

Abstracts of the Twentieth Meeting of the Intensive Care Society, Britain

Held at the Academic Centre, John Radcliffe Hospital, Oxford, England (11–12 April 1980)

Ten Years in Ten Minutes

David J. Price

At the ripe age of ten years, our Society is the oldest national multi-disciplinary intensive care organisation. Alan Gilston initiated the idea in early 1970 by circulating a proposal letter and the first meeting was held at the Royal College of Surgeons later that year.

In 1972, Council was formed and the first World Congress was planned. This congress in 1974 attracted a very large number of delegates and proved very successful. From this the World Federation of Societies in Intensive and Critical Care Medicine evolved and it now has a membership of 30 societies. In recent years, an Industrial Liaison Group and a Computer Group have been formed and annual Travelling, Fellowships and Prizes have been kindly donated by Industry.

This is our twentieth meeting and over the years Society Membership has steadily risen. We look forward to the future.

Baragwanath Hospital I.C.U. – Undermonitoring?

Dr. R. A. Blackwood (Oxford)

Baragwanath Hospital in Soweto, Johannesburg, performs about 400 open heart procedures per year on the black population. It is short of trained doctors, has a relatively lower standard of nursing and a huge volume overload of patients compared with English hospitals. The pre-operative and post-operative care of the cardiac patients is therefore less carefully monitored than is usual. The results of cardiac surgery, however, in both the immediate and late post-operative period do not seem to be significantly different from those of published series. Perhaps this is because of the relatively young age group of the patients at Baragwanath and the fact that there is little if any coronary artery disease. Nonetheless, the black man presents very late in his illness, often as an emergency, is usually poorly nourished and has had frequent attacks of acute rheumatic fever leaving him with poor left ventricular function. The surgical results are therefore very good despite what would be considered in other centres as poor patient monitoring.

Advances in Cardiovascular Pharmacology

Dr. P. Foëx (Oxford)

Better understanding of cardiovascular physiology has contributed as much as the development of new drugs to a more diversified approach to the treatment of cardiovascular disorders. The Fifties had seen an extensive use of vasopressors; the prevailing view was that priority should be given to maintaining arterial pressure. The

failing heart, however, responds to an increase of afterload by a reduction of stroke volume and tissue perfusion becomes poorer. By the Sixties, increased filling of the ventricle was often advocated; again the failing heart may not increase its performance when its preload is excessive. The next phase was to improve perfusion by enhancing myocardial performance by stimulating the adrenergic beta-receptors; isoprenaline was widely used. Tachycardia, dysrhythmias and hypotension were often observed and there was a need for drugs with better characteristics. For example, dopamine appears to cause less tachycardia and, at small doses, produces a specific and useful renal vasodilatation; dobutamine stimulates essentially the beta-receptors and thus does not modify vascular resistance. All inotropic agents increase myocardial oxygen consumption, however, and may worsen the balance between oxygen demand and oxygen supply. Another approach to improving cardiac performance, and particularly cardiac output, is to reduce the afterload by vasodilator therapy. Vasodilators may act predominantly on the arteriolar bed (hydralazine, minoxidil), or may cause essentially venodilatation (nitroglycerin) while some agents combine those two effects (sodium nitroprusside, phentolamine). Reducing arteriolar resistance facilitates ejection and increases cardiac output, particularly when resistance and filling pressures are high. Venodilatation (nitroglycerin) lowers the filling pressures and thus improves myocardial perfusion, but does not increase cardiac output.

Most of the advances have been concerned with the performance of the left ventricle, including the effects of drugs on regional myocardial function. Cardioprotection with adrenergic beta-receptor blockers and with calcium antagonists is becoming increasingly important. The importance of the right ventricle should not, however, be underestimated. In acute respiratory failure, pulmonary hypertension may cause distension of the right ventricle; this in turn may reduce the compliance of the left ventricle and cause left ventricular inflow obstruction.

A more detailed knowledge of the circulation in the severely ill patient will lead to an increasingly diversified use of cardiovascular drugs.

Neuro-Intensive Care in Past and Present Decades

Mr. D. J. Price (Wakefield)

The concept of neurosurgical intensive care has developed relatively slowly over the last decade. Few neurosurgical units in Britain have intensive care wards dedicated exclusively to their requirements and

many District General Hospitals are taking an increasing share in the management of severe head injuries.

