded polytetrafluoroethylene. Independent automated transducer systems autoregulated venous and arterial roller pumps. Data were obtained before, at 30 min. intervals during, and at 1,4,

and 24 hrs. after bypass. The following were measured: Hgb, Hct, WBC, platelets (direct), IgA, IgM, IgG, C'3, C'4, total protein, plasma Hgb, fibrin split products (FSP), protamine sulfate precipitations (PSP), electrolytes, gases, pH, glucose, BUN, urinary output, CVP, MAP, HR, temperature, blood loss and volume replacement. All cases used hemodilution, systemic and topical cardiac hypothermia and ischemia arrest. The average perfusion time in the long cases was 188 ± 14 min., range 121 - 316 min. In the short cases the average time of perfusion was 109 ± 11 min. The results demonstrated statistically similar changes in Hgb, Hct, and total protein in all cases reflecting similar degrees of hemodilution. Significant changes favorable to membrane oxygenators occurred only in the long cases where less WBC, platelet, C'3 decrease, less postoperative blood loss, and markedly lower hemolysis occurred. FSP and PSP were less frequently elevated or present with membrane oxygenators in long cases. Pump flows and urinary output were greater and total peripheral resistance during perfusion was decreased compared to bubble. C'4 losses were greater with membranes in long perfusions. It is concluded that the theoretic advantages of folded membrane oxygenators are only evident in long perfusions and may be offset by greater cost, complexity and less margin of safety.

*By invitation

8. Pulsatile Perfusion Vs. Conventional High Flow Non-pulsatile Perfusion for Rapid Core Cooling and Rewarming of Infants for Circulatory Arrest Cardiac Surgery

G. DOYNE WILLIAMS, ASTRIDE B. SEIFEN*, JIM B. NORTON*,*

RICHARD I. READINGER, THOMAS W. DUNCAN*, and*

JANE K. CALLAWAY, Little Rock, Arkansas

Sponsored by: Gilbert S. Campbell, Little Rock, Arkansas

Thirty consecutive infants undergoing hypothermia and circulatory arrest for repair of VSD, TGV, or A/V canal defects were alternately selected for conventional high flow non-pulsatile perfusion (Group A) or pulsatile perfusion (Group B) during core cooling and rewarming. All received morphine anesthesia, 30 mg/kg solu-medrol and 10-15 micrograms/kg phentolamine. Group A was perfused at 160-180 cc/kg/min with a roller pump and oxygenator with arterial pressure of 50-55 mm. Hg. Group B utilized a roller pump and oxygenator and an especially constructed pulsatile assist device (Datascope Corp.) was interposed in the arterial line to provide pulsatile perfusion with 75/40 mm. Hg. pressure at slightly reduced flow (150 cc/kg/min). The average rectal, esophageal, and tympanic membrane temperatures were reduced to approximately 16° C prior to circulatory arrest. Following repair, perfusion was resumed until these temperatures returned to 37° C. Results were as follows:

	Group A (Non-pulsatile)	Group B (Pulsatile)
# of patients	15	15
Average weight	6.5 kg.	6.7 kg.
Average cooling time	15.1 minutes	9.9 minutes
Average warming time	31.0 minutes	19.7 minutes
Total pump time	46.1 minutes	29.6 minutes
Total urine on pump	14.0 cc	29.1 cc

Plasma free hemoglobin	36 mg. %	32 mg. %
Mortality	2	1
Post rewarming pH	7.31	7.42
Average rectal temperature when esophageal reached 16° C	25.2° C	18.0° C

Cooling and rewarming were enhanced by pulsatile perfusion with over 30% reduction in total pump time. Additionally, the larger patients in the pulsatile group cooled almost as rapidly as the smaller. The rate of decline and subsequent rise of rectal, esophageal, and tympanic membrane temperatures were equal in the pulsatile group but, the rectal lagged far behind in the non-pulsatile infants. The pulsatile flow infants awakened more quickly, were more alert, and required less post-operative mechanical ventilation. We suggest that pulsatile perfusion for core cooling and rewarming of infants is safe and is more rapid and physiologic than conventional high flow non-pulsatile perfusion.

*By invitation

9. Intramyocardial pH as an Index of Myocardial Metabolism During Cardiac Surgery

*FRANCIS J.M. WALTERS**, *GREGORY J. WILSON**,

*DAVID J. STEWARD**, *RAUL J. DOMENECH** and

DAVID C. MacGREGOR, Toronto, Ontario, Canada

A practical method for continuously monitoring the state of tissue metabolism in the individual patient's heart during cardiac surgery is not yet available. We have examined the use of microelectrode measurements of myocardial interstitial pH to provide this monitoring capability, making comparisons with intracellular pH in left ventricular (LV) biopsy specimens and with tissue pCO₂ measured by mass spectrometry. An H⁺ sensitive glass microelectrode, housed in the bevelled end of a 21 gauge (0.8 mm diameter) needle, plus a 2 mm diameter reference electrode, with an internal Ag/AgCl electrode coupled to tissue through a saline bridge, were used. Microelectrode pH measurements in blood at 37°C were compared with conventional blood gas analysis over a pH range from 7.4 to 6.4. Linear regression analysis (n=26) revealed a high correlation (r=0.997) and a negligible difference in paired observations of only 0.01 ± .004 (mean ± SEM) pH units.

In 14 dogs on cardiopulmonary bypass, the pH needle and reference electrodes were inserted into the anterior wall of the LV to a mean depth of 6 mm. Under control conditions (37°C, arterial pH 7.36 ± .02, pCO₂ 2.39 ± 1.3 mm Hg, pO₂ >100 mm Hg) the tissue microelectrode pH was 7.32 ± .02. Ischemic arrest of the heart at 37°C was then used to alter myocardial pH. In Group I (n=8), intracellular pH was estimated from LV biopsy specimens (400 mg each) taken at intervals over a microelectrode pH range of 7.37 to 6.37. The microelectrode and biopsy pH measurements were significantly correlated (r=0.905, n=41, P<.001). Microelectrode (interstitial) pH exceeded biopsy (intracellular) pH under control conditions by 0.28 ± .025 pH units (P<.001), but below a microelectrode pH of 6.8 the results of the two techniques did not differ significantly. In Group II (n=6), tissue pCO₂ in the anterior wall of the LV was determined by mass spectrometry. The tissue pCO₂ rose from 69 ± 2 mm Hg under control conditions to a final plateau during ischemia of 419 ± 25 mm Hg, the latter not being significantly different from a level of 422 ± 28 mm Hg

theoretically calculated from the pH change ($7.37 \pm .014$ to $6.01 \pm .07$), providing a further independent check on the pH microelectrode technique.

These results indicate that continuous microelectrode intramyocardial pH measurements do reflect the evolving state of intracellular metabolism during elective arrest of the heart and have a great potential for clinical application.

*By invitation

10. Hypothermic Circulatory Arrest: 31-P Nuclear Magnetic Resonance (NMR) of Isolated Perfused Neonatal Rat Brain

WILLIAM I. NORWOOD, CAROL R. NORWOOD*,*

*JOANNE S. INGWALL *, ALDO R. CASTANEDA and*

ERIC T. FOSSEL, Boston, Massachusetts*

Deep hypothermic circulatory arrest facilitates repair of congenital cardiac anomalies in infants. However, in spite of its widespread use, little is known of the fundamental cellular and molecular changes induced. An isolated perfused brain model was developed in part to study high energy phosphate metabolism with 31-P NMR at 109.3 MHz. Neonatal Sprague-Dawley rats cannulated through the ascending aorta were perfused with modified Krebs-Henseleit buffer. Soft tissues surrounding the calvarium, and cervical and thoracic spine were excised and the preparation lowered into a 15 mm. OD NMR tube. 200 to 400 free induction decays were averaged and transformed to produce each spectrum. The 31-P NMR spectra of well perfused brain show six major resonances representing α , β , and γ phosphates of ATP, sugar phosphate, inorganic phosphate (Pi), and creatine phosphate (CrP). Preparations equilibrated to 37°C and 20°C were subjected to 20 minutes of ischemia with 15-20 minutes of reperfusion. Levels of CrP and ATP fell coordinately to $13 \pm 1\%$ and $28 \pm 4\%$ of control levels, respectively by 15 minutes of normothermic ischemia. This is distinctly different from rat heart where CrP significantly precedes the decrease in ATP. At 20°C CrP fell rapidly while ATP remained unchanged suggesting isolation of creatine kinase from the ATP pool in brain. On reflow at 37°C, ATP and CrP recovered substantially, but failed to return to control levels ($51 \pm 16\%$ and $52 \pm 8\%$, respectively). Following ischemia at 20°C ATP and CrP returned to control levels by 10 minutes. Intracellular pH determinations by chemical shift of Pi revealed a decrease from 7.2 to 6.7 during ischemia at 37°C, while pH at 20°C remained unchanged at 7.4. NMR proved a valuable tool for studying high energy phosphate metabolism in brain. This study suggests that permanent changes in ATP and CrP pools induced by 20 minutes of normothermic ischemia are attenuated while intracellular pH changes are abated by hypothermia.

INTERMISSION - VISIT EXHIBITS

*By invitation

11. Acute Adrenal Insufficiency Following Cardiac Surgical Procedures

WILLIAM C. ALFORD, JR., CLIFTON K. MEADOR,*

GEORGE R. BURRUS, DAVID M. GLASSFORD, JR. *,*

*WILLIAM S. STONEY and CLARENCE S. THOMAS, JR. *,*

Four of 4,064 adult patients undergoing cardiac surgical procedures at this hospital from 1974 to 1978 have experienced bizarre and confusing postoperative courses, ultimately shown to be on the basis of acute adrenal insufficiency. Three were men and the age range was 53 to 70 years (average 60.5 years). None had evidence of preoperative Addison's Disease or endocrine hypofunction.

In each instance, the operation was coronary artery bypass performed without untoward incident. Following uncomplicated postoperative courses ranging from 4 to 7 days, each developed insidious symptoms of flank or abdominal pain, delirium, low grade fever and eventual shock, occasionally preceded by hypertension. Diagnoses considered include leaking abdominal aneurysm, ischemic bowel, retroperitoneal hemorrhage, cholecystitis, pancreatitis, nephrolithiasis, stress ulcer, cecal volvulus, septicemia, brain tumor, cerebral edema and schizophrenia. None had infection. All had abdominal surgical consultation and three underwent laparotomy.

The correct diagnosis was first suspected at postoperative day 11 to 34 (average 20.5) and proven at postoperative day 15 to 41 (average 29.0). Low serum cortisol levels strongly suggested adrenal insufficiency. Confirmation was based on lack of rise in urinary steroid determinations after 3 days of maximal adrenal stimulation with ACTH. The four patients remain well on steroid replacement 7 to 58 months later, except for one who died 16 months postoperatively of aortic dissection. The adrenal glands showed apparent old hemorrhagic destruction, the cause of which is speculative.

The complexities of care of the postoperative cardiac surgical patient make the recognition of new adrenal insufficiency especially difficult. However, the rare person with such a diagnosis can be managed successfully and expect long-term clinical benefit.

*By invitation

12. The Bjork-Shiley Tilting Disc Valve - A Ten Years' Appraisal

VIKING O. BJORK and AXEL HENZE, Stockholm, Sweden*

The Bjork-Shiley tilting disc has passed 10 years, clinical use with an excellent performance and with significant improvement within its original design in the three most important aspects:

1. Durability. The original Delrin disc still gives an excellent performance after 10 years in patients. The pyrolytic carbon disc has increased the durability and diminished the regurgitation. The large strut has been made an integral part of the valve ring and thereby three times stronger. No genuine mechanical failure has been encountered in more than 1800 consecutive patients at Karolinska Hospital.

2. Flow-resistance. Haemodynamic evidence at rest and during exercise in 140 cases has been reported from our clinic to confirm the appropriate haemodynamic performance of the Bjork-Shiley prosthesis. No other presently available biological or mechanical heart valve shows such a low flow-resistance or gradient for a given tissue diameter, a fact of particular importance in cases with narrow aortic roots. A 10% further reduction in flow-resistance was obtained by the new convexo-concave version.

3. Thrombo-resistance. The new convexo-concave model uses an opening mechanism that adds a sliding of the disc when it tilts open and simultaneously increases the smaller opening of the prosthesis by 40%. Early experience in 320 operated cases, followed-up to 2⁺ years, has shown a promising low incidence of thrombo-embolic complications, which is probably due to increased

velocity of flow through the minor prosthetic orifice and elimination of the low flow area behind the disc. Single MVR had no thrombo-embolic complications in 701 patient months and 1 thrombosis in AVR+MVR during 216 patient months.

4. Function control. The disc was equipped with a ring-shaped radi-opaque marker, permitting non-invasive function control of the tilting motion by means of cine-radiography or fluoroscopy.

A summary of the 10-year-experience is given.

*By invitation

13. Long-term Evaluation of the Porcine Xenograft Bioprosthesis

*PHILIPPE. OYER**, *EDWARD B. STINSON**, *BRUCE A. REITZ**,

*D. CRAIG MILLER**, *STEVEN ROSSITER**,

and NORMAN E. SHUMWAY, Stanford, California

The principal advantage of bioprosthetic cardiac valves, as compared to mechanical valve substitutes, consists of relative freedom from embolic complications and anticoagulant-related morbidity and mortality. However, the long-term durability of presently available biopros-theses has not been fully documented. This report provides followup data on 1285 patients [557 aortic (AYR), 561 mitral (MVR),and 167 aortic-mitral (AVR+MRV) replacements] who received Hancock xeno-graft valves at Stanford between 1971 and 1978. The total followup duration is 2740 patient-years, with a maximum followup of 7.3 years. One hundred ninety-six patients have been followed for > 4 years and 66 for > 5 years. Actuarial survival (\pm SEM) for AVR patients was 77 (\pm 4)% at 4 years, for MVR patients 72 (\pm 3)% at 5 years, and for AVR+MVR patients 73 (\pm 4)% at 4 years. Linearized morbidity and mortality expressed as percent per patient-year, unless otherwise indicated, are tabulated below.

	AVR	MVR	AVR+MVR
Operative mortality	5.7%	8.9%	14.9%
Late mortality	4.1	5.5	4.4
Thromboembolism			
Overall	2.1	3.1	1.6
Fatal	0.04	0.04	0.0
Anticoagulant hemorrhage			
Overall	0.9	1.2	0.6
Fatal	0.0	0.04	0.0
Valve Dysfunction	1.1	1.2	1.6
Endocarditis	1.5	0.5	2.2
Xenograft replacement rate	0.6	0.8	1.3

Long-term anticoagulation was maintained in 10% of AVR patients and 31% of MVR patients (usually because of severe atherosclerosis of the ascending aorta, anatomic left-atrial abnormalities,

or persistent atrial arrhythmias), accounting for the small incidence of anticoagulant-related morbidity and mortality reported. Actuarial probability (\pm SEM) of remaining free of thromboembolism for AVR patients is 95 (\pm 2)% at 4 years, for MVR patients 92 (\pm 2)% at 5 years, and for AVR+MVR patients 96 (\pm 2)% at 4 years. The actuarial probability of remaining free of valve dysfunction for AVR patients is 95 (\pm 2)%, for MVR patients 93 (\pm 2)%, and for AVR+MVR patients 95 (\pm 3)% at 4, 5, and 4 years respectively. These current data over an extended followup interval indicate that the Hancock xenograft valve continues to perform satisfactorily in terms of bioprosthesis-related morbidity and mortality, and, in particular, has shown no propensity for late failure due to leaflet tissue disruption.

*By invitation

14. Failure of Porcine Valve Heterografts in Children

*ALEXANDER S. GEHA, HILLEL LAKS**,

*HORACE C. STANSEL, JR., J. FREDERICK CORNHILL**,

JAMES W. KILMAN, MORTIMER J. BUCKLEY and

*WILLIAM C. ROBERTS**, *New Haven, Connecticut,*

Columbus, Ohio, Boston, Massachusetts, and Bethesda, Maryland

Heterograft porcine valves have gained wide acceptance in replacement of diseased cardiac valves and their clinical performance in adults has been very satisfactory over follow-up periods of up to eight years. Valve replacement in children is relatively infrequent and experience with porcine xenografts is necessarily small. Our combined experience at three university hospitals has been with 25 children, 17 months to 16 years of age, who have been followed for five months to five years (mean follow-up 28 months). Porcine valves were used to replace the aortic valve in 15, the mitral valve in four, the tricuspid valve in one, and the pulmonary valve in five patients. Four (12%) of these valves have failed so far and required replacement because of severe stenosis in mitral (one) or aortic (three) valve prostheses at 18 to 45 months after implantation. Pathologic examination showed extensive fragmentation of collagen with focal heavy calcification and degeneration. In addition we have encountered deterioration and calcification of one porcine valve in 23 valved conduits followed up to five years (mean three years), requiring removal and replacement of the valve five years after implantation.

