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Obstetric and neonatal care related to outcome

A comparison of two maternity hospitals

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Obstetric and neonatal care related to outcome: a comparison of two maternity hospitals. Infants of birthweight up to 2500 g born in 1966 in two district hospitals were followed-up until their school medical examination at six years. Neonatal mortality rates differed in the two cohorts despite similar maternal age, parity, and social class distribution; differences in the management of labour and in neonatal care may have been responsible. Numbers were small but the prevalence of mild or more severe handicaps among the survivors did not differ significantly between the cohorts; an improved mortality was not achieved at the expense of an increased overall morbidity, although there was a suggestion of a difference in cerebral palsy prevalence. It is suggested that the neonatal mortality rate in conjunction with the prevalence of handicaps among the survivors of low birthweight infants be used as an indicator of the efficacy of perinatal care.

An infant weighing 2500 g or less at birth is considered 'premature' by internationally accepted definition. Such infants are 'at risk' both for mortality and for morbidity among the survivors. Approximately 6·5% of all live births in England and Wales weigh 2500 g or less, yet they account for almost 60% of neonatal mortality and 50% of infant mortality. Moreover, the lower the birthweight, the higher the proportion of handicaps found in later childhood. Among very low birthweight infants (<1500 g), previous workers have found 33-68% of survivors to have handicaps in later life (Lubchenco *et al.,* 1963; Drillien, 1967; McDonald, 1967). Various reports indicate that 40-70% of children with paraplegia and 25-45% of children with di- or tetra-plegia have a birthweight of 2500 g or less (Asher and Schonell, 1950; Childs and Evans, 1954; Eastman and DeLeon, 1955).

Recent improvements in medical and nursing care have increased the proportion of premature infants that survive; the neonatal death rate in England and Wales of infants of 2500 g or less has fallen progressively from 149·2 per 1000 in 1955 to 98·5 per 1000 in 1974. Fears have been expressed that any improvement in mortality rates may be achieved only at the expense of an increase in the prevalence of serious handicaps among the survivors (Drillien, 1958; Holt, 1970). However, recent accounts of the follow-up of survivors of very low birthweight indicate that these fears may be unfounded. Stewart (1972) reported that, among 100 survivors of very low birthweight (<1500 g), only 10% had a physical or mental handicap. Davies and Tizard (1975) reported that, during the period 1961-64, the incidence of cerebral palsy among infants of birthweight <1500 g was 10 out of 58 but during 1965-70 it fell to 0 out of 107. Similar results have also been reported from Switzerland (Prod'hom, Calame, and Steinhauer, 1972). This suggests that morbidity and mortality may be improved simultaneously.

These reports have emerged from highly specialized intensive care baby units; it is likely they represent the outcome of sophisticated technological advances—for example, the routine monitoring of breathing, arterial oxygen tension, blood pH, serum bilirubin, and blood glucose in addition to advantageous ratios of medical and nursing staff to patients. This poses the question—to what extent does the community as a whole, served by its ordinary district hospitals, show similar improvements in morbidity and mortality?

To answer this, cohorts of infants of birthweight 2500 g or less, born in 1966, in two maternity hospitals serving adjacent districts have been followed-up. An interhospital comparison of neonatal mortality rates and of the proportion of survivors with mental and/or physical handicap has been made and related to the management of labour and the care of the neonate.

Methods

In this survey, the two maternity hospitals are referred to as Hospital A and Hospital B.

The name and address of every infant of birthweight 2500 g or less, born in 1966, in the two maternity hospitals, was abstracted from the birth register held by the local health authority and was checked against the hospital admission records. Follow-up information concerning mental, physical, and sensory handicaps was obtained from the school medical examination record.

The prevalence of handicap among the survivors was determined using the classification of Drillien (1969).

Moderate/severe handicap included all children ineducable in a normal school on account of mental retardation, severe physical defect, dull intelligence with disturbed behaviour and all those suffering with cerebral palsy and/or epilepsy whether or not they were excluded from normal school.

Mild handicap included children educable in a normal school but with educational difficulties associated with a dull intelligence and physical defects which did not affect school performance but which did constitute a definite disability.

Maternal age and parity, length of labour and whether spontaneous or induced, and the type of delivery, was determined from the obstetric notes on the mother. Information on social class was also sought but because of inadequate recording in most cases, meaningful analysis was impossible. However, the 1966 census records show no pronounced social class differences between the two districts and the assumption has to be made that the distribution of the mothers in the survey also shows no serious disparity. The lack of social class information is unlikely to be critical because its effect on the perinatal mortality risk is very small after allowing for birthweight (Elwood, Mackenzie, and Cran, 1974).

Medical and nursing records were abstracted for information on resuscitation methods and feeding policy.

