Thorax (1968), **23**, 566.

Proceedings of the Thoracic Society

The Summer Meeting of the Thoracic Society was held on 5 and 6 July 1968 at the Royal College of Physicians and Surgeons, Glasgow. There were six short papers and four symposia. Summaries follow.

ANEURYSMS OF THE THORACIC AORTA

Introduction

M. V. BRAIMBRIDGE Aneurysms of the thoracic aorta are best divided for description into saccular and fusiform on the one hand and dissecting on the other. Saccular and fusiform aneurysms are due to syphilis, arteriosclerosis, and trauma. The incidence of syphilis has fallen markedly, whereas that of arteriosclerosis and trauma has risen. The cause of dissecting aneurysms is unknown but is associated with a physical change in the aortic wall allowing the layers of the media to part easily.

Saccular and fusiform aneurysms are commonly asymptomatic but may produce pressure on surrounding structures. Dissecting aneurysms present with pain and loss of pulses. The diagnosis is suspected by plain chest radiography and is confirmed by angiography.

Treatment depends on the type of aneurysm and the section of aorta affected by the lesion. Combinations of cardiopulmonary bypass and hypothermia can be used to cure all types of aneurysms, but at the cost in some cases of a high mortality.

Traumatic Rupture of the Aorta

F. ASHTON and G. SLANEY Seven cases of traumatic rupture of the aorta are presented, being the experience of a combined cardiothoracic and vascular unit over 8 years. Two cases were chronic, presenting 17 and 7 years after the original accident, and one survived. Five cases were acute, ranging from one dead on arrival to one admitted three weeks after injury; two were paraplegic. The diagnosis and management are discussed.

Dissecting Aneurysm of the Aorta

D. B. CLARKE Untreated dissecting aneurysm of the aorta is attended by a grave prognosis and attempts to correct the condition surgically have been disappointing. Thirty-two patients with dissecting aneurysm are reviewed. In three, the dissection was confined to the ascending aorta; all died after operation. In 23, the lesion extended from the ascending aorta to the abdominal aorta. Surgery was undertaken in 11, with two survivors. The performance of a fenestration procedure does not prevent proximal dissection and death from cardiac tamponade. Controlled hypotension as a method of conservative management has not been effective in our hands. In six patients the dissection originated distal to the left subclavian artery. All were subjected to surgery and there were two survivors. Our current practice is to transect the aorta and reattach the intima, using cardiopulmonary bypass. Of four patients thus treated, two have survived and two died from further dissection two weeks after operation. Death results from cardiac tamponade, infarction of the brain or abdominal viscera, or rupture into the pleura. The presenting signs and symptoms and the angiographic appearances are discussed.

Aneurysm of the Sinus of Valsalva

L. D. ABRAMS The manner of presentation of a series of eight cases operated on with survival is presented. Eight patients with ruptured aortic sinus aneurysm, who have been operated upon successfully, are described. The anatomy of the various lesions encountered is described, and the different methods used to repair the aneurysm, the associated ventricular septal defect, and malformation of the aortic valve are discussed. All patients are symptomatically improved, although the repair is incomplete in some.

ELECTRON MICROSCOPY OF THE LUNG

Anatomical Aspects

LYNNE REID and BARBARA MEYRICK With light microscopy in man the differentiated airway cells are seen to include the following types: (1) ciliated cell and (2) goblet cell. With electron microscopy an additional type has been recognized, (3) the brush cell. The features of these cells will be illustrated.

Two cell types lining the alveolus have been described, the type I pneumonocyte, also known as type A or small, and the type II pneumonocyte, also known as type B, large or granular. The first cell is flat, lines the larger part of the alveolar surface, and is not detectable by light microscopy: the second is higher and can be detected by the light microscope.

A third cell type has recently been described in the rat alveolus (Meyrick and Reid, 1968, in press): it resembles a brush cell and may represent a third pneumonocyte. Its structure, distribution, and possible function will be discussed.

Bronchial Kultschitzky Cells and Tumours arising from These Cells

HERBERT SPENCER The oat-cell form of lung cancer, which possesses distinctive features when seen by light microscopy, has in recent years been shown to be sometimes associated with certain endocrine disturbances, notably Cushing's syndrome and the carcinoid syndrome. Similar endocrine disturbances are known to be produced by bronchial carcinoids, suggesting a possible link between these tumours.