Aggressive intensive care has shown a significant improvement on the eventual outcome of three groups of patients. These are those with head injury, spontaneous intracranial haemorrhage and some posterior fossa tumours adjacent to the brain stem. In addition, the urgent control of repeated epilepsy in post-operative and post-traumatic patients demands high levels of care. Management of all these patients is based entirely on the two principles of maintaining adequate perfusion of well-oxygenated blood to the brain and reducing brain distortion to the minimum. Compliance with both principles demands the ability to monitor blood oxygenation, intracranial perfusion pressure and brain shift as only then can corrective measures be taken.

In the 1970's the CT scanner revolutionised the monitoring of patients with head injury and spontaneous intracranial haemorrhage. Intracranial pressure measurement has now been established as an essential routine for all patients at risk of developing raised pressure with subsequent reduction in cerebral perfusion.

For the management of head injuries in the 1980's, I foresee a greater dependence on the use of risk factor tables, sensitive coma scales, computerised ultra-sound and closed-loop control of both intracranial pressure and blood oxygenation. The optimum timing of aneurysm surgery may well be improved with the introduction of simplified bedside cerebral blood flow and trans-cerebral conduction time monitoring. One day, perhaps, even vasospasm might become treatable.

Investigation and Treatment of Renal Problems

Dr. F. D. Thompson (St. Philip's Hospital)

Isotopic techniques are now widely employed in the investigation of renal function. It is now possible with a single injection of Cr 51-labelled EDTA and I 131-labelled Hippuran to measure glomerular filtration rate and effective renal plasma flow. The probe renogram is now a portable piece of apparatus and can be brought to the bedside. This will produce within a 20-min period an accurate measure of overall and individual kidney function. The harnessing of computer systems to the standard gamma camera will allow additional anatomical information to be obtained and with the same apparatus accurate measurements of cardiac function can also be obtained. In the area of acute renal failure, early haemodialysis remains the treatment of choice and in this area equipment has become more portable, and access to the circulation with single needle dialysis and femoral catheterisation becomes easier. The major advances in the recognition and treatment of transplant rejection are mainly of interest to the nephrologist and are outside the scope of this review but, in conclusion, it is of relevance to all personnel working in intensive care units to be aware of the advances made in kidney retrieval and perfusion, and so from patients who die, long-term benefit may be achieved for those patients on chronic maintenance haemodialysis.

Aspects of Infection

Dr. I. McA. Ledingham (Glasgow)

Severe infection remains one of the commonest and most taxing problems in intensive care practice. Patients may become infected either (1) prior to admission to the Intensive Therapy Unit (this complication leading to their referral) or (2) while being treated in the ITU for other reasons.

Patients in the first category are usually suffering from severe or multisystem infection, e.g. Gram-negative septicaemia and necrotizing fasciitis. Progress in intensive care techniques over the past ten years has improved prognosis significantly in these conditions.

Patients in the second category may be receiving intensive therapy for life-threatening cardiovascular or respiratory complications, and often have reduced host defence mechanisms, which may allow infection to arise endogenously, by cross-infection, or secondary to concurrent therapy. Examples of the latter are fungal sepsis and pseudomembranous colitis. The incidence and severity of infections in this category of patients has increased as the duration of their survival has been extended.

Conventional bacteriological analysis provides valuable information but clinical significance may be difficult to interpret. Additional, and perhaps more sensitive, techniques for assessing the severity of and susceptibility to infection are needed. These include assays of endotoxin and complement levels in blood, and the patient's response to common skin antigens. Such measurements could lead to earlier detection and more efficient treatment of life-threatening infections in these high-risk patients.

Pathogenesis of Intraventricular Haemorrhage

Dr. J. S. Wigglesworth (Hammersmith Hospital)

Subependymal haemorrhage/intraventricular haemorrhage (SEH/IVH) in the pre-term newborn infant has until recently been assumed to be due to rupture of the terminal vein or to venous infarction.

Injection studies of the vessels of the newborn infant brain from 24–40 weeks gestation have allowed development of alternative ideas on the pathogenesis of the condition [2, 6, 5].

