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Babies born under 1000 g – Perinatal Outcome

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SUMMARY

Improved survival of very pre-term infants is a result of advances in obstetric and neonatal medicine. To provide relevant data for a Northern Ireland population group, we evaluated mortality and morbidity of extremely low birthweight (ELBW; <1000 g) infants from a tertiary referral neonatal unit. Seventy-seven ELBW infants were admitted on the first day of life during the period April 1990 to April 1992. Mean (SD) gestational age (GA) was 26.2 (2.1) weeks and birthweight (BW) was 781 (132) g. The degree of severity of initial illness was high, with a mean (SD) CRIB (clinical risk index for babies) score of 7.4 (4.2). Fifty (65%) babies survived, being discharged home at a mean (SD) age of 95 (34) days. Survivors were more likely to have received maternal steroid therapy or been born in this hospital. Ten (20%) of the survivors had evidence of severe neonatal brain injury on cranial ultrasonography – Papile grade 3 or 4 intraventricular haemorrhage (IVH) or periventricular leucomalacia (PVL). Survival rate of ELBW infants without severe brain injury was 54% overall; this ranged from 0% in ELBW infants born at 23 weeks GA and 33% at 24 weeks GA to 85% at 27 weeks GA.

INTRODUCTION

There have been great improvements in the survival of tiny babies in the last decade. These have been due to advances in obstetrical management such as the use of tocolytic agents to prevent pre-term birth[1] and the use of antenatal corticosteroids to increase maturity of fetal lungs,[2] and in neonatal intensive care, such as surfactant replacement therapy.[3] However, our goal is not survival at all costs, but rather the highest quality of survival.

Studies of neonatal outcome for tiny babies have been reported from geographical regions[4, 5] or from tertiary referral hospitals.[6, 7] Some have only been of ELBW infants,[6] others have been of babies born at less than a defined gestational age.[5, 7] Some have excluded babies born <500 g,[6] others have excluded babies transferred for intensive care after initial resuscitation elsewhere.[7] To provide comparative data, the aim of this descriptive study is to provide information on mortality and morbidity in ELBW infants surviving to neonatal unit admission from a Northern Ireland population in the 1990s. This information will aid the counselling of parents at risk of having a tiny pre-term baby.

METHODS

Detailed prospective records were maintained on all 77 ELBW infants admitted to a regional neonatal intensive care unit (NICU) from April 1990 to April 1992. Babies who died in the labour ward or who were transferred to our NICU later than the first day of postnatal life were excluded from this study.

Gestational age was estimated from the date of the last menstrual period, fetal ultrasonography, and physical examination of the baby.[8] Small for gestational age (SGA) babies are those with a weight <10th centile for age. The presence of congenital infection was determined by one or more of the following criteria[9] – prolonged rupture of membranes, signs of chorioamnionitis and clinical signs suggesting infection of the infant at delivery. The criteria for rescue treatment of neonatal respiratory distress syndrome (RDS) have been previously defined.[10] Initial disease severity was calculated by the clinical risk index for babies (CRIB) score.[11] Chronic lung disease (CLD) was defined as the need for supplemental oxygen at 28 days and bronchopulmonary dysplasia (BPD) as CLD plus classic chest

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radiographic changes.[8] Intraventricular haemorrhage (IVH) was graded 0-4 on the Papile classification of cranial ultrasonographic appearances.[12] Periventricular leucomalacia (PVL) was defined as cyst formation, but not transient echodensities, on cranial ultrasonography.[8] Severe neonatal brain injury was defined as IVH grade 3 or 4 and/or PVL. Other indicators of neonatal morbidity included cholestasis (conjugated bilirubin >30 umol/l for >1 week), necrotising enterocolitis (NEC – suspicious clinical signs plus gas in the bowel wall on abdominal radiograph),[8] retinopathy of prematurity (ROP) and need for cryopexy,[13] confirmed bacterial or fungal septicaemia, duration of parenteral nutrition, amount of transfused blood product (blood or plasma), need for postnatal steroid therapy for ventilator dependency,[8] and growth parameters at discharge.

For statistical analysis the chi-squared test and student t test were used as appropriate. A p value < 0.05 was considered significant.

