

## Proceedings of the Thoracic Society

The Spring Meeting of the Thoracic Society was held on 3–4 March 1972 at the Royal College of Physicians, London. There were seven short papers, one review, and four symposia. Summaries follow.

### SURGICAL ASPECTS OF BACTERIAL ENDOCARDITIS

T. A. H. ENGLISH and J. K. ROSS Survival in patients with bacterial endocarditis has improved greatly since the introduction of antibiotics. The nature of the disease and indications for operative treatment have also changed.

Forty patients with a previous history of bacterial endocarditis were treated surgically. Thirty-five were male and five female. Their ages ranged between 12 and 68 years, with a maximal incidence in the fourth, fifth, and sixth decades.

Twenty-seven patients were operated on electively at varying intervals after completion of antibiotic therapy. One patient had an isolated mitral valve replacement and 26 had aortic valve replacements. Of these 26, 10 also required either repair (4) or replacement (6) of the mitral valve, and three others had closure of a ventricular septal defect secondary to the infective process. There were four deaths (mortality 15%).

Seven patients underwent emergency operation for intractable heart failure before completion of antibiotic treatment. The interval between initiation of chemotherapy and surgery varied between 6 and 42 (mean = 20) days. Six of the seven survived operation and there was one late death (mortality 29%).

Six patients had infections on pre-existing cardiac prostheses. Three required emergency surgery. One patient with a large mycotic aneurysm of the aortic root died at operation. Another died five days after replacement of an infected aortic homograft valve by a Starr-Edwards prosthesis. The other four survived (mortality 33%). These included one patient who had triple valve replacement of aortic, mitral, and tricuspid prostheses affected by fungal endocarditis. There were no late infections.

Endocarditis on cardiac prostheses is difficult to cure and reports of successful cases are rare. Our results indicate that surgical treatment has an important role both in the management of intractable heart failure consequent on bacterial endocarditis and in the eradication of infection. The timing of operation is crucial, particularly where valve destruction occurs early, and in this event operation may be necessary before completion of antibiotic therapy.

### SMALL AIRWAY CLOSURE IN LEFT HEART FAILURE

J. V. COLLINS, T. J. H. CLARK, and S. MCHARDY-YOUNG Closing volume (CV) is defined as that lung volume at which airway closure begins during expiration. The

technique for its measurement involves a maximal inhalation of a marker gas from residual volume (RV) followed by a slow expiration back to RV. During expiration the concentration of marker gas at the mouth and the expired volume are recorded. A characteristic trace shows an alveolar plateau (phase 3) followed by a rise in concentration of marker gas (phase 4) at low lung volume. The junction of phases 3 and 4 is thought to represent the lung volume at which airway closure begins and has been shown to be gravity dependent; in practice, phase 4 is measured from the trace as a volume and added to RV measured by another method to give closing volume. Using Xenon-133 as a marker gas, we have measured closing volume in normal subjects and in patients with disease predominantly affecting the left heart.

In normal subjects we have found that CV/TLC shows a linear increase with age and is a reproducible measurement. In patients with left heart failure and without evidence of airways obstruction by conventional spirometric testing (FER > 70%) the CV/TLC has been found to be increased; this increase in CV consists of an increase in both phase 4 and RV and remains gravity dependent.

Following administration of Salbutamol by aerosol the closing volume has fallen in the majority of patients towards a normal value for age. In some of these patients there has been a comparable reduction in CV following inhalation of atropine by aerosol, and subsequent inhalation of Salbutamol has had no additional effect. There has been no reduction in the size of CV in normal subjects following the inhalation of either  $\beta$ -adrenergic or atropine aerosols.

These results suggest that some of the mechanical abnormality of the lungs found in patients with left heart failure may resemble those observed in mild bronchial asthma, affecting predominantly peripheral airways of small calibre.

### EFFECTS OF FRUSEMIDE ON GAS EXCHANGE IN LEFT VENTRICULAR FAILURE

A. E. TATTERSFIELD Patients with left ventricular failure have interstitial and alveolar oedema of the lung which causes ventilation-blood flow mismatching and results in hypoxaemia and increase in the dead space-tidal volume ratio and venous admixture. We have studied the effect of an acute diuresis induced by 80 mg of frusemide on gas exchange in patients with myocardial infarction and left ventricular failure. Stable and reproducible blood gas and cardiac output

and pressure measurements were obtained before giving the frusemide intravenously and the changes were followed over a six-hour period in 20 patients. Measurement of dead space-tidal volume ratio and venous admixture was made in 11 patients. Changes in gas exchange were correlated with change in cardiac output.

