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Proceedings of the Thoracic Society

The Summer Meeting of the Thoracic Society was held at the University of Sussex on 1 and 2 July 1966. There were 10 short papers and three symposia. Summaries follow.

'RECIPE BRIGHTON'?

PROFESSOR BORIS FORD, Dean of the School of Educational Studies at the University of Sussex, was invited by the Society to say something of the concepts of the new University of Sussex.

He gave a most interesting account of the history, of the administration arrangements, of the type of student, and of the academic achievements. The talk was very well received in Sir Basil Spence's beautifully designed University, and the Society appreciated that Professor Ford came on his birthday.

Professor Ford commented that both his initial delivery a few years ago, and the delivery of his lecture, were characterized by a small delay, but the Society felt that the quality of his talk more than made up for this.

VENOUS GANGRENE WITH BRONCHIAL CARCINOMA

R. A. L. SUTTON (introduced by P. D. B. DAVIES) said that venous gangrene results from extensive venous occlusion in the presence of patent arteries. Multiple superficial and deep vein thromboses appear to be necessary, and in most series about half the cases result from thrombophlebitis migrans associated with neoplasms.

Of six cases of venous gangrene collected in a single hospital, four were associated with bronchial carcinoma. These four case histories were presented. In each case thrombophlebitis, usually resistant to anticoagulants, preceded diagnosis of the tumour, which was always an adenocarcinoma (in one, the alveolar cell variety).

This particular complication, therefore, is predominantly associated with adenocarcinoma and may be due to abnormal protein products of the neoplasm increasing blood coagulability.

PULMONARY HYPERTENSION DUE TO UNUSUAL CAUSES

C. BARRINGTON PROWSE presented two cases of pulmonary hypertension, one associated with lymphangitis carcinomatosa from a rare primary source and the other of the so-called 'primary' type; the gross and minute pathology of each was described.

The literature concerning 'primary pulmonary hypertension' was reviewed and its nature and aetiology were discussed.

It was concluded that a predisposing cause or causes must exist, though this may not always be evident, and it was suggested that the qualification 'unexplained' is preferable to 'primary' in this type of pulmonary hypertension.

SPONTANEOUS RUPTURE OF MITRAL CHORDAE TENDINEAE

A. M. JOHNSON (introduced by W. M. MACLEOD) described the clinical, radiological, and electrocardiographic features in five cases of spontaneous rupture of mitral chordae tendineae, three fatal and two surviving. In three, haemodynamic and angiocardiographic findings, in two, findings at operation, and in one, the morbid anatomical appearances, were also described.

The predominance of respiratory symptoms gave rise to an initial diagnosis of acute respiratory tract infection in every case. The cardiac murmur was ignored because of the lack of cardiac enlargement in the chest radiograph; and the abnormal lung markings were thought to be inflammatory.

The features of this type of acute mitral regurgitation were contrasted with those of chronic mitral regurgitation.

The need for early diagnosis and correct management of such cases was stressed.

MITRAL VALVE REPLACEMENT

INDICATIONS FOR REPAIR OR REPLACEMENT OF THE MITRAL VALVE

J. F. GOODWIN said that the syndromes of mitral valve disease cover many disorders, both congenital and acquired, and these were briefly mentioned. The most important lesion likely to require valve repair or replacement is acquired rheumatic mitral incompetence, or combined incompetence with stenosis and a rigid calcified valve. Heavy calcification usually dictates replacement rather than repair. Mitral stenosis is not regarded as an indication for open operation. Acute subvalvar mitral incompetence due to ruptured chordae or papillary muscle insufficiency often requires open operation, and repair can sometimes be achieved, although replacement is commonly required.

In rheumatic mitral incompetence a knowledge of the natural history of the disease is of paramount importance, and this was described before setting out the indications for operation, which consist mainly of severe incapacity and a shortened life span. The assessment of severity of mitral incompetence was also described.

The problems of systemic embolism and other valve lesions in relation to mitral incompetence were briefly mentioned, as were the indications for mitral valve repair or replacement in congenital lesions such as endocardial defects.

Current Studies of Valve Replacement

Albert Starr reported that clots do not form on the Stellite but they do on the Teflon or graphite-coated cage. The results of the new design of mitral valve were fully discussed, and in isolated mitral disease during the last 18 months 20% of the old valves had given rise to emboli, but in the same period new valves had produced no emboli. Considering all valve replacements, including double and treble, 36 using the old Starr valve had 25% emboli and 44 of the new had 9% emboli. The majority of emboli occur in the first year. Over all his figures there are 23% emboli in the first year and only 4% in the fourth year, but a few occurred up to six years. Operative deaths were very low in the under-40 age group, but in the 41–50 age group there were 12%. One hundred and thirty-five mitral valves were replaced in six years with 23 operative deaths and 14 late deaths, age group 13–60+.

