Appropriate Technology

Care of the newborn

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The present high levels of perinatal mortality (100 per 1000 births) and maternal deaths (10 per 1000 births) in the Third World,^{1,3} might be improved—not by introducing advanced medical technology, but by implementing simple common sense measures. These stem from an assessment of the factors that contribute to high risks of mortality for the mother and her infant: obstetric and medical complications, social and cultural factors, and biological determinants such as age, parity, birth interval, and nutritional state. No one factor can be taken in isolation, and because of this modern methods of obstetrics and neonatal intensive care cannot produce the appreciable and lasting benefits that accrue from a general improvement in the nutrition and health of the whole community. Improved hygiene and prenatal care, the identification of mothers at risk, and monitoring to ensure that fetal growth is adequate are essential. At present four fifths of all births in the developing world are conducted by traditional birth attendants and there is much scope for upgrading their skills through appropriate training.⁴ In the Sudan a training programme was first established in 1921 and many nations have now developed similar programmes.^{5,6,7}

Low birth weight

Low birth weight, defined as below or equal to 2500 g remains a problem in many countries (fig 1) and is one of the most important factors in the survival and well being of the infant, not only during the neonatal period but also throughout infancy. An analysis of infant mortality in Madras found that 73% of all deaths occurred in infants with birth weights of less than 2000 g.⁸ The inter-American investigation of mortality in childhood found that immaturity was an underlying or associated cause of death in infancy for at least 20 per 1000 live births in several different geographical regions.⁹ Thus promotion of adequate fetal growth by improving the general health and nutrition of the women in the community, especially during pregnancy, is vital. Anaemia and malnutrition must be corrected; prophylactic antimalarial treatment during the last trimester of pregnancy may also improve the weight of the infant (by as much as 160-200 g) besides conferring protection on the mother.¹⁰

In many communities the wet season has been identified as a particularly difficult time for pregnant and lactating women, and studies in the Gambia and Tanzania have shown the importance of seasonal influences on fetal growth, with a reduction in birth weight during the wet seasons.^{11,12} This is because food stores are low at this time, and long hours of hard work on the land are needed. This work is traditionally carried out by women—irrespective of whether they are pregnant—and the increased

expenditure of energy coupled with scarcity of food produces excessive nutritional demands on mothers, who may well be on the borderline of malnutrition.

Infections

Neonatal tetanus is the second most important cause of death in the newborn in developing countries and it claims more victims (over 20 per 1000 births) than the current total perinatal mortality in Britain. Effective prevention may, however, be achieved by immunising the mother with tetanus toxoid in the third trimester of pregnancy. This produces an antibody response and the antibodies cross the placenta to confer protection on the fetus. Several countries are currently setting up national strategies for preventing neonatal tetanus.^{13,14}

Perinatal infection continues to be a major problem, and congenital syphilis and gonococcal ophthalmia are still encountered in the Third World. Cross infection in the newborn nursery, including eye, skin, and cord infection progressing occasionally to more generalised septicaemia, is an ever present hazard, especially when a communal bath tub or changing table is used. Mothers should be discouraged from applying anything to the cord, which is best left alone. If the child is sent home early it may be a good idea to apply the triple dye (which includes crystal violet, brilliant green, and proflavine hemisulphate) preparation as an antiseptic. Staff must be trained to provide and encourage essential measures of hygiene and basic nursing care, for such simple measures are the key to successful care of the newborn. The incidence of infection may also be reduced by encouraging breast feeding. In a recent study in the Philippines a change from routine care of the neonate in a nursery to "rooming in"—where the mother was allowed to stay permanently with the child—resulted not only in higher rates of breast feeding but also in an appreciable reduction in the incidence of sepsis and diarrhoea.¹⁵ Another simple but important provision is that of running water, soap, and a plentiful supply of towels: this is likely to be much more effective than antibiotics for preventing sepsis. When antibiotic treatment is indicated, careful monitoring of the common bacteria and their sensitivities may help in planning appropriate treatment.

Care of the newborn

At birth the baby's basic needs are to establish respiration and adequate nutrition, maintain normal body temperature, and avoid contact with infection. The object of care at birth is to ensure that these needs are met and to help the baby in making the adjustment to extrauterine life. Many of the diseases of the neonatal period arise from a failure to make this adjustment—for example, because of congenital malformations, maternal illness, or infection, physical or biochemical injury, or sepsis. Nevertheless, many problems are generated because of a failure to carry out routine normal procedures after the birth of healthy infants.