Throughout the gestational age range of susceptibility to SEH/IVH there is an exceptionally rich blood supply to the basal ganglia and subependymal germinal matrix from branches of the anterior and middle cerebral arteries. This basal ganglia orientation of the circulation gradually changes to a cortical orientation as the subependymal matrix disappears and the cortical convolutions develop. Injection studies show that SEH/IVH originates from the microcirculation in the periventricular germinal matrix with venous obstruction as an inconstant secondary phenomenon. This has prompted reconsideration of SEH/IVH in terms of the altered cerebral circulatory physiology to be expected in the pre-term infants with respiratory distress syndrome (RDS) who are most at risk of developing the condition. Cerebral vasodilatation resulting from hypoxia and hypercapnia in infants with RDS should cause cerebral hyperperfusion which may be accentuated by hypertensive episodes. It has recently been confirmed that cerebral hyperperfusion may precede development of IVH [1]. The studies of Lou et al. [3, 4] suggest as an alternative mechanism that haemorrhage may develop when a period of hypotension and cerebral ischaemia is followed by restoration of normal or increased blood pressure and cerebral blood flow.

Current evidence thus indicates that SEH/IVH of the pre-term newborn infant results from the effects of a labile BP and CBF exerted on a poorly supported subependymal microcirculation.

References

1. Cooke RWI, Rolfe P, Howat P (1979) Apparent cerebral blood flow in newborns with respiratory disease. *Dev Med Child Neurol* 21:154–160
2. Hambleton G, Wigglesworth JS (1976) Origin of intraventricular haemorrhage in the pre-term infant. *Arch Dis Child* 51:651–659
3. Lou HC, Lassen NA, Friis-Hansen B (1977) Low cerebral blood flow in hypotensive neonatal distress. *Acta Neurol Scand* 56:343–352
4. Lou HC, Lassen NA, Friis-Hansen B (1979) Impaired autoregulation of cerebral blood flow in the distressed newborn infant. *J Pediatr* 94:118–121

5. Pape KE, Wigglesworth JS (1979) Haemorrhage, ischaemia and the perinatal brain. *Clinics in Developmental Medicine*, No. 69/70. SIMP/Heinemann, London; Lippincott, Philadelphia
6. Wigglesworth JS, Pape KE (1978) An integrated model for haemorrhagic and ischaemic lesions in the newborn brain. *Early Hum Dev* 2:179–199

Cerebral Blood Flow in the Pre-Term Infant

Dr. R. Cooke (*Liverpool Maternity Hospital*)

Few attempts at measuring CBF in the newborn infant have been made, mainly because of technical and ethical considerations. It has, however, been widely suggested that disordered CBF may produce, or at least initiate, periventricular haemorrhage (PVH) in the newborn.

In animals, and adult man, overall CBF is normally fairly constant, but will alter dramatically with variations in arterial PCO₂. Moreover, the ability to autoregulate is lost after short periods of asphyxia. Recent research has largely confirmed these two effects in the pre-term human infant.

Even in the healthy individual, the ability to autoregulate presupposes the ability of the systemic circulation to support the CBF. In the pre-term infant the cerebral circulation may comprise more than one third of the cardiac output. When cardiac output falls, it is unlikely that CBF can be maintained at normal levels even in the presence of "centralising reflexes" and wide swings in cerebral perfusion may occur. There is evidence to suggest that this occurs with apnoea in sick pre-term infants.

Intermittent positive pressure ventilation (IPPV) may be responsible for cerebral venous hypertension and congestion, especially if lung compliance is high. IPPV is associated with PVH. If IPPV produced PVH, it would require that the haemorrhage were venous in origin. Recent work suggests that arterial capillaries are the likely origin and thus the association between IPPV and PVH may be due to a common factor of respiratory disease.

Sudden and unregulated changes in CBF through a cerebral vascular bed dilated by hypercapnia or asphyxia would seem the likely initiating event in PVH.

Two Aspects of Upper Airway Obstruction in Children

Mr. M. S. McCormick (*Oxford*)

Acute

Epiglottitis

Epiglottitis has a high mortality unless managed positively and effectively. An alternative airway is obligatory. The differential diagnosis, methods of treatment and consequent problems are discussed.

Chronic

The Sleep Apnoea Syndrome

Chronic upper respiratory tract obstruction results in *cor pulmonale* in extreme cases. The patient suffers from hypersomnolence with associated changes in mood and behaviour before heart failure becomes apparent.

The presentation and management of one such extreme case is described. An investigation into the prevalence of this syndrome were performed. A random series of 92 children added to the waiting list for tonsillectomy and adenoidectomy had a standard electrocardiogram recorded. Three ECGs showed evidence of pulmonary hypertension with right heart changes. These reverted to within normal limits following tonsillectomy and/or adenoidectomy.