This experience indicates a disquietingly high incidence of relatively early failure of porcine xenograft valves in children. This is significantly higher than the failure rate observed in adult patients, and may be related to the small size of the implanted valves which become relatively narrow with the growth of the patient, leading to excessive turbulence and trauma to the prosthesis. Other factors which may contribute to these failures should be examined also in order to obtain better long-term results. A satisfactory performance would make heterografts the ideal valvular prostheses in children since anticoagulation is avoided.

*By invitation

TUESDAY MORNING, MAY 1, 1979

8:30 A.M. Scientific Session

Ballroom

15. Management of Symptomatic Tetralogy of Fallot in the First Year of Life

WILLIAM Y. TUCKER, KEVIN TURLEY*, DANIEL J. ULLYOT,*

and PAUL A. EBERT, San Francisco, California

The surgical management of tetralogy of Fallot (TOP) in infants is debatable. The questions of total correction versus palliation, and the type of palliative procedure, remain controversial.

During the past 3½ years, 28 infants, ages 12 months or less, with symptomatic TOP underwent either total correction (21 infants) or palliation by relieving the pulmonary stenosis with a right ventricular outflow tract (RVOT) patch (7 infants). The age range of these infants was two days to 12 months, with a mean of 5.8 months. There were four hospital deaths in the entire group (mortality 14.3%), with three deaths occurring in the total correction group (14.3%) and one in the palliation group (14.3%).

The right pulmonary artery diameter to ascending aortic diameter ratio (PA:AO ratio) was measured on the anteroposterior cineangiogram and calculated for all patients. Nineteen of 21 patients in the total correction group had PA:AO ratios of greater than 1/3. All patients in the palliation group had PA:AO ratios of less than 1/3 and six of seven infants had PA:AO ratios of less than 1/4. The two patients in the total correction group with PA:AP ratios of less than 1/3 accounted for two of the three operative deaths in that group.

Three of four patients receiving palliation with a RVOT patch who have been recatheterized have shown an increase in their PA:AO ratio from less than 1/4 to greater than 1/3.

If the PA:AO ratio is greater than 1/3, total correction can be undertaken with good functional results and low mortality irrespective of age. Infants with PA:AO ratios of less than 1/3 should be palliated. We prefer palliation by relieving pulmonary stenosis with a RVOT patch whenever possible as this allows for growth of the main and branch pulmonary arteries.

*By invitation

16. Repair of Double Outlet Right Ventricle

ROBERT W. STEWART, JOHN W. KIRKLIN,
ALBERT D. PACIFICO, EUGENE H. BLACKSTONE*, and
LIONEL M. BARGERON, JR. *, Birmingham, Alabama*

We have reviewed the 61 patients (pts) with double outlet right ventricle (DORV) and concordant atrioventricular connection, repaired between 1967 and July 1978, to define the determinants of the high hospital mortality (21 deaths, 34%, 70% CL 28%-42%) and ways of reducing it. 2 (12%, CL 4%-27%) deaths occurred in the 16 relatively uncomplicated cases (2/14 in pts with *subaortic* or *doubly committed* VSD and intraventricular repair and 0/2 in pts with *Lincoln-Danielson type* DORV). One death was from faulty patch geometry and 1 from postoperative error. Age at repair was not a determinant of risk, nor was presence or absence of pulmonary stenosis (p for difference = 0.7). Surgical enlargement of the VSD as part of the repair did not increase risk (p = 0.9). However, previous surgery was an incremental risk factor (14 deaths among 30 secondary repairs, 47%, vs. 7 of 31 with primary repair 23%, p < 0.05), as was use of a transannular patch or non-valved conduit in patients with pulmonary stenosis (5 deaths in 6 pts, 83%) vs. a valved

external conduit (1 of 8, 12%) ($p = 0.01$). When the VSD was *non-committed* (A-V canal type 2, muscular 2), risk was high with 2(50%, CL 18%-82%) deaths after repair which included intraventricular tunneling and a valved external conduit. 2(50%) of 4 pts with DORV and *complete A-V canal* died. The *Taussig-Bing type of DOR V* is a very different malformation. 1 patient in this group, who died, had complete A-V canal, and 24 *subpulmonary VSD*. Of these, one patient, who survived, had only intraventricular rerouting, 2(20%, CL 7%41%) died among 10 in whom the Rastelli repair was used, as did 6(46%, CL 30%-64%) of 13 in whom the VSD was closed and a Mustard repair done ($p = 0.3$). Late postoperative results were good except in the Taussig-Bing DORV group, in which 5 of the 6 hospital survivors with the Mustard repair died late postoperatively as did 3 of the 8 with valved external conduits ($p=0.3$). We conclude that all types of DORV can be repaired, that the first operation should be a complete repair, that a completely intraventricular repair with a precisely tailored tunneling patch (described in the report) should be done whenever possible, that when necessary a valved external conduit should be used rather than transannular patching, that the VSD should be enlarged anteriorly when necessary for the repair, and that the Taussig-Bing type of DORV should usually be treated by a completely intraventricular repair, or the Rastelli technique.

*By invitation

17. Surgical Technique to Reduce the Risk of Complete Heart Block Following Closure of Ventricular Septal Defect in Atrioventricular Discordance

MARC R. DELEVAL†, PEDRO BASTOS*, JAROSLAV STARK*,*

*JAMES F. N. TAYLOR *, ROBERT H. ANDERSON*, and*

FERGUS J. McCARTNEY, London, England*

Sponsored by John W. Kirklin, Birmingham, Alabama

Complete heart block (CHB) remains a complication of closure of ventricular septal defects (VSD) in patients (pts) with atrioventricular discordance (AVD). The location of the A-V node and bundle, the presence of a conduction tissue sling in some pts and the position of the bundle and its bifurcation on the morphologic left side all contribute to surgical CHB. To reduce the risks of injury to the bundle and its bifurcation, a technique of placement of the VSD patch on the morphologic right side without opening the systemic ventricle was used in 12 consecutive pts operated since 1975. Ages ranged from 5 months to 15 years (mean 12.1 years). All had AVD and VSD. Associated anomalies included: situs inversus (2 pts), dextrocardia (3 pts), ventriculo-arterial discordance (7 pts), double outlet right ventricle (4 pts), pulmonary stenosis (9 pts), pulmonary atresia (1 pt), pulmonary venous return anomalies (2 pts), tricuspid valve regurgitation (2 pts) and subaortic stenosis (1 pt). The VSD was closed through the mitral valve or the left ventricle in 11 pts. All stitches were placed through the VSD on the morphologic right side of the septum using continuous or interrupted sutures. In 1 pt with AVD and ventriculo-arterial concordance, the patch was sewn through a right ventriculotomy. Associated anomalies were dealt with appropriately, including the insertion of an external valved conduit in 10 pts. 2 pts were in AV dissociation before cardi-otomy, of which 1 died on the table and 1 other remained in AV dissociation with a ventricular rate > 100/min. 10 pts were in sinus rhythm at completion of the repair and remained in continuous sinus rhythm, except for one transient episode of CHB in 1 pt and one episode of nodal rhythm on 24-hour monitoring in another pt. There were 2 early and 2 late non-arrhythmic deaths. Postoperative electrocardio-graphic features of morphologic right bundle branch block were present in 6 pts and none showed evidence of left bundle branch block. Thus, the technique has produced no serious conduction disturbances.

†Dr. de Leval was the 24th EVARTS A. GRAHAM MEMORIAL TRAVELING FELLOW (1973-74).

*By invitation

18. Modified Fontan Operation for Univentricular Heart and Complicated Congenital Lesions

ALAN W. GALE†, GORDON K. DANIELSON,*

DWIGHT C. McGOON, ROBERT S. WALLACE and

*DOUGLAS D. MAIR *, Rochester, Minnesota*

Since May 1974, 15 patients (pts) have undergone right atrio-pulmonary shunts combined with closure of atrial septal defect and patch closure of the right atrioventricular (A-V) valve for congenital cardiac anomalies other than tricuspid atresia. Eleven pts had a univentricular heart (type AIII, 7 pts; type All, 2 pts; type AI, 1 pt; type C, 1 pt). One pt had corrected transposition, pulmonary stenosis and a straddling A-V valve and another had double outlet right ventricle with non-committed ventricular septal defect and pulmonary stenosis. Two pts had dextrocardia, inverted ventricles, ventricular septal defect, pulmonary stenosis, and transposition of the great arteries, one with straddling A-V valve and one with common A-V orifice. One pt had tricuspid valve hypoplasia. The atrial septal defect was closed by suture in 8 pts early in the series but subsequently was closed with a patch.

There were 3 early deaths, all in the univentricular heart group (the first 2 pts in 1974 and 1975 and one in 1978). Early complications of fluid retention and renal failure requiring dialysis occurred in 2 pts. Pleural effusions were uniform. Complete heart block occurred in 3 pts (2 permanent, one transient).

On follow-up, dehiscence of the patch closure of the tricuspid orifice occurred in one pt who underwent successful reoperation. One pt with dextrocardia died suddenly at home of unknown cause. The remaining pts are improved, compared to their preoperative status.

The modified Fontan procedure offers an alternative palliative operation which may be applied to those patients with severe pulmonary stenosis and normal pulmonary artery pressure and size. This procedure is especially appealing for those patients in whom septation or complete repair cannot be performed or is too risky. The long-term effects of systemic venous hypertension require further elucidation.

†Dr. Gale was the 28th EVARTS A. GRAHAM MEMORIAL TRAVELING FELLOW (1977-78).

INTERMISSION - VISIT EXHIBITS

*By invitation

19. Pulmonary Atresia with Intact Ventricular Septum - A 16 Year Experience

ANTHONY L. MOULTON, FREDERICK O. BOWMAN, JR.,*

RICHARD N. EDIE, CONSTANCE HAYES, KENT ELLIS**

and JAMES R. MALM, New York, New York

Infants with pulmonary atresia and intact ventricular septum (PA & IVS) usually require urgent surgical intervention. 28 of 32 patients with this anomaly seen at the Columbia-Presbyterian Medical Center between 1962 and 1978 had palliative operations within the first three days of life. 6 underwent a closed pulmonary valvotomy alone without a survivor; 5 had only a systemic to pulmonary artery shunt with 3 survivors. Based on this experience, 17 had a combined procedure of valvotomy and shunt with 14 survivors. 3 patients died before operation and 1 recently had a definitive right ventricular outflow patch using cardiopulmonary bypass.

Eight patients subsequently have had corrective open heart procedures with 5 long term survivors ranging from 2 to 10 years. Repair employed an aortic homograft unicus in 5 and a Hancock valve conduit in 3. Five patients are presently awaiting surgery.

We conclude that the initial surgical management of these critically ill infants must not only increase pulmonary blood flow but in addition provide an opportunity for right ventricular growth. Thus we continue to advocate the combined procedure of a valvotomy plus a shunt to provide adequate palliation and allow for definitive correction at a later date.

*By invitation

20. Technique, Indications and Clinical Use of 24-Hour Esophageal pH Monitoring

TOM R. DeMEESTER, CHING-I WANG, JORGE A. WERNLY*,*

CARLOS A. PELLEGRINI, ALEXANDER G. LITTLE*,*

LAWRENCE F. JOHNSON and DAVID B. SKINNER,*

Chicago, Illinois

Dissatisfaction with symptomatology, radiology, esophageal manometry, and intraesophageal pH testing to diagnose gastroesophageal reflux, led us to develop continuous 24-hour esophageal pH monitoring as an objective test for reflux. Over the past six years, 393 patients have undergone 24-hour pH monitoring in addition to endoscopy, manometry, and standard acid reflux test. The patients were divided into eight different groups based on their presenting symptoms and indications for 24-hour pH monitoring. 1) 105 patients had typical reflux symptoms with endoscopic evidence of esophagitis (85) or stricture (20), and were candidates for anti-reflux surgery due to failure of medical therapy. The test confirmed abnormal reflux in 77 to 85 patients, without stricture, and indicated those most at risk for developing stricture (58), and those likely to develop the post-operative gas bloat syndrome (4). 15 patients had abnormal reflux only in the supine position. The 8 patients with a normal test had either a borderline test result or another etiology for esophagitis. 2) 94 patients had typical reflux symptoms in the absence of endoscopic esophagitis. Abnormal reflux was confirmed by 24-hour pH monitoring in 53 patients. In the remaining patients, other causes for symptoms were subsequently identified. 3) 18 patients had a variety of respiratory symptoms; in 11 the respiratory symptoms were proven to be secondary to occult reflux by 24-hour pH monitoring. 4) 13 patients had atypical chest or abdominal pain; in 6 the pain was proven to be secondary to abnormal reflux by 24-hour pH monitoring. 5) 48 patients with other diseases of the chest and abdomen also had symptoms suggestive of reflux. In 27, the presence of abnormal reflux was detected by 24-hour pH monitoring and directed appropriate therapy. 6) 31 children, who were unable to communicate their symptoms, and who had a history of recurrent pneumonia, asthma, repeated vomiting, apnea, or failure to thrive were tested for the presence of reflux. In 21, abnormal reflux was documented as the cause of their symptoms by 24-hour pH monitoring and indicated anti-reflux surgery. 7) 28 patients had a motility disorder, 13 of whom had untreated achalasia. Abnormal reflux was recognized by 24-hour pH monitoring as a cause for, or resulting from, the motility disorder in 17 patients. 8) 56 patients had recurrent reflux symptoms after esophageal surgery. Abnormal reflux was demonstrated by 24-hour pH monitoring

in 10 of 16 patients who had a previous myotomy for achalasia. 46 patients had a previous hiatal hernia repair and recurrent reflux was documented by 24-hour pH monitoring in 25. 24-hour pH monitoring had a higher sensitivity and specificity than the standard acid reflux test or a DBS pressure less than 10 mm. of Hg. for the diagnosis of abnormal reflux. Based on this experience, 24-hour pH monitoring has emerged as a clinically useful technique for the evaluation of esophageal pathology, and significantly contributes to the clinical management of patients by selecting those who will benefit from anti-reflux surgery.

*By Invitation

21. Realistic Expectations Following Aggressive Surgical Treatment of Acute and Chronic Aortic Dissections - Experience with 111 Patients over a 14 Year Period

D. CRAIG MILLER, EDWARD B. STINSON*,*

PHILIPS. OYER, STEPHEN J. ROSSITER*, BRUCE A. REITZ*,*

RANDALL B. GRIEPP, and NORMAN E. SHUMWAY,*

Stanford, California

Current therapy of aortic dissections remains unstandardized due to the rarity of these catastrophic events and the lack of prospective trials. This data-bank study defined the long-term results (mean follow-up = 5 years(YR), maximum = 14 YR, cumulative = 318 PT-YR) of surgical treatment of 111 unselected patients (PTS). Forty-eight PTS were classified acute Type A(AC-A), 26 were chronic Type A(CH-A), 18 were acute Type B(AC-B), and 19 were chronic Type B(CH-B). Mean age was 57 YR. Regardless of moribund status or age, no acute PTS were denied surgery. Aortic valve replacement (AYR) was performed in 10% of the AC-A PTS and 35% of the CH-A PTS. The intimal tear was resected in 68% of PTS. Reoperation rate was 3.8%/PT-YR; re-dissection rate was 0.3%/PT-YR. No PTS were lost to follow-up.

Operative mortality(OP MORT) and 8 YR actuarial survival(\pm SEM) were 38% and $33 \pm 10\%$ for AC-A, 15% and $49 \pm 12\%$ for CH-A, 50% and $40 \pm 13\%$ for AC-B, and 21% and $43 \pm 14\%$ for CH-B PTS. OP MORT was statistically($p < 0.05$) greater for those ACUTE PTS with new paraplegia, AC-B PTS who had failed medical therapy, and several other selected PT subsets. Twenty-nine percent of the hospital deaths and 69% of the late deaths were cardiovascular or cerebrovascular in nature. Whether AYR had been performed or the intimal tear had been resected did not significantly($p > 0.05$) correlate with OP MORT, late functional result, late reoperation, or late mortality. No redissections occurred among Type A PTS in the preserved rim of supra-anular aorta. Eight year actuarial survival probability for those AC-A PTS discharged from the hospital was $53 \pm 15\%$; for CH-A, $58 \pm 14\%$; for AC-B, $80 \pm 18\%$; and CH-B, $54 \pm 16\%$. Although sustaining slightly higher OP MORT, the AC-B PTS experienced the least late attrition.

No medical or surgical study heretofore has included follow-up of this duration and magnitude with which to define the postoperative "natural" history of aortic dissections. These results should be interpreted as unduly pessimistic due to the totally unselected nature of the study population and lower contemporary OP MORT. These long-term results support a philosophy of early emergency surgery for both AC-A and AC-B PTS. Furthermore, we continue to urge adaption of this simplified functional classification system(based on involvement of the ascending aorta irrespective of the site of tear) since the biological behavior of aortic dissections is primarily predicated on this concept.