Operative technique: Incision in the left atrium between the inferior pulmonary vein and the inferior vena cava gives access to the valve through a median sternotomy, and this is valuable for checking on the other valves. Anoxic cardiac arrest is used. He has replaced valves in 459 patients with 10% late deaths, half of them due to embolus. Most of the late deaths in mitral replacement have occurred in the first 18 months. In 7% of mitral replacement tricuspid replacement is also required, but if mitral and aortic valves were both replaced, 30% required tricuspid replacement.

Total results 1960–66: Isolated mitral replacement —135 patients—72% alive. Double valve replacement —463 patients—75% alive. Five patients had leaks with re-operation on the mitral, and he always managed to resuture the old valve. The problem will arise when the model is very much better and one will wonder whether to replace it.

Aseptic precautions include urine culture and treatment of all carrier subjects. Two or three prophylactic antibiotics are given starting the day before operation. The same is done for cardiac catheterization. The anoxic arrest is produced by 10–15 min. clamping at 30° C. and the lower aortic segment is vented when releasing the clamp to stop coronary air embolism. He is using anticoagulants now on all his patients and they do better if they go to the care of good physicians.

Physiological Studies after Mitral Valve Replacement

John Hamer said that 37 patients with severe mitral valve disease, often with intractable congestive failure, had had mitral valve replacement by Mr. O. S. Tubbs or Mr. Ian Hill at St. Bartholomew's Hospital, and there had been five deaths, a mortality rate of 15%. Nine of these patients had a pulmonary vascular resistance of more than 10 units, and there was only one death in this group.

Twelve patients had been followed for from eight to 24 months and had shown considerable clinical, electrocardiographic, and radiological improvement. Although the tricuspid valve was not repaired, tricuspid incompetence had often resolved after operation, suggesting resolution of pulmonary hypertension in these patients. There had been no major post-operative embolus. Two patients had not benefited from the operation and showed evidence of incompetence alongside the mitral prosthesis.

Cardiac catheterization in eight other patients had confirmed the clinical impression of improvement. The pulmonary artery wedge pressure had fallen to normal or near normal levels at rest, the cardiac output had risen, and raised pulmonary vascular resistances had fallen to normal, apart from one patient studied three months after operation who showed only partial resolution.

In view of the dramatic improvement produced by mitral valve replacement in these patients, a high pulmonary vascular resistance must be regarded as an indication rather than a contra-indication to this operation.

SOME PHYSICAL AND CHEMICAL PROPERTIES OF SPUTUM

An Introduction to the Chemistry and Physics of Mucus

R. A. Gibbons said that mucus is a visco-elastic gel; physically it is best regarded as a very easily distorted solid. It contains a soluble fraction and a gel component. The former is rheologically irrelevant and contains electrolytes, chiefly Na^+ and Cl', and serum proteins. The latter is the rheologically important constituent and contains a major component (epithelial glycoprotein) and a minor component (a protein).

The major component of the gel is a high molecular weight macromolecule with a very long, flexible, threadlike form. It contains 70 to 80% of sugars and 20 to 30% of amino acids, the saccharide constituents being galactose, glucosamine, galactosamine, fucose, neuraminic acid (synonym-sialic acid), and ester sulphate. The amino acid distribution is highly characteristic; it is polydisperse—that is, there is an element of randomness in its chemical structure; it is resistant to proteolytic enzymes and very labile to alkali. The polysaccharide moiety is probably made up of a large number of rather short galactose plus

glucosamine chains having fucose and neuraminic acid side chains and terminal units, and it is attached to the serine and threonine in the polypeptide chain via *O*-glycosidic (and possibly some ether) linkages. The amounts of fucose, neuraminic acid, and ester sulphate show inter- and probably intra-species variations.

The protein which can be extracted from the washed mucus gel is a rather minor component; its amino-acid distribution is unremarkable, but it is believed to be concerned in cross-linking the glycoprotein molecules to give a three-dimensional network. This structure is responsible for the extraordinary visco-elastic and cohesive properties of mucus. Large variations in the consistency of mucus are the result of quite small changes in the amount of cross-linking. Proteolytic enzymes and sulphydryl reagents, *e.g.*, *N*-acetyl cysteine, break down the cross-linking protein and liquify the mucus.

