Paediatric intensive care in a district general hospital

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SUMMARY Five years' experience of paediatric intensive care in a district general hospital were analysed retrospectively. A total of 54 infants and children required respiratory support during this time—21 on a high dependency area of the children's ward and 33 on a general intensive care unit. Forty two (78%) of the patients survived, and 33 (61%) of the patients required respiratory support within four hours of admission, thus the experience of the local paediatric and anaesthetic team was crucial to the management of these children. Good intensive care for children can be provided within a district general hospital.

In most district hospital paediatric units the numbers of critically ill children admitted are small and are not sufficient to justify the setting up and staffing of separate paediatric intensive care areas. In such hospitals, however, there has to be provision for the resuscitation and intensive care of critically ill children. In Northampton, as in many districts, such care is provided in two areas within the general hospital: in a high dependency area of the general paediatric ward and on the general intensive care ward. We describe the results of five years' experience of providing care for children in this manner.

Background

Northampton General Hospital is a district hospital of 700 beds providing acute services for south Northamptonshire and serving a total population of 301 400 (1986) of which 59 700 are children. The paediatric unit has 56 beds, including several cubicles which can be adapted for intensive care; there is also a neonatal unit of 28 cots with four intensive care cots. Medical staff comprises three consultants, a senior registrar, a registrar, and five senior house officers. The general intensive care unit has seven beds two of which are in side rooms off the main intensive care area. Medical staff comprise two consultant anaesthetists, who specialise in intensive care, and two senior house officers in anaesthetics who alternate 24 hour cover. On the children's ward medical care is provided by the paediatric team with the anaesthetic team advising on request. Nursing care is provided by the general ward staff most of whom are trained as registered sick children's nurses. On the intensive care unit care is shared between the anaesthetic and paediatric teams; most

of the nurses have specific intensive care training but not paediatric training.

The decision to admit to either area for intensive care depends on several factors including age (infants are generally cared for on the children's ward), place of resuscitation, and workload and staffing levels in the two areas. The need for referral to a tertiary centre is assessed on an individual basis. We would usually refer neurosurgical problems, particularly head injuries, complicated neurological problems, and renal problems requiring dialysis.

Equipment in the intensive care areas and investigation facilities within the hospital comply with the main recommendations of the British Paediatric Association working party on paediatric intensive care.¹ We are able to provide full respiratory support; perform electrocardiography, monitor the respiratory rate, arterial and venous pressure; measure blood and transcutaneous oxygen and carbon dioxide concentrations; and we can deliver long term total parenteral nutrition. We do not have the ability to monitor intracranial pressure and, at present, patients have to be transferred to a referral centre for computed tomography.

Methods

The care of all paediatric patients who received intensive care during the five years between 1 January 1982 and 31 December 1986 was analysed in retrospect. A paediatric patient was defined as being less than 14 years old; intensive care was defined as the treatment of any child who required maintenance by an artificial airway or by artificial ventilation. As an indication of the paediatric workload of a general intensive care unit we

included children who were admitted to the intensive care unit for observation but who did not require respiratory support.

Results

A total of 54 patients needed airway or ventilatory support, or both during the five years. This represents 0.6% of all paediatric admissions, which totalled 8924 during this time. Altogether, 21 infants (39%) were managed on the children's ward; their mean age was 7.25 months (range 17 days to 19 months). Thirty three infants and children (61%) were managed on the general intensive care unit; their mean age was 4.9 years (range 8 weeks to 13.5 years), of these only two were less than 1 year old. Seventeen additional children were observed on the intensive care unit but did not require respiratory support; their mean age was 3.7 years (range 1 year to 11.25 years). These 50 patients represented 3.8% of the total of 1307 admissions to the intensive care unit.