*By invitation

22. Treatment of Transverse Aortic Arch Aneurysm

E. STANLEY CRAWFORD, SALWA A. SALEH,
JOHNS. SCHUESSLER*, and RAUL GARCIA-RINALDI*,
Houston, Texas*

Surgical treatment of aneurysms involving the transverse segment of aortic arch is difficult and associated with high mortality and morbidity. The latter is primarily related to techniques of cerebral protection employed during the period of aortic branch occlusion needed for reconstruction. Recent reports suggest the superiority of deep hypothermia and circulatory arrest; however, the mortality reported varies from 16-25%. This report is concerned with treatment of 25 patients with arch lesions in whom cerebral perfusion was selected based upon the extent and location of aneurysm. In 11, the lesion involved the distal arch and descending aorta requiring replacement of the subclavian artery. Cerebral perfusion techniques were not employed in these cases even though the left common carotid artery was temporarily clamped in most cases. All patients survived without neurologic problems. The aneurysm involved two or all three vessels in 13. Cerebral perfusion was maintained by dacron shunts in 4 of these patients in whom the proximal ascending aorta was not involved and normothermic cardiopulmonary bypass techniques in 9 patients with total involvement of the ascending aorta. Death occurred in one of the former from graft disruption and one of the latter from cerebral damage. The perfusion technique in the latter patient was that employed early in the experience when high pulsatile flow rates (250-350cc per minute per vessel) were used. Low flow rates (60-75cc per vessel) with low pulse amplitude were employed in the last 5 patients. All survived without complication, suggesting this to be a very satisfactory method of cerebral protection and complications associated with deep hypothermia and circulatory arrest are avoided.

11:15 Address of Honored Speaker

CARDIOTHORACIC SURGERY IN THE ANTIPODES
Sir Brian Barratt-Boyes Auckland, New Zealand

*By invitation

TUESDAY AFTERNOON, MAY 1, 1979

2:00 P.M. Scientific Session

Ballroom

23. A Comparison of Crystalloid and Blood Potassium Cardioplegia During Prolonged Hypothermic Aortic Occlusion

SHINICHI TAKAMOTO, FREDERICK H. LEVINE*,
N. SCOTT ADZICK*, PAUL J. LARAIA *, JOHN T. FALLON*,
W. GERALD AUSTEN and MORTIMER J. BUCKLEY,*

Boston, Massachusetts

Blood cardioplegia has recently been advocated as a superior method of myocardial protection, but comparison to an asanguinous crystalloid cardioplegic solution has not been presented. This study was undertaken to compare the protective effect of blood (BCP) and crystalloid (KCP)

potassium cardioplegic solutions during 2 hours of hypothermic (22°C) aortic occlusion and 45 minutes of reperfusion (R). Twelve dogs were placed on cardiopulmonary bypass. In six dogs the aortic root was perfused with BCP (Het 35%) and in the other six dogs KCP was used. Both perfusates contained 25 mg/L KCl buffered to pH 7.4. Change in ventricular function was defined as the arithmetic difference in center of mass between pre and post arrest Sarnoff curves and expressed as percent recovery of function. Regional myocardial flow was measured with microspheres and metabolism monitored by lactate and oxygen utilization. Ventricular biopsies were serially obtained for myocardial water, electron microscopy, and ATP, CP and Ca⁺⁺. The KCP group recovered 75% of function while recovery in the BCP group was 65%. Endo/epicardial flow ratio was increased immediately after R in both groups but return to baseline was prolonged in the BCP group (1.36 vs 1.04 at 10 min R (p<.05) indicating less adequate myocardial protection. Oxygen consumption (BCP-5.6 vs KCP-5.6 ml/100g/min) was lactate extraction (BCP-0.042 vs KCP-0.049 mM/min) were similar in both groups after R. Small but similar increases in myocardial water (BCP-1.9 vs KCP-2.1%) were noted and ATP, CP and Ca⁺⁺ levels were well preserved in both groups. Electron microscopy demonstrated similar minor endothelial and myocytic changes.

BCP offers no advantage over a similar KCP solution. Though protection is adequate in both groups, ventricular function and blood flow distribution are better preserved with an asanguinous perfusate. The oxygenated environment of BCP may preclude the rapid arrest necessary for optimal myocardial protection.

*By invitation

24. The Importance of Preoperative Myocardial Nutrition in Human Cardiac Preservation

DAVID M. LOLLEY, JEFFERSON F. RAY, III,
WILLIAM O. MYERS, RICHARD D. SAUTTER and
DUANE A. TEWKSBURY*, Marshfield, Wisconsin*

Glycogen is an important indicator of cardiac nutrition acting as an energy source during stress with enhanced levels increasing cardiac tolerance to acute ischemia. This prospective study was designed to see if improved myocardial nutrition results in significant preservation of the human heart during cardiac surgery. Coronary artery surgery patients (n=117) were divided into four groups of similar size. Group I had low cardiac glycogen and no cardioplegia, group II had low cardiac glycogen and KCl cardioplegia, group III had high cardiac glycogen and no cardioplegia, and group IV had high cardiac glycogen and KCl cardioplegia. All cases were done with systemic and topical hypothermia, intermittent cross-clamping, and moderate hemodilution. Enhanced cardiac glycogen was achieved with overnight glucose with or without fat loading diet.

Group	Number of Patients	Mean Cardiac Glycogen	Transmural Myocardial Infarct	Atrial Arrhythmias**	Ventricular Arrhythmia***	Vasopressor Dependence***
I	27	754 ± 34	14.4%	35%	65%	31%
II	30	736 ± 34	6.4%	6.7%	18%	16.7%
III	26	1208 ± 86*	0	3.8%	27%	7.80%
IV	34	1516 ± 69*	0	0.0%	14.0%	2.86%

* (± standard error of mean) p

METHODS: Fifteen dogs underwent 45 minutes of normothermic ischemic arrest. Fifteen minutes after unclamping, no heart could support the systemic circulation. In all dogs, we reduced cardiac O₂ demands by immediately reinstating total bypass for 30

more minutes. In 10 of these dogs, we reclamped the aorta for 5 minutes and lowered O₂ demands further by continuously infusing a 37°C blood cardioplegic solution (K⁺ 30mEq/L, pH 7.6, CA⁺⁺ 1mEq/L) at 50-75 ml/min. In all studies, coronary blood flow (microspheres), metabolism (LV O₂ uptake), water content (wet/dry weight), LV compliance (intraventricular balloon), and LV performance (Starling curves) were measured during control and at 15 and 45 minutes after unclamping.

RESULTS: Dogs treated by prolonging bypass alone for 45 minutes showed progressive but limited improvement in ventricular function, water content, compliance, and the ability to use oxygen. Hearts treated with secondary blood cardioplegia during prolonged bypass, however, showed better recovery of compliance (85 vs 55%*), a higher stroke work index (0.72 vs 0.52 g-m/kg*), and more ability to augment O₂ uptake (85 vs 45%*) when demands were increased by making the heart work.

CONCLUSION: Rearresting the heart with a brief, continuous infusion of a blood cardioplegic solution results in more complete reversal of ischemic damage than possible by prolongation of bypass alone. We believe the increased recovery with secondary cardioplegia results from diversion of delivered oxygen towards reparative processes rather than by expending needless electromechanical work while bypass must be prolonged.

p<.025 cardioplegia vs prolonged bypass at 45 minutes

*By invitation

26. Protection of Myocardial Function Not Enhanced by High Concentrations of Potassium During Cardioplegic Arrest

R. J. ELLIS, D. MANGANO*, D. VANDYKE*, and
PAUL A. EBERT, San Francisco, California*

The effect of high (20 mEq/L) versus physiologic (5 mEq/L) concentrations of potassium in hypothermic cardioplegic arrest was compared in twenty patients undergoing myocardial revascularization. Ten patients received high potassium solution and ten received the low K solution. The patients were selected randomly and were comparable in all important respects. All distal anastomoses were performed under one continuous cardioplegic arrest (40-60 min) induced by a single infusion of 800 ml of cardioplegic solution. Myocardial function was assessed by intraoperative measurement of ejection fraction (EF) using a precordial scintillation probe. The probe enabled computation of ejection fraction by recording the passage of an injection of Teh⁹⁹ albumin through the central circulation. Simultaneous cardiac output determinations were made by thermal dilution and pulmonary capillary wedge pressures (PCW) at various loading conditions before and 30 minutes after the termination of cardiopulmonary bypass. LV compliance (PCW vs EDV), and ventricular function (SWI vs EDV) were computed using the measurement of end diastolic volume (EDV). Myocardial oxygen consumption was estimated using the product of heart rate times systolic blood pressure (HR x SBP).

RESULTS:

	5 mEq K+		20 mEq K+		
SWI	†“	47%	†“	45%	PNS

EF	†*	7%	†*	2%	PNS
Compliance	†*	20%	†*	18%	PNS
HR x SBP	†*	1%	†*	2%	PNS

CONCLUSION:

The addition of high concentrations of potassium to hypothermic perfusates did not enhance protection of the myocardium during cardioplegic arrest. Cardiac performance was the same whether a high or physiologic potassium concentration was used. We conclude that a high concentration of potassium in cardioplegic solutions is of no demonstrable value

INTERMISSION - VISIT EXHIBITS

*By invitation

27. Preservation of ATP, infrastructure, and Ventricular Function Following Aortic Crossclamping and Reperfusion - Clinical Use of K⁺ Blood Cardioplegia

JOSEPH N. CUNNINGHAM, JR., PETER X. ADAMS,
EDMOND A. KNOPP*, F. GREGORY BAUMANN*, and
FRANK C. SPENCER, New York, New York*

Multidose blood cardioplegia (K⁺ 30 mEq/L, pH 7.4, normal Ca⁺⁺) in combination with profound myocardial hypothermia (<20°C) was studied in 24 patients undergoing cardiac surgery. Serial myocardial biopsies were obtained to assess the preservation of myocardial ATP and ultrastructure during crossclamping and after reperfusion. Cardiac output was measured serially before and after bypass.

Several technical details were found of crucial importance. These included: monitoring myocardial temperature and avoiding rewarming, topical hypothermia (endocardial and epicardial), volume and frequency of cold blood injection, and monitoring of injectate pressure.

Patients could be divided into 2 groups: Grp. I (17 pts.) had optimal myocardial protection (multidose reinjections, maintenance of myocardial temperature <20°C, and absence of EKG activity during cross-clamping). Grp. II (7 pts.) had some return of EKG activity and rise in myocardial temperature (>25°C) before unclamping because of errors in technique.

Group	No. of Pts.	Aortic Occlusion Time (minutes)*	ATP**		Deaths	Low Output	TEM
			End of Crossclamp	After 30 min. Reperfusion			
I	17	77 ± S.E. 8	†*53% ± S.E. 15%	†*8% ± S.E. 11%	0	1/17	Minor Change
II	7	92 ± S.E. 15	□40% ± S.E. 9%	□54% ± S.E. 12%	0	3/7	Marked Change

The finding that ATP actually increased (53%) during crossclamping and returned to normal following reperfusion indicates excellent myocardial protection. This is supported by electron microscopic findings (no irreversible changes) and the absence of low cardiac

output. In contrast, the importance of technical details, especially the degree of hypothermia, is shown by the ATP decrease in Grp. II, frequently followed by poor cardiac function and irreversible ultrastructural changes. These data indicate that with proper technique, cold blood K⁺ cardioplegia combined with topical cooling is distinctly superior to other methods of myocardial protection.

*I vs. II-p>.05 **p<.05

*By invitation

28. Changing Patterns in Pacemaker Patient Care, 1963-78

JOSEPH W. RUBIN, ROBERT G. ELLISON, H. VICTOR MOORE*,
and GANESH PAI*, Augusta, Georgia*

Transtelephone surveillance (TTS) of pacemaker patients, with electrocardiograms recorded weekly or monthly, is often initially accompanied by an observed increase in pacemaker system malfunction. This apparent increase probably more nearly reflects the true incidence of pacemaker system malfunction. Industry claims of pacemaker reliability are misleading because of incomplete retrieval of out-of-use generators. A review of 16 years of pacemaker experience at the Medical College of Georgia was analyzed to determine survival, complications, and effectiveness of follow-up techniques in a 300-mile radius area. 461 consecutive patients have undergone 687 subsequent operations for battery and/or lead replacement and for complications of the pacemaker system (M 2.5 operations/patient). 891 generators (794 Hg-Zn, 93 lithium, 4 plutonium-238) were used. Of 253 patients now alive, 152 are followed by our TTS system, 66 are seen by personal physicians and infrequently in pacemaker clinics, 31 have moved or transferred care, and 4 pacemaker systems have been removed. In 2 years, TTS has detected 60 complications of pacing systems (asymptomatic in 39) which, if undetected, could progress to pacing failure; 38 patients required re-operation. Local physicians were notified of arrhythmias, congestive failure, etc. in 46 patients. Generator exhaustion accounted for only 20% of pacemaker malfunction in the TTS group; lead and sensing problems (53%), component failure (15%), and wound problems (12%) also complicated pacemaker performance. Average life of generators followed by TTS to battery exhaustion was 43 mo., while overall Hg-Zn generator life averaged only 25 mo. During the first 2 years of TTS, 13% (22 of 174) of the TTS group died, while 38% (41 of 107) of the non-TTS group died. TTS is inexpensively available and greatly improves patient safety.

4:00 P.M. Executive Session (limited to Active and Senior Members) -Ballroom

*By invitation

TUESDAY EVENING, MAY 1, 1979

7:00 P.M. President's Reception
Constitution Ballroom

8:00 P.M. President's Dinner and Dance
Ballroom

WEDNESDAY MORNING, MAY 2, 1979

8:30 A.M. Scientific Sessions
Ballroom

29. Modified Senning Operations for Treatment of Transposition of the Great Arteries in Infancy

EDUARDO OTERO COTO†, WILLIAM I. NORWOOD*
and ALDO R. CASTANEDA, Boston, Massachusetts*

Since February 1978, 26 infants, ranging in age from 3 weeks to 12 months (mean age 5 months) and in weight from 2.0 kg. to 8.5 kg. (mean weight 5.5 kg.) underwent a modified Senning procedure, under deep hypothermic circulatory arrest, for correction of transposition of the great arteries (TGA). Ten patients were less than 3 months of age and weighed less than 4.0 kg. Eight had concomitant transatrial closure of a large VSD. Additional defects included: multiple VSD's (1), total anomalous pulmonary venous connection (1), and coarctation of the aorta (2). Modifications of the original Senning operation included: (1) Patch augmentation (pericardium or Cortex) of the atrial septal flap and (2) Pericardial patch enlargement of the pulmonary venous atrium. Two patients died (7.5%); a 3 month old with multiple VSD's and coarctation had Stage IV pulmonary vascular disease. The other death occurred in a 2 month old treated with prostaglandin E₁ for three weeks before surgery. One patient with VSD had transient complete heart block and three patients were discharged in junctional rhythm. Intraoperative measurements (24 pts.) and postoperative catheterizations (5 pts.) showed that none of the patients had gradients exceeding 3 mm.Hg. between superior and inferior vena cavae to right atrial junction or across the pulmonary venous atrium.

The potential advantages of the modified Senning over the Mustard operation in infants include a more readily standardized technique and the greater reliance on autogenous tissue for construction of the atrial chambers. The use of additional material (pericardium or Cortex) was not totally avoided, however, particularly in the neonate or very small infant. The early postoperative hemodynamic results and the relatively low incidence of conduction abnormalities (12%) at the time of hospital discharge support the policy of continued evaluation.

†Dr. Coto is the 29th EVARTS A. GRAHAM MEMORIAL TRAVELING FELLOW (1978-79).

*By invitation

30. Complete Transposition of the Great Arteries with Intact Ventricular Septum and Left Ventricular Outflow Tract Obstruction: Surgical Management and Anatomic Considerations

*CHRISTOPHER LINCOLN**, *GIANCARLO CRUPI**,

*and ROBERT ANDERSON**, *London, England*

Sponsored by Mortimer J. Buckley, Boston, Massachusetts

The surgical management of patients with transposition of the great arteries with intact ventricular septum (IVS) and sub-pulmonary stenosis remains controversial. Although direct resection of the obstruction is usually attempted, an alternative approach has been to place a conduit from the left ventricle to the pulmonary artery.

Among 130 consecutive patients undergoing Mustard's operation for repair of complete transposition at the Brompton Hospital were 5 patients in whom sub-pulmonary stenosis required surgical treatment. Their age at operation ranged from 13 months to 5.3 years. Each had a combined Mustard's procedure and placement of an external conduit from the left ventricle to the pulmonary artery. There was one hospital death. Post-operative cardiac catheterization performed in the survivors showed good relief of the stenosis and no significant gradient across the conduit.

Our study of the morphology of the left ventricular outflow tract in complete transposition with IVS and sub-pulmonary stenosis shows that the position of both the mitral valve and the conduction tissue is such that satisfactory resection of the stenosis is difficult without major risk of damaging these structures. Consequently, insertion of a conduit from the left ventricle to pulmonary artery in total correction of patients with complete transposition with IVS and sub-pulmonary stenosis represents a good alternative.

