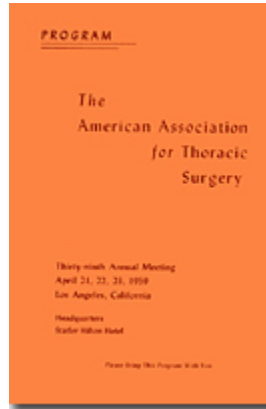


# 1959 ANNUAL MEETING PROGRAM



## THE AMERICAN ASSOCIATION *for* THORACIC SURGERY 1958-59

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## Tuesday Morning, April 21, 1959

### 8:30 A.M. Business Meeting - Pacific Ballroom

#### Scientific Session: REGULAR PROGRAM

#### 1. Studies of Pulmonary Diffusion after Open Heart Surgery.

ROBERT J. SCHRAMMEL (*by invitation*), ROBERT CAMERON (*by invitation*),  
MORTON ZISKIND (*by invitation*), MAURICE ADAM (*by invitation*),  
and OSCAR CREECH, JR., New Orleans, La.

This study was undertaken to determine the factors responsible for the high incidence of serious pulmonary complications in patients undergoing open heart surgery with the aid of extracorporeal circulation. Diffusion of carbon monoxide was measured by the technique of Filley in eight patients pre-operatively and post-operatively on the second, seventh, fourteenth, and twenty-first days. These studies demonstrated marked depression of the carbon monoxide diffusing capacity in every instance. This depression existed occasionally without significant roentgenographic changes and without clinically apparent pulmonary complications. To further evaluate the factors responsible for this depression, the carbon monoxide diffusing capacity was measured in dogs undergoing unilateral thoracotomy alone; extracorporeal circulation without inflow occlusion and without thoracotomy; extracorporeal circulation with inflow occlusion and without thoracotomy; extracorporeal circulation, inflow occlusion, and thoracotomy. The results of these experiments will be reported together with an evaluation of the relative contribution of the incision, extra-corporeal circulation, and existing heart disease to the observed depression of carbon monoxide diffusing capacity.

#### 2. Clinical Results of Correction under Hypothermia of Atrial Septal Defects and Pulmonary Valvular Stenosis.

EARLE B. MAHONEY, JAMES A. MANNING (*by invitation*), JAMES A.  
DEWEESE (*by invitation*) and SEYMOUR I. SCHWARTZ  
(*by invitation*), Rochester, N.Y.

This report is concerned with thirty-six patients who have had "open-heart" surgery performed under hypothermia for the closure of atrial septal defects and/or correction of pulmonary valvular stenosis. These patients have been subjected to long-term clinical observation following operation and have undergone post-operative cardiac catheterization. There has been uniform evidence of adequate correction of the defects, and the physiological data will be presented in detail. Twenty-four patients had coronary autoperfusion during inflow tract occlusion; eighteen had repair of ostium secundum defects of the atrial septum; and eighteen had pulmonary valvulotomy for so-called pure pulmonary valvular stenosis; three patients had both defects and had both corrected.

The surgery was performed under direct vision at temperatures between 28° C. and 31° C. for periods of caval occlusion averaging 5 minutes, 20 seconds. In those who received coronary perfusion, the myocardium was perfused with warm, oxygenated, heparinized blood previously withdrawn from the patient's aorta during simultaneous intravenous replacement of fresh heparinized donor blood. This autoperfusion has resulted uniformly in a fully saturated perfusate, and it has had the same evidence of beneficial effect on the myocardial tone, metabolism, and electrical activity as we have recorded in experimental observations. There has been one operative death in this group.

The long-term results indicate that the hypothermic technique offers an open-heart method for the correction of the defects, which is simple, and complete correction can be accomplished. The efficacy of the method demands accurate preoperative diagnosis which is possible with careful evaluation. The use of the pump oxygenator is reserved for lesions requiring ventriculotomy or prolonged periods of exposure for repair.

#### 3. Simplified Technic for Direct Vision Pulmonary Valvotomy.

CONRAD R. LAM and RODMAN E. TABER, Detroit, Mich.

It is now well recognized that a completely satisfactory operation for congenital pulmonic stenosis must be done under direct vision, rather than by the transventricular methods. Following the example of Swan, many surgeons have employed hypothermia to provide adequate operating time for the valvotomy, and more recently, even pump-oxygenators have been employed during the operation.

It has seemed to us that with the valve clearly visualized, not more than one minute of time would be required to make the cuts necessary to open it completely. If this is the case, neither hypothermia nor the pump oxygenator are needed. In line with this theory, we have operated on 45 cases of congenital pulmonic stenosis with the patients at normal temperature. The period of caval occlusion has never exceeded a minute and a half, and there has been no instance of brain damage. One infant died of pulmonary complications in the postoperative period. Instances of isolated infundibular stenosis must and can be differentiated by catheter pressure tracings, and these cases must be operated on with the aid of the pump-oxygenator.

The procedure will be illustrated by a short motion picture film.

#### 4. Surgical Treatment of Isolated Pulmonary Infundibular Stenosis.

WILLIAM P. HEDERMAN (*by invitation*), S.GILBERT BLOUNT  
(*by invitation*), and HENRY SWAN, Denver, Colo.

Infundibular stenosis occurring with an intact interventricular septum and a normal pulmonary valve is a relatively unusual condition. This paper discusses the relative incidence, clinical features, pathology, and differential diagnosis of the lesion. It is possible to identify the existence of this entity pre-operatively with some certainty. Four cases of our own who had surgical correction of isolated infundibular stenosis are reported, including objective post-operative studies of the hemodynamic changes effected by surgery. The need for accurate recognition of the lesion is stressed and the surgical approach and techniques involved, using hypothermia, are discussed in detail.

## 5. Surgical Experiences in the Treatment of Congenital Mitral Stenosis and Mitral Insufficiency.

GEORGE W. B. STARKET, Boston, Mass.

Although congenital mitral valvular lesions are among the rarer anomalies they certainly can cause severe incapacitation and death in children. There have been seven patients operated upon to the date of submission of abstract. (Several more will undoubtedly be done before April 1959.) There has been one death from unexplained cause on the fifth postoperative day. The ages of these patients range from fifteen months (nineteen pounds) to fourteen years. All patients had been or were in heart failure. Both closed and open surgical methods have been used.

This group does not include the mitral insufficiency so often found in ostium primum defects - i.e. the bifid mitral septal leaflet. The pathological variations, catheterization data and clinical course of this very interesting group of patients will be presented and discussed.

## 6. The Etiology and Prevention of Atrial Fibrillation after Mitral Valvotomy.

C. FREDERICK KITTLE, and JAMES CROCKETT (by invitation),  
Kansas City, Kan.

One of the most common postoperative complications after mitral valvotomy is the occurrence of atrial fibrillation in a patient with a previously normal sinus rhythm. Although recognized for several years, the prevention, etiology, and occurrence of this iatrogenic arrhythmia are poorly understood. Analysis has been made of 250 consecutive patients undergoing mitral valvotomy with particular attention to postoperative fibrillation.

Of the 250 patients 153 had a normal sinus rhythm preoperatively and 42 developed atrial fibrillation (an incidence of 27%). Of the 97 patients with atrial fibrillation preoperatively an attempt to establish a normal sinus rhythm was made in 45 with success in 12.