Electron microscopy has now revealed the presence of Kultschitzky cells incorporated in normal bronchial surface and mucous gland epithelia. These cells possess the characteristic neurosecretory-type of cytoplasmic granules seen in all the cells of the parocrine system and in other tissues of neural derivation. Bronchial carcinoid tumour cells possess identical cytoplasmic granules, often in very large numbers. Recently, similar cytoplasmic neurosecretory-type granules have been found in a proportion of the oat-cell type of lung cancer cells. The number of granules in the carcinoma cells tend to be fewer.

The discovery, following the use of electron microscopy, of Kultschitzky cells in the bronchial tree, and the relation of such cells to those forming bronchial carcinoids and now oat-cell carcinomas, provide additional evidence for regarding these tumours as a distinctive group with a cell of origin different from that of all other benign and malignant lung tumours.

Busulphan Lung

BRIAN HEARD Groups of C57 black mice were given a single oral dose of 3 mg. busulphan (Myleran) and the lungs were removed four days later and prepared for electron microscopy. A consistent change was found in the appearance of all the large alveolar epithelial cells after administration of busulphan as compared with the controls. The osmiophilic material of the lamellar bodies was either reduced in amount or absent altogether.

The relevance of these preliminary experimental findings to busulphan lung in man (Heard and Cooke, *Thorax*, **23**, 187, 1968) will be discussed.

Pleural and Pericardial Mucins

DOUGLAS BREWER Using the periodic acid-thiocarbohydrazide method, mucin can be seen with the electron microscope in vacuoles in the pleural and pericardial mesothelial cells and on the free surface of the cells. It can further be demonstrated electron-microscopically, using Hale's dialysed iron method, showing that it is an acid mucin.

The nature and possible function of this mucin will be discussed.

THE UICC/CINCINNATI CLASSIFICATION OF CHEST FILMS OF ASBESTOS-EXPOSED WORKERS

J. C. GILSON Asbestosis and asbestos-associated cancers are increasing. Surveys of workers exposed to different types of asbestos and in different countries require a systematic method of recording the changes in the chest films. An account will be given of the work of an international group who are attempting to provide for this need. The results of an international reading trial by 12 readers on 100 films will be given.

PLEURO-PULMONARY AMOEBIASIS

B. T. LE ROUX Experience with amoebic infestation of the pleural space and of the lung, in an area where amoebiasis is endemic, serves to establish that amoebic empyema is common, and amoebiasis as a cause of empyema thoracis is, in fact, next in frequency only to trauma. The onset may be abrupt or insidious. The right pleural space is more commonly involved, and left amoebic empyema is often associated with amoebic pericarditis. Treatment with appropriate drugs and intermittent or continuous closed drainage of the pleural space are often successful. Where there is the need for open drainage or decortication, secondary infection has usually occurred.

Pulmonary amoebiasis usually develops as the result of perforation of a subphrenic or hepatic abscess across an obliterated pleural space and may present as a pulmonary opacity, sometimes cavitated, or as a hepatobronchial fistula with little related pulmonary parenchymal damage. Appropriate drug therapy usually results in rapid healing. The gel diffusion test is a valuable guide to amoebic infestation. A persistent pulmonary opacity in the right lower lobe, in a patient who resides in an endemic area, is so commonly amoebic that it is the rule to manage such an opacity with antiamoebic drugs and confidently to expect the lesion to heal, rather than to make recourse to exploratory thoracotomy with a provisional diagnosis of bronchial carcinoma, as would be the inclination in an area where bronchial carcinoma is the common cause for a persistent pulmonary opacity.

THE THYMUS GLAND

Functional and Clinical Disorders

C. W. H. HAVARD The thymus is a vital part of the immunological system, as it is the site of the primary proliferation and differentiation of the lymphocytes which are responsible for most of the immunological activity of the body. The normal thymus exerts its greatest immunological activity in the neonatal period, while later in life this function is taken over by other lymphoid organs. Stem cells from the bone marrow develop into precursors of immunologically competent cells within the thymus. Furthermore, the epithelial cells of the thymus secrete a hormone which confers on lymphocytes elsewhere in the body the capacity to respond to antigenic stimulation. It has been suggested that all primary immune patterns originate in the thymus. The cells carrying these patterns then migrate out to the lymph nodes and spleen and there proliferate in response to appropriate antigenic stimulation.