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ELECTROLYTES IN SPUTUM

W. M. MACLEOD had studied the sodium, potassium, and chloride content of sputum. The sodium varies from under 10 to over 180 mEq/kg. wet weight. This wide distribution is contrasted with the more consistent levels in individual patients, who tend to hold their concentration over a 40 to 50 mEq/kg. band.

The chloride follows a similar pattern and range. The potassium varies from 5 to 30 mEq/kg. Those with a low sodium usually have a high potassium. Resting saliva shows lower sodium concentrations and higher potassium. Salivary contamination does not explain the sputum variations. Sputum volumes are also independent of electrolyte concentrations.

There is no distinctive disease pattern related to different sodium levels. Bronchorrhoea may show a low concentration, but patients with varied chronic bronchial diseases including mucoviscidosis have average values.

NEURAMINIC ACID CONTENT OF SPUTUM IN CHRONIC BRONCHITIS AND BRONCHORRHOEA

E. E. KEAL said that neuraminic acid can be taken as a marker of acid mucopolysaccharide in sputum, its concentration in saliva being very low. The concentration of neuraminic acid in patients with chronic bronchitis is different from that in patients with bronchorrhoea, and the neuraminic acid levels in sputum behave differently with steroids.

THE CONTROL OF MUCUS SECRETION: ORGAN CULTURE

D. LAMB reported that human bronchial mucosa and submucosa had been cultured *in vitro* using the technique of organ culture, to which radioactive metabolites had been added.

The effects of pharmacological agents added to the culture medium on the three secretory cell types found in the bronchial wall had been studied.

The mucus and serous cells of the submucosal glands are both stimulated to secrete by cholinergic drugs and inhibited in part by atropine—that is, there is evidence for a basal secretory rate not under cholinergic control. The level of this basal secretion rises in proportion to the amount of gland present in the bronchus, as shown by increased gland/wall ratio.

KLINEFELTER'S SYNDROME AND BRONCHITIS

A. BLOOM (introduced by P. D. B. DAVIES) described a case first seen at the age of 32 with a history of asthmatic bronchitis dating from childhood. He showed the clinical features of Klinefelter's syndrome with gynaecomastia and hypogonadism. The diagnosis was confirmed by examination of the buccal cells, which were chromatin-positive. His bronchitis deteriorated and he died at the age of 48 with cor pulmonale. Evidence was presented which suggests that the relationship of Klinefelter's syndrome and pulmonary disorders is more than casual. The possible reasons for this relationship were discussed.

ACUTE CORONARY CARE

This symposium was introduced by A. JOHN ROBERTSON, who spoke of Julian's pioneer work in Sydney and his later modifications at a Coronary Care Unit in Edinburgh. This was a research unit, whereas Smith had a small unit in Perth, Western Australia, within a general ward. Vaughan Williams would bridge the gap between theoretical concept and practical consideration.

CHANGING CONCEPTS IN AUSTRALIA AND BRITAIN

D. JULIAN said that intensive care for myocardial infarction—the constant surveillance of patients by persons trained and equipped to treat cardiac arrest —was introduced in 1962 because many patients were dying in general medical wards in the absence of appropriate facilities. Its essential components are a highly trained nursing staff, E.C.G. monitoring, the immediate availability of defibrillation and catheter pacemaking, and the concentration of patients at high risk in a special area. It can be expected to reduce mortality by about one-sixth. The design and operation of a six-bedded Coronary Care Unit was described.

W. G. SMITH considered that 'coronary-care units' are now fairly widely accepted as a means of reducing hospital mortality in acute myocardial infarction, but they are expensive to run.

A two-bed coronary-care unit has recently been established in an acute medical ward. The patients

are nursed in a room adjacent to the sister's station and are observed through a sliding glass window. Remote control Electrodyne, QRS indicators, rate-meter, and alarm units are installed in the sister's station, thereby avoiding undue anxiety to the patient in the event of a 'false alarm'. All facilities for immediate resuscitation are available and all nursing and medical staff are trained in resuscitation. One or two extra nurses are required, but there is no necessity for a nurse to be constantly at the bedside. The equipment has proved reliable and simple to operate. An hourly strip of the E.C.G. is taken throughout the 24 hours or at any other time if indicated. Automatic heart-pacing is not used.

Fifty-five unselected patients with acute myocardial infarction were admitted to the unit between 7 August 1965 and 23 May 1966. Seven patients died within the first six weeks, but four were resuscitated from certain death and several others have had an arrhythmia diagnosed at an early stage and the appropriate therapy given. Good results had been obtained with antazoline (antistin) and diphenyl-hydantoinate (phenytoin, dilantin); quinidine is never used. External D.C. countershock was used in only four patients, and was successful in one of these, who is now alive and well.