The most important first step after delivery is to establish respiration and if clearing of air passages is necessary, gravity may

FIG 1—Prevalence of infants with low birth weight by country in 1982. (Modified from the World Health Organisation Thirty-Seventh World Health Assembly. Provisional agenda item 20, 23 March 1984.)

help to drain the fluid and blood from the mouth, nose, and oropharynx. Excess mucus in the nose and mouth should be cleared with a mucus extractor, but suction must be gentle and applied briefly. Mechanical suckers in the newborn may be dangerous and are best avoided.

Apgar score

	0	1	2
Heart rate	Absent	<100/min	>100/min
Respiratory effort	Absent	Slow, regular	Good cry
Muscle tone	Limp	Some flexion of extremities	Active motion
Reflex irritability	No response	Some motion	Cry
Colour	Blue or pale	Body pink, limbs blue	Completely pink

Assessing the newborn

The newborn child should be carefully examined for the presence of any obvious congenital defects or deformities. In many traditional societies abnormal babies are considered to be "bad omens" and are at risk of being neglected or even abandoned by their parents. The most widely used method to assess the vitality of the newborn is the Apgar score taken at birth and at five minutes (table). A score below 5 means that prompt action is necessary. Certain symptoms indicate serious illness, and the nursing staff should be trained to look out for such danger signals as cyanosis, pallor, bleeding, melaena, echymoses, jaundice, convulsions, no bowel movement in first 24 hours, no urine passed in first 24 hours, apnoeic spells and respiratory difficulties, vomiting, excessive drooling, inability to feed, sclerema, and oedema.

Certain obstetric situations are commonly associated with difficulty in establishing respiration and should alert the doctor to the possible need for resuscitation. These include prolonged second stage of labour, prolonged rupture of membranes, prolapse of the cord or cord entanglement, and difficulty with delivery of the shoulders. Signs of fetal distress—meconium stained liquor and changes in heart rate (tachycardia >160/min or bradycardia of <100/min) should also prompt anticipatory action.

Resuscitation

The basic principles of resuscitation of a baby who is not breathing are as follows:

- (1) Establish and maintain airway through suction and insertion of an airway.
- (2) Ensure oxygenation (at a flow rate of 4 litres/min if administered by a funnel and 1 litre/min if via a nasal catheter).
- (3) Secure adequate ventilation by mouth to mouth respiration (rate 40/min) while occluding the oesophagus with finger pressure over the cricoid, or by Ambu bag and mask if available.
- (4) Correct acidosis if necessary (intravenous sodium bicarbonate 3 ml/kg of an 8.4% solution).
- (5) Support circulation by cardiac massage if necessary (rate 80-100 per minute).

Stimulation of the respiratory centre by analeptics (for example, nikethamide) is unnecessary and may be dangerous. If the mother has had pethidine then naloxone hydrochloride (60 micrograms/kg) by intramuscular injection is helpful. Infants who have difficulty establishing respiration will usually have difficulty in

FIG 2—Equipment for care of the newborn. (Modified from the Teaching Aids at Low Cost (TALC) set of teaching slides on care of the newborn.)

maintaining it; hence careful observation for a day or so is necessary. An apnoea alarm may be valuable in alerting the staff to take prompt action. The Draeger apnoea alarm is reliable and sturdy and requires little servicing. It costs about £150 and the pads, which need to be changed regularly are £26 each. Apnoeic spells (pauses greater than 20 seconds) or the development of a dusky colour due to poor respiratory drive often respond to theophylline 2 mg/kg every eight hours. Other causes of apnoea—for example, intracranial bleeding, patent ductus arteriosus, pneumonia, sepsis, and the respiratory distress syndrome—should be carefully looked for. If aspiration of meconium has occurred tracheal intubation and careful sucking out are necessary. A good infant laryngoscope with a MacIntosh or straight blade is essential, together with endotracheal tubes of sizes 2.5 to 5 mm.

Neonatal intensive care

The major debate in centres providing neonatal care is on the cost and effectiveness of neonatal intensive care units. It is estimated that in the United States it costs about \$1000 a day for a baby to be in intensive care, and the average stay is 23 days. The care of very small infants (<1000 g) costs proportionately more.¹⁶ Nevertheless, a neonatal unit need not be expensive, and in my view a district hospital in the Third World should have a newborn unit to provide special care for those babies that require it. The unit may also be of value for training and counselling health care workers on how to care for the newborn and how to establish and supervise simple common sense routines for handling babies who have special problems.