The mean time between admission and intubation was 11.5 hours (range 0–144 hours). In 21 cases (39%) intubation was required within one hour of admission, 33 (61%) required intubation within four hours of admission. Of those requiring resuscitation in the first four hours, 28 went to the intensive care unit and five went to the children's ward. The mean amount of time spent on respiratory support was 100 hours (range 12–576 hours). The diagnostic categories and details of the children are shown in the table.

Thirty two patients had primarily respiratory problems. The 14 cases with upper respiratory problems all made a full recovery, and of the 18 cases with lower respiratory problems, 16 made a full recovery. One child with measles pneumonia died, and one child with bronchiolitis subsequently developed spastic quadriplegia; this child had had a convulsion before ventilation was started.

Of 13 patients who primarily had neurological problems, five made a full recovery. Three children with meningococcal meningitis died as did two children with encephalopathy. In one of these the diagnosis remained uncertain, in the other Reye's syndrome was diagnosed. This child was transferred within the first 24 hours to a tertiary referral centre and died two days later. Both children with encephalitis were left with sequelae, one with both physical and intellectual sequelae, the other with just physical sequelae. One child who had a severe head injury became nerve deaf in one ear.

Five cases had had a cardiorespiratory arrest before admission and were resuscitated in casualty; all these children subsequently died: in three of

Table *Diagnostic categories of children in intensive care who required respiratory support*

Diagnosis	No of children	Mortality	Morbidity
Upper respiratory tract problems (n=14)			
Epiglottitis	8	0	0
Croup	4	0	0
Foreign body	2	0	0
Lower respiratory tract problems (n=18)			
Pneumonia	7	1	0
Bronchiolitis	6	0	1
Asthma	4	0	0
Anaesthetic complication	1	0	0
Neurological problems (n=13)			
Status epilepticus	4	0	0
Meningitis	4	3	0
Encephalitis	2	0	2
Encephalopathy	2	2	0
Trauma	1	0	1
Arrest before admission (n=5)			
Sudden infant death syndrome	2	2	0
Drowning	1	1	0
Infanticide	1	1	0
Congenital heart disease	1	1	0
Miscellaneous (n=4)			
Postoperative ventilation	2	0	0
Chest trauma	1	0	0
Septicaemia, trisomy 21	1	1	0
Total (no (%))	54	12 (22)	4 (9.5)

them intensive support was withdrawn after they were confirmed brain dead, and two had a further cardiac arrest while on ventilation. The diagnoses of this group are given in the table. Of the four children in the miscellaneous group, three made a full recovery. One child with Down's syndrome, a total atrioventricular canal, and septicaemia died.

Seventeen children were admitted to the general intensive care unit who did not require respiratory support. Seven of these children had upper respiratory and two lower respiratory problems, three had neurological problems, two postoperative complications, and three had ingested toxic substances. Of these children, 15 made a full recovery. Two children with severe head injuries were transferred to a neurosurgical centre: one was left with significant neurological deficit, the other died after a period of ventilation in the referral centre.

The mortality of the total 71 patients was 18.3% with a morbidity of 8.4% in the survivors. In the 54 patients requiring respiratory support the mortality was 22.2% with a morbidity of 9.5%. Mortality of

those receiving assisted ventilation on the children's ward was 19% and those on intensive care 24%.

Discussion

There have been no reports of paediatric intensive care from district general hospitals since this department reported its experience in 1970.² In fact, very few other series have been reported recently, although Eastham *et al* described their experience of caring for children on a general intensive care unit in a general hospital that acted as a referral centre for certain paediatric conditions.³ Their overall mortality of 16.6% compared closely with our figure of 18.3%. Comparisons are difficult though in that no two units will accept the same variety of patients. Of the children who died in our series, an appreciable number of deaths (five of 12) were probably unavoidable in that the patients arrived at hospital too late for intensive care to be able to offer them a viable future. Morbidity is the other important measure of success in intensive care. We would accept that our morbidity data may be incomplete in terms of length of follow up in some more recent patients. We could identify only four patients, however, who were left with neurological problems after intensive care and of these three occurred in conditions where sequelae are common even in those not requiring ventilation.^{4 5} Half the combined mortality and morbidity in patients receiving ventilation occurred in those with primarily neurological problems. We do not have the facilities to do intracranial pressure monitoring and we do not have a computed tomographic scanner in this hospital; both of these techniques can be useful in such patients. In each case the difficult decision had to be made as to whether the risks of transporting or transferring the child to a centre that could carry out these measurements justified the potential benefits. Three children were transferred; two died after a period of ventilation in the referral centre and one, who was not ventilated, was left with an appreciable neurological deficit. In those not transferred clinical evidence of raised intracranial pressure was treated empirically with mannitol, dexamethasone, and hyperventilation.