The predisposing factors of age, associated mitral insufficiency, prior attacks of atrial fibrillation, and electrolyte disturbances are discussed in relation to this postoperative arrhythmia. The suppressive actions of digitalis and/or quinidine in preventing this complication are analyzed.

# Tuesday Afternoon, April 21, 1959

## 2:00 P.M. Scientific Session: REGULAR PROGRAM -Pacific Ballroom

## 7. The Surgical Management of Complications of Staphylococcal Pneumonia in Infancy and Childhood.

DAVID C. SABISTON, JR., EDWARD W. HOPKINS (by invitation), and  
ROBERT E. COOKE (by invitation), Baltimore, Md.

With the increasing incidence of antibiotic resistant strains of the staphylococcus, clinical problems presented by infections with this organism have become of considerable importance. One disease in which a striking rise has occurred is staphylococcal pneumonia. This disease was formerly characterized by its low incidence and high mortality. In a series observed during the past three years at the Johns Hopkins Hospital there have been 67 cases. In this group 62 (92%) were primary. Five (8%) were secondary to some other systemic illness (cystic fibrosis of the pancreas, nephrosis, hypogammaglobinemia). The complications which may follow staphylococcal pneumonia include: (1) empyema, (2) tension pneumothorax, (3) pneumatoceles, (4) persistent abscess, and (5) fibrotic pleurisy ("captive lung"). Of the entire group 29 (43%) have required some form of surgical therapy. The procedures employed have included: (1) closed intercostal catheter drainage, (2) rib resection with open drainage, and (3) pulmonary decortication. In addition all patients have received large doses of antibiotics. The mortality in the primary group was 7% and for the five patients in the secondary group 100%.

As an example of the magnitude of this problem as a postoperative complication, the case of a young patient with coarctation of the aorta may be cited. During recovery following operation of the coarctation, the patient developed a staphylococcal pneumonia and empyema overlying the site of the aortic anastomosis. Prompt open drainage and massive intravenous antibiotics resulted in a complete recovery.

## 8. Surgical Treatment of Pulmonary Coccidioidomycosis: Ten Year Study.

BERT H. COTTON and J. W. BIRSNER (by invitation), Pasadena, Calif.

This paper represents further observations of Coccidioidomycosis which is a follow-up of a preliminary report of 30 cases presented before this Association in 1950. The material represents 1500 cases of which 120 have received surgical treatment.

The x-ray, pathologic and bronchoscopic findings plus symptoms have been correlated to predict the course and termination of the pulmonary manifestations of Coccidioidomycosis and the complications, thus, crystalizing the indications for surgical treatment of cavities and granulomas.

Since there has been considerable divergence of opinion as to the proper treatment for these focalized lesions, we hope this paper will contribute to a more uniform approach in management. The complications of surgical treatment are listed, and possible causes are suggested.

## **9. The Effect of Mean Endotracheal Pressure on the Cardiac Output of Patients Undergoing Intrathoracic Operations.**

THOMAS F. NEALON, JR., RICHARD T. CATHCART (*by invitation*),  
WILLIAM FRAIMOW (*by invitation*), EDWARD D. MCLAUGHLIN  
(*by invitation*), and JOHN H. GIBBON, JR., Philadelphia, Pa.

Previous work from this laboratory demonstrated that an increase in mean endotracheal pressure causes a significant decrease in the cardiac output of patients undergoing intra-abdominal operations. Changes in the cardiac output were related only to changes in the mean endotracheal pressure and were independent of any other single component of the time pressure pattern employed. The present study is concerned with the effect of the mean endotracheal pressure on cardiac output of patients undergoing intrathoracic operations.

The patients were anesthetized with ether and oxygen administered via a circle anesthetic system which included a cuffed endotracheal tube. Ventilation was provided by an intermittent positive and negative pressure ventilator. Five mg. of Evans Blue dye (T-1824) were injected via a catheter into an axillary vein. A sample of arterial blood was drawn at a constant rate directly from a brachial artery into a cuvette densitometer. Endotracheal pressures and the dye dilution curve were recorded on a multiple channel oscilloscope. Cardiac outputs were measured after a suitable period of stabilization: (1) after the operation was begun but before the chest was opened (a) with a mean endotracheal pressure of approximately 3 cm. of water and (b) with a mean endotracheal pressure of approximately 15 cm. of water and (2) after the chest was opened employing the same two mean endotracheal pressures.

In conformity with our previously reported observations, a significant decrease in cardiac output occurred when the mean endotracheal pressure was increased before the chest was opened. However, when the chest was open, no change in cardiac output resulted from a similar increase in the mean endotracheal pressure.

## **10. Injuries of the Trachea and Major Bronchi.**

R. MAURICE HOOD, Austin, Tex., and HERBERT E. SLOAN, Ann Arbor, Mich.

Injuries of the trachea and major bronchi which have been but rarely diagnosed in the past are now occurring with rapidly increasing frequency. Repair of such injuries without sacrifice of lung tissue and with prevention of serious respiratory disability or death is feasible in the majority of cases.

Seven patients sustaining injuries of this type will be presented.

An analysis of all cases since the last complete review of this subject by Kinsella, in 1947, will be presented. From these data it will be shown that despite the relative ease with which early diagnosis may be established, the nature of the injury frequently has not been suspected for weeks or even months. Far too often resection has been utilized even in recent years.

The purpose of this study will be to emphasize the symptoms and findings presented by patients with injuries to the trachea or bronchi during the first few hours following injury. These findings will be compared with those characteristic of the late post-injury period.

The useful diagnostic procedures, in the acutely injured patient and in cases where initial diagnosis has been missed, will be discussed. The management of the diagnosed early injury and the methods of surgical treatment of the late injury will be discussed. The authors' cases will be used to illustrate problems of diagnosis, treatment, and complications which may occur.

## **11. Adverse Surgical Experience in the Treatment of Pulmonary Disease Caused by Atypical Acid-fast Bacilli.**

ROBERT W. HARRISON (*by invitation*), ARTHUR F. REIMANN (*by invitation*),  
EDWIN T. LONG (*by invitation*), WILLIAM LESTER, JR. (*by invitation*),  
and WILLIAM E. ADAMS, Chicago, Ill.

The use of reliable bacteriological techniques has led to increased recognition of the role of "atypical" acid-fast bacilli in human pulmonary disease. In our experience, 35% of patients with positive sputum cultures have "atypical" acid-fast bacilli in their cultures. These cultures are classified on the basis of growth characteristics and morphology into three major groups: (1) Photochromogenic; (2) Skotochromogenic; and (3) Indeterminate.

The photochromogenic group is of greatest clinical interest. These cultures uniformly show elevated resistance to the standard anti-tuberculous drugs and patients infected with them respond very poorly to conventional therapy. To date, photochromogenic cultures have been obtained from 88 patients with pulmonary disease and 27 surgical procedures (resections and/or thoracoplasties) were performed on 22 of them. This group had a 40% rate of post-surgical complications or reactivations of disease, representing failures of surgical treatment. This rate of failure was found to be more than twice that observed for comparable patients infected with typical tubercle bacilli or other types of atypical organisms. Pulmonary resections in cases of photochromogenic infection were found to have an especially high incidence of complications. Histopathologic studies on resected and autopsy specimens from these cases have suggested certain explanations for these results.

