



Evolution of intensive care in the UK

Intensive Care Society © 2003

Prepared on behalf of the Council of the Intensive Care Society by Saxon Ridley, Mark Dixon and members of the Intensive Care Society's Standards Committee.

Standards Committee: Andy Bodenham, Bernadette O'Riordan, David Goldhill, Kate Bray, Peter Ford, Saxon Ridley.

All rights reserved. No reproduction, copy or transmission of this publication may be made without written permission. No paragraph of this publication may be reproduced, copied or transmitted save with written permission or in accordance with the provisions of the Copyright, Designs and Patents Act 1988 or under the terms of any licence permitting limited copying issued by the Copyright Licensing Agency, 80 Tottenham Court Road, London W1P 0LP.

Contents

- 1. Introduction**
- 2. Initiating factors**
- 3. Further developments**
- 4. Present day**
- 5. Summary**
- 6. References**

Evolution of intensive care in the UK

1 INTRODUCTION

Intensive care medicine originated in response to an epidemic of poliomyelitis in Copenhagen fifty years ago. From these humble beginnings, intensive care has developed into a specialty at the forefront of organ support and other advances in medicine and surgery.

Critical care has only recently been recognised as a specialty, being awarded this status in the UK in June 1999. Unfortunately, the development of intensive care in most countries has not been co-ordinated by a long-term national or even regional strategic plan. Nearly every aspect of intensive care has developed as a reactive response to local clinical pressures rather than as a logical expansion or extension of a service following estimates of future need or changing workload. This includes planning a hospital's requirement for critical care beds to setting up training programmes for physicians wishing to undertake a career in intensive care medicine.

One of the most important aspects of this evolution has been a change in emphasis, from the intensive care unit as a location in which to gather critically ill patients, towards intensive care medicine as an evidence and knowledge base directed at providing for the critically ill throughout the hospital. The first intensive care units were set up for reasons we would recognise now; grouping patients by severity of illness enabled attention to be directed towards the most dependent patients. The idea of concentrating the sickest patients together was not new. It had already been used in postoperative recovery areas and in temporary units set up in response to various crises, such as the Coconut Grove fire in Boston, Massachusetts in 1942. Other factors were needed to drive change from considering intensive care as a unit to a philosophy for managing critically ill patients throughout a hospital.

2 INITIATING FACTORS

One of the most important initiating factors was the broad social change that took place after the Second World War, in particular the development of state-funded welfare systems in Europe and America. The most comprehensive example of this was the UK National Health Service which was founded in 1948. During the 1950s and 60s hospitals generally became larger and clinicians were increasingly involved in specialist practice treating patients who were not directly responsible for their medical bills.

The second significant development was an improved understanding of the pathophysiology of organ failure. Much of this came from the experience of treating

Figure 1
Iron lung ventilators.



severely injured soldiers during the two World Wars and the Korean War. The importance of shock and intravascular volume replacement was well established by the end of the First World War. Both saline and colloid solutions were used. Although Landsteiner had described the four main blood groups in 1901 the techniques of blood transfusion were not sufficiently widespread to have an impact until the Second World War. Further developments occurred during the Second World War particularly in the fields of neurosurgery and burns. Surgeons were forced by circumstance to improvise procedures not previously thought survivable; successful recovery of these patients required prolonged supportive therapy.

A further important advance came during a major epidemic of polio in Copenhagen in 1952¹. At that time the mortality associated with respiratory failure due to polio was 87 per cent. The treatment used was negative pressure ventilation with either cuirass or tank 'iron lung' ventilators.

An anaesthetist, Bjorn Ibsen, was asked to assist in the management of a 12-year-old girl who was dying despite negative pressure ventilation. After careful assessment of the girl's condition Ibsen proposed using positive pressure ventilation through a tracheostomy. The girl's condition rapidly improved as secretions were cleared and hypoxia and hypercarbia reversed. The technique was adopted immediately; however because no mechanical ventilators were available many patients were ventilated by hand, often for many weeks. Following this change in ventilation the mortality associated with polio fell to 26 per cent.