*By invitation

31. Tracheo-Bronchial Surgery

*B. V. PETROVSKY**, *M. I. PERELMAN**, *Moscow, U.S.S.R.*

Sponsored by Hermes C. Grillo, Boston, Massachusetts

Between 1963 and 1977, 164 patients were operated upon for diseases of the trachea. The lesions included, in descending order of incidence, 76 malignant tumors, 42 benign stenoses, 17 benign tumors, 11 tracheo-esophageal fistulas, 5 malformations, 4 injuries and 4 inflammatory diseases. The operations consisted of sleeve resection-51, resection of tracheal bifurcation-29, tracheotomy for resection of tumor-14, window resection-5, plastic repair of the membranous wall-20, repair of tracheo-esophageal fistula-11, repair of defects in the tracheal wall-4, palliative procedures for malignant lesions-17. There were 26 deaths.

Two hundred sixty-five operations were done on the bronchi. These procedures were done for resections of bronchopulmonary cancer-84, benign tumors-60, post-pneumonectomy fistula-53, cicatricial stenosis-24, bronchoesophageal fistula-20, post-traumatic occlusion-21. There were 141 bronchial resections with lobectomy, 30 bronchial resections, 53 resections of bronchial stumps, 21 bronchial repairs after occlusion and 20 repairs of broncho-esophageal fistula. There were 22 deaths.

Respiratory bypass was used principally to maintain ventilation. In 9 complex resections hyperbaric oxygenation was utilized to permit interruption of ventilation for periods of up to 10 minutes. The upper trachea was approached anteriorly and the lower trachea through a right thoracotomy.

After extensive tracheal or carinal resection the left main bronchus was oversewn with the left lung remaining *in situ*. The membranous wall was splinted in some cases of malacia with lyophilized cadaveric bone.

If the anastomoses stenose reconstructive procedures are repeated, only 1/3 to 1/4 of patients with adenomas or stenoses of the large bronchi can be subjected to reconstruction.

*By invitation

32. Sleeve Resection for Carcinoma of the Lung

RICHARD D. WEISEL, JOEL D. COOPER, NORMAN C. DELARUE,
THOMAS R. J. TODD* and F. GRIFFITH PEARSON,
Toronto, Ontario, Canada*

Sleeve resection of the bronchus for a carcinoma in the proximal airway preserves lung tissue and permits actuarial five year survival comparable to pneumonectomy.

Seventy patients (pts) underwent sleeve resection of a bronchus for proximal carcinoma between 1967 and 1978. There were 9 peri-operative deaths (13%), four from bronchovascular fistulae. Eighteen pts (26%) had a palliative resection because all intra-thoracic tumour could not be removed. The 1 year survival was 43% but no patient survived 5 years. Fifty-two pts (74%) had potentially curative sleeve resections with a 1 year survival of 75% and a 5 year survival of 36%. Twenty-eight pts (40%) underwent sleeve resection because respiratory impairment prevented pneumonectomy. The 1 year survival was 55% and the 5 year survival was 5%. Eighteen pts in the group (64%) had curative resections, however, 11 (61%) died post-operatively without evidence of recurrent tumour. The remaining 42 pts (60%) had adequate pulmonary reserve but underwent elective sleeve resection because of the anatomic position of the lesion. The 1 year survival was 84% and the 5 year survival was 34%. Eight of the 42 pts had palliative resections with a 38% 1 year and 15% 5 year survival. Among the 34 pts with adequate pulmonary reserve who underwent potentially curative sleeve resections, there was an 84% 1 year and 43% 5 year survival.

Forty-five patients underwent pneumonectomy for a carcinoma in the proximal bronchi. The peri-operative mortality was lower (4%) although the difference was not significant ($p=.13$). The 8 pts who had palliative resections had a 37% 1 year survival and none lived beyond 2 years. The 1 year (90%) and 5 year (45%) survival of patients undergoing curative pneumonectomies is not different from the survival of pts with adequate pulmonary reserve undergoing curative sleeve resections. The incidence of local (intra-thoracic) recurrence after sleeve resection at 1 year (15%) and 5 years (54%) was not different than the incidence among pneumonectomy patients (1 year: 10%; 5 years: 56%).

Sleeve resection provides an adequate disease-free interval for patients with impaired pulmonary reserve. In patients with adequate pulmonary function, a curative sleeve resection provides results comparable to pneumonectomy while preserving lung tissue.

INTERMISSION - VISIT EXHIBITS

*By invitation

33. Anterior Mediastinal Tracheostomy - Indications, Techniques, and Clinical Experience

MARK B. ORRINGER and HERBERT SLOAN, Ann Arbor, Michigan

Anterior mediastinal tracheostomy has wider clinical application than its initially described use for treatment of stomal recurrences following laryngectomy for carcinoma. For this procedure provides access to the cervico-thoracic esophagus, permitting resection and reconstruction in an area traditionally regarded as "no-man's land". This report reviews our experience with 14 patients who have undergone anterior mediastinal tracheostomy for cervicothoracic esophageal carcinoma (9); pharyngeal carcinoma following previous laryngectomy (2); stomal recurrence following laryngectomy (1); extensive thyroid carcinoma (1); and stomal stenosis following laryngectomy and radiation therapy for carcinoma.

Eight patients underwent concomitant laryngopharyngectomy, 10 blunt trans-mediastinal esophagectomy, and 11 visceral esophageal substitution using either stomach (pharyngogastrostomy in 7) or colon (pharyngocolostomy in 4). A bipediced upper thoracic apron flap was used to construct the mediastinal tracheostomy in 10 patients; four patients required a thoraco-acromial rotational flap because of the need to resurface the anterior neck following resection of skin involved with tumor. Operative techniques will be described.

Three deaths occurring within 30 days of operation resulted from innominate artery rupture (1), acute myocardial infarction (1), and respiratory insufficiency (1). Iatrogenic hypoparathyroidism and hypo-thyroidism occurred in 5 patients. After a period of follow-up ranging from 2-20 months (average 10 months), satisfactory airways have been achieved in all of the surviving 11 patients, 2 of whom developed mild stomal stenoses which are easily dilated. Anterior mediastinal tracheostomy enables excellent palliation in patients with selected cervicothoracic neoplasms which compromise both the upper airway and/or the esophagus.

*By invitation

34. Surgical Treatment of Post-Intubation Tracheal Injuries: Cumulative Experience Since 1965

HERMES C. GRILLO, Boston, Massachusetts

Since January, 1965, 201 patients with post-intubation tracheal injury have been treated by resection and reconstruction (to October, 1978). The injuries included stenosis, malacia, and fistulas to esophagus and innominate artery. One hundred twelve resulted from exposure to high pressure cuffs or to "low pressure" cuffs used in a high pressure range. Seventy-four originated in stomal injuries. In 13, both types of injuries were seen and in 2 the locus could not be determined. In the last 5 years the number of stomal injuries has proportionately increased.

A total of 208 operations were completed, 199 transcervically, 80 through sternotomy, 6 transthoracically and 1 by staged reconstruction. Circumferential resection and primary anastomosis were employed in all but 3, with care to avoid devascularization. Injury to arteries and recurrent laryngeal nerves were avoided by close tracheal dissection. Length was gained chiefly by minimal anterior mobilization, cervical flexion, plus laryngeal release in 17. Partial cricoid resection to the anterior commissure was necessary in 8 patients.

Technical problems were posed by lesions involving the subglottic larynx, previous operations, extraordinary lengths of damage and individual anatomy. Stomas were variously managed-left in place, excised in continuity, replanted or closed.

Five deaths followed resection, only one in a truly elective case. Sutureline granulations were the most common complication. Restenosis occasioned 7 reoperations. Other rare complications included one innominate arterial hemorrhage, wound infections, hoarseness and dysphagia. Results were generally good anatomically and functionally as determined by systematic follow-up. The lessons learned over the 14 years encompassed will be detailed.

35. Screening for Bronchogenic Carcinoma - The Surgical Experience

R. ROBINSON BAKER, MELVYN S. TOCKMAN,
BERNARD R. MARSH*, FREDERICK P. STITIK*,
WILMOT C. BALL, JR. *, JOSEPH C. EGGLESTON*,
YENER S. EROZAN*, MORTON LEVIN* and
JOHNK. FROST*, Baltimore, Maryland*

This paper describes the surgical experience with a project designed to detect early lung cancer. The screening population consisted of 10,362 males. Half of the patients had sputum cytologies and a chest x-ray, the other half had a chest x-ray. Seventy-one bronchogenic carcinomas were detected in the initial screen, 34 patients in the sputum cytology plus x-ray group, 37 patients in the x-ray group alone. Following clinical assessment including mediastinoscopy and mediastin-otomy in selected cases, 38 of the patients had exploratory thoracot-omies. Thirty-six of these patients (95%) had tumors resected for cure, 75% by lobectomy, the remainder by sleeve resection or pneumon-ectomy. At thoracotomy, the mediastinum was evaluated by palpation, only suspicious nodes were removed for histologic study and none of these nodes were found to contain histologic evidence of metastases. The three year survival rate of patients with Stage 0 disease was 100%, Stage I disease - 70%, and Stage II - III - 17%. This study demonstrates a higher resectability rate in comparison to previous studies, i.e. 50% of the tumors detected were resected and in all instances but one, the patient could tolerate a thoracotomy. The survival rates obtained thus far were obtained in patients who did not have the mediastinal nodes routinely removed at thoracotomy. Although adjuvant therapy is clearly indicated in patients with Stage II and III disease, the advisability of currently available adjuvant therapy in patients with Stage I disease and a 70% chance of survival is open to question.

*By invitation

36. Treatment of Far Advanced Bronchogenic Carcinoma by Extracorporeal Induced Systemic Hyperthermia

LEON C. PARKS, DEANNA MINABERRY*, DOYLE P. SMITH*,
and WILLIAM A. NEELY, Jackson, Mississippi*

Hyperthermia (HT) of 41.5° to 42.0°C was induced in patients (P) with pre-terminal bronchogenic carcinoma by use of a heat exchanger incorporating, TDMAC-treated, extra-corporeal circuit (ECC) cooperative with a dacron femoral arteriovenous shunt. A Temperature Regulating Device (TRD) autoregulated heat exchanger and thereby patient temperature (T) ± 0.1°C as measured in the urinary bladder with a thermistor-tipped foley catheter.

A total of 76 treatments averaging 4 hrs. in duration were administered to 22P, 20 of whom had failed previous radiation/chemotherapy. Cytosan 250 mg/M² and BCNU 50 mg were given during mid-HT. The distribution of tumor histology was 13 (59%) squamous, 4 (19%) large cell, 2 (9%) adeno, 2 (9%) oat cell, and 1 (5%) alveolar cell carcinoma.

Adverse effects were principally moderate marrow suppression. Neurologic abnormalities occurred early in the series, but were eliminated by maintenance of serum phosphate levels. Fifteen (68%)P have died, 11 of tumor progression only 2 of whom completed their treatment series, 4 from infection or bleeding of necrosing tumor, and 1 of treatment complications. Patients post

pneumonectomy or with significant COPD adequately tolerated treatment. There was no instance of ECC related hemolysis, thromboembolism, or significant cardiac failure.

Of 11P at risk for 2 or more months an antitumor effect was evidenced by x-ray or histologic findings in 9 (69%). Regressions were typically incomplete and progression occurred at 4-6 months post HT in 5 of the 8P at risk. Three P have stable regressed disease 6,7, and 13 months post HT.

Conclusion: These data suggest: (1) Hyperthermia can regress bronchogenic carcinoma resistant to other modes of therapy; (2) Hyperthermia of 4 hrs. duration and 41.5 to 42.0°C magnitude will not routinely control bronchogenic carcinoma even with adjuvant cytotoxic agents; (3) Further exploration of treatment regimens, particularly as applied to minimal residual disease, may be indicated.

Luncheon Intermission until 2:00 P.M. - Visit Exhibits

12:15 P.M. Panel of Experts Luncheon for Cardiothoracic

Residents - Fairfax Room

*By invitation

WEDNESDAY AFTERNOON, MAY 2, 1979

2:00 P.M. Scientific Sessions

Ballroom

37. Surgery for Mitral Insufficiency Secondary to Coronary Artery Disease

*JEROME HAROLD KAY, PABLO ZUBIATE**,

MICHAEL A. MENDEZ, NEAL VANSTROM**,

TARO YOKOYAMA and MOHAMMAD A. GHARAVI**,

Los Angeles, California

From September 1970 to December 1977, 61 patients were operated upon for significant mitral insufficiency secondary to coronary artery disease. Thirty-eight men and 23 women ranged from 44 to 71 years. Preoperatively, 48 had angina, 33 were in New York Heart Association (NYHA) Class IV and 28 in Class III. Ejection fraction (EF) ranged 0.15-0.70, mean 0.40. Nine had an EF of 0.20 or less. Twenty had EF of 0.25-0.40. Mitral regurgitation ranged grade 2/6 to 5/6, mean 3/6 (except for one patient with I/VI mitral insufficiency). Mitral repair was performed in 52 patients (85%) and valve replacement in 9 (15%). Ruptured or infarcted papillary muscle or torn chordae tendineae were present in 38 patients. Five internal mammary artery and 109 vein graft anastomoses were performed. There were 5 hospital deaths (8%) and 11 late deaths (18%). Of the 45 surviving patients, 4 have slight angina. Twenty-four are in NYHA Class I and 18 are in Class II. Of 25 vein grafts in 12 patients restudied, 20 are patent (80%). Mitral regurgitation decreased from a mean of 3.0 to 0.8 (p 0.001). Average improvement in EF was 0.08, p 0.01. Survivability was 74% at 7 years. The authors urge mitral repair rather than replacement when feasible.

*By invitation

38. Real Time Sound Spectroanalysis for Malfunctioning Prosthetic Valve

*YUZURU KAGAWA **, *SHINICHI NITTA **, *NAOSHI SATOH**,
*TADAYOSHI HONGOH** and *HITOSHI MOHRI*, Sendai, Japan

Materials and methods: Sound spectral analyses were carried out 220 times on 127 cases bearing prosthetic valves. Four of those had thrombosed valves and other 7 cases experienced major cerebral embolization. The new system, which was developed in our institute, consists of a moving coil microphone, preamplifier, spectrum analyzer and display system. Valvular clicks are displayed on oscilloscope or X-Y recorder in 5 different modes. Section patterns, which represent transformation of the sound spectrum most directly, was used in this study. Maximal frequency taken at -30/36 db level (normalized maximal frequency, NMF) was used as a parameter.

Results: NMF values of the normally functioning valves with silastic poppet were significantly lower than that of the metal or high density polymer made poppet valves. Both opening and closing clicks of these valves registered almost same NMF values except tilting disc valves. No correlations were found between NMF values and postoperative time course.

NMF values were significantly low in 4 cases of thrombosed valve and 4 cases with cerebral embolization. Accuracy of the diagnosis of thrombosed valve by this real time sound spectral analysis, was proven at reoperating.

Conclusion: A newly developed real time sound spectral analyzer was very useful for diagnosis of the malfunctioning prosthetic heart valves and was thought to be superior to other methods such as phono-cardiography and echocardiography.

*By invitation

SESSION ON CONTROVERSIES

Mitral Repair Versus Mitral Replacement

39. Durability of Measured Mitral Annuloplasty: A Seventeen Year Study

GEORGE E. REED, *RICHARD W. POOLEY**,
and *RICHARD A. MOGGIO**, Valhalla, New York

This report deals with the result of measured mitral annuloplasty performed in 192 patients with isolated mitral valve disease in the 17 years between January 1961 and January 1978. Because tricuspid re-gurgitation usually results from advanced mitral disease, patients with this lesion were included. One hundred and seven patients (55%) have been followed for at least 10 years and 147 patients (75%) have been followed for up to 5 years. Ages ranged from 3 to 70 years and 51 patients were under 18 years of age.

That this is not a select, low risk group, is demonstrated by the distribution, according to operation, of all patients with isolated mitral disease (but including tricuspid regurgitation) seen during this period. There were 553 such patients. Of these, 98 (17.7%) had closed commissurotomy, 27 (4.8%) had open commissurotomy, 192 (34.7%) had annuloplasty and 236 (42.8%) required mitral valve replacement.

The annuloplasty patients were divided into two groups: (1) 113 patients who had annuloplasty (with or without valvuloplasty) and (2) 79 patients who had commissurotomy and annuloplasty

(with or without valvuloplasty). Valvuloplasty included various techniques for reefing the free edge of either leaflet (imbrication, plication, wedge resection), extension of the leaflets by insertion of a gusset, and debride-ment of calcium and fibrous tissue. There were 9 deaths for an overall mortality of 4.6% in these 2 groups of annuloplasty patients; 7 of these occurred in the first 4 years. Late mortality, from all causes, was 7.3%, considerably less than is reported for mitral replacement during this period. There were 6 arterial emboli during the 17 years. Thirteen patients (6.7%) required re-operation and in 5 of these, it was possible to again repair the valve. With rare exception, none of these patients was anticoagulated. This permitted unrestricted physical activity in the young age group, multiple uncomplicated pregnancies among the women of child bearing age and, liberal alcoholic intake in the older age group.