Pathological changes in the thymus gland are recognized in a number of clinical syndromes. Hyperplasia of the thymus in myasthenia gravis is the most familiar example, but hyperplasia with germinal centre formation is also a feature of systemic lupus erythematosus and thyrotoxicosis. Tumours of the thymus may be accompanied by hypogammaglobulinaemia or by disorders of auto-immunity, such as systemic lupus erythematosus, myasthenia gravis, myositis, myocarditis, acquired haemolytic anaemia, and erythroblastic aplasia. These associations are far too frequent to be explained by chance. Furthermore, individual patients may show several of the disorders which are separately associated with thymic tumours, and this strongly suggests a common aetiology. The nature of the relationship, however, remains obscure. Recently an immunological deficiency disease of infants, known as hereditary lymphocytophthisis, has been described, in which aplasia of the thymus is accompanied by atrophy of lymphatic tissues together with the absence of lymphoid follicles and lack of gammaglobulin production throughout the body.

Development, Structure, and Pathological Changes

A. C. THACKRAY The thymus is a bilobed structure developing from a pair of solid buds growing from the third pharyngeal pouches at about the sixth week of embryonic life. The normal gland is made up of lobules, each composed of epithelial reticular cells and lymphocytes. Cortical and medullary zones can be distinguished, the former densely packed with lymphocytes and with sparse epithelial cells, the latter with more prominent epithelial cells grouped in places into the Hassall's corpuscles. Electron microscopy has elucidated certain aspects of the normal cellular structure. Apart from tumour formation, other pathological changes seen in the gland include aplasia or hypoplasia, pathological (as opposed to physiological) involution, hyperplasia (often with germinal centres in the prominent lymphoid follicles), and infiltrations. These abnormalities may result from various causes, hormonal and otherwise, and may be associated with various clinical syndromes, some showing evidence of immunological deficiency, and others having an autoimmune basis.

The Thymus and Anaemia

J. J. TAYLOR Some evidence in favour of the relationship between the thymus and certain well-defined types of anaemia is presented. In animals a progressive haemolytic disorder is predominant, whilst in man hypoplasia of varying severity is characteristically associated with thymoma.

Recent work indicates that similar mechanisms may underlie both types of disorder; in man the demonstration of anti-nuclear factor, abnormalities of serum gammaglobulins, and positive anti-globulin tests allows the consideration of the human clinical situation as a possible auto-immune phenomenon. The occurrence of other forms of auto-antibody activity in such cases affords some support for this view. This concept of the thymoma-red cell aplasia syndrome is of clinical relevance in that it might suggest that cases recorded so far have not received adequate therapy. If the hypothesis of auto-immunity is correct then treatment with cytotoxic agents might be considered in addition to thymectomy and steroid therapy.

Myasthenia Gravis—The Present Position

J. A. SIMPSON For many years myasthenia gravis was the only disease believed to be closely connected with the thymus. There have been four eras.

1900–40 *Clinico-pathological correlation:* The high incidence of thymoma was recognized. Argument about the nature of the thymic abnormality in the remainder ?hypertrophy ?failure to atrophy. Castleman emphasized the importance of germinal centres. The production of curare-like substance was postulated. The main stream of medicine and experimental biology considered the thymus as an endocrine gland with a possible function in the growth of the young animal.

1940–60 *Thymectomy:* Acrimonious debate of value was resolved in favour of Keynes by Simpson (1958), who reviewed all large series and showed therapeutic value if (*a*) thymectomy was performed during the 'active' stage of the disease, and (*b*) thymoma was not present.

1960–68 *Autoimmunity:* Simpson (1960 *et seq.*) drew attention to associated disorders of other organs and suggested that all known clinical and pathological data pointed to an immunological disorder in myasthenia with the thymus as the important regulator. He was rapidly supported by the independent work of Strauss *et al.* (1960) and others who demonstrated anti-muscle antibodies. Miller (1961) confirmed the immunological role of the thymus—mechanism debatable.

1968– *Biology of growth and repair:* Renewed work on the thymus (Szent-Györgyi *et al.* (1962) and others) suggests the fundamental place of thymic immunological mechanisms in the control of normal growth, tissue differentiation, and repair.