News of this success spread rapidly. Positive pressure ventilation was used widely in the treatment of respiratory compromise due to both polio and other diseases such as tetanus. As experience of the technique grew, simple complications, sometimes with tragic consequences, such as disconnection from the ventilator or blockage of the tracheal tube, led to the creation of respiratory care units in some hospitals. A report² in 1961 of four years' experience in Toronto provides interesting reading. The authors reported a substantial fall in preventable deaths. They also noted that while they had anticipated that the majority of patients would be admitted with neurological disease, 78 per cent had come in with other problems: "a substantial proportion arising from within the hospital itself, indicating the frequency of coincidental respiratory insufficiency in a large busy general hospital".

The development of effective vaccines, particularly against polio, accelerated the shift away from respiratory support as the predominant indication. The skills and resources that had been devoted to treating what had been common infectious diseases focused

Figure 2
A young man with tetanus being ventilated by hand via a Waters canister (courtesy of Dr A Bodenham, Consultant in Anaesthesia and Intensive Care, Leeds General Infirmary).



instead on patients that we would be more familiar with now, critically ill patients with more heterogeneous underlying diseases. Advances in technology contributed to the concentration of resources; intensive care units as we now understand them first emerged in the same decade as man reached the moon. Monitoring equipment that we now use routinely throughout hospitals was once scarce, cumbersome and expensive.

3 FURTHER DEVELOPMENTS

Nurses embraced the idea of intensive care earlier and more enthusiastically than their medical colleagues. This may reflect the nursing profession's focus on the patient rather than disease. Treating patients according to their dependency seemed obvious. From a nursing perspective the development of intensive care seems to be driven by the concentration of human resources and expertise. Politicians were also quick to seize upon the potential savings such concentration might provide. In 1962 the Department of Health published 'Progressive Patient Care'³. This outlined the "systematic grouping of patients according to their illness and dependence on the nurse, rather than by classification of disease or sex".

With this document came funding to establish intensive care units; many were set up from scratch and consequently their learning curve was steep. 'Progressive Patient Care' also recommended that for ICUs "generous provision of working space and all necessary storage areas" should be available and suggested that between 2 and 5 per cent of a hospital's acute beds should be for intensive care.

Throughout the 1960s there were reports from individual intensive care units sharing experiences of this novel form of care. Some of the experiences, such as Safar's report⁴ from Baltimore, of using one Moersch piston ventilator to ventilate two patients simultaneously now seem a little outlandish. However much remains the same, for example the organisational issues of who is responsible for the patient, insistence on adequate space around the patient and attempts to control cross infection.

During the 1970s and 80s the modern concept of critical illness developed. Research and clinical experience identified common features of sepsis and multiple organ failure. Alongside the traditional medical model of diagnosis, treatment and cure, the parallel model of identification and correction of physiological disturbance and support of failing organ systems became established. It was often only one or two enthusiastic clinicians within a hospital who established and managed the intensive care unit. The respiratory system was the only organ system that could be reliably

Figure 3 The concentration of monitoring and life support equipment as patients were grouped according to severity of illness in early ICUs (courtesy of Dr A Bodenham, Consultant in Anaesthesia and Intensive Care, Leeds General Infirmary).



supported at that time. The skills involved required that these clinicians were, in the UK at least, often anaesthetists. There was some scepticism about what motivated people to become intensive care doctors. A paper⁵ in the 'British Medical Journal' in 1969 acknowledged that although the clinical relevance of anaesthetists to the intensive care unit was clear, the extent to which they should be involved in the administrative management was less clear. The authors advocated anaesthetists spending no less than half of their time working in the operating room, fearing that necessary skills would be lost. Interestingly they opined "there is no piece of knowledge or skill which the intensivists can claim to be unique to him that cannot equally well be so claimed by other doctors as well". The line of argument would be easily dismissed now. Advances in our understanding of critical illness, such as the concept of the sepsis syndrome⁶ with the realisation that the patient is far from being simply a passive recipient of the septic episode, stemmed from basic scientific research that has improved our understanding of the molecular biology of inflammation.