This experience has modified our views on the surgical management of patients infected with atypical photochromogenic acid-fast bacilli. As a result, our present philosophy towards the surgical treatment of photochromogenic infections is not dissimilar to the earlier attitude regarding the role of surgery in tuberculosis prior to the advent of chemotherapy.

## **12. The Surgical Treatment of Tuberculosis in Children.**

WALTER W. FISCHER, New York, N.Y.

Prior to the use of specific antibiotics, surgery had very limited application in the treatment of tuberculosis in children. Antibiotic therapy has radically altered the prognosis of both complicated primary and reinfection tuberculosis in children, so that excisional therapy now has occasional useful application. This report is based on a group of thirty-eight children

who have been subjected to excisional surgery on the pediatric service at Bellevue Hospital during the past six years. These included five pneumonectomies, sixteen lobectomies and sixteen segmental resections. The youngest child was one year and seven months of age, the oldest fifteen. The average age was seven and one half. Eight were considered to have reinfection type of tuberculosis. The remaining thirty had surgery because of the complications of primary tuberculosis. In this group lies the difference in indications for surgery in children and adults. The discussion is directed primarily to the complications of primary tuberculosis that may require surgical intervention, namely, progressive primary disease and post-primary disease.

In post-primary disease we are dealing with patients whose tuberculous infection may be largely controlled but in whom irreversible pathologic changes have occurred as a result of the primary infection. The role of the lymph node component of primary disease and its relation to endobronchial disease is discussed. Bronchoscopy and bronchography are essential in evaluating these patients. The presence of bronchiectasis as well as x-ray evidence of persisting obstructive lesions involving segments, lobes, or entire lungs are the most common indications for surgery. Representative cases are presented.

### **13. Persistent Pleural Air Space Following Resection for Pulmonary Tuberculosis.**

T. W. SHIELDS (*by invitation*), WM. M. LEES, R. T. Fox,  
and G. SALAZAR (*by invitation*), Chicago, Ill.

A persistent pleural air space following resection for pulmonary tuberculosis has been encountered frequently in recent years. The significance of such a space varies from complete benignancy to that of a fatal complication. To evaluate this problem the roentgenograms and clinical records of 100 individuals presenting a pleural air space persisting longer than two weeks post-resection (lobectomy, segmentectomy, and wedge resection) have been reviewed. Of these 100 air spaces 60 caused no symptoms and, though some persisted as long as 24 months, produced no adverse effect on the patient's clinical course. The remaining 40 air spaces caused such symptoms as pain, cough, dyspnea, hemoptysis and fever, and required operative intervention of varying magnitude for their control. Thoracoplasty was necessary in 19 patients, closed tube drainage in 12, and multiple aspirations, pneumoperitoneum or phrenic nerve crush, alone or in combination were successful in obliterating the space in the remaining 9 patients of this symptomatic group. The most serious complications were bronchopleural fistula and empyema, and these led to chronic invalidism or death in 5 patients. The etiology, prevention, and treatment of these air spaces are discussed and the early clinical differentiation between the benign space and the potentially hazardous one is emphasized.

## **Wednesday Morning, April 22, 1959**

### **8:30 A.M. Scientific Session: THORACIC SURGERY FORUM Pacific Ballroom**

#### **14. Metabolic Acidosis and the Dissociation Curve of Hemoglobin During Extracorporeal Circulation.**

GEORGE J. MAGOVERN (*by invitation*), ROBERT S. CARTWRIGHT

(*by invitation*), JOHN F. NEVILLE, JR. (*by invitation*), and

EDWARD M. KENT, Pittsburgh, Pa.

Hypoxia during cardio-pulmonary bypass is frequently the result of inadequate surface area exposure of the blood. This will result in metabolic acidosis and further hypoxia due to a shift in the dissociation curve of hemoglobin to the right. Despite careful evaluation preoperatively, this apparent situation has been observed on several occasions during approximately 100 clinical cases of extracorporeal circulation and stimulated the present study, in an attempt to explain the cause and remedy the situation during surgery. Experimental and clinical data are presented.

PROCEDURE: Twenty-five mongrel dogs between 18 and 30 Kg. were placed on total extracorporeal circulation using the Kay-Cross Oxygenator. The pH, pO<sub>2</sub>, pCO<sub>2</sub>, Hgb., temperature, and oxygen and carbon dioxide saturation were determined. Arterial and venous pressures were monitored throughout and the flow rate was maintained at approximately 70-100 cc/Kg. body weight. Hypoxia was then deliberately induced by slowing the disc speed, resulting in inadequate surface area exposure. The changes in all the above mentioned parameters were recorded and the pH was brought down to approximately 7.0 to 7.1 range. Alkali, in the form of molar sodium lactate or sodium bicarbonate was then added directly to the oxygenator and the above data were recorded until the pH was in the normal or alkalotic range.

Ten other mongrel dogs were placed on cardio-pulmonary bypass using adequate surface area exposure and lactic acid was added to the blood until metabolic acidosis resulted. The change in oxygen saturation and its relation to the partial pressure of oxygen, as determined by the Clark electrode, was determined.

The results will be described by graphs and the relationships of the hemoglobin dissociation curve, pH, pCO<sub>2</sub> and oxygen saturation will be discussed. Clinical examples will be presented. Methods for the management and prevention of metabolic acidosis occurring during the use of a pump-oxygenator will be reviewed.

## **15. Studies of a New Donor Blood Anticoagulant-Preservative Mixture for Extracorporeal Circulation.**

WIRT W. SMITH (*by invitation*), IVAN W. BROWN, JR., W. GLENN

YOUNG (*by invitation*), and W. C. SEALY, Durham, N.C.

The acquisition of large quantities of fresh heparinized blood for extracorporeal circulation is frequently a major problem for blood banks, surgeons, patients and their families.

Heparinized blood has a short storage life. This necessitates collecting all that will be required for a particular case within 24 to 30 hours before scheduled surgery. Occasionally, the extracorporeal perfusion is cancelled or delayed after the blood has been collected. Theoretically, this blood is then available for routine transfusion use. Practically, however, its short storage life and heparin content limits safe distribution, and most often it is discarded.

A system for collecting donor blood suitable for extracorporeal circulation based on a new anticoagulant-preservative solution (sodium edathamil, sodium gluconate, glucose, magnesium chloride) has been under study for the past 1½ years. This system permits the accumulation of donor blood up to 5 days prior to surgery. Blood thus collected, when not used for extracorporeal circulation, may be used for routine transfusion after storage up to 18-21 days.

The theoretical basis and fundamental studies of this system will be presented. Results from our experimental studies and from over 60 clinical perfusions employing this system have more clearly denned the relative importance of certain constituents of the priming and transfusion blood, particularly the role of the ionic components, and the acceptable variations which are physiologically tolerable under conditions existing during extracorporeal circulation.

## **16. Simple, Automatic, Self Regulating Heart-Lung Machine Pump.**

JOSH FIELDS (*by invitation*), FRANCIS X. BYRON, and

WILLIAM C. DALE (*by invitation*), Beverly Hills, Calif.

This new pump principle utilizes compressed gas as its motivating force and the design permits automatic self regulation. The pump chamber is completely non-traumatic to blood and consists of a rolling diaphragm with no rubbing surfaces. The volume flow is infinitely variable to over 20 liters per min. The pump rate (volume) automatically adjusts to maintain the desired blood pressure and/or flow in the patient due to the inherent feedback control system design. The pumping pressure is also variable and accurately controlled. The rate is sensitive to the level of blood in the arterial reservoir and can change with varying volumes. An inherent safety feature stops the flow if the reservoir is empty and will not permit air to be pumped.

