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Improved survival of non-ventilated very-low-birth-weight infants at Madadeni Hospital, KwaZulu-Natal

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Most reports of survival of very-low-birth-weight (VLBW) babies focus on infants in tertiary care centres in large metropolitan areas.[1-5] Extrapolating data from major centres to peripheral hospitals is problematic because of various factors, including poor socio-economic conditions, absence of intensive/special-care facilities and equipment, and limited number of staff with knowledge and skills in neonatal care in smaller hospitals.[3] We were able to raise the survival rate (SR) from 21% to 40% following the use of low-cost measures between 2002 and 2005.

Madadeni Hospital and its 9 midwifery-run clinics provide the main neonatal services in northern KwaZulu-Natal for a population of about 1.5 million. The nursery has a capacity for 40 babies, including 10 special-care beds. Respiratory support for moderately to severely distressed babies is provided mainly by nasal continuous positive airway pressure (NCPAP). The nearest neonatal intensive care unit (NICU) is about 300 km away in Pietermaritzburg. Thus critically ill or very premature babies are frequently cared for in our nursery. This study was conducted against the backdrop described, similar to the conditions in many public hospitals in South Africa.

Methods

We aimed to determine the SR up to hospital discharge in babies weighing 500 - 1 499 g. This audit is based on very-low-birth-weight (VLBW) infants admitted to our special-care unit between 1993 and 2005. The first phase included 758 babies, studied retrospectively from 1993 to 2001. This showed that only 160 infants survived (21%).[6] Because of this dismal record we instituted a series of measures in 2002 aimed at improving the SR of VLBW infants. As hospital policy, very premature babies are discharged when they attain the weight of 2 000 g, and in this series survival rate (SR) was therefore defined as the percentage of infants living up to 2 000 g.

Results

This series comprised 1 234 VLBW babies (male/female ratio 1:1.4), representing 3.7% of all 33 423 admissions from 1993 to 2005. About 24% (*N* = 294) weighed 500 - 999 g, while the remaining 940 weighed 1 000 g or more. Multiple births occurred in 112 instances.

Antenatal care (one or more visits) was provided to 54% of the mothers. Only 14.5% (*N* = 179) of the babies were outborn, including 51 in the clinics and 50 home deliveries (Fig. 1). Babies delivered in an ambulance or private vehicle (*N* = 28) on the way to the hospital were categorised as 'en route'. The mode of delivery was vaginal in 93% of cases and by caesarean section in 7%.

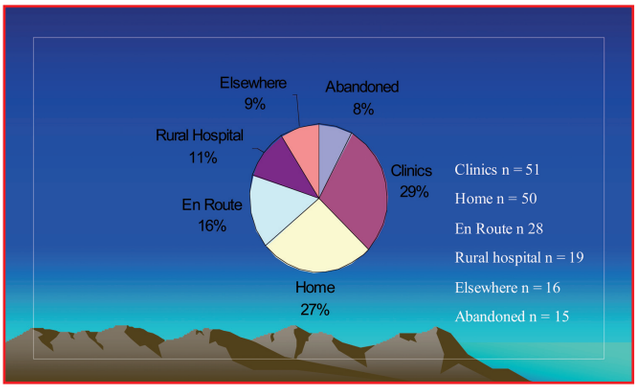

Fig. 1. Place of delivery of 179 babies.

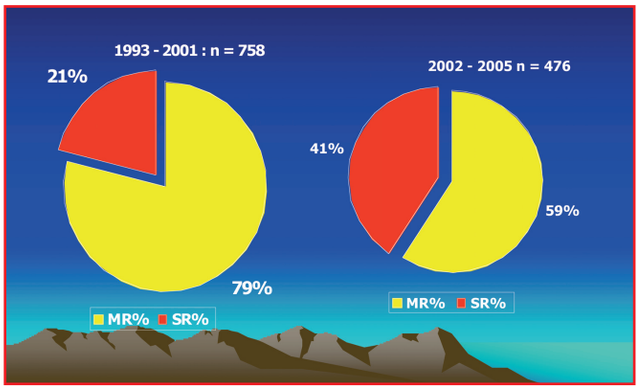

Fig. 2. Survival of very-low-birth-weight infants in the two study periods (all weights).

While we were unable to determine the number of VLBW infants exposed to HIV, the number of babies receiving nevirapine at Madadeni nursery has increased steadily; 261 440 and 976 for the years 2003, 2004 and 2005 respectively. In contrast only 4.2% of our mothers were Wassermann reaction (WR)-positive.

There was no clear association between aggressively promoted breastfeeding and the incidence of neonatal infections such as necrotising enterocolitis (NEC) in our study population.

Survivors

Only 28.7% (*N* = 354) of infants studied between 1993 and 2005 survived. The SR for the 2002 - 2005 cohort (40.8%) was much better than for the 1993 - 2001 group (21.1%) (Fig. 2.) and this was evident in all weight categories (Fig. 3). Also, the SR for the 940 babies weighing 1 000 - 1 499 g (36%) was superior to the SR for the 294 infants weighing below 1 000 g (5%). The SR was lowest in 1999 (15.1%) and highest in 2002 (56.7%) (Fig. 4). Although the SR improved after the implementation of a variety of intervention programmes in 2002, there was no consistent pattern.

Mortality

Prematurity and its complications, namely respiratory distress syndrome, immaturity, NEC and intraventricular haemorrhage (IVH) were the commonest causes of death in the 2002 - 2005 series (Table I). Immaturity refers to infants weighing below 800 g in whom other causes of death could not be identified. Perinatal asphyxia (Apgar score below 6 at 5 minutes) with or without encephalopathy, was the second commonest cause of death. Respiratory distress incorporated pneumonias and other ill-defined causes of severe rib retraction.