4 PRESENT DAY

While several surveys of critical care facilities available in the UK have been undertaken, the most recent and extensive was performed by the Audit Commission⁷. This survey was undertaken between May and August 1998 in all acute hospital trusts in England and Wales. The Audit Commission asked about the number of critical care units within a trust; and in more detail about the provision of general adult critical care beds. Their results represent the most up-to-date and comprehensive review available for the UK.

There were 228 ICUs, 221 combined ICUs with high dependency units (HDUs) and 263 HDUs in England and Wales in 1998. However, a large number of these critical care services were either single specialty, such as medical or surgical, or served specific groups of patients such as children, those with burns or requiring neurosurgery or cardiac surgery. If these specialist units are excluded, then there were only 128 ICUs, 83 combined ICU/HDUs and 25 HDUs serving adult general patients. The total complement of adult general critical care beds was just over 1,400. As a result of a government review in 2000⁸, £142.4 million was made available for the enhancement of adult critical care services, and by January 2002 there were a total of 1,711 ICU beds and 1,319 HDU beds⁹. The number of beds used for general critical care was 2,267 (75 per cent), while the remaining 763 (25 per cent) were used for specialist critical care.

In 1998, the median size of an ICU was 5.3 beds, combined ICU/HDUs had 6 beds and HDUs 4 beds. However, 56 per cent of ICUs, 55 per cent of combined ICU/HDUs and 15 per cent of HDUs reported that additional beds could be opened at short notice by bringing in additional staff. Indirect evidence suggests that there is still a shortfall of critical care beds; an association between discharge at night and higher hospital mortality suggests that there is still pressure on beds as patients are returned to the general ward before they are completely stable¹⁰. In one English ICU, nearly 30 per cent of patients were discharged with a Therapeutic Intervention Scoring System (TISS) score greater than 20, implying a need for continuing high levels of medical and nursing support¹¹. These patients had a higher hospital mortality rate than those who were more stable at ICU discharge (21 per cent versus 3.7 per cent).

There was senior physician cover in 100 per cent of ICUs, 96 per cent of ICU/HDUs and 21 per cent of HDUs. The median number of daytime weekday consultant sessions (i.e. half-days) was 10 on ICUs, 8 on ICU/HDUs but 0 on HDUs. Critical care units were directed or led by a consultant with designated daytime clinical sessions in 96 per cent of ICUs, 80 per cent combined ICU/HDUs and 18 per cent HDUs. These results suggest that management of patients who are moderately ill but potentially unstable (i.e. HDU patients) is not undertaken by doctors, who are used to looking after ICU patients. This implies that while the most severely ill are looked after by appropriately trained senior doctors, less ill patients remain under the care of medical staff whose main interest is not critical illness. However, most adult general units appear to have written guidelines concerning admission (89 per cent ICUs, 82 per cent ICU/HDUs and 94 per cent HDUs) and discharge (80 per cent ICUs, 76 per cent ICU/HDUs and 74 per cent HDUs). Senior doctors were supported by trainees in 53 per cent of ICUs, 35 per cent of combined ICU/HDUs and 6 per cent of HDUs.

Competing interests within the traditional specialties of surgery, medicine and anaesthesia have delayed the development of formal training and accreditation in intensive care. Most UK intensive care doctors have entered the specialty through anaesthesia training programmes. However, the first formal intensive care training for doctors in the UK was established in 1986 via the Joint Advisory Committee for Intensive Therapy (JACIT), formed by the Royal College of Surgeons, the Faculty of Anaesthetists and the Royal College of Physicians. Ten 'JACIT' training posts were set up to provide trainees from a wide range of specialties with a comprehensive two-year training programme in intensive care. Since 2000, training has been administered by the Intercollegiate Board for Training in Intensive Care Medicine; this has adopted a competency-based framework and introduced a Diploma in Intensive Care Medicine. This is likely to become an increasingly important part of a trainee's portfolio. Once trained, few intensive care specialists in the UK dedicate all their clinical time to intensive care.