*By invitation

40. Conservative Surgery for Mitral Insufficiency. Critical Analysis Supported by the Postoperative Haemodynamics of 72 Patients.

CARLOS G. DURAN, JOSE L. POMAR*, JOSE M. REVUELTA **

JOSE POVEDA, ALBERTO OCHOTECO*and
JOSE L. UBAGO*, Santander, Spain*

Sponsored by Lawrence H. Cohn, Boston, Massachusetts

Since May 1974, 230 mitral reconstructions have been performed at our Institution. Forty-three Carpentier and 187 Flexible Rings were used. A critical analysis of this last group, with 58 predominant stenotic, 22 insufficient and 107 (57.3%) mixed lesions, is reported. 90.7% were of rheumatic origin. 65 tricuspid and 39 aortic valves were simultaneously repaired or replaced. 18 valves had calcific nodules and 19 patients atrial thrombi. The mean ischaemic time in the non-aortic group was of 43 minutes (our mitral replacement time is 44'). Reconstruction included 157 commissural, 14 cusp, 85 papillary and 26 chordal surgical manoeuvres. Valve anatomy was good in 53% of cases, medium in 38.5% and bad in 8.5%.

The routine intraoperative valve checking showed perfect closure in 157, non significant regurgitation in 30 and incorrect repair in 18 patients, (not included in this study) requiring valve replacement with a 55% increase in ischaemic time.

Three (1.6%) hospital and 3 late deaths occurred. No permanent anticoagulation was used (1 embolic accident) except in the high risk group (8 accidents). The postoperative resting (R) mean transmitral gradient was of 9.9 (\pm 4.1) mm Hg. and 13.7 (\pm 5.9) mm Hg. after volume load (L). The mean effective orifice area was of 2.42 (\pm 0.86) cm². The cardiac index was 2.9 l/min/m². The ejection fraction rose from 47.3% to 54.84%. Angiographically 17 cases (25.8%) had significant regurgitation, 8 requiring reoperation without mortality. 5 were due to ring dehiscence and 3 to an original defective technique. 80% of patients moved to Class I.

Our 143 isolated Hancock Mitral Replacements, had a mortality of 10.4% and 2.3%. There were no reoperations; mean transmitral gradients of 11.9 (R) and 15.5 (L) mm Hg. and mean effective area of 2.51 cm². Cardiac index was of 3.3 l/min/m². The ejection fraction moved from 54.4 to 47.0% in the 59 patients recatheterized.

We conclude that the reconstruction of the mitral valve, being more physiological than present day prosthesis, is - whenever possible - a superior surgical solution to the problem of mitral insufficiency.

*By invitation

41. Reconstructive Surgery of Mitral Valve Incompetence

ALAIN CARPENTIER, ALAIN DELOCHE*, JOHN RELLAND*,
SYLVAIN CHAUVAUD*, JEAN-NOEL FABIANI* and
CHARLES DUBOST, Paris, France*

Reconstructive surgery of the mitral valve raises 3 controversial questions: 1) Predictability of results, 2) Reproducibility of techniques, 3) Selection of patients.

Five hundred fifty-one cases of mitral incompetence were treated by reconstructive techniques between January 1969 to January 1978. Mitral valve incompetence (M.I.) was classified into 3 types according to leaflet pliability. Type I MI: normal leaflet motion, 150 cases. Type II MI: leaflet prolapse, 213 cases. Type III MI: restricted leaflet motion, 188 cases. Associated tricuspid valvular disease was present in 174 cases (31.5%) and treated by prosthetic ring annuloplasty.

The operative mortality was 5% (19/377) in the mitral group and 13.8% (24/174) in the mitral tricuspid group.

Follow-up data is available in 416 patients from 1 year to 9 years (mean 4.6 years). Late mortality was 3% (13/416). Actuarial curves show a 89% survival rate at 8 years. 27 patients (6.5%) underwent re-operation for either residual M.I. (19) or recurrent M.I. (8). Thrombo-embolism occurred in 12 patients (2.8%) in spite of the fact that 48% were not anticoagulated. According to the N.Y.H.A. classification 73% (275/376) of the patients were in Class I, 21% (79/376) were in Class II, 6% (22/376) were in Class III. Post-operative catheterization and angiocardiology are available in 42 patients. Comparison between the various groups shows that the best results were obtained in type II M.I. followed by type I M.I. and type III M.I.

This experience suggests the following answers to the 3 initial questions:

- 1) Predictable and stable long-term results have been achieved by techniques of valvular reconstruction with a low incidence of thrombo-embolism.
- 2) Reproducibility of the technique is predicated upon adequate training with cadaver and animal hearts.
- 3) Patient selection is based on the valvular pathology rather than age, physical condition or etiology.

Non calcified mitral valve disease should be considered for valve repair, but the final decision is made at operation. It requires accurate knowledge of both the lesions of the mitral valve and the limitations of the technique.

*By invitation

42. Long Term Results of the Mitral Plication Suture Technique

D. F. SHORE, P. WONG*and M. PANETH*, London, England
Sponsored by Mortimer J. Buckley, Boston, Massachusetts*

Our initial experience with 67 mitral valve repairs by use of the mitral plication suture technique was reported in 1977. Early follow-up indicated good clinical results could be obtained

with a low mortality. In addition the overall rate and pattern of left ventricular filling determined by echocardiography was normal or near normal in all patients studied after mitral valve repair.

Encouraged by these early results a total of 246 patients have had attempted mitral valve repairs between January 1975 and September 1978. There were 38 operative failures. Five mitral valve replacements were performed during the early postoperative period. The hospital mortality was 5.7%. Of 190 patients discharged and considered to have had a successful repair, reliable follow-up information is available in 80 cases. These patients form the basis of this report and their average age of 54 years contrasts with the average age of 33 years of those patients from overseas and not included.

Fourteen patients have subsequently had a mitral valve replacement. There have been nine late deaths, four following mitral valve replacement. The clinical state of the remaining 62 patients as judged by symptomatic, clinical and radiological criteria is as follows: 34 patients have had a good result, and 19 patients a satisfactory result. In five patients the results have been unsatisfactory and it is difficult to assess mitral valve function in the remaining four.

An analysis of the results with reference to the surgical pathology and the echocardiographic assessment of mitral valve function and left ventricular filling will be presented.

These results have caused us to reconsider the place of conservative mitral valve surgery and in our hands the long-term results of this method of repair are unacceptable in this age group.

Adjournment

*By invitation

ALTERNATE PAPERS

A.1 Hemodynamic Effect of Mitral Valve Commissurotomy in Patients with Mitral Stenosis

GLENNE. NEWMAN, STEPHEN. RERYCH*, MARK T. UPTON**

and ROBERTH. JONES, Durham, North Carolina*

Sponsored by David C. Sabiston, Jr., Durham, North Carolina

The recent development of noninvasive radionuclide angiography has provided a means to assess multiple parameters of cardiac function with simplicity and accuracy and more importantly during maximal exercise. Left ventricular function was assessed by radionuclide angiocardiography in 9 patients with isolated mitral stenosis before and approximately 6 months after mitral commissurotomy (MC). The mean mitral valve gradient was 14.0 ± 2.8 mmHg, and the mean mitral valve area was 1.20 ± 0.26 cm². Each patient was evaluated at rest (R) and during maximal exercise (E) on an isokinetic bicycle ergometer before and after commissurotomy. Heart rate (HR), LV ejection fraction (EF), LV end-diastolic volume (EDV), pulmonary transit time (PTT), LV stroke volume (SV), cardiac output (CO) and diastolic ventricular filling rate (DVFR) were determined by the nuclide technique. Before operation patients with mitral stenosis had characteristic changes from rest to exercise which supported restriction to diastolic left ventricular filling as the primary limitation in generating a cardiac output during exercise. The SV was unchanged from rest to exercise because the EDV decreased ($P < 0.05$) and the EF increased ($P < 0.05$). Thus, the CO during exercise was HR dependent. However, after commissurotomy the SV increased ($P < 0.05$) from R to E because the EDV was unchanged and the EF increased ($P < 0.05$). Therefore, the CO during E was achieved by HR and an augmented SV. Moreover, the PTT was reduced during R ($P < 0.05$) and E ($P < 0.05$) after MC. The table reflects the differences during R and E and the paired-statistic ($*P < 0.05$) before and after MC.

	At rest (preop)	At rest (postop)	Exercise (preop)	Exercise (postop)
HR	94 ± 16	90 ± 17	155 ± 21	159 ± 20
EF-%	51 ± 12	56 ± 7	61 ± 10	68 ± 10
EDV-ml	100 ± 24	$133 \pm 32^*$	84 ± 21	$125 \pm 43^*$

SV-ml	51 ± 16	75 ± 21*	51 ± 17	85 ± 27*
CO-L/min	4.7 ± 1.6	6.6 ± 1.8*	7.8 ± 2.4	13.7 ± 3.9*
PTT-sec	9.3 ± 2.3	6.3 ± 1.2*	6.4 ± 1.4	3.6 ± 1.4*
DVFR-ml/sec	137 ± 52	194 ± 66*	235 ± 66	422 ± 176*

An increased EDV, SV, CO and DVFR and a decreased PIT are demonstrated at rest and during exercise after commissurotomy. The cardiac output rose from 6.6 L/min during exercise before operation to 13.7 L/min postoperatively. These differences in hemodynamic parameters at rest and during exercise document the mechanics of increased tolerance in patients with mitral stenosis after mitral commissurotomy.

A.2 PEEP in the Management of the Post-Operative Bleeding Heart Patient

PATRICK) A. ILABACA, JOHNL. OCHSNER, and
NOEL L. MILLS, New Orleans, Louisiana*

This prospective study involves 406 consecutive adults who had heart surgery with extracorporeal circulation. Fifteen patients (3.7%) bled at the rate of 200 cc per hour or more in the post-operative period. Thirteen of the 15 patients who bled had had coronary surgery.

After checking and correcting all clotting parameters, and when applicable, hypertension, Positive End Expiratory Pressure (PEEP) was used in managing the bleeding of these patients. Initially, ten centimeters of PEEP were used; this was increased to 15 cm. in those cases in which ten did not sufficiently decrease the rate of hemorrhage. Before institution of PEEP, the average bleeding was 330 cc per hour for one to five hours. After PEEP was instituted in the 11 cases in which bleeding was controlled, an average output of 25 cc per hour for one to ten hours was recorded. Patients were kept on PEEP for five to ten hours. No patient rebled while weaning off PEEP.

In seven patients hemorrhage was controlled with 10 cm. of PEEP; four required 15 cm. of PEEP to stop bleeding; three were explored for continuous bleeding on 15 cm. of PEEP and one because she did not tolerate it. The bleeding sources in the four cases explored were; (1) a branch of a saphenous vein graft; (2) a branch of the internal mammary; (3) a large vein severed at the xiphoid; and (4) no definite site was found, but a large clot in the posterior descending graft suture line was seen at the time of surgery.

In 11 of the 15 patients who bled post-operatively (73%), surgery was avoided by judicious use of PEEP. We believe that PEEP increases mediastinal pressure and that the overdistended lung can obliterate some bleeders in the mediastinum, thus controlling bleeding in many of these patients. We conclude that PEEP is a valuable tool in the management of the post-operative bleeding heart patient.

*By invitation

The American Association for Thoracic Surgery, 1978-1979

(Listed by Countries, States, Provinces and Cities)

ALABAMA	Flintridge
Birmingham	Hughes, Richard K.
Karp, Robert B.	Fresno
Kessler, Charles R.	Evans, Bryon H.
Kiiklin, John W.	Hemet
Kouchoukos, Micholas	Hewlett, Thomas H.

Labrosse, C.
Pacifico, Albert D.
Montgomery
Simmons, Earl M.

ALASKA

Anchorage
Phillips, Francis J.

ARIZONA

Phoenix
Brown, Lee B.
Cornell, Wm. P.
McPhail, Jasper L.
Nelson, Arthur R.
Sun City
Read, C. Thomas
Tucson
Burbank, Benjamin
Melick, Dermont W.
Sanderson, Richard G.

ARKANSAS

Jasper
Hudson, W. A.
Little Rock
Campbell, Gilbert S.
Read, Raymond C.
Pine Bluff
Tiffiou, D. J.

CALIFORNIA

Anaheim
Main, F. Beachley
Carmel
Daniels, Albert C.

Inglewood
Carey, Joseph S.
Irvine
Connolly, John E.
Miller, Don R.
Wakabayashi, Akio
La Canada
Aronstam, Elmore M.
Laguna Hills
Cracovaner, Arthur J.
La Jolla
Fosburg, Richard G.
Hutchin, Peter
La Mesa
Long, David M.
La Quinta
Cotton, Bert H.
Loma Linda
Wareham, Ellsworth E.
Long Beach
Bloomer, William E.
Carlson, Herbert A.
Stemmer, Edward A.
Los Angeles
Baisch, Bruce F.
Buchberg, Gerald D.
Davis, Lowell L.
Fonkalsrud, Eric W.
Goldman, Alfred
Kay, Jerome Harold
Lindsmith, George G.
Longmire, William P., Jr.
Maloney, James V., Jr.
Matloff, Jack M.
Meyer, Bert W.
Morton, Donald L.

Davis

Andrews, Neil C.

Duarte

Benfield, John

Escondido

Mannix, Edgar P.

Martinez

Treasure, Robert Z.

Montebello

Lui, Alfred H. F.

Oakland

Dugan, David J.

Ecker, Roger R.

May, Ivan A.

Orange

Bartlett, Robert H.

Salyer, John M.

Orinda

Stephens, H. Brodie

Pacific Palisades

Weinberg, Joseph A.

Palm Desert

Julian, Ormand C.

Palo Alto

Cohn, Roy B.

Gonsalves-Levin, Lorenzo

Jamplis, Robert W.

Wilson, John L.

Pasadena

Ingram, Ivan N.

Silver, Arthur W.

Piedmont

Samson, Paul C.

Sacramento

Mulder, Donald G.

Ramsay, Beatty H.

Ringler, Leo G.

Stiles, Quentin R.

San Jose

Angell, William, Jr.

Santa Ana

Gazzaniga, Alan B.

Santa Barbara

Higginson, John F.

Jahnke, Edward J., Jr.

Lewis, F. John

Love, Jack W.

South Laguna

Oatway, William H.

South Pasadena

Brewer, Lyman A. III

Stanford

Mark, James B. D.

Shumway, Norman E.

Thousand Oaks

Tsuji, Harold K.

Torrance

Moore, Thomas C.

Nelson, Ronald J.

State, David

Ventura

Dart, Charles H.

West Covina

Carter, Paul R.

COLORADO

Hurley, Edward J.
Miller, George E., Jr.
Smeloff, Edward A.

San Bernadino

Flynn, Pierce J.

San Diego

Baronofsky, Ivan D.
Chambers, John S., Jr.
Daily, Pat O.
Lamberti, John J.
Peters, Richard M.
Trummer, Max J.
Utley, Joe R.

San Francisco

Culiner, Mortis M.
Ebert, Paul A.
Faulkner, William B., Jr.
Fishman, Noel H.
Gardner, Richard E.
Gerbode, Frank
Grimes, Orville F.
Hill, J. Donald
Kerth, William J.
Leeds, Sanford E.
Richards, Victor
Roe, Benson B.
Rogers, W. L.
Thomas, Arthur N.
Ullyot, Daniel J.

Stansel, Horace C., Jr.
Stern, Harold
Wesolow, Adam

Norwalk

Denver

Brown, Robert K.
Burrington, John
Condon, William B.
Eiseman, Ben
Grow, John B.
Kovarik, Joseph L.
Newman, Melvin M.
Pappas, George
Paton, Bruce C.
Rainer, W. Gerald
Waddell, William R.

Englewood

Pomerantz, Marvin

Lakewood

Swan, Henry

Wheatridge

Harper, Frederick P.

CONNECTICUT

Branford

Lindskog, Gustaf E.

Hartford

Kemler, R. Leonard

New Haven

Baue, Arthur E.

Carter, Max G.

Geha, Alexander

Glenn, William W. L.

Hammond, Graeme L.

Naples

Linberg, Eugene J.

North Miami Beach

Spear, Harold C.

Pool, John L.
Norwich
Kelley, Winfield O.
Sharon
Wylie, Robert H.

DELAWARE

Wilmington
Pecora, David V.

DISTRICT OF COLUMBIA

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Iovine, Vincent M.
Keshishian, John M.
Peabody, Joseph W., Jr.
Randolph, Judson G.
Simmons, Robert L.
Smyth, Nicholas P. D.