Hypothermia accounted for about 10% of the fatal cases. Bleeding disorders included pulmonary haemorrhage and disseminated intravascular coagulopathy. Other causes were anaemia (*N* = 6), congenital abnormalities (*N* = 3), persistent hypoglycaemia (*N* = 2) and kernicterus (*N* = 1). Nine deaths could not be classified. Also, the causes of deaths for the period 1993 - 2002 could not be established.

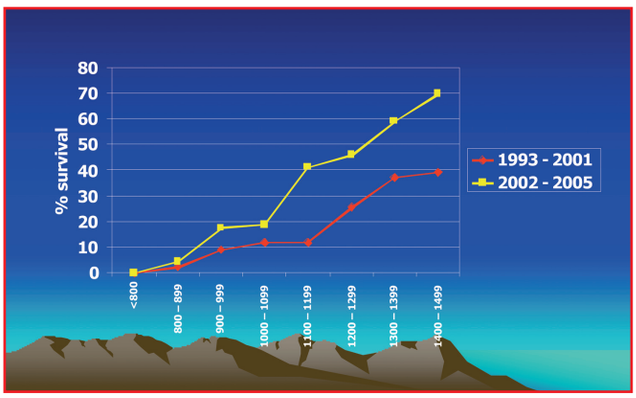

Fig. 3. Weight-specific survival rates for different time periods.

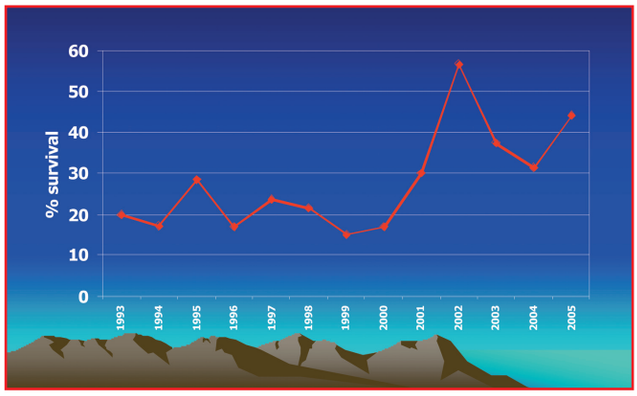

Fig. 4. Yearly survival of very-low-birth-weight infants, 1993 - 2005.

Discussion

In South Africa, three levels of neonatal care have been identified. In the private sector, babies have access to the best available technology. The second group consists of infants born in large public hospitals who also have access to all levels of care, except that infants below 1 000 g may not be ventilated because of limited resources.[2,3] The third group comprises babies delivered outside the major centres, who frequently receive only rudimentary neonatal care. This investigation determined the survival rate of VLBW infants in a level 2 nursery with sparse resources. It involved a total of 1 234 VLBW infants admitted to our nursery between 1993 and 2005. The first 758 of these babies admitted from 1993 to 2003 were analysed retrospectively. It was found that only 21% of them survived.[6] This figure contrasts sharply with the SR of about 90% in recent reports from major centres in South Africa.[3]

As such, from 2002 we put in place a number of low-cost measures aimed at improving the SR of VLBW infants. These were: (*i*) devolution of maternity services to the clinics; (*ii*) early use of nasal CPAP especially in instances of worsening respiratory distress associated with apnoea, hyaline membrane disease and meconium aspiration syndrome; (*iii*) concentration on breastfeeding; (*iv*) intermittent kangaroo mother care; (*v*) two nurses were trained in neonatal medicine – they in turn trained and supervised other nurses in supportive care including close monitoring of blood sugar, body temperature, fluids and electrolytes as well as lactation management; and (*vi*) monthly visits by a consultant neonatologist from a nearby tertiary hospital.

The period (2002 - 2005) following the implementation of these interventions resulted in a remarkable improvement in SR from 21% to 40%, with this improvement evident across all weight categories.

Our results could have been substantially better if the implementation and sustainability of the strategies adopted

TABLE I. CAUSES OF DEATH IN VERY-LOW-BIRTH-WEIGHT INFANTS, 2002 - 2005

Diagnoses	No. of cases	% of total
Prematurity-related (RDS 53, immaturity 28, NEC 22, IVH 10)	113	40.0
Perinatal asphyxia	52	18.0
Respiratory distress	35	12.0
Hypothermia	28	10.0
Sepsis	17	6.0
Disseminated intravascular coagulopathy/pulmonary haemorrhage	16	6.0
Other (including 9 unclassified)	21	8.0
Total	282	100.00

had not been hampered by many problems. These included low nurse/infant ratio, overcrowding of the patients, the scourge of HIV and the rapid rotation or departure of core nurses. It is possible that these factors further compromised the quality of care given to our patients, and thus the outcome.

The Perinatal Problem Identification Programme (PPIP) has noted that prematurity and perinatal asphyxia are the commonest causes of neonatal deaths (NND) and that substandard care is a major impediment to optimal neonatal care especially in the peripheral hospitals and clinics.[7,8] In this report, about 60% of NND were due to pematurity and asphyxia neonatorum. On the other hand, while infection was an infrequent (6%) cause of NND in our series and hypothermia featured prominently, infection accounted for 27% of deaths and hypothermia did not seem to be major factor in a recent report by Velaphi and others.[3]

The infrequency of infection in our series is probably due to underdiagnosis[8] and the pre-eminence of hypothermia relates to the fact that a majority of our ambulance personnel lack training in the thermal management of very premature babies.

While every infant needs the best start in life, the reality is that in developing countries many newborns do not have access to optimal neonatal care. Nevertheless, it is possible to reduce neonatal deaths substantially even in the absence of sophisticated technology.

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