Due to the nature of their illness, critically ill patients and their relatives require considerable nursing input. In the UK critically ill patients have traditionally received 1:1 nursing care, with a lower ratio usually provided to those receiving high dependency care. The exact nursing requirement for high dependency care patients will be influenced by the patients' needs and the nursing skill-mix. However, in a large district general hospital supporting all services except hepatology, transplantation, cardiac and neurosurgery, the required nurse to patient ratio on HDU was found to be 2:3¹². Nursing staff represent the largest component of costs. In 1999, the median total ICU nursing budget was £705,311; for combined ICU/HDUs it was £607,056; and for HDUs £251,182. However, units report a wide range of nursing skill-mix and

expertise that is not always explained by differences in patient demography. There has been a parallel increase in the input from allied health professionals, e.g. physiotherapists, radiographers, pharmacists and other technicians.

From an early stage there has been an awareness of how much it costs to treat relatively few patients. There has been an emphasis on data collection, analysis and presentation using tools such as TISS for comparison of ICU costs¹³. Other scoring systems have proved to be better indices of severity of illness, in particular the Acute Physiology and Chronic Health Evaluation (APACHE) score. The first version of this score was described by Knaus et al in 1981¹⁴ and is now the most commonly used severity of illness scoring system. The UK has been at the forefront of this information gathering culture through the Intensive Care National Audit and Research Centre, established in 1994. The centre is now responsible for publishing case mix adjusted outcome data for over half of the ICUs in the UK.

5 SUMMARY

Much has changed over the last fifty years. In many ways intensive care has developed in response to gaps in service provision. Hospitals have become larger and more specialised, expectations of patients have increased and society has changed. Recruitment to professions with day and night demands is more difficult, so making nursing staff a particularly scarce resource. In this challenging environment, intensive care in the UK has come of age. An intensive care unit is essential in all acute hospitals, as the skills developed there are in demand throughout the hospital. If the intensive care team is to satisfy patients' needs, the speciality of intensive care medicine must continue to advance and evolve.

6 REFERENCES

1. Lassen HCA. A preliminary report on the 1952 epidemic of poliomyelitis in Copenhagen with special reference to the treatment of respiratory insufficiency. *Lancet* 1953; i: 37–41.
2. Fairley HB. The Toronto General Hospital Respiratory Unit. *Anaesthesia* 1961; 16: 267–74.
3. Progressive Patient Care: Interim report of a departmental working group. *Monthly Bulletin MOH and PHLS* 1962; 21: 218–26.
4. Safar P, DeKornfeld TJ, Person JM. The intensive care unit, a three year experience at the Baltimore City Hospital. *Anaesthesia* 1961; 16: 275–84.
5. Mushin WW, Lunn JN. The anaesthetist and intensive care. *British Medical Journal* 1969; 2: 683–84.
6. Bone RC, Fisher CJ, Clemmer TP, et al. Sepsis syndrome: a valid clinical entity. *Critical Care Medicine* 1989; 17: 389–93.
7. Audit Commission. *Critical to Success. The place of efficient and effective critical care services within the acute hospital.* Audit Commission Publications, 1999.
8. Comprehensive Critical Care: a review of adult critical care services. London: Department of Health, May 2000. www.doh.uk/nhsexec/compcritcare.htm
9. NHS Executive. Department of Health Form KH03a. Department of Health, 2002.
10. Goldfrad C, Rowan K. Consequences of discharges from intensive care at night. *Lancet* 2000; 355: 1138–42.
11. Smith L, Orts CM, O'Neil I, Batchelor AM, Gascoigne AD, Baudouin SV. TISS and mortality after discharge from intensive care. *Intensive Care Medicine* 1999; 25: 1061–65.
12. Garfield M, Jeffrey R, Ridley S. An assessment of the staffing level required for a high-dependency unit. *Anaesthesia* 2000; 55: 137–43.
13. Cullen DJ, Civetta JM, Briggs BA, et al. Therapeutic intervention scoring system. A method for quantitative comparison of patient care. *Critical Care Medicine* 1975; 2: 57–61.
14. Knaus WA, Zimmerman JE, Wagner DP, et al. APACHE: acute physiology and chronic health evaluation: a physiologically based classification system. *Critical Care Medicine* 1981; 9: 591–97.

INTENSIVE CARE SOCIETY

**29B Montague Street
London WC1B 5BH
Tel: 020 7291 0690**