RESULTS

Initial clinical data on entry to the NICU are shown in Table I. These babies were born at a mean (SD, range) GA of 26.2 (2.1, 23-33) weeks with a mean (SD, range) BW of 781 (132, 345-991) g. The range of initial disease severity is shown by the mean (SD, range) CRIB score of 7.4 (4.2, 1-19).

TABLE I

Clinical details of 77 ELBW infants on the first day of life. Figures are number (%)

Male sex	41 (53)
Singleton	54 (70)
Antenatal steroids	46 (60)
Birthweight <750 g	28 (36)
Small for gestational age	21 (27)
Inborn	69 (90)
Congenital infection	7 (9)
Respiratory distress syndrome	45 (58)
Requiring supplemental oxygen	68 (88)
Requiring ventilation	54 (70)
Requiring surfactant	33 (43)

Fifty (65%) infants survived. There was a non-significant difference in survival rate of 28 infants born with a BW < 750 g and 49 with a BW of 750-999 g. Fifteen (54%) of the < 750 g group and 35 (71%) of the 750-999 g group respectively survived. Forty-six (67%) of inborn and 4 (50%) of outborn babies survived. Thirty-three (72%) of babies whose mothers had received some or all of a course of antenatal steroids survived compared to 17 (55%) surviving of those born before antenatal steroid therapy could be commenced. There was a significant ($p < 0.0001$) difference in mean (SD) CRIB score of survivors and non-survivors, at 5.8 (2.6) and 10.4 (4.8) respectively.

Table II shows relative survival at differing gestational ages and birthweights for ELBW infants. Not all babies born at less than 34 weeks gestation weigh less than 1000 g. During the study period the number of babies admitted with a birthweight ≥1000 g were 0 at 23-25 weeks, 2 at 26 weeks and 11 at 27 weeks gestation. Of these only 1 baby died, giving a total survival of 48 (64%) of the 75 babies born <28 weeks. Of the 27 ELBW infants who died, 10 died in the first 48 hours of life and 24 by day 21. All these deaths were expected in view of their clinical condition. Three babies died of complications related to BPD, at ages of 139, 202 and 206 days respectively, whilst still in the NICU.

TABLE II

Number of ELBW babies surviving when grouped in gestational age (GA) and birthweight (BW) categories.

Group	*Number*	*Survivors (%)*
GA: 23 weeks	4	0 (0)
GA: 24 weeks	12	5 (42)
GA: 25 weeks	16	9 (56)
GA: 26 Weeks	17	10 (59)
GA: 27 Weeks	13	12 (92)
GA: 28 weeks	5	4 (80)
GA: 29-33 weeks	10	10 (100)
BW: <500 g	2	0 (0)
BW: 500-749 g	26	15 (58)
BW: 750-999 g	49	35 (71)

Morbidity in the neonatal unit is shown in Table III for the 50 babies who survived. Of the 23 babies with IVH, three had grade 3 and three also had grade 4. Of the babies with ROP, only four had grade 3 and two had grade 4. Thirty-seven babies had at least one episode of coagulase-negative staphylococcal septicaemia. The mean (SD, range) of duration of supplemental oxygen was 52 (34, 0-164) days and of mechanical ventilation was 21 (19, 0-77) days. These babies had a mean (SD, range) of 1.4 (1.0, 0-4) episodes of septicaemia and a mean (SD, range) of 16 (8, 1-34) transfusions of blood products.

Details of condition at time of hospital discharge are shown in Table IV. Babies were discharged at a mean (SD, range) of 95 (34, 39-203) days at a weight of 2555 (687, 1715-5574) g. Forty (54%) babies had intact survival, defined as survival without severe brain injury. Incidence of infant survival of ELBW infants at differing gestational ages and birthweights is shown in Table V. The incidence of intact survival of babies of all birthweights born < 28 weeks was 37 of 75 (49%) over this time period.

TABLE III

Incidence of neonatal morbidity in 50 surviving ELBW infants while in the NICU. Figures are number (%).