The Management of Patients following Thymectomy for Myasthenia

J. T. MULVEIN The limited indications for thymectomy in the treatment of myasthenia gravis at the present time are discussed. The post-operative management of nine cases of myasthenia gravis following thymectomy is reported. An attempt was made to allow three of these patients to breathe spontaneously in the immediate post-operative period, but all ultimately required artificial ventilation. The remaining six patients received elective artificial ventilation in the post-operative period, one via an endotracheal tube and the remainder via a tracheostomy.

Those patients who had elective intermittent positive pressure ventilation on the whole recovered more quickly and with fewer complications than those who were initially allowed to breathe spontaneously, even although the more severe cases were chosen for elective artificial ventilation.

The dangers of post-operative respiratory inadequacy are stressed, and it is suggested that since thymectomy is now virtually confined to severe and moderately severe cases, there is a definite indication for the routine management of all myasthenic thymectomy patients with artificial ventilation either by a tracheostomy or by an endotracheal tube in the immediate post-operative period.

RESPIRATORY EFFECTS OF BARBITURATE POISONING

T. B. STRETTON Studies done in collaboration with J. B. L. Howell, A. Chiesa, and A. A. E. Massoud will be described. Twenty-two patients judged on clinical grounds to have severe respiratory depression due to barbiturate poisoning have been investigated. Hypoventilation (defined as being present if arterial P_{CO_2} was greater than 50 mm. Hg) was found in only three patients whilst one other was apnoeic on arrival at hospital. Mean minute ventilation in 11 of those with a normal P_{aCO_2} was 6·50 litres/min. (B.T.P.S.) with a range of from 8·08 to as low as 3·26, whilst alveolar ventilation was from 4·18 to 1·70 litres/min. (mean alveolar ventilation 3·04'. Conversely, a patient whose P_{aCO_2} was 80 mm. Hg had a minute ventilation volume of 15 litres/min. Although ventilation was in most cases appropriate to the metabolic state, unsaturation of the arterial blood might nevertheless be present. This appeared to be due to regions within the lungs with a low ventilation–perfusion ratio. The ventilatory response to CO_2 was shown to be impaired in some of the patients whose P_{aCO_2} was normal; this is thought to be due to an impaired sensitivity to CO_2. The findings of the study reveal the inadequacy of clinical observation in this context and emphasize the need for objective measurements, especially if the response to treatment by different methods is to be subjected to controlled investigation.

MEASUREMENT OF OXYGEN CONSUMPTION IN CRITICALLY ILL PATIENTS

JOHN C. A. RAISON Respiratory gas exchange is measured as part of an on-line, real-time, computer-based physiological study and care system in a cardiovascular surgical intensive unit. Using a modified pneumotachograph, with rapid sensing infra-red CO_2 and hot ceramic electrode O_2 analysers, volumes and gas contents are computed on a breath-by-breath basis every 10 minutes or on demand. Oxygen uptake (OUP) values are displayed immediately in alphanumeric and digital forms on a c.r.t. and in printed logs. The system is used in any ventilator airway or tight facemask and has been acceptable to 200 patients. Methods of calibration, computer programmes, compensatory corrections, and limitations will be described. Measurement of ventilatory equivalent, with other calculations, have modified ventilator control. An automated Fick cardiac output estimation is performed. The characteristic recovery pattern after open-heart surgery is of moderately raised OUP initially (+10–20%), steadily declining after two to six hours, but not of the order anticipated after severe trauma. Changes in OUP when using controlled or assisted ventilation are not detectable. Shivering and fits increase OUP. In a few patients who have died in long-standing, low-output failure and shock we have not observed any diminution of OUP.

ALVEOLAR AND BLOOD GAS RELATIONSHIPS DURING HYPERVENTILATION IN EMPHYSEMA AND BRONCHITIS

F. MORAN, A. R. LORIMER, G. BOYD, and R. J. MILLS Patients with severe chronic obstructive airways disease were divided into two groups according to the presence or absence of definite radiological evidence of emphysema. A group of nine patients (group A) were considered to have predominant emphysema, while the rest were allocated to the bronchitic group (group B, 13 cases).

The ratio of physiological dead space to tidal volume (V_D/V_T) and the difference between ideal alveolar and arterial partial pressure of oxygen ($A\text{-}aDO_2$) were calculated during quiet normal breathing and during submaximal voluntary increase of tidal volume. The latter procedure increased alveolar ventilation in all cases and there was no significant difference in the mean increase in tidal volume between the two groups. The mean V_D/V_T decreased by 0·08 in group A and by 0·18 in group B on changing from resting ventilation to hyperventilation. This difference is significant at the 1% level. Hyperventilation caused no change in the $A\text{-}aDO_2$, which remained equal in the two groups, although both achieved a rise in the arterial partial pressure of oxygen.