The multiple safety and self regulating features are part of the mechanical principles of the design and do not depend upon accessory electronic circuits.

The entire assembly consists of three separate pump units each capable of putting out 20 liters per min. and is remarkably simple, inexpensive and weighs less than 30 lbs. Three separate pumps are contained within a space 12x10 inches and the entire pump unit can be autoclaved assembled. It is small enough to be placed in strategic position at the head of the operating table where the pump operator can also follow the progress of the surgery.

Any desired oxygenation may be used with this pump unit.

## **17. An Improved Inexpensive Automatically Controlled Pump-Oxygenator.**

ADMAN KANTROWITZ (*by invitation*), and DONALD ABELSON (*by invitation*).

*Sponsored by* ALFRED HURWITZ, Brooklyn, N.Y.

A simplified pump-oxygenator employing a constant, precise, and totally automatic control mechanism has been designed for improved extracorporeal circulation. It consists of a rotating convoluted disc oxygenator operated on the gravity flow principle. The separate venous reservoir is eliminated and a single arterial line pump is used. The output of this pump is automatically controlled by a photo-electric device, which responds to minute increments in the patient's central venous pressure during perfusion. The mechanism of the controlling unit will be described along with the absolute safeguards to insure high reliability.

Among the advantages of the system are:

1. The elimination of the venous line pump and the consequent diminution in the trauma to the formed elements.
2. Complete automation.
3. A highly reliable automatic control.

4. A completely autoclavable system.
5. A fixed volume at all times in the extracorporeal circuit.

#### **18. An Externally Valved Hydraulic Cardiac Substitute.**

I. A. BRECKLER (*by invitation*), R. L. GINSBERG (*by invitation*),

C. L. PORTNOFF (*by invitation*), and JACK L. BITTERLY

(*by invitation*), Encino, Calif.

A cardiac pump is presented which has no internal valving and which utilizes tubing of uniform diameter from caeve to artery. Energy is imparted to the surface of tygon tubing through sterile saline. Valving is accomplished by two asynchronous pressure bars at either end of a small chamber. The entire unit is assembled and then autoclaved. Blood is ejected from the pump with a minimum of trauma. Pulse rate, stroke volume, and pulse characteristics are individually controlled.

Data are presented which compare the effect of this pump, the Sigmamotor pump, and the DeBakey pump on blood by studying serum hemoglobin and proteins, red blood cells and platelets before and after prolonged perfusions.

The hydraulic pump is found to be the least traumatic to blood of the three pumps studied. In addition the hydraulic pump is considerably more adaptable to varying conditions of perfusion technics.

#### **19. Physiological P Wave Cardiac Stimulator.**

SAM E. STEPHENSON, JR. (*by invitation*), W. H. EDWARDS

(*by invitation*), P. J. JOLLY (*by invitation*), and

H. W. SCOTT, JR., Nashville, Tenn.

In the past year the use of external cardiac pacemakers in the treatment of post-surgical heart block has become common practice. The units in use must utilize empirical rates of cardiac action and bear no relation to the physiological rate of the heart in response to the post-surgical state, temperature elevation, or activity.

We have developed an electronic device whereby the normal auricular P wave can be monitored, amplified and used to trigger a mechanical ventricular stimulator. In the case of complete heart block normal ventricular rates for that particular individual are then obtained under all circumstances.

The unit has been evaluated on approximately thirty-five animals who have undergone complete destruction of the bundle of His. Use of the P wave stimulator immediately returns to normal the elevated venous pressure, decreased arterial pressure, decreased rate and decreased cardiac output. These studies show an improvement in function from that obtained from the use of a conventional pacemaker. Clinical application will be discussed.

#### **20. "Tranquilization" of the Heart with the Ataractic Drugs.**

RUSSELL M. NELSON, Salt Lake City, Utah

Irritability of the heart continues to be a problem for the surgeon operating upon patients with cardiac malformations. Interest in the effects of the ataractic-antihistamine group of drugs as possible cardiac "tranquilizers" was first evoked in this laboratory with the observation that high doses of diphenhy-dramine (Benadryl) injected into the coronary circulation of the dog heart caused cardiac arrest and a stable heart in the recovery period of perfusion.

Isolated dog heart preparations employing controlled perfusions from a donor dog were used for this study. Temperature, perfusion flow rates and pressures were regulated and electrocardiograms recorded from the surface of the heart. After ventricular fibrillation was established by low (3-15) voltage electric shocks, perfusion of the coronary circulation with hydroxyzine (Ata-rax), 50 mg. in 4 to 6 minutes, was added. Conversion to normal sinus rhythm regularly followed. Moreover, the hearts became resistant to further attempts to induce ventricular fibrillation with the usual low voltage shocks. To date, 23 isolated heart experiments with these findings have been performed. Further work is under way with WIN 5494 (a coronary vasodilator), and other related ataractic drugs which will be reported.

#### **21. The Mechanism of Ventricular Fibrillation and Cardiac Arrest During Surgery.**

ARCHER S. GORDON (*by invitation*) and JOHN C. JONES, Los Angeles, Calif.

Prevention is the most rewarding approach to the problem of ventricular fibrillation and cardiac arrest during surgery. This requires an understanding of the basic etiologic mechanisms underlying these phenomena.

Anoxia, hypercarbia, hemorrhage, stress, reflexes and drugs have been implicated in the production of cardiac arrest and ventricular fibrillation. However, the exact mechanism by which these act during surgery has not been detailed previously. Now experimental studies have revealed that the production of ventricular fibrillation is a result of explosive ionic imbalances acting on the myocardium. Extreme potassium alterations from endogenous sources can occur on a second-to-second basis as a result of anoxia, CO<sub>2</sub> excess, stress, hemorrhage, etc., acting alone or in combination. It has been possible to determine the exact degree of hyperpotassemia resulting from each of these factors and the exact serum potassium level and time: dose relationship required to produce fibrillation.

Carefully graded potassium injections can also produce either ventricular fibrillation or cardiac arrest. However, the amounts required to produce cardiac arrest are so large that they cannot be attained from endogenous sources. Accordingly, cardiac arrest on a clinical basis is due primarily to severe myocardial anoxia.

Clinical cases of ventricular fibrillation and cardiac arrest are cited to substantiate these experimental findings.

## **22. Prevention of Post-Hypercapnic Ventricular Fibrillation in Dogs.**

BERNARD GOOTT (*by invitation*), FLETCHER A. MILLER (*by invitation*),

and OWEN H. WANGENSTEEN, Minneapolis, Minn.

Previous investigations in our laboratory have demonstrated that following the cessation of inhalation of 40 per cent carbon dioxide, many of the dogs died immediately thereafter from ventricular fibrillation. Since ventricular fibrillation is probably the specific mechanism underlying the death of most patients dying from acute coronary thrombosis, we felt that a more concise understanding of the biological changes in association with fibrillation is indicated. The following studies have been carried out on dogs using the technique mentioned above for induction of the fibrillation.