Polygraphic recordings of cardiovascular, respiratory and cerebral function during sleep is the most useful aid in diagnosis.

A report of the death of a child during surgery attributed to this syndrome emphasizes the potentially fatal condition which appears at present to be underdiagnosed.

Near Drowning in Children

Dr. A. D. Simcock (*Truro*)

Of the 58 patients rescued from drowning in the last five years, approximately 30% were children or infants. The majority suffered salt water drowning but the actual type of immersion did not alter resuscitation and treatment. Dry drowning is undoubtedly an entity; children who had been unconscious in the water do not always suffer inhalation but may require treatment for hypothermia and metabolic acidosis.

The majority of patients, however, had clinical and radiological evidence of inhalation. If these patients seemed, initially, to have adequate spontaneous ventilation, they were treated with steroids, antibiotics and oxygen therapy. None required intubation and all recovered quickly. There were no long term complications.

The more serious drownings had inadequate or absent ventilation and these patients were immediately intubated and ventilated prior to transfer to the I.C.U. They usually were severely hypothermic, very acidotic and liable to suffer electrolyte imbalance. Methods of treating these problems and the value of peritoneal dialysis will be discussed. In only one patient did a "shock lung" type of picture develop and this will be reviewed.

Patients who arrived apnoeic and pulseless were not declared dead until an E.C.G., central temperature recording and, whenever possible, a history had been obtained. Case reports of patients who have suffered cardiac arrests will be presented.

First M and IE Guest Lecture

Recent Developments in the High Frequency Ventilation Technique

U. Sjöstrand (*Örebro, Sweden*)

Intermittent positive pressure ventilation with considerably higher frequencies than occur in conventional IPPV can, with an appropriate pressure and flow pattern (but at the expense of an increased dead space ventilation), provide adequate alveolar ventilation. In order to achieve *high frequency positive pressure ventilation* (HFPPV) with low intrathecal and transpulmonary pressures but adequate alveolar ventilation, a ventilator system with a negligible compressible volume and minimal internal compliance, and which gives no increase in the patient's physiological dead space is required. The ventilatory pattern of HFPPV has been found to give a pressure/flow pattern that has lower systemic effects and interferes less with cardiocirculatory function than conventional IPPV. This form of artificial ventilation is therefore of much clinical interest.

The major characteristics of the ventilatory pattern of volume controlled HFPPV are *a*) a ventilatory frequency of about 60–100/min and an inspiration:expiration ratio of less than 0.3, *b*) smaller tidal volumes, and thereby lower maximal and mean airway, thus lower transpulmonary pressures, yet a higher functional residual capacity than in conventional IPPV/CPPV, *c*) positive intrathecal and negative intrapleural pressures throughout the ventilatory cycle, *d*) less cardiocirculatory interference than in conventional IPPV/CPPV, *e*) reflex suppression of spontaneous respiratory rhythmicity (under certain conditions) during normoventilation, *f*) decelerating inspiratory flow without an end-inspiratory plateau, and *g*) more efficient pulmonary gas distribution than in conventional IPPV/CPPV.

Reference

Sjöstrand U (in press, May 1980) High frequency positive pressure ventilation (HFPPV): A review. *Crit Care Med* 8 (5)

Even Higher Frequency Ventilation

Dr. P. Fletcher (Columbia University, New York)

There has been a recent upsurge in interest in mechanical ventilation at frequencies above the normal respiratory range, particularly in patients with abnormal respiratory function. It has been suggested that high-frequency ventilation (HFV) may allow maintained or improved gas-exchange (compared with conventional techniques) while producing minimal cardiovascular compromise and also that anatomical and physiological dead space may be markedly reduced at high frequencies. The current literature consists largely of anecdotal reports of the use of HFV in animals or man. Few authors have attempted to measure respiratory gas flows and those

who have tried have found their efforts bedevilled by technical problems.

Using a specially designed ventilator/spirometer system, we have been able to measure and analyse uncontaminated expired gas in rabbits at respiratory frequencies up to 22 Hz (1320 breaths/min). We have shown that dead space (as calculated by the Enghoff modification of the Bohr equation) remains remarkably constant with increasing frequency, resulting in a massive increase in the minute volume requirement. At constant PCO_2 , however, oxygenation seems to improve with increasing frequency.

We have used our experimental results in devising and testing mathematical models of the lung/ventilator system, with particular reference to the effect of HFV on intrapulmonary pressures.