Results

During 1966, there were 209 infants of birthweight 2500 g or less born in Hospital A, of which 167 (79·9%) were singletons, and in Hospital B there were 167 births of which 131 (78·4%) were singletons. Maternal records were available for 208 Hospital A and 165 Hospital B births.

Table I
DISTRIBUTION OF BIRTHS BY WEIGHT, MATERNAL AGE, AND PARITY

	Hospital A	Hospital B
Total births 2500 g and under	209	167
Birthweight distribution (grams)	%	%
<1000	4·3	4·2
1001–1500	8·6	9·0
1501–2000	23·4	25·1
2001–2500	63·6	61·7
*Maternal age (years)		
<20	12·0	7·3
20–24	34·6	36·4
25–29	23·6	26·7
30–34	16·8	14·5
35–39	10·1	12·7
40+	2·9	2·4
*Parity		
0	47·6	45·5
1	26·0	23·6
2 and 3	18·3	24·2
4	8·2	6·7

*Based on maternal records for 208 in Hospital A and 165 in Hospital B

The distribution by birthweight is given in Table I. The distribution of births by birth weight, maternal age, and parity is similar. This accords with the assumption that there is no serious discrepancy in social class distribution as these variables tend to be related. The number of previous pregnancies ending in miscarriage or in a stillbirth also showed no significant differences between the two hospitals.

Obstetric Management

Significant differences between Hospitals A and B are evident for several aspects of obstetric management.

Induction of labour or elective caesarean section was carried out for 32·5% of Hospital A and 22·0% of Hospital B deliveries ($P < 0·05$).

Differences in the length of the first stage of labour were not significant. In any case, there are difficulties in the precise determination of the time of onset of labour. The length of the second stage of labour can be more accurately recorded; a greater

proportion of women had the second stage of labour lasting over an hour in Hospital B (Table II). Here it is worth noting that, in this survey, all the infants were small—that is, 2500 g or less.

TABLE II
LENGTH OF SECOND STAGE OF LABOUR

Time (minutes)	Hospital A %	Hospital B %
<30	72·4	61·8
30–59	21·5	22·2
60–89	3·9	10·4
90+	2·2	5·6
Total no. of patients	181	144

Excludes 6 cases for which duration is not known and 21 caesarean sections in Hospital A. Excludes 10 cases for which duration is not known and 11 caesarean sections in Hospital B.

Possible reasons for the difference become evident when aspects of management during delivery are examined. Assisted delivery—that is, vacuum or forceps extraction in a vertex presentation, or forceps to the after-coming head in a breech presentation, was more common in Hospital A (Table III) and an episiotomy was more frequent (48% of Hospital A deliveries, 20% of Hospital B, $P < 0{\cdot}05$).

TABLE III
TYPE OF DELIVERY

Type of Delivery	Hospital A %	Hospital B %
Vacuum or forceps extraction	23·7	5·0
Spontaneous	66·2	88·5
Caesarean section	10·1	6·9
Total no. of patients	208	165

Thus, the management of labour in Hospital A tended to be more 'active' and this was reflected in a shorter second stage of labour.

CARE OF THE NEONATE

Active resuscitation of the infant—for example, intubation and the administration of oxygen, was more often carried out in Hospital A (Table IV). However, for those infants who were given oxygen, there was no difference in the length of time it was given.

Feeding policy also differed; the infants were fed earlier and breast feeding was more common in Hospital A. The greater emphasis on breast feeding was further evident in that 42% of infants in Hospital A and 28% in Hospital B were breast feeding on discharge from hospital. This higher proportion in Hospital A was present although the length of stay in hospital was longer (median length of stay 18·2 days in Hospital A, 9·8 days in Hospital B).

OUTCOME

Hospital B fared worse in both stillbirth and neonatal mortality rates (Table V) although the differences were not statistically significant. However, the reports of the Medical Officers of Health of the two districts served by Hospitals A and B revealed such differences in stillbirth and early neonatal mortality rates over at least the five-year period 1964-68. Table VI shows that the causes of death of stillbirth and neonatal death were similar in the two hospitals.

Follow-up to the time of the school medical examination at six years of age was possible in 139 (82·2%) of survivors from Hospital A and 105 (84·7%) from Hospital B. Unsuccessful follow-up was usually the result of an unnotified change of address, attendance at a private school in which case the school medical examination is not performed by the local health authority, or if the mother was single.