FLORIDA

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Lasley, Charles H.
Coral Gables
Cooke, Francis N.
Delray Beach
Geary, Paul
Ft. Lauderdale
Maurer, Elmer R.
Gainesville
Hartley, Thomas D.
Moulder, Peter V.
Jacksonville
Gilbert, Joseph W., Jr.
Stephenson, Sam E., Jr.

Orlando
Sherman, Paul H.
Ponte Vedra Beach
Stranahan, Allan
St. Petersburg
Clerf, Louis H.
Daicoff, George R.
DeMatteis, Albert
Wheat, Myron W.
South Miami
Chesney, John G.
Tallahassee
Kraeft, Nelson H.
Tampa
Blank, Richard H.
Connar, Richard G.
Seller, Hawley H.
Winter Park
Bloodwell, Robert D.

GEORGIA

Atlanta
Hatcher, Charles R., Jr.
Hopkins, William A.
Jones, Ellis L.
King, Richard
Logan, William D., Jr.
Mansour, Kamal A.
Rivkin, Laurence M.
Symbas, Panagiotis N.
Augusta
Ellison, Robert G.
Rubin, Joseph W.
Savannah
Yeh, Thomas J.

Lakeland

Brown, Ivan W., Jr.

Miami

Bolooki, Hooshang

Center, Sol

Daughtry, DeWitt C.

Gentsch, Thomas O.

Jude, James R.

Kaiser, Gerard A.

Papper, Emanuel M.

Reis, Robert L.

Ripstein, Charles B.

Swenson, Orvar

Thurer, Richard J.

Miami Beach

Greenberg, Jack J.

Grodin, Pierre

HAWAII

Honolulu

Gebauer, Paul W.

Kailua

McNamara, Joseph Judson

Kailua, Kona

Fell, Egbert H.

IDAHO

Boise

Ashbaugh, David G.

Herr, Rodney H.

ILLINOIS

Chicago

Anagnostopoulos, Constantine

Barker, Walter L.

Hanlon, C. Rollins

Head, Louis R.

Hudson, Theodore R.

Hunter, James A.

Idriss, Farouk S.

Javid, Hushang

Jensik, Robert J.

Kittle, C. Fredrick

Langston, Hiram T.

Leininger, Bernard J.

Levitsky, Sidney

MichaeUs, Lawrence L.

Midell, Allen I.

INDIANA

Indianapolis

Battersby, James S.

King, Harold

King, Robert D.

Mandelbaum, Isidore

Shumacker, Harris B., Jr.

Siderys, Harry

South Bend

Van Fleit, William E.

IOWA

Cedar Rapids

Lawrence, Montague S.

Des Moines

Dorner, Ralph A.

Watkins, David H.

Najafi, Hasson
Raffensperger, John G.
Replogle, Robert L.
Shields, Thomas W.
Skinner, David B.
Thomas, Paul A., Jr.
Weinberg, Milton, Jr.
Evanston
Dorsey, John M.
Fry, Willard A.
Tatooles, Constantine J.
Glencoe
Rubenstein, Laurence H.
Glenview
Fox, Robert T.
Hines
Keeley, John L.
La Grange
Faber, L. Penfield
Lincolnwood
Lees, William M.
Maywood
Pifarre, Roque
Oak Brook
Nigro, Salvatore L.
Palos Heights
DeMeester, Tom R.
Paris
Pratt, Lawrence A.
Peoria
DeBord, Robert A.
Skokie
Baffes, Thomas G.
Winnetka
Mackler, S. Allen

Iowa City
Doty, Donald B.
Ehrenhaft, Johan L.
Rossi, Nicholas P.

KANSAS

Cunningham
Allbritten, Frank F.
Kansas City
Friesen, Stanley R.
Wichita
Tocker, Alfred W.
Winfield
Snyder, Howard E.

KENTUCKY

Lexington
Crutcher, Richard R.
Dillon, Marcus L.
Louisville
Bryant, J. Ray
Barter, John S.
Mahaffey, Daniel E.
Ransdell, Herbert T., Jr.

LOUISIANA

Alexandria
Knoepp, Louis F.
Baton Rouge
Beskin, Charles A.
Metairie
Ochsner, Alton, Jr.
New Orleans
Blalock, John B.
DeCamp, Paul T.
Glass, Bertram A.

Hewitt, Robert Lee

Lindsey, Edward S.

Mills, Noel L.

Ochsner, Alton

Ochsner, John L.

Pearce, Charles W.

Rosenberg, Dennis M.

Schramel, Robert J.

Strug, Lawrence H.

Webb, W. R.

Ellis, F. Henry, Jr.

Frank, Howard A.

Gaensler, Edward A.

Grillo, Hermes C.

Harken, Dwight E.

Moncure, Ashby C.

Neptune, Wilford B.

Overholt, Richard H.

Rheinlander, Harold F.

Russell, Paul S.

Scannell, J. Gordon

Schuster, Samuel R.

Starkey, George W. B.

Watkins, Elton, Jr.

Weintraub, Ronald M.

Wilkins, Earle W., Jr.

MAINE

Liberty

Hurwitz, Alfred

Portland

Drake, Emerson H.

Hiebert, Clement A.

MARYLAND

Baltimore

Attar, Safuh M. A.

Baker, R. Robinson

Brantigan, Otto C.

Brawley, Robert K.

Cowley, R. Adams

Donahoo, James

Gott, Vincent L.

Haller, J. Alex, Jr.

Hankins, John R.

Mason, G. Robert

McLaughlin, Joseph S.

Michelson, Elliott

Rienhoff, William F., Jr.

Turney, Stephen Z.

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Madoff, Irving M.

Concord

Soutter, Lamar

Lawrence

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Medford

Boyd, Thomas F.

Desforges, Gerard

Taylor, Warren J.

Methuen

Wilson, Norman J.

Nantucket

Mahoney, Earle B.

Newton Lower Falls

Bethesda

Morrow, Andrew G.

Worton

Walkup, Harry E.

Zajtchuk, Rostik

MASSACHUSETTS

Boston

Austen, W. Gerald

Badger, Theodore L.

Barsamian, Ernest M.

Berger, Robert L.

Bernhard, William F.

Bougas, James A.

Boyd, David P.

Braunwald, Nina S.

Buckley, Mortimer J.

Burke, John F.

Castaneda, Aldo R.

Cleveland, Richard J.

Clowes, George H. A., Jr.

Cohn, Lawrence H. .

Collins, John J., Jr.

Daggett, Willard M.

Deterling, Ralph A., Jr.

Laforet, Eugene G.

Lynch, Joseph P.

Strieder, John W.

South Weymouth

Malcolm, J. A.

Springfield

Engelman, R. M.

Stoughton

Black, Harrison

MICHIGAN

Ann Arbor

Behrendt, Douglas M.

Gago, Otto

Kirsh, Marvin M.

Morris, Joe D.

Orringer, Mark B.

Sloan, Herbert

Detroit

Arbulu, Agustin

Arciniegas, Eduardo

Day, J. Calude

Dodrill, Forest Dewey

Lam, Conrad R.

Wilson, Robert F.

Grand Rapids

Harrison, Robert W.

Meade, Richard H.

Rasmussen, Richard A.

Grosse Pointe Farms

Benson, Clifford D.

Grosse Point Shores

Gerbasi, Francis S.

Grosse Point Woods

MISSOURI

Columbia

Silver, Donald

Kansas City

Adelman, Arthur

Ashcraft, Keith W.

Benoit, Hector W., Jr.

Holder, Thomas M.

Killen, Duncan A.

Taber, Rodman E.

Kalamazoo

Neerken, A. John

Royal Oak

Timmis, Hilary H.

Southfield

Barrett, Raymond J.

MINNESOTA

Crookston

DeNiord, R. N.

Duluth

Fuller, Josiah

Minneapolis

Anderson, Robert W.

Garamella, Joseph J.

Humphrey, Edward W.

Jensen, Nathan K.

Johnson, Frank E.

Kiser, Joseph C.

Lillehei, Richard C.

Myers, J. Arthur

Nicoloff, D. M.

Varco, Richard L.

Wangenstein, Owen H.

Rochester

Bernatz, Philip E.

Clagett, O. Theron

Danielson, Gordon K., Jr.

McGoon, Dwight C.

Moersch, Herman

Olsen, Arthur M.

Payne, W. Spencer

Pluth, James R.

Wallace, Robert B.

St. Paul

Mayer, John H., Jr.

Padula, Richard T.

Reed, William A.

Mount Vernon

Campbell, Daniel C., Jr.

St. Louis

Barner, Hendrick B.

Bergmann, Martin

Clark, Richard E.

Collins, Harold A.

Ferguson, Thomas B.

Kaiser, George C.

Lewis, J. Eugene, Jr.

Lucido, Joseph L.

Roper, Charles L.

Weldon, Clarence S.

Willman, V. L.

NEBRASKA

Omaha

Fleming, William H.

Hopeman, Alan R.

Malette, William G.

Sellers, Robert D.

NEW HAMPSHIRE

Hanover

Tyson, M. Dawson

Jaffrey Center

Woods, Francis M.

NEW JERSEY

Browns Mills

Fernandez, Javier

Camden

Camishion, R. C.

Leven, N. Logan
Lillehie, C. Walton
Miller, Fletcher A.
Perry, John F., Jr.

MISSISSIPPI

Jackson
Hardy, James D.
Johnston, J. Harvey, Jr.
Neely, William A.
Netterville, Rush E.

Newark
Aberdeen, E.
Neville, William E.
Parsonnet, Victor
New Brunswick
Kunderman, Philip J.
North Caldwell
Wychulis, Adam R.
Pennsauken
Pierucci, Louis, Jr.
Piscataway
Mackenzie, James W.
Short Hills
Demos, Nicholas J.
Tenafly
Gerst, Paul H.

NEW MEXICO

Albuquerque
Edwards, W. Sterling
Las Vegas
Thai, Alan P.
Rociada

East Orange
Auerbach, Oscar
Gerard, Franklyn P.
Haworth
Edie, Richard N.
Hillsdale
Amberson, J. B.
Jersey City
Timmes, Joseph J.
Moorestown
Morse, Dryden P.

New Hyde Park
Wisoff, B. George
New York
Bailey Charles P.
Beattie, Edward J., Jr.
Bowman, Frederick O., Jr.
Boyd, Arthur D.
Cahan, William G.
Ching, Nathaniel P. H.
Clauss, Roy H.
Conklin, Edward F.
Cournand, Andre
Cunningham, Joseph N., Jr.
Davidson, Louis R.
Findlay, Charles W., Jr.
Fischer, Walter W.
Fitzpatrick, Hugh F.
Ford, Joseph M.
Gay, Wm. A., Jr.
Giannelli, Stanley, Jr.
Glenn, Frank
Green, George E.
Holman, Cranston W.

Wilson, Hugh E., HI

Sante Fe

Wilson, Julius L.

NEW YORK

Albany

Alley, Ralph D.

Kausel, Harvey W.

McKneally, Martin F.

Bay Shore

Ryan, Bernard J.

Bronx

Altai, Lari A.

Bloomberg, Allan E.

Friedlander, Ralph

Hirose, Teruo

Robinson, George

Bronxville

Prater, Robert W. M.

Brooklyn

Levowitz, Bernard S.

Sawyer, Philip N.

Buffalo

Adler, Richard H.

Anderson, Murray N.

Lajos, Thomas Z.

MacManus, Joseph E.

Subramanian, Sambumurthy

Cooperstown

Blumenstock, David A.

Great Neck

Crasinopol, Philip

Mineola

Mangiardi, Joseph L.

Holswade, George R.

Humphreys, George H., II

Hutchinson, John E., III

Isom, O. Wayne

Jartzki, Alfred, III

King, Thomas C.

Kirschner, Paul A.

Lambert, Adrian

Litwak, Robert S.

Maier, Herbert C.

Malm, James R.

Martini, Nael

Nealon, Thomas F., Jr.

Okinaka, Arthur J.

Redo, S. Frank

Reemtsma, Keith

Rubin, Morris

Seley, Gabriel P.

Spencer, Frank C.

Steichen, Felicien M.

Thompson, Samuel A.

Tice, David A.

Veith, Frank J.

Wichern, Walter A., Jr.

Wolff, William I.

Patchoque

Finnerty, James

Pittsburgh

Potter, Robert T.

Port Washington

Johnson, Elgie K.

Poughkeepsie

Douglass, Richmond

OHIO

Rochester

DeWeese, James A.
Schwartz, Seymour I.
Stewart, Scott
Zaroff, Lawrence I.

Roslyn

Thomson, Norman B., Jr.

Saranac Lake

Decker, Alfred M., Jr.
Merkel, Carl G.

Scottsville

Emerson, George L.

Setauket

Dennis, Clarence

Southampton

Heroy, William W.

Staten Island

Garzon, Antonio A.

Stony Brook

Soroff, Harry S.

Syracuse

Bugden, Walter F.
Effler, Donald B.
Parker, Frederick B., Jr.

Valhalla

Reed, George E.

Westhampton Beach

Sarot, Irving A.

NORTH CAROLINA

Asheville

Scott, Stewart N.
Sethi, Gulshan K.
Takaro, Timothy

Chapel Hill

Murray, Gordon F.
Starek, Peter J. K.

Akron

Falor, William H.

Chardon

Mautz, F. R.

Cincinnati

Carter, B. Noland

Gonzalez, Luis L.

Helmsworth, James A.

Rosenkrantz, Jens G.

Cleveland

Ankeney, Jay L.

Cross, Frederick S.

Groves, Laurence K.

Kay, Earle B.

Loop, Floyd

Mendelsohn, Harvey J.

Wright, George W.

Columbus

Clatworthy, H. William, Jr.

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Meckstroth, Charles V.

Vasko, John S.

Williams, Thomas E.

Dayton

Dewall, Richard A.

Toledo

Blakemore, William S.

Selman, Morris W.

OKLAHOMA

Oklahoma City

Elkins, Ronald C.

Felton, Warren L., II

Greer, Allen E.

Munnell, Edward R.

Wilcox, Benson R.
Charlotte
Robiesek, Francis
Taylor, Frederick H.
Durham
Hart, Deryl
Oldham, H. Newland, Jr.
Sabiston, David C.
Sealy, Will C.
Smith, David T.
Wechsler, Andrew S.
Wolfe, Walter G.
Young, W. Glenn, Jr.
Greensboro
Deaton, W. Ralph W., Jr.

Oteen
Belts, Reeve H.
Winston-Salem
Cordell, A. Robert
Hudspeth, Allen S.
Johnston, Frank R.
Meredith, Jesse H.

Hamburg
Judd, Archibald R.
Haverford
Flick, John B.
Havertown
Chodoff, Richard J.
Hershey
DeMuth, William E., Jr.
Pierce, William S.
Waldhausen, John A.

Lancaster
Witmer, Robert H.

Wilder, Robert J.
Williams, G. Rainey
Zuhdi, M. Nazih
Tulsa
Guernsey, James M.
Leibovitz, Martin

OREGON

Days Creek
Miller, Arthur C.
Portland
Lawrence, G. Hugh
Poppe, J. Karl
Starr, Albert

PENNSYLVANIA

Bethlehem
Snyder, John M.
Fairfield
McClenathan, James E.
Gladwyne
Johnson, Julian

SOUTH CAROLINA

Charleston
Bradham, Randolph R.
Hairston, Peter
Parker, Edward F.
Sade, Robert M.
Columbia
Almond, Carl H.
Ryan, Thomas C.

TENNESSEE

Chattanooga

Lumberville

O'Neill, Thomas J. E.

Narberth

Burnett, W. Emory

Philadelphia

Brockman, Stanley K.

Edmunds, L. Henry, Jr.

Fineberg, Charles

Haupt, George J.

Lemmon, William M.

Lemole, Gerald M.

MacVaugh, Horace, III

Mendelssohn, Edwin

Mundth, Eldred D.

Nemir, Paul, Jr.

Rosemond, George P.

Stayman, Joseph W.

Templeton, John Y., III

Wallace, Herbert W.

Pittsburgh

Bahnson, Henry T.

Ford, William B.

Magovern, George J.

Pontius, Robert G.

Rams, James J.

Ravitch, Mark M.

Rydal

Frobese, Alfred S.

Sayre

Sewell, William H.

Wynnewood

McKeown, John J., Jr.

Yardley

Sommer, G. N. Jr.

RHODE ISLAND

Providence

Adams, Jesse E., Jr.

Hall, David P.

Jackson

Chandler, John H.

Johnson City

Bryant, Lester R.

Lefemine, A. A.

Knoxville

Blake, Hu Al

Domm, Sheldon E.

Memphis

Cole, Francis H.

Eastridge, Charles E.

Garrett, H. Edward

Howard, Hector S., Jr.

Hughes, Felix A., Jr.

McBurney, Robert P.

Pate, James W.

Robbins, S. Gwin

Rosensweig, Jacob

Skinner, Edward F.

Nashville

Alford, William C., Jr.

Bender, Harvey W., Jr.

Dale, W. Andrew

Diveley, Walter L.