We find there are very few problems associated with caring for children on a general intensive care unit. Almost all the children are cared for in side rooms, which isolates them from the possibly frightening main intensive care area. The environment in the side room can be made more 'paediatric' with the addition of toys, wall posters, a television, etc, as indicated by the awareness of the patient. Initially the nurses in the intensive care unit often feel a certain amount of concern at the prospect of

caring for a seriously ill child. Invariably, at a time when technical skills are most important, they rise to the challenge and most eventually enjoy the experience. When more paediatric input is needed this can be provided by the paediatric department nursing and paramedical staff. There is close co-operation between the intensive care unit and paediatric medical staff; care is taken not to delineate areas of responsibility to the detriment of patient care. The number of medical staff involved in counselling has occasionally led to confusion for the parents, with people saying the same things in different ways and very occasionally saying different things. A uniform approach to counselling parents is of vital importance.

At present there are more problems with providing nursing cover for intensive care on the children's ward. Often it is the senior nurses who have most experience in intensive care, thus a ventilated patient stretches the number of nurses available to run the rest of the ward. Most of the equipment and technical skills used in the care of a child aged less than 1 year are similar to those used in neonatal intensive care. Our department is currently being redeveloped to bring the neonatal unit geographically and administratively onto the same site; this will allow rotation and transfer of nursing staff between the two units, and it will improve development and access to intensive care nursing skills. The experience and technical skills that junior medical staff learn on the neonatal unit transfer easily to the care of these infants. The redevelopment of this department will also include the provision of a purpose built paediatric high dependency area. The current arrangement is to adapt one of the paediatric ward cubicles when the demand for intensive care arises, the main problem with this is the physical difficulty of finding room for all the equipment in the cubicle.

The decision to admit a patient to either area for intensive care is based on flexible criteria. Most of the expertise in ventilation within the paediatric department is with newborn infants. For this reason most of the patients under the age of 1 year are cared for on the children's ward. Older children, who will benefit from the wider experience of the anaesthetic department, will usually be admitted to the general intensive care unit. Other factors, however, will also be taken into consideration—for example, geographical factors. In this hospital the casualty department and intensive care unit are situated close together and are some distance from the children's wards; for this reason an infant resuscitated in casualty may be transferred to intensive care.

It has been advocated that paediatric intensive

care should become more centralised with more children who require intensive support being transferred from district hospitals to central paediatric intensive care units. In this series 61% of patients required respiratory support within four hours of admission, most of these in the first hour. Many of those ventilated later than this were due to a sudden deterioration in conditions, such as bronchiolitis, where spontaneous recovery was expected. Thus the experience of the local paediatric and anaesthetic team was crucial in the resuscitation and initiation of intensive care, which is often the most difficult period of intensive care. Centralisation of intensive care will always be necessary for certain types of paediatric illness. Our experience would suggest that total centralisation would dilute peripheral experience and decrease the standards of immediate care these critically ill children would receive and would also add to the practical hazards of transporting these children between hospitals.

The results achieved within this unit would support the main recommendation of the British Paediatric Association working party on intensive care that, while each region should have at least one

paediatric intensive care unit, intensive care can and should be done with a wider network of intensive care areas within larger district general hospitals.¹

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