This study so far indicates that such a unit, as part of an acute medical ward, is both feasible and economical. A number of patients can be saved who would undoubtedly die in the usual general medical unit.

It is necessary for an experienced physician to be in charge of such a unit to control admissions and discharges and to advise on the appropriate therapy.

Electrophysiological Background

VAUGHAN WILLIAMS said that over the last few years the action of various antiarrhythmic agents had been studied on contracting isolated cardiac muscle with the aid of micropipettes small enough to penetrate and record the intracellular potential of individual cells; contractions and conduction velocity were measured in addition. It was found that all the drugs studied had certain actions in common. (1) They left the 'resting' or diastolic potential unaltered. (2) They had little or no effect on the repolarization phase of the action potential, so that its duration was virtually unchanged. (3) They greatly reduced the rate of rise of the depolarization phase of the action potential. (4) They reduced conduction velocity. In accordance with current views on the ionic current flows underlying the electrical activity of the heart it was concluded that antiarrhythmic compounds have no effect on potassium permeability or on the metabolic reactions which maintain ionic concentration differences, but interfere specifically with the entry of depolarizing current. The recently introduced β-receptor blocking agents, pronethalol and propranolol, had similar actions.

RESISTANT AND CURRENT VENTRICULAR FIBRILLATION

T. B. BOULTON and A. I. MUNRO (introduced by G. SIMON) discussed the aetiology of recurrent ventricular fibrillation and its resistance to defibrillation.

The influence of acidosis, alkalosis, potassium depletion, hyperventilation by intermittent positive pressure and the use of valve prostheses was considered and the measures necessary to counteract these factors were illustrated from data obtained during the treatment of post-operative and other cases.

SPONTANEOUS RESOLUTION OF A TRAUMATIC VENTRICULAR ANEURYSM

CLIVE P. ABER reported a 21-year-old woman who developed cardiac arrest after massive obstetric haemorrhage. Her initial management included 70 minutes' cardiac massage (external and open), electrical defibrillation, controlled hypothermia, and assisted ventilation. On rewarming, she went into severe left ventricular failure (?herniation through the pericardium) and developed a monilial pneumonitis. Subsequently, she developed a large ventricular aneurysm, which later resolved spontaneously.

This patient's management was discussed, and recent haemodynamic and angiographic studies were presented.

MANAGEMENT OF TRACHEAL STENOSIS AFTER TRACHEOSTOMY

PETER GIBSON said that cuffed tracheostomy tubes and intermittent positive pressure respiration are often a life-saving procedure, but tracheal stenosis is a serious late complication. Its aetiology and the difficulty of its prevention were discussed. In a number of patients so treated, acute tracheal infection with ulceration and widespread pneumonia caused death in three. Similar infection was followed by stricture in five others, and surgical correction was necessary in three of these. A staged plastic repair of tracheal stenosis following tracheostomy was described.

BLOOD GASES IN ASTHMA

H. A. REES (introduced by K. W. DONALD) said that there is little written on the serial changes in arterial gas tensions and *p*H in status asthmaticus. All the 24 patients he had studied were hypoxic on admission and it was sometimes very severe (Pa_{O_2} <40 mm. Hg). In about a third of patients Pa_{CO_2} was <36 mm. Hg and *p*H reflected this measurement. Greatly increased Pa_{CO_2} or decreased *p*H, though not common, were of grave import. An increasing Pa_{CO_2} or falling *p*H may indicate the need for assisted

ventilation. Pa_{O_2} did not correlate with the clinical state, $F.E.V._{\cdot 1 \cdot 0}$ or F.V.C., but correlated negatively with pulse frequency ($P<0{\cdot}001$).

STUDIES ON THE PULMONARY CIRCULATION IN THE ANDES

D. HEATH and P. HARRIS said that the structure of the pulmonary trunk in the foetus is similar to that in the aorta, both vessels showing the same dense network of elongated and parallel elastic fibres. During the first two years of extra-uterine life at sea level, the elastic tissue in the wall of the pulmonary trunk undergoes involution, becoming fragmented and forming an open network of branched fibrils. In people who are indigenous to high altitude the pulmonary arterial pressure is permanently raised because of hypoxia, and this causes the involutional process in the elastic tissue of the pulmonary trunk to be delayed into adult life. In these circumstances the wall of the pulmonary trunk contains an abnormally high proportion of elastin and is less extensible than normal.