Frusemide initially produced a large diuresis and a small but significant fall in arterial oxygen tension. This correlated with a fall in cardiac output and was associated with an increase in venous admixture. Four and six hours after frusemide, when the patients had a large negative fluid balance, there was no significant difference from pretreatment values in arterial oxygen tension, carbon dioxide tension, dead space-tidal volume ratio or venous admixture. It is suggested that frusemide does not cause a rapid reduction in the volume of pulmonary oedema, and that the changes observed acutely are not due to change in pulmonary oedema but to alteration in the haemodynamic state.

#### MEASUREMENT OF MYOCARDIAL CONTRACTILITY

M. I. M. NOBLE This communication summarizes a half-day meeting held by the Royal Society of Medicine on 28 June 1971. For the purposes of this meeting a change of myocardial contractility was defined as a change in the mechanical performance of the heart which is not due to a change in the length of the muscle fibres (Frank-Starling mechanism) and is not directly due to a change in the load on the muscle.

B. R. Jewell explained why valid measurement of this property of the myocardium has not proved possible in isolated heart muscle, the major problems being (1) the lack of agreement on the correct model to be adopted for heart muscle, and (2) the dependence of contractility on time during the contraction.

K. B. Saunders explained why any attempt to apply concepts derived from isolated heart muscle to the intact heart were bedevilled by the inexactitude of the geometric interrelationship between force and ventricular pressure, velocity of shortening and blood flow, muscle length and ventricular volume. However, if end-diastolic volume and aortic pressure are controlled by right heart bypass and aortic resistors, it was shown by J. H. Mitchell that changes in contractility could be demonstrated by determining the relationship to end-diastolic volume of stroke volume, stroke work or ejection fraction. This solution of the problem appeared attractive to physiologists but not to clinicians who need to assess contractility in the intact animal. It was for this reason that a number of 'indices of contractility' had been advocated. These were reviewed by G. van den Bos, who pointed out that while the maximum rate of rise of left ventricular pressure (LV dp/dt max) and the maximum acceleration of blood from the left ventricle had proved useful in the hands of some authors, neither these nor any other indices had been shown to be valid in all circumstances. There were a number of contributions describing efforts to assess myocardial contractility

in animals and patients, but the general consensus of the meeting was that, at the present time, the problems in the measurement of myocardial contractility are far from being solved.

#### RADIOGRAPHIC CENTILES OF LUNG AND HEART GROWTH

##### Patterns of Growth

G. SIMON and J. M. TANNER Standard centiles for lung width, lung length, and heart transverse diameter have been constructed for boys and girls from age 6 to 19 based on serial chest radiographs taken annually on 84 boys and 78 girls. Mean velocity curves for these dimensions are also presented. The age at peak velocity for lung width and heart diameter coincides with age at peak height velocity; peak velocity for lung length occurs some six months later. The lungs are exceptional in that the adolescent growth spurt is of the same magnitude in both sexes and the girls' mean values do not exceed the boys' even in adolescence. At age 6 heart diameter is 80% of its adult value whereas lung width is 66% and lung length 63%.

##### Use of Lung Centile Charts in Asthma

NICOLA CONNOLLY Changes in measurements in the chest radiographs of a series of 97 children with asthma are shown. The children were divided into three groups on the basis of their chest radiographs: normal (78%), simple overinflation with normal vessels (11%), and overinflation with large hilar vessels relative to the intrapulmonary vessels (10%). In the last two groups the lung length was increased in relation to the centile charts of the normal children. In the third group the ratio of lung length to lung width was greater than 1.0 in 60%, a finding uncommon in normal children.

The relation of respiratory function tests and clinical features to the x-ray appearances is shown. Apart from a tendency for the very severe cases to fall into the third radiological group, correlation was poor and some of the worst cases had a normal chest radiograph.

##### Use of Lung Centile Charts in Cystic Fibrosis

M. B. MEARNS A series of patients with cystic fibrosis seen at the age of 5 years or more and followed up for a minimum of five years was studied, and measurements were made on the annual radiographs as described above. These measurements were then plotted on the lung centile charts of the normal children to try to detect any abnormalities of lung growth associated with or due to the disease. Patients were grouped on combined clinical and radiological criteria as described by Jackson and Young. The height and lung percentiles were correlated with the clinical course. Changes in serial measurements of ventilatory capacity over a minimum period of five years are also correlated with the lung centile changes, and the pattern of change is discussed.