The proportion of children from the two hospitals with mild and moderate/severe handicaps are similar (Table VII). However, examination of the cause of handicap reveals that six out of 139 from Hospital A had cerebral palsy but only one out of 105 from Hospital B. This difference is not

TABLE IV
INFANTS GIVEN OXYGEN OR INTUBATED

Management	Hospital A			Hospital B		
	⩽1500 g	1501–2500 g	Total	⩽1500 g	1500–2500 g	Total
Total records available	20	166	186	16	125	141
Given oxygen %	100·0	34·9	41·9	87·5	21·6	29·2
Intubated %	40·0	9·6	12·9	0·0	3·2	2·8

TABLE V
STILLBIRTHS AND NEONATAL DEATHS

Outcome	Hospital A			Hospital B		
	⩽1500 g	1501–2500 g	Total	⩽1500 g	1501–2500 g	Total
Stillbirths	7	13	20	6	12	18
Neonatal deaths	11	9	20	12	12	24
Survivors	9	160	169	4	121	125
Total births	27	182	209	22	145	167
Stillbirth rate per 1000 total births			95·7			107·8
Neonatal mortality rate per 1000 live births			105·8			161·1

TABLE VI
CAUSES OF DEATH AMONG STILLBIRTHS AND NEONATAL DEATHS

Cause of Death	Hospital A	Hospital B
Stillbirths		
Congenital abnormalities	3	4
Rhesus isoimmunization	1	3
Other (accidental haemorrhage, placental insufficiency, toxaemia, etc.)	16	11
Neonatal deaths		
Congenital abnormalities	3 (2 renal agenesis, 1 ectopia cardis)	3 (1 renal agenesis, 1 neural tube defect, 1 congenital heart)
Rhesus isoimmunization	2	0
Other (prematurity, respiratory distress syndrome, etc.)	15	21

TABLE VII
PREVALENCE OF HANDICAP

No. of Infants	Hospital A	Hospital B
Surviving	169	124
Followed-up	139	105
With moderate/severe handicap	9 (6·5%): 3 cerebral palsy at normal school; 3 cerebral palsy at ESN(S) school; 1 hypothyroid cretin at ESN(S) school; 2 at ESN(M) school	6 (5·7%): 1 cerebral palsy at normal school; 1 hydrocephalus at ESN(S) school; 1 Down's syndrome at ESN(S) school; 3 at ESN(M) school
With mild handicap	7 (5·0%): 4 poor vision*; 1 partially deaf**; 2 mentally dull	6 (5·7%): 3 poor vision*; 1 partially deaf**; 2 mentally dull

*Poor vision = vision of 6/12 or worse in the better eye
**Partial deafness = hearing loss of 35 dB or worse.

significant ($P = 0·1$); nevertheless, it does suggest that there may be more cases of cerebral palsy when neonatal mortality is lower.

Combining both series of results, 15 out of 244 (6·1%) premature children who were followed-up had moderate/severe handicap, seven (2·9%) had cerebral palsy. In the light of modern developments most of the latter must be considered potentially preventable.

DISCUSSION

The 1960s was a period of controversy over various aspects of neonatal care. Primarily, there was the fear that active resuscitation of a very small infant would merely increase the proportion of handicapped survivors. Also the risk of retrolental fibroplasia had prompted the ultracautious use of oxygen and attention has recently been drawn to the halt in the previous steady decline in neonatal

mortality in both Britain and the USA following restrictions in the use of high concentrations of oxygen (Cross, 1973; Bolton and Cross, 1974). Similarly, there was disagreement concerning the relative merits of early or late feeding; late feeding used to be advocated to reduce the danger of aspiration pneumonia. The pendulum has since swung towards early feeding which may reduce hyperbilirubinaemia and prevent hypoglycaemia, especially in the small-for-dates infants (Smallpeice and Davies, 1964; Wennberg, Schwartz, and Sweet, 1966; Wu *et al.*, 1967).

The two hospitals concerned in this survey and their policies relating to perinatal management represent polar views of the controversies that existed at the time and perhaps accounted for the differences in the neonatal mortality rate. Fears that handicapping may have increased with the improvement in neonatal mortality have not proved completely unfounded. In the present study, although numbers are few and the overall prevalence of handicaps is no greater when neonatal mortality is lower, the prevalence of cerebral palsy does appear to be increased.

Because perinatal management is so important in the low birthweight infant, the neonatal mortality rate in this group is an important indicator of the efficacy of hospital care. It has become particularly relevant now that over 90% of all births (and an even higher percentage of premature births) take place in hospital, so that anomalies introduced by variations in the utilization of services do not distort the picture. As an indicator it could be used by any District Community Physician in the National Health Service to monitor hospital services. An average sized 'district' with a population of 200 000, a birth rate of 13 per 1000, and a prematurity rate of 6·5%, would involve the follow-up of about 170 live births a year. Approximately 140-150 will survive the neonatal period. An extension of this would be the follow-up of the infant at, say, two years of age in the child welfare clinics, when any major physical handicap—for example, cerebral palsy, should be evident. If the numbers involved in the individual follow-up of all infants of birthweight 2500 g or less were too great for the resources of the District Community Physician, follow-up could be limited to the very small infants—that is, those of birthweight 2000 g or even 1500 g or less. The mortality and prevalence over the years of handicaps among them would give some indication of the quality of perinatal care they had received.

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Notes