These results suggest that examination of the adaptations to changed patterns of respiration in the handling of gas by the lung may reveal differences between groups of patients with airways obstruction not easily detectable by other means.

CARDIO-RESPIRATORY EMERGENCIES IN INFANCY

Respiratory Disorders in the Newborn

J. H. HUTCHISON A brief account will be given of the causes and diagnosis of the defined causes of respiratory distress in the first week of life. These include intrauterine pneumonia, hyaline membrane disease, meconium aspiration syndrome, spontaneous pneumothorax, diaphragmatic hernia, congenital lobar emphysema, and oesophageal atresia.

Pulmonary or cardiac disease should be suspected in any newborn infant if the respiratory rate has not fallen to 50 per minute or less when over two hours have elapsed from the time of delivery.

Cardiovascular Emergencies

ERIC N. COLEMAN The dimension of this problem is reflected by the admission to the Royal Hospital for Sick Children, Glasgow, during a six-year period (1959–65) of 320 children in the first year of life with cardiovascular symptoms; 177 did not reach their first birthday. Of those admitted during 1962–65, 55% suffered from cyanotic disease and 54% were already in congestive cardiac failure. Those with acyanotic disease and not in

cardiac failure had 3 chances in 4 of surviving to the first birthday, while those with cyanotic disease and in congestive cardiac failure when admitted had only 1 chance in 10. Eighty-six per cent of admissions and 79% of deaths occurred in the first six months of life. Fifty-three per cent of admissions and 61% of deaths were attributable to complicated ventricular septal defects, complete transposition of the great arteries, or preductal coarctation of the aorta. The number of deaths averted by emergency surgery increased steadily during the review period. This number would have been even greater but for the many patients who reached the diagnostic service too late. During the review period the number of diagnostic assessments increased relative to the number of successful operations. Multiple independent anomalies were found in 51% of those investigated but not operated upon; 60% of those who died after investigation had malformations whose multiplicity or complexity rendered them irremediable.

Acute Pulmonary Problems

J. G. STEVENSON This paper is the outcome of a survey of the acute pulmonary reasons for admitting infants to the Cardio-Thoracic Unit of Mearnskirk Hospital, Glasgow, over the past 18 years. Congenital cardiac or vascular disease secondarily causing pulmonary symptoms has been excluded as this forms the subject for separate consideration by other contributors to this symposium. Uncomplicated lung infections rarely, if ever, qualify for admission to a cardio-thoracic unit and are therefore not represented in this paper. None the less, severe pleural complications of such infections constitute the greater part of this series, and the impact over the years of increasingly potent antibiotics on the incidence of intrathoracic empyema emerges in this retrospective survey.

Simple and malignant tumours, mediastinal cysts, diaphragmatic herniae, congenital emphysema, and even tuberculosis have all contributedi n small numbers to the overall total. Many of these infants have required surgical or semi-surgical treatment, and their management is discussed in some detail. The overall numbers are small, and prospectively we can anticipate a further reduction with each successive antibiotic inroad on pulmonary infection.

Surgical Management

F. RONALD EDWARDS Cardiac failure, severe dyspnoea and failure to thrive can be due to overwhelming left-to-right shunts, *e.g.*, patent ductus arteriosus, ventricular septal defect, and obstructions such as valve stenosis, coarctations, and aortic arch anomalies. Diagnosis frequently requires catheterization and angiography, and once made, the timing of the appropriate action can be decided upon. Ligation of ductus, banding of the pulmonary artery, excision of coarctation, or pulmonary valvotomy may all be required in the first three months of life.

Cyanotic heart disease, such as tetralogy of Fallot, may require a systemic-pulmonary shunt as a palliative measure.

Obstruction at the foramen ovale, as is found in aortico-pulmonary transposition and total anomalous pulmonary venous drainage, can be relieved by creating an artificial atrial septal defect either with circulation occlusion or by-pass.

Acute respiratory emergencies are laryngo-tracheal deformities, lung cysts, mediastinal emphysema, and diaphragmatic hernia. These may require surgical treatment.

Although deaths from cardiac and respiratory emergencies are high in children under 3 months, more effective surgical treatment is gradually reducing the figure.