Foster, John H.

Gobbel, Walter G., Jr.

Johnson, Hollis E.

Sawyers, John L.

Scott, Henry W., Jr.

Stoney, William S.

Sewanee

Thrower, Wendall B.

TEXAS

Austin

Karlson, Karl E.
McEnaney, M. Terry
Simeone, Fiorindo A.

Hood, R. Maurice
Ross, Raleigh R.
Beaumont
Harrison, Albert W.
Dallas
Adam, Maurice
Davis, Milton V.

Holland, Robert H.
Kee, John L., Jr.
Lambert, Gary J.
Mitchel, Ben F., Jr.
Paulson, Donald L.
Platt, Melvin R.
Razzuk, Maruf A.
Shaw, Robert R.
Sugg, Winfred L.
Urschel, Harold C., Jr.

VERMONT

Brattleboro
Gross, Robert E.
Burlington
Coffin, Laurence H.
Miller, Donald B.
Chester Depot
Adams, Herbert D.
White River Junction
Crandell, Walter B.

Galveston

Derrick, John R
Tyers, G. Frank O.
Tyson, Kenneth R.T.

VIRGINIA

Houston

Beall, Arthur C., Jr.
Burdette, Walter J.
Cooley, Denton A.
Crawford, E. Stanley
De Bakey, Michael E.
Hallman, Grady L., Jr.
Henly, Walter S.
Mattox, Kenneth L.
Morris, George C., Jr.
Norman, John C.
Overstreet, John Wm.
Reul, George J., Jr.

Arlington
Conrad, Peter W.
Klepser, Roy G.
Charlottesville
Crosby, Ivan K.
Dammann, John F.
Drash, Everett C.
Minor, George R.
Muller, William H., Jr.
Nolan, Stanton P.
Wellons, Harry A.
Great Falls
Mills, Mitchell
Lynchburg
Moore, Richmond L.

Seybold, William D.
Lackland Air Force Base
Stanford, William
La Porte
Barkley, Howard T.
Lubbock
Bricker, Donald L.
Dalton, Martin L., Jr.
San Antonio

Arom, Kit V.
Dooley, Byron N.
French, Sanford W., III
Grover, Frederick L.
Heaney, John P.
Hood, Richard H., Jr.
Nixon, James W.
Proctor, Oscar S.
Trinkle, J. Kent
Temple
Brindley, G. Valter, Jr.

UTAH

Salt Lake City
Cutler, Preston R.
Johnson, Clive R.
Liddle, Harold V.
Mortensen, J. D.
Nelson, Russell M.
Wolcott, Mark W.

WEST VIRGINIA

Charleston
Walker, James H.
Morgantown
Tarnay, Thomas J.

Richmond
Bosher, Lewis H.
Brooks, James W.
Cole, Dean B.
Greenfield, Lazar J.
Gwathmey, Owen
Johns, Thomas N. P.
Lower, Richard R.

WASHINGTON

Mercer Island
Mills, Waldo O.
Seattle
Anderson, Richard P.
Cantrell, James R.
Dillard, David H.
Hill, Lucius D.
Jarvis, Fred J.
Jones, Thomas W.
Merendino, K. Alvin
Pinkham, Roland D.
Sauvage, Lester R.
Thomas, George I.
Spokane
Berg, Ralph, Jr.

West Vancouver
Robertson, Ross
Victoria
Stenstrom, John D.

Warden Herbert E.
Huntington
Littlefield, James B.

WISCONSIN

La Crosse
Gundersen, A. Erik
Madison
Chopra, Paramjeet S.
Curreri, Anthony R.
Kahn, Donald R.
Young, William P.

Marshfield
Myers, William O.
Ray, Jefferson F., III
Sautter, Richard D.

Milwaukee
Boncheck, Lawrence I.
Flemma, Robert J.
Hausmann, Paul F.
Johnson, W. Dudley
Lepley, Derward, Jr.
Litwin, S. Bertrand
Mullen, Donald C.
Narodick, Benjamin G.
Tector, A. J.
Weisel, Wilson

Wausau
Davilla, J. C.

West Bend
Gardner, R. J.

WYOMING

Teton Village
Kaunitz, Victor H.

CANADA

MANITOBA

Winnipeg
Barwinsky, Jaroslaw
Cohen, Morley

NEWFOUNDLAND

St. Anthony
Thomas, Gordon W.
St. John's
Brownrigg, Garrett M.
Couves, Cecil M.

NOVA SCOTIA

Halifax
Murphy, David A.
Kentville
Quinlan, John J.

ONTARIO

Hamilton
Sullivan, Herbert J.
London
Heimbecker, Raymond O.
Ottawa
Keon, Wilbert J.
Sudbury
Field, Paul
Walker, George R.

Toronto
Baird, Ronald J.
Bigelow, Wilfred G.
Cooper, Joel D.
Delarue, Norman C.
Ginsberg, Robert J.
Goldman, Bernard S.
Henderson, Robert D.

ALBERTA

Calgary

Miller, George E.

Edmonton

Callaghan, John C.

Meltzer, Herbert

Sterns, Laurence P.

BRITISH COLUMBIA

Vancouver

Allen, Peter

Ashmore, Phillip G.

Harrison, Elliott

Joynt, George H. C.

Key, James A.

Lockwood, A. L.

MacGregor, David C.

Mustard, Wm. T.

Pearson, F. Griffith

Trimble, Alan S.

Trusler, George A.

Westbrook

Lynn, R. Beverley

Woodbridge

Laird, Robert

QUEBEC

Montreal

Blundell, Peter E.

Bruneau, Jacques

Chiu, Chu-Jeng (Ray)

Dobell, Anthony R. C.

Grondin, Claude M.

Kunstler, Walter E.

MacLean, Lloyd D.

McIntosh, Clarence A.

Mulder, David S.

Scott, Henry J.

Vineberg, Arthur M.

Outremont

Lepage, Gilles

Quebec City

Gravel, Joffre-Andre

OTHER COUNTRIES

ARGENTINA

Buenos Aires

FRANCE

Paris

Dubost, Charles

GERMANY

Aachen

Messmer, Bruno J.

HOLLAND

Amsterdam

Boerema, I.

Leiden

Brom, Gerard A.

INDIA

Bikaner, Raiputana

Van Allen, Chester M.

Noakhali, Bangladesh

McCord, Colin W.

IRELAND

Dublin

Favaloro.Rene G.

BRAZIL

Sao Paulo

Zerbini, E. J.

ISRAEL

Jerusalem

Blair, Emil

GUATEMALA

Guatemala City

Herrera, Rudolfo

VENEZUELA

Caracas

Tricerri, Fernando E.

ENGLAND

Bristol

Belsey, Ronald

Hampden Row

Sellers, Sir Thomas Holmes

Hereford

Thompson, Vernon

London

Brock, Lord

Kennedy, J. H.

Ross, Donald

O'Malley, Eoin

JAPAN

Sendai, Miyagi-ken

Mohri, Hitoshi

Tokyo

Sakakibara, Shigeru

SCOTLAND

Edinburgh

Logan, Andrew

SWEDEN

Stockholm

Bjork, Viking O.

Crafoord, Clarence

SWITZERLAND

Zurich

Senning, Ake

BY-LAWS OF
THE AMERICAN ASSOCIATION
FOR THORACIC SURGERY

ARTICLE I. Name

The name of this Corporation is The American Association for Thoracic Surgery (hereinafter the "Association").

ARTICLE II. Purposes

The purposes of the Association shall be:

To associate persons interested in, and carry on activities related to, the science and practice of thoracic surgery, the cure of thoracic disease and the related sciences.

To encourage and stimulate investigation and study that will increase the knowledge of intrathoracic physiology, pathology and therapy, and to correlate and disseminate such knowledge.

To hold scientific meetings featuring free discussion of problems and developments relating to thoracic surgery, and to sponsor a journal for the publication of scientific papers presented at such meetings and other suitable articles.

To succeed to, and continue to carry on the activities formerly conducted by, The American Association for Thoracic Surgery, an unincorporated association.

ARTICLE III. Membership

Section 1. There shall be four classes of members: Honorary, Senior, Active and, for a time, Associate. Admission to membership in the Association shall be by election. Membership shall be limited, the limits on the respective classes to be determined by these By-Laws. Only Active and Senior Members shall have the privilege of voting or holding office, except as provided by these By-Laws.

Section 2. Honorary Membership shall be reserved for such distinguished persons as may be deemed worthy of this honor by the Council with the concurrence of the Association.

Section 3. The number of Senior Members shall be unlimited. Active Members automatically advance to Senior Membership at the age of sixty years. In addition, a younger Active Member may be eligible for Senior Membership if incapacitated by disability, but for no other reason.

Section 4. Active Membership shall be limited to six hundred. A candidate to be eligible must be a citizen of the United States of America or Canada, unless in unusual cases this citizenship requirement shall have been waived by the Council. The candidate shall have achieved distinction in the thoracic field or shall have made a meritorious contribution to knowledge pertaining to thoracic disease or its surgical treatment.

Section 5. Election to Honorary, Senior or Active Membership shall be for life, subject to the provisions of Section 9 following. There shall be no further additions to the Associate Membership. All new members shall be elected directly to Honorary or Active status.

Section 6. Associate Membership for those members elected after 1960 shall be limited to a five year period. During this limited period, an Associate Member, if properly qualified, may be elected to Active Membership. After the expiration of this limited period an Associate Member, if not yet qualified for Active Membership, must either be re-elected to an additional period of Associate Membership or dropped from the rolls of the Association.

Section 7. Candidates for membership in this Association must be formally nominated and seconded, in an approved manner, by not less than three Active or Senior Members. Such nomination must have been in the hands of the Membership Committee for not less than four months, and the name of the candidate must have been distributed to all members of the Association before final action may be taken on any new candidate for election to Active Membership. Provided the foregoing requirements have been met and the candidates have been approved by the Membership Committee and by the Council, their names shall be presented to the Association at a regularly convened annual meeting for final action. A three-fourths vote of those present and voting shall be required to elect. Any candidate for membership in this Association who has failed of election for three successive years shall automatically cease to be a candidate and may not be renominated until after a lapse of three years.

Section 8. The report of the Membership Committee shall be rendered at the second executive session of each annual meeting of the Association. Candidates shall be presented in groups in the following order: Candidates for Honorary Membership; retirement of Active Members to Senior Membership; Candidates for Active Membership, Associate Members for re-election; members dropped from the rolls of the Association.

Section 9. Membership may be voluntarily terminated at any time by members in good standing. The Council, acting as a Board of Censors, may recommend the expulsion of a member on the grounds of moral or professional delinquency,

and submit his name, together with the grounds of complaint, to the Association as a whole at any of the regularly convened meetings, after giving such member ample opportunity to appear in his own behalf.

Section 10. The Council shall recommend that any Active or Associate Member whose dues are in arrears for two years, or who has been absent, without sufficient excuse, from three consecutive annual meetings, shall have his membership terminated.

Section 11. Notwithstanding Section 10, any member of the Association over 60 years of age is excused from the attendance requirement and upon his specific request may likewise be excused from the payment of dues.

ARTICLE IV. Board of Directors ("Council")

Section 1. The Board of Directors of the Association shall be called the Council and shall be composed of the President, Vice-President, Secretary, Treasurer and Editor of the Association, and five Councilors. All members of the Council must be Active or Senior Members of the Association, except that the Editor may be an Honorary Member.

Section 2. The Council shall be the governing body of the Association, and shall have full power to manage and act on all affairs of the Association, except

as follows:

- a. It may not alter the initiation fees or annual dues, or levy any general assessments against the membership, except that it may, in individual cases, waive annual dues or assessments.
- b. It may not change the Articles of Incorporation or By-Laws.
- c. It may neither elect new members nor alter the status of existing members, other than to apply the provisions of Article III, Section 9.
- d. It may not deplete the principal of the Endowment Fund.

Section 3. At the conclusion of the annual meeting, the retiring President shall automatically become a Councilor for a one-year term of office. One of the other four Councilors shall be elected at each annual meeting of the Association to serve for a four-year term of office in the place of the elected Councilor whose term expires at such meeting, but no Councilor may be reelected to succeed himself. Any Councilor so elected shall take office upon the conclusion of the annual meeting at which he is elected.

Section 4. Vacancies in the office of Councilor shall be temporarily filled by the Council subject to approval of the Association at the next annual meeting of the Association.

ARTICLE V. Officers

Section 1. The officers of the Association shall be a President, a Vice-President, a Secretary, and a Treasurer. All officers must be Active or Senior Members of the Association. Said officers shall be ex officio members of the Council of the Association.

Section 2. The Council may, for the purposes of Article IX, give status as officers of the Association to the individual members of any ad hoc Committee appointed by the Council.

Section 3. The President, Vice-President, Secretary and Treasurer shall be elected at the annual meeting of the Association and shall take office upon conclusion of the meeting. The President and the Vice-President shall be elected for a one-year term of office and neither may be reelected to succeed himself in the same office, unless such officer is filling the unexpired term of an officer previously elected to such office. The Secretary and the Treasurer shall be elected for a one-year term of office and may be reelected indefinitely.

Section 4. The President of the Association shall perform all duties customarily pertaining to the office of President. He shall preside at all meetings of the Association and at all meetings of the Council.

Section 5. The Vice-President of the Association shall perform all duties customarily pertaining to the office of the Vice-President, both as to the Association and the Council. In the event of a vacancy occurring in the office of President, the Council shall advance the Vice-President to the Presidency and appoint a new Vice-President.

Section 6. The Secretary of the Association shall perform all duties customarily pertaining to the office of Secretary. He shall serve as Secretary of the Association and as Secretary of the Council. When deemed appropriate, an Active or Senior Member may be elected to serve as an understudy to the Secretary in anticipation of the latter's retirement from office.

Section 7. The Treasurer of the Association shall perform all duties customarily pertaining to the office of Treasurer. He shall serve as Treasurer of the Association and shall also serve as custodian of the Endowment Fund.

Section 8. The Editor of the Association is not an officer of the Association. He shall be appointed by the Council at its annual meeting; provided, however, that such appointment shall not become effective until approved by the Association

at the annual meeting of the Association. The Editor shall be appointed for a five-year term and may not be appointed to more than two successive terms; provided, however, that an Editor completing two years or less of the unexpired term of a previous Editor may be appointed for two successive five-year terms. The Editor shall serve as the Editor of the official Journal and shall be ex officio the Chairman of the Editorial Board and a member of the Council of the Association.

Section 9. Vacancies occurring among the officers named in Section 1 or a vacancy in the position of Editor shall be temporarily filled by the Council, subject to approval of the Association at the next meeting of the Association.

ARTICLE VI. Committees

Section 1. The Council is empowered to appoint a Membership Committee, a Program Committee, a Necrology Committee and such other committees as may in its opinion be necessary or desirable. All such committees shall render their reports at an executive session of the Association, except that no ad hoc committee need report unless so directed by the Council.

Section 2. The Membership Committee shall consist of seven Active or Senior Members. The Council may appoint not more than one of its own members to serve on this Committee. The duties of the Membership Committee are to investigate all candidates for membership in the Association and to report its findings as expeditiously as possible to the Council through the Secretary of the Association. This Committee is also charged with searching the literature of this and other countries to the end that proper candidates may be presented to the Association for consideration. Appointment to this Committee shall be for a period of one year, and not more than five of the members may be reappointed to succeed themselves. This Committee is also charged with maintaining a record of membership attendance and participation in the scientific programs and reporting to the affected members and to the Council any deviations from the requirement of Article VIII, Section 4, of these By-Laws.

Section 3. The Program Committee shall consist of five members: the President, Secretary, and Editor of the Association, and two members-at-large. The duties of this Committee shall be to arrange, in conformity with instructions from the Council, the scientific program for the annual meeting.

Section 4. The Necrology Committee shall consist of one or more Active or Senior Members. Appointments to this Committee shall be for a one-year term of office. Any or all members of this Committee may be reappointed to succeed themselves. The Council may, if it so desires, appoint one of its own members to serve as Chairman of this Committee. The duties of the Necrology Committee shall be to prepare suitable resolutions and memorials upon all deaths of members of the Association and to report such deaths at every annual meeting.

Section 5. The Nominating Committee shall consist of the five (5) immediate Past Presidents of the Association. The most senior Past President shall serve as Chairman. This Committee shall prepare a slate of nominees for Officers and Councilors upon instruction from the Council as to the vacancies which are to be filled by election and shall present its report at the Second Executive Session of the Annual Meeting.

Section 6. The Association as a whole may authorize the Council to appoint Scientific or Research Committees for the purpose of investigating thoracic problems and may further authorize the Council to support financially such committees to a limited degree. When Scientific or Research Committees are authorized by the Association, the Council shall appoint the Chairmen of these Committees, with power to organize their committees in any way best calculated to accomplish the desired object, subject only to the approval of the Council. Financial aid rendered to such Committees shall not exceed such annual or special appropriations as may be specifically voted for such purposes by the Association as a whole. Members are urged to cooperate with all Scientific or Research Committees of the Association.