Fifteen dogs have had their hearts denervated by bilateral thoracic sympathectomies. Only one of these animals fibrillated when exposed to the stimulus described. Conversely 90 per cent of the control animals were observed to fibrillate under similar circumstances. Data will be presented concerning the changes in the blood chemistry during these investigations.

We are currently studying changes in the electrical fibrillation threshold following sympathectomy and/or hypercapnia. These data will also be presented.

A preliminary group of experiments has demonstrated that the fibrillation threshold following acute coronary ligation is raised after sympathectomy. This group of experiments is being expanded and the results will be presented.

## **23. A Method for the Simultaneous Measurement of Maximum Breathing Capacity, Pulmonary Volumina and Effective Lung Ventilation.**

GEORGE W. WRIGHT, and SOL GUILFORD (*by invitation*), Cleveland, Ohio

The importance of recognizing and quantitating the impairment caused by

cardio-pulmonary diseases prior to thoracic surgical procedures has been amply demonstrated. A rapid method (requiring three minutes or less) for performing the test and calculations to measure the Maximum Breathing Capacity, Pulmonary Volumina (including Residual Volume) and Effectiveness of Lung Ventilation simultaneously has been devised. A comparison of this method to the conventional ones will be made.

## **24. A New Foam Plastic Arterial Prosthesis.**

RICHARD W. HARDY (*by invitation*), Washington, D.C.

Based on a study of the physical makeup of human arteries in regard to tensile strength and stress-strain performance, a new and previously unreported arterial prosthesis has been developed which closely resembles the human artery in handling qualities and physical properties.

The prosthesis is made of a newly developed elastomer foam, a non-plasticized terpolymer. Its internal wall is smooth and it is easily handled and sutured. The prosthesis can be cut at any angle and conforms to shape even in flexion creases. Preclotting is unnecessary. It is strong, and chemical data on the plastic material indicate that it will not lose its strength on long term implantation or by repeated flexion. Fabrication of complex shapes is simple and inexpensive.

Tensile strength and tissue reaction studies of the plastic foam have been underway for more than four months. The abdominal aorta has been replaced in 15 dogs and long term follow-up will be reported. It is also being evaluated for use in reconstructive procedures in cardiac surgery.



## 25. Experimental Observations on Poststenotic Dilatation.

DAVID L. BRUNS (*by invitation*), JOHN E. CONNOLLY (*by invitation*),

EMILE HOLMAN, and RAYMOND C. STOFER (*by invitation*),

San Francisco, Calif.

The frequent finding of poststenotic dilatation in the low pressure region distal to a vascular stenosis has evoked much speculation as to its cause. Hoi-man was the first to shed considerable light on the problem by stressing the importance of considering the physical factors involved in blood flow through a stenosis.

New discoveries in the field of fluid mechanics have led us to believe that the presence of murmurs and especially of thrills in the poststenotic region may be more significant than those forces related to pulsatile flow. This is because we feel that murmurs, and hence thrills, are due to rapid and nearly periodic pressure fluctuations in the wake downstream of a stenosis and as such, constitute forces of sufficient energy to cause structural fatigue and dilatation of the vessel wall.

To exclude any forces due to flow, thin-walled latex rubber tubes were filled with water and stoppered at both ends. They were placed under constant hydrostatic pressure loads. A vibrating blade was inserted through the center of one stopper. After from seven hours to 120 hours structural fatigue occurred and dilatation developed in the area of maximum vibration. However, no dilatation occurred in similar tubes subjected to high static or grossly fluctuating pressures.

This report demonstrates that a physical basis for poststenotic dilatation exists. Furthermore, other than a possible congenital weakness of the vessel wall, thrills are the only factors of sufficient magnitude which are peculiar to the region beyond the stenosis. It seems reasonable then that dilatation occurs in a low pressure area, secondary to vibrational stress.

## 26. Surgical Management of Metallic Foreign Bodies in the Pulmonary Artery: Experimental and Clinical Observations.

LYMAN A. BREWER, III, EDWARD L. KING (*by invitation*),

ELLSWORTH E. WAREHAM (*by invitation*) and JACK M. FARMS

(*by invitation*), Los Angeles, Calif.

The surgical management of a metallic foreign body lodged in the pulmonary arterial circulation poses a difficult problem to the surgeon because of the paucity of reports and diversities of opinion in the medical literature. However, it is probable that this condition is not as rare as is recorded in the medical literature for we have known of several unreported cases. Since World War II, potential infection, hemorrhage, emboli and septicemia have been recommended as indications for removal of the foreign body. Yet, when the foreign body is asymptomatic and has produced no changes in the lung, on the chest roentgenogram, the performance of a thoracotomy to remove this foreign body has been questioned. We have been faced with this problem clinically and have not been satisfied with our handling of this type of case. Therefore, a series of animal experiments were undertaken in which metallic foreign bodies were introduced into the pulmonary and systemic arteries in a group of mongrel dogs. Fundamental observations over a 20 month period on the reaction of an artery to a metallic foreign body shows that rapid growth of the intima holds the foreign body in a protective cocoon. The fate of the tissue distal to the foreign body depends mainly on the efficiency of the collateral circulation. This was true for both pulmonary and systemic arteries. Erosion of the arterial wall was not encountered. Foreign bodies in a branch pulmonary artery were well tolerated, as compared to those in the main pulmonary artery itself. Based on this experimental study and the accumulated clinical experience to date, a plan of treatment is presented.

## 27. The Cause of Death Following Cardioangiography.

RAYMOND C. READ (*by invitation*).

*Sponsored by* RICHARD L. VARCO, Minneapolis, Minn.

X-ray visualization of the heart and great vessels has proven to be a useful diagnostic procedure in cardiovascular disease. However, its application has been limited by a small but definite mortality rate (approximately 2%). The only explanation for this hazard is the proposed role of either hypersensitivity, allergy, iodism or vascular spasm. The purpose of this paper is to present experimental evidence suggesting that red cell agglutination is the main mechanism responsible for the reactions occasionally observed.

The rapid intravenous administration of 1 cc/kgm of 90% Hypaque or other widely used organic iodides into the dog was found to be associated with a phasic pulmonary hypertension. The magnitude of this response was variable.

A similar transitory increase in pulmonary vascular resistance was demonstrated in the isolated lung perfused at constant flow. This phenomenon could only be produced when red cells were present in the perfusate.

The failure of the response to persist in spite of recirculation suggested an increase in viscosity, rather than a vasomotor response. This hypothesis was confirmed by direct microscopic examination of the small vessels in the lung. Agglutination

of red cells with plugging of vascular channels in the lung was seen to follow the injection of concentrated radio-opaque agents in spite of heparinization. A moving picture illustrating this phenomenon will be shown.

These findings help to explain why the morbidity of cardioangiography is known to be greatest in patients with restricted pulmonary blood flow.

### **28. Physiological Response of the Coronary Circulation to Unilateral Pulmonary Artery Ligation.**

JAMES B. LITTLEFIELD (*by invitation*), PHYLLIS R. INGRAM (*by invitation*),

and WILLIAM H. MULLER, JR., Charlottesville, Va.

Previous studies in dogs with left pulmonary artery ligation (producing extensive collateral pulmonary circulation) revealed the inability initially to arrest the heart with potassium for more than 10 minutes. Bronchial artery casts consistently demonstrated plastic (10%) in the left coronary artery, when injection was made *only* into the doubly clamped descending aorta.