Required supplemental oxygen	47 (94)
Required mechanical ventilation	41 (82)
Developed chronic lung disease	37 (74)
Developed bronchopulmonary dysplasia	19 (38)
Required steroid therapy for CLD/BPD	27 (54)
Required oxygen at term	6 (12)
Developed intraventricular haemorrhage	23 (46)
Developed periventricular leucomalacia	5 (10)
Developed retinopathy of prematurity	28 (56)
Required cryotherapy for ROP	5 (10)
Developed cholestatic jaundice	2 (4)
Developed necrotising enterocolitis	5 (10)
Developed bacterial septicaemia	42 (84)
Developed fungal septicaemia	2 (4)

TABLE IV

Condition at hospital discharge of 50 surviving ELBW infants. Figures are number (%).

Weight < 10th centile	46 (92)
Weight < 3rd centile	31 (62)
Length < 10th centile	43 (86)
Length < 3rd centile	31 (62)
Head circumference < 10th centile	15 (30)
Head circumference < 3rd centile	4 (8)
Home with supplemental oxygen	2 (4)
Severe brain injury	10 (20)

TABLE V

Numbers (%) of surviving ELBW infants without severe neonatal brain injury when grouped into gestational age (GA) and birthweight (BW) categories.

GA: 23 weeks	0 (0)
GA: 24 weeks	4 (33)
GA: 25 weeks	7 (44)
GA: 26 weeks	5 (29)
GA: 27 weeks	11 (85)
GA: 28 weeks	4 (80)
GA: 29-33 weeks	9 (90)
BW: < 500 g	0 (0)
BW: 500-749 g	13 (50)
BW: 750-999 g	27 (55)

DISCUSSION

There are many reasons for examining closely the results of intensive care for tiny babies. We would contend that the most important is that involved physicians can accurately counsel parents who are at risk of delivering an ELBW infant. This will prevent expectations being too high, and lower the risk of letting absolute numbers of survivors become more important

than their quality of life.[14] Other reasons include audit of obstetric and neonatal practice, the provision of accurate data for follow-up studies and the relation to health care costs. The cost of producing and looking after a new pre-term survivor with modern intensive care has been estimated at £10,000-£15,000.[15] However, the emotional and physical cost to caregivers and lifelong financial cost of a severely neurologically damaged survivor must also be considered. It is also important to examine recent data from ongoing scientific and technological advances; had these babies been born in 1996 they would have been likely to have had steroid therapy for ventilator dependence at an earlier age.[16]

These results can be set in context with other published neonatal outcome data. A study of all pre-term babies born in Scotland in 1984 showed survival of 78 of 204 ELBW infants, a rate of 38%.[4] When all registered births in England and Wales in 1989 were examined, 357 of 923 babies born at BW of 500-799 g survived, a rate of 39%.[17] Both these studies were based on geographical region. In a hospital study from Melbourne, 92 of 194 ELBW infants survived in the period 1985-7, a rate of 47%.[6] Other studies have examined outcomes of babies based upon gestational age. In a tertiary referral centre in the Mersey region, 465 of 823 babies born at less than 29 weeks gestation during 1980-89 survived, a rate of 57%.[18] In the Oxford region, 164 of 342 babies born at less than 29 weeks gestation during the period 1984-86 survived, a rate of 48%.[5]

Analysis of survival figures in this study showed no survivors who were born less than 500 g birthweight or 24 weeks gestational age. Major neurodevelopmental handicap has an incidence of 50-100% in pre-term infants with grade 3-4 IVH or PVL,[7] that is, those babies defined as having severe neonatal brain injury in this study. The survival rate without severe neonatal brain injury of ELBW infants in this regional NICU in the period of 1990-92 was 0% at GA of 23 weeks or BW < 500 g, and 33% at 24 weeks GA. We and others[7] suggest that aggressive resuscitation should only be provided after mature discussion among physicians and parents of babies at the current limit of viability – that is < 500 g BW and < 24 weeks gestation. Survival of ELBW infants of < 25 weeks gestation should be closely monitored, both in terms of early and longterm outcome.[19] Longterm outcome is being monitored for the surviving ELBW infants in this study and we will report results of their neurodevelopment, growth and medical problems in early childhood.

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