Section 7. The Evarts A. Graham Memorial Traveling Fellowship Committee shall consist of six members: the President, Secretary, and Treasurer of the Association and three members-at-large, one member being appointed by the President each year to serve a term of three years. The Chairman shall be the member-at-large serving his third year. The duties of the committee shall be to recommend Fellowship candidates to the Graham Education and Research Foundation and to carry out other business pertaining to the Fellowship and the Fellows, past, present, and future.

Section 8. The Editorial Board shall be appointed by the Editor, subject only to the approval of the Council. The Editor shall be, ex officio, the chairman of this board and shall be privileged to appoint and indefinitely reappoint such members of the Association, regardless of class of membership, and such non-members of the Association as in his opinion may be best calculated to meet the editorial requirements of the Association.

Section 9. The Ethics Committee shall consist of five members appointed by the Council. No member shall serve more than four years. The Ethics Committee shall advise the Council concerning alleged breaches of ethics. Complaints regarding alleged breaches of ethics shall be received in writing by the Ethics Committee and shall be investigated by it. In addition, the Ethics Committee may investigate on its own initiative.

ARTICLE VII Finances

Section 1. The fiscal year of the Association shall begin on the first day of March and end on the last day of February each year.

Section 2. Members shall contribute to the financial maintenance of the Association through initiation fees, annual dues, and special assessments. The amount of the annual dues and the initiation fees shall be determined by these By-Laws. If, at the end of any fiscal year, there is a deficit in the current funds of the Association, the Council may send out notices to that effect and invite Active members to contribute the necessary amount so that no deficit is carried over from one fiscal year to another. The Association may, in any regularly convened meeting, vote a special assessment for any purpose consistent with the purposes of the Association, and such special assessment shall become an obligatory charge against the classes of members affected thereby.

Section 3. To meet the current expenses of the Association, there shall be available all revenue derived by the Association subject to the provisions of Section 4, following.

Section 4. Funds derived from the payment of initiation fees shall not be available for current expenses and shall be placed in a special fund, to be invested and reinvested in legal securities, to be held intact, and to be known as the Endowment Fund. The Council is responsible for the proper management of the Endowment Fund, and may divert any surplus in the current funds of the Association into this fund, but may not withdraw any of the principal of the Endowment Fund except in accordance with the provisions of Section 6, following.

Section 5. The income from the Endowment Fund shall be expended as the Council directs.

Section 6. The principal of the Endowment Fund may be withdrawn, in whole or in part, under the following conditions only: The amount of principal to be withdrawn shall have been approved by the Council; it shall have been approved by a majority of the members present and voting at a regularly convened annual meeting; it shall have been tabled for one year; it shall have been finally passed by a three-fourths vote of the members present and voting at the next regularly convened annual meeting.

Section 7. In the event of the dissolution of the Association, the Endowment Fund shall be distributed among national institutions of the United States and Canada in a proportion equal to the then existing ratio between the numbers of citizens of the two nations who are members of the Association.

ARTICLE III. Meetings

Section 1. The time, place, duration, and procedure of the annual meeting of the Association shall be determined by the Council and the provisions of these By-Laws.

Section 2. Notice of any meeting of the Association shall be given to each member of the Association not less than five nor more than forty days prior to any annual meeting and not less than thirty nor more than forty days prior to any special meeting by written or printed notice delivered personally or by mail, by or at the direction of the Council, the President or the Secretary. Such notice shall state the place, day and hour of the meeting and in the case of a special meeting shall also state the purpose or purposes for which the meeting is called.

Section 3. A special meeting of the Association may be called by the Council or on the written request of fifteen members delivered to the Council, the President or the Secretary. The specific purposes of the meeting must be stated in the request.

Section 4. Attendance at annual meetings and participation in the scientific programs shall be optional for all Honorary and Senior Members, but it shall be expected from all Active and Associate Members.

Section 5. Each annual meeting shall have at least two executive sessions.

Section 6. When the Association convenes for its annual meeting, it shall immediately go into the first executive session, but the business at this session shall be limited to:

1. Appointment of necessary committees.
2. Miscellaneous business of an urgent nature.

Section 7. The second executive session of the Association shall be held during the afternoon of the second day of the meeting. The business at this session shall include, but is not limited to:

1. Reading or waiver of reading of the minutes of the preceding meetings of the Association and the Council.
2. Report of the Treasurer for the last fiscal year.
3. Audit Report.
4. Report of the Necrology Committee.
5. Report of the Program Committee.
6. Action on amendments to the Articles of Incorporation and By-Laws, if any.

7. Action on recommendations emanating from the Council.
8. Unfinished Business.
9. New Business.
10. Report of the Membership Committee.
11. Election of new members.
12. Report of the Nominating Committee.
13. Election of officers.

Section 8. Except where otherwise required by law or these By-Laws, all questions at a meeting of the members shall be decided by a majority vote of the members present in person and voting. Voting by proxy is not permitted.

Section 9. Fifty voting members present in person shall constitute a quorum at a meeting of members.

Section 10. While the scientific session of the annual meeting is held primarily for the benefit of the members of the Association, it may be open to non-members who are able to submit satisfactory credentials, who register in a specified manner, and who pay such registration fee as may be determined and published by the Council from year to year.

Section 11. There shall be an annual meeting of the Council held during the annual meeting of the Association. Additional meetings of the Council may be called on not less than seven days' prior written or telephonic notice by the President, the Secretary or any three members of the Council.

Section 12. Five members of the Council shall constitute a quorum for the conduct of business at any meeting of the Council, but a smaller number may adjourn any such meeting.

Section 13. Whenever any notice is required to be given to any member of the Council, a waiver thereof in writing, signed by the member of the Council entitled to such, notice, whether before or after the time stated therein, shall be deemed equivalent thereto.

Section 14. Any action which may be or is required to be taken at a meeting of the Council may be taken without a meeting if a consent in writing, setting forth the action so taken, shall be signed by all of the members of the Council. Any such consent shall have the same force and effect as a unanimous vote at a duly called and constituted meeting.

ARTICLE IX. Indemnification of Directors and Officers

Section 1. The Association shall indemnify any and all of its Councilors (hereinafter in this Article referred to as "directors") or officers or former directors or officers, or any person who has served or shall serve at the Association's request or by its election as a director or officer of another corporation or association, against expenses actually and necessarily incurred by them in connection with the defense or settlement of any action, suit or proceeding in which they, or any of them, are made parties, or a party, by reason of being or having been directors or officers or a director or officer of the Association, or of such other corporation or association, provided, however, that the foregoing shall not apply to matters as to which any such director or officer or former director or officer or person shall be adjudged in such action, suit or proceeding to be liable for willful misconduct in the performance of duty or to such matters as shall be settled by agreement predicated on the existence of such liability.

Section 2. Upon specific authorization by the Council, the Association may purchase and maintain insurance on behalf of any and all of its directors or officers or former directors or officers, or any person who has served or shall serve at the Association's request or by its election as a director or officer of another corporation or association, against any liability, or settlement based on asserted liability, incurred by them by reason of being or having been directors or officers or a director or officer of the Association or of such other corporation or association, whether or not the Association would have the power to indemnify them against such liability or settlement under the provisions of Section 1.

ARTICLE X. Papers

Section 1. All papers read before the Association shall become the property of the Association. Authors shall leave original copies of their manuscripts with the Editor or reporter, at the time of presentation, for publication in the official Journal.

Section 2. When the number of papers makes it desirable, the Council may require authors to present their papers in abstract, and may set a time limit on discussions.

ARTICLE XI. Initiation Fees, Dues and Assessments

Section 1. Honorary Members of the Association are exempt from all initiation fees, dues, and assessments.

Section 2. Annual dues for Active Members shall be \$75.00 and shall include a year's subscription to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY.

Section 3. Annual dues for Associate Members shall be \$75.00 and shall include a year's subscription to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY.

Section 4. Senior Members are exempt from dues.

Section 5. The initiation fee for those elected directly to Active Membership shall be \$15.00.

Section 6. If and when an Associate Member is elected to Active Membership, he shall pay an additional \$5.00 initiation fee.

Section 7. Associate and Active Members must subscribe to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY to retain their membership status.

Section 8. Subscription to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY is optional for Senior Members.

Section 9. Bills for membership dues and for subscriptions to THE JOURNAL OF THORACIC AND CARDIOVASCULAR SURGERY will be mailed to members by the Treasurer after the annual meeting.

ARTICLE XII. Parliamentary Procedure

Except where otherwise provided in these By-Laws or by law, all parliamentary proceedings at the meetings of this Association and its Council and committees shall be governed by the then current Sturgis Standard Code of Parliamentary Procedure.

ARTICLE XIII. Amendments

Section 1. These By-Laws may be amended by a two-thirds vote of the members present and voting at an executive session of a properly convened annual or special meeting of the Association provided that the proposed amendment has been moved and seconded by not less than three members at a prior executive session of that meeting or a prior meeting of the Association.

Section 2. These By-Laws may be suspended in whole or in part for a period of not more than twelve hours by a unanimous vote of those present and voting at any regularly convened meeting of the Association.

THE AMERICAN ASSOCIATION FOR THORACIC SURGERY

Charter Members

June 7, 1917

E. Wyllis Andrews	Arthur A. Law
John Auer	William Lerche
Edward R. Baldwin	Howard Lilienthal
Walter M. Boothby	William H. Luckett
William Branower	Morris Manges
Harlow Brooks	Walton Martin
Lawrason Brown	Rudolph Matas
Kenneth Bulkley	E. S. McSweeney
Alexis Carrel	Samuel J. Melter
Norman B. Carson	Willy Meyer (Founder)
J. Frank Corbett	James Alexander Miller
Armistead C. Crump	Robert T. Miller

Charles N. Dowd	Fred J. Murphy
Kennon Dunham	Leo S. Peterson
Edmond Melchior Eberts	Eugene H. Pool
Max Einhorn	Walther I. Rathbun
Herman Fischer	Martin Rehling
Albert H. Garvin	B. Merrill Ricketts
Nathan W. Green	Samuel Robinson
John R. Hartwell	Charles I. Scudder
George J. Heuer	William H. Stewart
Chevalier Jackson	Franz Torek
H. H. Janeway	Martin W. Ware
James H. Kenyon	Abraham O. Wilensky
Adrian V. S. Lambert	Sidney Yankauer

Meetings of the American Association for Thoracic Surgery

1918-Chicago.....	President, Samuel J. Meltzer
1919-Atlantic City.....	President, Willy Meyer
1920-New Orleans.....	President, Willy Meyer
1921-Boston.....	President, Rudolph Matas
1922-Washington.....	President, Samuel Robinson
1923-Chicago.....	President, Howard Lilienthal
1924-Rochester, Minn.....	President, Carl A. Hedblom
1925-Washington.....	President, Nathan W. Green
1926-Montreal.....	President, Edward W. Archibald
1927-New York.....	President, Franz Torek
1928-Washington.....	President, Evarts A. Graham
1929-St. Louis.....	President, John L. Yates
1930-Philadelphia.....	President, Wyman Whittemore
1931-San Francisco.....	President, Ethan Flagg Butler
1932-Ann Arbor.....	President, Frederick T. Lord
1933-Washington.....	President, George P. Muller
1934-Boston.....	President, George J. Heuer
1935-New York.....	President, John Alexander
1936-Rochester, Minn.....	President, Carl Eggers

1937-Saranac Lake..... President, Leo Eloesser
 1938-Atlanta..... President, Stuart W. Harrington
 1939-Los Angeles..... President, Harold Brunn
 1940-Cleveland..... President, Adrian V. S. Lambert
 1941-Toronto..... President, Fraser B. Gurd
 1944-Chicago..... President, Frank S. Dolley
 1946-Detroit..... President, Claude S. Beck
 1947-St. Louis..... President, I. A. Bigger
 1948-Quebec..... President, Alton Ochsner
 1949-New Orleans..... President, Edward D. Churchill
 1950-Denver..... President, Edward J. O'Brien
 1951-Atlantic City..... President, Alfred Blalock
 1952-Dallas..... President, Frank B. Berry
 1953-San Francisco..... President, Robert M. Janes
 1954-Montreal..... President, Emile Holman
 1955-Atlantic City..... President, Edward S. Welles
 1956-Miami Beach..... President, Richard H. Meade
 1957-Chicago..... President, Cameron Haight
 1958-Boston..... President, Brian Blades
 1959-Los Angeles..... President, Michael E. De Bakey
 1960-Miami Beach..... President, William E. Adams
 1961-Philadelphia..... President, John H. Gibbon, Jr.
 1962-St. Louis..... President, Richard H. Sweet (Deceased 1-11-62)
 President, O. Theron Clagett
 1963-Houston..... President, Julian Johnson
 1964-Montreal..... President, Robert E. Gross
 1965-New Orleans..... President, John C. Jones
 1966-Vancouver, B. C..... President, Herbert C. Maier
 1967-New York..... President, Frederick G. Kergin
 1968-Pittsburgh..... President, Paul C. Samson
 1969-San Francisco..... President, Edward M. Kent

1970-Washington, D. C.....	President, Hiram T. Langston
1971-Atlanta.....	President, Thomas H. Burford
1974-Las Vegas.....	President, Lyman A. Brewer, III
1975-New York.....	President, Wilfred G. Bigelow
1976-Los Angeles.....	President, David J. Dugan
1977-Toronto.....	President, Henry T. Bahnson
1978-New Orleans.....	President, J. Gordon Scannell

EVARTS A. GRAHAM MEMORIAL TRAVELING FELLOWS

1st	1951-52	L. L. Whytehead, M.D., F.R.C.S. 790 Sherbrooke St., Winnipeg 2, Manitoba, CANADA
2nd	1953-54	W. B. Ferguson, M.B., F.R.C.S. Royal Victoria Infirmary, Newcastle-upon-tyne, ENGLAND
3rd	1954-55	Lance L. Bromley, M. Chir., F.R.C.S. St. Mary's Hospital, London, W.2, ENGLAND
4th	1955-56	Raymond L. Hurt, F.R.C.S. The White House, 8 Loom Lane, Radlett Herts, ENGLAND
5th	1956-57	Mathias Paneth, F.R.C.S. Brompton Hospital, London, S.W. 3, ENGLAND
6th	1957-58	Peter L. Brunnen, F.R.C.S. Department of Thoracic Surgery, Woodend General Hospital Aberdeen, SCOTLAND
7th	1958-59	N. G. Meyne, M.D. University of Amsterdam, Wilhelmina-Gasthuis, Amsterdam, HOLLAND
8th	1960-61	Godrej S. Karai, M.D. Calcutta, INDIA
9th	1961-62	Fritz Helmer, M.D. Second Surgical Clinic, University of Vienna, Vienna, AUSTRIA
10th	1962-63	Theodor M. Scheinin, M.D. Oulun Laaninsairaala, Oulu, FINLAND
11th	1963-64	Masahiro Saigusa, M.D. Department of Surgery, Tokyo University School of Medicine 1 Motofuji-cho, Bunkyo-Ku, Tokyo, JAPAN
12th	1963-64	Adar J. Hallen, M.D. Department of Thoracic Surgery, University Hospital Uppsala, SWEDEN
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14th	1964-65	Elias Carapistolis, M.D., F.A.C.S. University Hospital A.H.E.P.A. Surgical Clinic Department Aristotelian University of Thessaloniki, Thessaloniki, GREECE
15th	1965-66	Gerhard Friehs, M.D. Chirurgische University Klinik, Graz, AUSTRIA
16th	1965-66	Ary Blesovsky, M.D. London, ENGLAND
17th	1966-67	C. Peter Clarke, F.R.A.C.S. Cardiac Surgeon, The Royal Childrens Hospital, Flemington Road, Parkville, Vic. 3052 AUSTRALIA
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21st	1970-71	Michel S. Slim, M.D. Department of Surgery, American University Hospital, Beirut, LEBANON
22nd	1971-72	Severi Pellervo Mattila, M.D. Department of Thoracic Surgery, Helsinki University Central Hospital, Helsinki 29, FINLAND
23rd	1972-73	Yasuyuki Fujiwara, M.D. Department of Cardiovascular Surgery, Tokyo Medical College Hospital, Shinjuku, Tokyo, JAPAN
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25th	1974-75	J. J. DeWet Lubbe, M.D. Dept. of Cardio-Thoracic Surgery, University of Stellenbosch P. O. Box 53 Bellville, REPUBLIC OF SOUTH AFRICA
26th	1975-76	Mieczyslaw Trenkner, M.D. Institute of Surgery Debinski, POLAND
27th	1976-77	Bum Koo Cho, M.D. St. Luke's Episcopal Hospital Houston, Texas, KOREA
28th	1977-78	Alan William Gale, M.D., FRACP, FRACS, Paddington, NSW, AUSTRALIA
29th	1978-79	Eduardo Otero Goto, M.D. Valencia, SPAIN