A method of investigation was then devised (employing total cardiopulmonary bypass with aortic and pulmonary artery occlusion) to separate the left auricular return from the coronary circulation. This technique completely isolated a short segment of the ascending aorta containing the coronary ostia. Acute studies in a series of dogs with left pulmonary artery ligation from 3 to 19 months were investigated and compared with normal controls. Vascular pressures and flows, oxygen saturation, angiography and plastic cast studies were made.

#### **RESULTS:**

*Before Bypass.* The coronary sinus flow was greater in the high collateral flow dogs (controls 40, others 118 cc/min.).

*Total Bypass.* The coronary sinus pressure and flows were the same in both groups but right auricular flow increased in the dogs with unilateral pulmonary artery ligation (controls 22, others 60 cc/min.).

*Total Bypass, Elective Cardiac Arrest.* Pulmonary artery and aorta were occluded. Controls showed coronary sinus and coronary artery pressure below 7 mm. Hg, *with no coronary sinus flow*. Ligated pulmonary artery dogs demonstrated coronary artery pressures of 44 mm. Hg; right heart flows of 320 cc/min.; left auricular flows 530 cc/min. (controls 36); and during aortic occlusion without cardioplegia normal cardiac rhythm continued 23 to 83 minutes (controls 15).

## **Wednesday Afternoon, April 22, 1959**

**2:00 P.M. Executive Session (Limited to Active and Senior Members). Pacific Ballroom.**

**3:00 P.M. Scientific Session: REGULAR PROGRAM -Pacific Ballroom.**

**ADDRESS BY THE PRESIDENT  
MICHAEL E. DE BAKEY, Houston, Texas**

### **29. Surgical Treatment of Cylindroma of the Bronchus (Adenoid Cystic Carcinoma).**

W. SPENCER PAYNE (*by invitation*), F. HENRY ELLIS, JR.,  
LEWIS B. WOOLNER (*by invitation*), and HERMAN J. MOERSCH,  
Rochester, Minn.

Cylindromas of the bronchus are sufficiently rare to warrant a critical review in an effort to assess the nature of the tumor and to determine the efficacy of treatment.

In 21 of 157 cases of adenoma of the bronchus encountered at the Mayo Clinic from 1927 through 1957, a microscopic diagnosis of cylindroma was made. Analysis of this group includes data relative to age, sex, symptomatology, x-ray appearance, anatomic distribution, bronchoscopic appearance, gross and microscopic pathology, treatment, and prognosis. At the time of writing this abstract, follow-up data for periods of 1 to 20 years are available on all but two of the 21 patients. Necropsy data, which are available for half of the patients who died, attest to the malignant course of this disease as well as to the ability of these tumors to metastasize distantly.

Eleven of the 21 patients received primary resective therapy (nine pneumonectomies and two lobectomies) without operative mortality. The other patients had either a combination of irradiation and endoscopic resection or no treatment at all.

The data suggest that pulmonary resection offers the best chance for cure when the tumor is totally resectable. Pulmonary resection also seems to offer excellent palliation in those patients in whom tumor must be left behind.

### **30. Bronchogenic Carcinoma: An Aggressive Surgical Attitude.**

J. MAXWELL CHAMBERLAIN, THOMAS M. MCNEILL (*by invitation*),  
JOHN R. EDSALL (*by invitation*), and PETER PARNASSA  
(*by invitation*), New York, N.Y.

A thoracotomy for bronchogenic carcinoma usually implies that the surgeon considers the lesion resectable. During the last ten years we have made a determined effort in every case to resect the carcinoma, even though it was necessary to include with the specimen a portion of the left atrial wall, the tracheal carina or the muscular wall of the esophagus. In several patients whose respiratory reserve was critically low, an upper lobectomy was performed with sleeve resection of involved main bronchus, thus permitting preservation of the lower lobe by anastomosis of its bronchus to the trachea.

The resectability rate was 80% in 240 cases operated upon. Preferential selection of cases was not a factor in the high resectability rate, as attested to by the large number of cases upon whom a "palliative" resection was performed (50%). A "radical" en bloc mediastinal dissection was not done, but an extended effort was made routinely to expose 6-7 cm. of the opposite bronchus, to resect the subcarinal nodes at the bifurcation of the trachea and any suspicious nodes in the upper mediastinum and along the course of the aorta and the esophagus.

There was histologic proof of carcinomatous involvement of pericardium, auricle or deep mediastinal nodes among a sufficient number of long-term survivors to indicate that these surgical efforts were crucial factors in their survival.

### **7:00 P.M. Banquet and Dancing. Pacific Ballroom.**

**Attendance limited to Members of the Association and their ladies, Invited Speakers and their ladies.**

**Dinner dress preferred.**

## **Thursday Morning, April 23, 1959**

### **9:00 A.M. Scientific Session: REGULAR PROGRAM -Pacific Ballroom.**

#### **31. Instantaneous Blood Loss Determination in Thoracic Surgery.**

ROBERT KLOPSTOCK, HARRY H. LEVEEN (*by invitation*), and

PHILLIP I. LEVITAN (*by invitation*), Brooklyn, N.Y.

At the Clinical Congress of the American College of Surgeons in 1957, an apparatus (Blood Loss Monitor) was described which instantaneously determined operative blood loss by a method utilizing electrical conductivity. The present report presents the results of studies in excess of 60 major thoracic surgical cases.

The blood loss in thoracic operations may be of considerable magnitude because these procedures are prolonged and because the largest vascular structures of the body are the ones involved in the surgical manipulations. Accidents are likely to cause profuse and sudden blood loss. Established estimates of blood loss in routine thoracic surgical procedures (including cardiac operations) are subject to wide variations and cannot be applied to the management of any individual case. The accuracy and the rate of blood replacement cannot and should not be related to the vital signs, since the undesirable physiologic changes have already occurred when they become detectable. Over-transfusion, on the other hand, produces a syndrome not unlike that of shock. Instantaneous monitoring of operative blood loss appears to be mandatory in cardiovascular procedures carried out under hypothermia. Continuous and instantaneous measurement of operative blood loss avoids these pitfalls. The conductivity method for measuring blood loss allows for continuous and instantaneous determination.

When blood replacement was made according to the loss indicated by the Monitor, erythrocyte concentrations, hemoglobin and hematocrit values on the following postoperative days failed to show significant changes as compared with the pre-operative determinations. Wide swings in operative pulse rates and blood pressures did not occur even in instances where the loss was as great as 4000 cubic centimeters in fifteen minutes.

Illustrative cases will be presented and a short film will be shown.

#### **32. Experiences with the Treatment of Postoperative Cardiac or Respiratory Failure with a Mechanical Respirator.**

F. C. SPENCER, D. W. BENSON (*by invitation*), W. C. Liu

(*by invitation*), and H T. BAHNSON, Baltimore, Md.

Ventilation with a mechanical respirator has been found of considerable value in the treatment of postoperative cardiac failure or respiratory insufficiency. Experience to date includes 9 patients who recovered after the use of a respirator for 2

to 40 days. Three patients had respiratory insufficiency following a crushing injury of the chest, a pneumonectomy with repeated cardiac herniation, and a decortication, respectively. Six patients had an intracardiac defect repaired with extracorporeal circulation; the defects included ventricular septal defect, tetralogy of Fallot, atrial septal defect with pulmonary hypertension, and mitral stenosis and insufficiency. The cardiac and respiratory failure in all of these patients was so severe that survival seemed unlikely before a respirator was employed.

A piston respirator attached to a tracheostomy tube was used in all instances. Serial determinations of the arterial pH and oxygen saturation were made on all patients, and cardiac output studies were done on some. The indications and the techniques employed with the respirator will be presented.

### **33. Intrathoracic Complications of Subdiaphragmatic Infection.**

DAVID P. BOYD, Boston, Mass.

A study of 115 cases of subphrenic infection seen at the Lahey Clinic in the past few years forms the basis for this report. A number of these cases showed interesting complications within the thorax.

The surgical and pathological anatomy of the diaphragm and suprahepatic spaces has been a source of confusion to students in the past. An attempt has been made to simplify this anatomy and pathology on the basis of anatomical studies and clinical findings.

Intrathoracic complications of Subdiaphragmatic infections are increasing because of the attenuation of these infections by modern methods of treatment. The chronicity of Subdiaphragmatic abscess today may have resulted in an increased frequency of intrathoracic complications. Examples will be cited in which the first symptom of infection below the diaphragm was the profuse expectoration of purulent material.

We have seen cases of bilateral subphrenic infection with bronchial fistula. These patients may not require pulmonary surgery if the Subdiaphragmatic infection is adequately drained. The importance of adequate drainage is emphasized by reference to case reports of patients who have died of fulminating bronchopneumonia as a result of acute massive perforation of such an abscess through the diaphragm into the bronchial tree.

A most interesting group of cases (closely related to the above) are those with bronchobiliary fistulas. We have seen a number of patients with postoperative strictures of the bile ducts who have accumulated subphrenic collections of bile which in turn perforated into the free pleural cavity. These are cases of pleurobiliary fistula. Other patients with pleural fusion have developed bronchobiliary fistula. Examples in each category will be shown.

### **34. The Early Elective Surgical Approach to the Treatment of Traumatic Hemothorax.**

MORRIS M. CULINER (*by invitation*), BENSON B. ROE,

and ORVILLE F. GRIMES, San Francisco, Calif.

The prevailing concepts of the treatment of traumatic hemothorax should probably be altered. The conservative approach to the problem is often unsatisfactory. Two major concerns exist, namely, (1) prevention of exsanguination and death, and (2) preservation of pulmonary function and reserve. In the latter instance, surgical maneuvers are often unduly delayed.

An early elective surgical approach to patients with residual hemothorax, remaining after needle or tube thoracentesis, has provided a method of control of expansion of the lung, obliteration of the pleural space, prevention of empyema, and has materially decreased the period of hospitalization.

In a series of 43 patients who sustained traumatic hemothorax, 10 patients have been operated upon for residual massive clotted or unclotted hemothorax from one to fourteen days after injury. The technical ease of evacuation of the pleural space and the manner in which lung expansion can be attained suggest that the early aggressive approach is preferred. The concept of the treatment of clotted hemothorax by decortication after a waiting period of three to six weeks following trauma may be justifiably questioned.

### **35. The Surgical Treatment of Peptic Esophagitis.**

FREDERICK S. CROSS, GEORGE V. SMITH, JR. (*by invitation*),

and EARLE B. KAY, Cleveland, Ohio

Interest in peptic esophagitis as a specific clinical entity has been increasing since the first description of this disease in 1934. Much of the impetus given this interest has come from surgeons in devising operative procedures for its correction ranging from a simple pyloroplasty, to gastric resection, to complicated plastic procedures on the esophago-gastric junction.

It is the purpose of the present report to reiterate the role of hiatal hernia in the production of peptic esophagitis, and to emphasize reconstitution of the cardiac sphincter mechanism as the logical treatment of this disease.

Since January, 1949, 125 patients with esophagitis of varying severity have been seen. In virtually all patients the presence and degree of esophagitis have been confirmed by esophagoscopy. Ninety-eight, or 78% of the patients studied, had an associated hiatal hernia. In the remaining 27 patients no hiatal hernia could be demonstrated. The etiological factors such as severe vomiting, the presence of an inlying gastric tube, or an associated duodenal or gastric ulcer in this latter group will be discussed.

In 60 patients with hiatal hernia and esophagitis, the hiatal hernia was repaired with uniformly good results; whereas, conservative therapy for esophagitis in the presence of a hiatal hernia gave uniformly poor results. Conservative therapy for esophagitis without the abetting factor of a hiatal hernia was more satisfactory. The results of hiatal hernia repair in the treatment of esophagitis will be related in detail along with our experience with other procedures that have been suggested for the treatment of severe stricturing esophagitis.

A proposal for the surgical reconstitution of the cardiac sphincter mechanism in those patients without a demonstrable hiatal hernia but with significant esophagitis will be discussed.

### **36. Utility of a New Procedure of Valvular Esophagogastronomy in Cases of Brachyoesophagus and Stricture: Clinical and Experimental Studies.**

DAVID H. WATKINS, WILLIAM R. RUNDLES (*by invitation*), and

LOUIS TATOM (*by invitation*), Denver, Colo.

Regurgitation esophagitis and peptic ulceration at the esophagogastric junction is an important problem at the present time. Different forms of incompetence of the cardia have been described. However, one should principally consider mechanical factors as causes of significant cardiac incompetence. Studies both experimental and clinical of the factors responsible for competence of the gastric cardia have shown the significance of the diaphragmatic crura, the angle of His, the sling muscle of the lesser curvature, and the valve of Gubaroff. The pathogenesis of esophagitis is attributable to the deficit of one or several of these factors which causes the gastric juice to flow back and forth and to attack the susceptible esophageal mucosa. Etiologically, various organic causes (sliding hiatus hernia, absence of the greater tuberosity of the stomach) and functional causes are to be distinguished. Reflux esophagitis begins with acute esophagitis and ends with the strictured brachyoesophagus.

While subtotal gastrectomy or vagotomy with gastroenterostomy diminishes the effects of gastric reflux into the esophagus, the stenosis frequently persists. Esophagitis may continue despite resection of the area and esophagogastronomy or cardioplastic operations. Lower esophageal and upper gastric resection with esophagoantrostomy may be impossible because of the length of esophagus involved. Total gastrectomy even with restoration of continuity utilizing the transverse colon may be inadvisable.

The experimental findings which form the basis of a modified valvular esophagogastronomy, which has been used by us clinically with gratifying results, will be presented. Illustrative cases in which the operation has been carried out will be shown.

## **Thursday Afternoon, April 23, 1959**

### **2:00 P.M. Scientific Session: REGULAR PROGRAM -Pacific Ballroom.**

#### **37. The Relationship of Postoperative Acidosis to Pulmonary and Cardiovascular Function.**

GEORGE H. A. CLOWES, JR., ANDRZEJ ALICHNIEWICZ (*by invitation*),  
LOUIS DEL GUERCIO (*by invitation*), and DAVID GILLESPIE  
(*by invitation*), Cleveland, Ohio

Alterations in the arterial electrolyte pattern and acid-base balance of 42 patients who underwent thoracic surgical procedures have been correlated with observations of their pulmonary and cardiovascular functions during the first two weeks postoperatively. Metabolic acidosis, evidenced by a mean rise of 260% in lactic acid, which only returned to normal by the end of three to five days, is related to the decrease in blood pressure and cardiac output as measured by dye dilution curves. In addition, it was augmented by the fact that almost all patients, and especially those undergoing lobectomy, had oxygen desaturation of the arterial blood for several days. Normally this metabolic acidosis was compensated by a decrease of pCO<sub>2</sub>, and was manifested by an increase of tidal volume in the immediate postoperative period. This took place despite a marked reduction of respiratory reserve which had returned to only a 50% value, on the average, by the end of two weeks.

A moderate depression of the ionized calcium level of the blood took place postoperatively in the majority of patients. This was associated with an elevation of inorganic phosphate which usually disappeared within three to four days as urinary output increased.

Seven patients showed signs indicating failure of the circulation in the presence of marked acidosis. In four, this was corrected by measures which improved pulmonary ventilation.

### **38. Surgical Treatment of Chronic Pericarditis.**

W. S. BLAKEMORE, C. K. KIRBY, H. F. ZINSSER, JR. (*by invitation*),  
W. B. WHITACRE (*by invitation*), and J. JOHNSON, Philadelphia, Pa.

The favorable results following pericardiectomy in seven patients with prolonged disability but no pericardial constriction or tamponade at operation have been sufficiently gratifying to report in detail. This type of pericarditis is a smouldering, chronic, disabling disease with recurrent exacerbations of fever, malaise and pericardial or pleuritic pain. Modest exertion apparently reactivated the disease, causing frequent hospitalization, financial loss and discomfort over periods of months. This led to trial of treatment by pericardiectomy. There were no operative deaths. The disease process was apparently terminated and rehabilitation was complete in these patients. Twenty-six additional patients have been treated surgically in the past ten years for constrictive pericarditis, with three operative deaths. The use of diagnostic aids such as angiocardiology and right heart catheterization have not been sufficiently satisfactory to preclude surgical exploration as a diagnostic procedure in the more difficult diagnostic problems. Operative technic and pre- and postoperative management must be individualized. The results have been sufficiently gratifying that a vigorous effort should be made to prove the diagnosis and proceed with operation even in severely ill patients.

### **39. The Results of Surgical Correction of Atrial Septal Defect Complicated by Pulmonary Hypertension.**

BERT W. MEYER, JOHN C. JONES, and HAROLD V. LIDDLE  
(*by invitation*), Los Angeles, Calif.

The surgical management of atrial septal defects by both open and closed methods has become an accepted procedure with very low mortality. There remains, however, a limited number of patients with atrial defects who have developed high pulmonary arterial pressures, often in excess of systemic pressure. In this group, operative risk is great and the postoperative morbidity severe. 131 patients have been operated upon for atrial septal defect. Among these there are fourteen whose pulmonary artery pressure was in excess of 50 mm. of mercury. Five patients in this series failed to survive the postoperative period. They are discussed in detail.

Pulmonary hypertension, based upon pulmonary vascular resistance, is the complication which so seriously increases the risk in this group of patients. Hypertension based upon elevated pulmonary flow alone does not present this serious risk. The differentiation of these two causes of pulmonary hypertension is difficult in patients with atrial septal defects. A clinical method which is of possible value in this differentiation is presented. The ultimate fate of these patients, including available postoperative catheterization studies, is discussed.

### **40. Coarctation of the Aorta in Infants: A Clinical and Experimental Study.**

THOMAS B. FERGUSON, THOMAS H. BURFORD, and DAVID COLORING  
(*by invitation*), St. Louis, Mo.

Preductal coarctation of the aorta, when associated with patency of the ductus arteriosus, is recognized as a grave cardiovascular condition. The majority of infants with this combination go into congestive heart failure very early in life. Response to medical treatment is poor. At St. Louis Children's Hospital about 60 proven cases have been seen since 1940 and only a few have survived beyond infancy on medical therapy alone. Because of this, a policy of operative intervention has been followed since 1950 in these seriously ill babies. Diagnosis is possible soon after birth using the "flush" blood pressure technique. Sixteen such infants have been treated, ranging in age from 9 days to 24 months. Thirteen were under 4 months of age. The first 5 cases in the series all died during or after operation. In the last 5 years there have been 11 cases with only 2 deaths. All the survivors are clinically well, although several are suspected of having septal defects which will require closure later. It is concluded from this experience that early surgical intervention is life-saving for infants with this disease.

Experimental studies were done to determine why this combination is so lethal. Dogs with either a patent ductus or a coarctation alone developed no pulmonary hypertension and lived until sacrificed. Eight animals with a patent ductus and a postductal coarctation developed no pulmonary hypertension, some died in pulmonary edema, while others lived until sacrificed. Seven dogs with preductal coarctation and patent ductus all developed pulmonary hypertension, were quite sick, and all died in congestive failure. The development of pulmonary hypertension in the preductal coarctation group seemed to contribute to the gravity of the condition.

### **41. Problems in the Surgical Management of Coarctation of the Aorta: Based on Experience with Sixty Consecutive Cases.**

L. K. GROVES and D. B. EFFLER, Cleveland, Ohio

Surgery for coarctation of the aorta is now well standardized and carries a relatively low operative risk. However there are several problems of selection, technique, and management which warrant discussion. These include:

#### **1. Coarctation Diagnosed in Early Infancy:**

Ten patients under one year of age have been operated upon with three deaths. This disease is a significant cause of lethal congestive heart failure in infancy, and successful operation will be lifesaving. Some of these patients may have surgically incurable problems, however, exploration will result in a gratifying salvage. It has on occasion proven extremely difficult to recognize the precise site of coarctation from the outside of the infantile aorta.

#### **2. Coarctation After Age 45:**

Three patients in this age group have been operated upon with two postoperative deaths. In this age group the individual may not tolerate the lowering of blood pressure associated with a successful operation. A paradox arises when the patient's cerebral circulation will not permit a surgical cure.

#### **3. How Large Should An Anastomosis Be:**

There is considerable disagreement as to what constitutes a satisfactory anastomotic lumen. A corollary to this problem is the question of when to use a graft. It is suggested that in most instances an anastomotic lumen with a diameter of one centimeter is probably adequate.

#### **4. Residual Hypertension:**

An occasional patient with a satisfactory anastomosis and equal blood pressures in the arms and legs will have residual hypertension. This problem is discussed and indications for late aortography are suggested.

5. Postcoarctation Syndrome:

Experience with this puzzling postoperative abdominal complication is presented.

**42. An Analysis of Deaths Following Cardiac Surgery.**

JAMES L. HARRISON (*ty invitation*), BART. D. IALA (*by invitation*), and  
ROBERT P. GLOVER, Philadelphia, Pa.

In recent years great emphasis has been placed upon the development of proper criteria for the selection of cardiac surgical cases. For the most part these criteria have been promulgated on the basis of long-existing and time-honored clinical concepts too often impressionistic rather than factual.

In an attempt to crystalize the indications for surgery a "backward" look at what has happened over the years seems fitting. To this end a detailed analysis of all cardiac deaths (72 in number) occurring consecutively over a five year period (December 1952 through December 1957 at Presbyterian Hospital) is presented. Specific surgical principles in the light of clinical history, electro-cardiography, radiology, hemodynamics, anesthesia, technique, anatomy and pathology have become apparent.

This study, therefore, points the way to better surgical judgment and performance, of utmost importance at this stage of indecision and possible transition from closed to open heart surgery.

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