Improved mortality figures in the West stem from the prevention and treatment of birth asphyxia, birth trauma, hypothermia, hypoglycaemia, and hyperbilirubinaemia. Both hypoglycaemia and hyperbilirubinaemia may be prevented by early feeding with breast milk, which is now routine in many neonatal units.¹⁷ Dextrostix provide a simple way to diagnose hypoglycaemia and they should be kept in all neonatal units. (In tropical climates it is important to store them in a cool place; otherwise their life is limited.) Deaths in infants weighing 1500 g or less may be reduced by about a quarter if their body temperature is maintained above 36°C and heat loss is kept at a minimum.¹⁸ The infant is particularly vulnerable at the time of delivery because of a sudden drop in environmental temperature and evaporative heat loss from a wet skin. What is tolerably warm for an adult may still be too cold for a small newborn baby. Immediate drying of the wet skin, adequate covering, including the head, and nursing close to the mother's body for warmth should prevent hypothermia in most cases, but if the infant's body temperature does drop, bottles of warm water, radiant heaters, or even an Anglepoise lamp may help. Hypothermia is easily dealt with provided it is diagnosed promptly. A low reading rectal thermometer should be available in all neonatal units. In many Third World countries the ambient temperature is such that only minimal heating is required to keep the temperature at a satisfactory level, so most neonatal units will not need incubators, which are expensive and need frequent servicing.

Incubators should thus be reserved for those babies who are very ill or who must be nursed naked for continuous monitoring. The choice of incubator should be guided by the facilities that it offers: the best ones have a side opening, good air circulation, thermostatically controlled heat regulation, and provision for cooling by ice if necessary, and they are easy to disinfect after use. Incubators which offer too many elaborations and need frequent servicing are best avoided. The Vickers incubator is good but costs £2900 and needs regular servicing, so its use will be restricted to those teaching hospitals and referral centres which can afford it. Figure 2 illustrates the equipment that is needed for care of the newborn.

Problems in the first week

Pulmonary immaturity and ventricular haemorrhage are the leading causes of death in preterm babies during the first week of

life. The hallmark of good respiratory care in the newborn is prompt intervention before the infant's condition deteriorates to a state where full ventilatory support is necessary. Much of the improvement in neonatal mortality in the developed countries stems from prompt and effective management of asphyxia rather than from the treatment of respiratory distress syndrome.¹⁹ The danger signals are delayed onset of respiration at birth, recurrent apnoeic episodes, tachypnoea of more than 50/min in the second hour of life, and hypothermia. The principles to adopt are well established²⁰: (a) prompt and efficient resuscitation of the preterm infant to establish ventilation and to help release surfactant from the pneumocytes; (b) avoidance of hypothermia, hypoxia, and acidaemia because of their secondary effects on the synthesis of surfactant.

Any unit undertaking mechanical ventilation for the respiratory distress syndrome must have an adequate number of trained nurses, staff skilled in arterial catheterisation and administering intravenous therapy, and a reliable laboratory to carry out essential biochemical tests. In the absence of these facilities there is little point in trying to run a neonatal intensive care unit.

Several specific problems occur in certain geographic areas. G6PD deficiency as a cause of neonatal jaundice is often encountered, especially among the Chinese, in west Africa, in some Mediterranean countries, and in some ethnic groups in South East Asia. Prophylactic phototherapy is an effective way to treat neonatal jaundice if the rise in serum bilirubin concentrations is gradual. A simple icterometer may help in early selection of babies who need phototherapy, and a canopy using fluorescent lamps is easy to assemble. (It is worth remembering that an infant in an incubator near a window who is exposed to six hours of daylight receives more of the effective wave length than an infant under a light canopy for 24 hours.)

Conclusion

Programmes of care for the newborn in the developing world must focus on the problem of low birth weight, for up to a third of all newborn infants fall into this group—most of them because of inadequate growth in fetal life. Priority should be given to prevention, which may be achieved through adequate prenatal care. A knowledge of neonatal physiology and the prompt instigation of immediate care of the small infant are essential, for thorough assessment and routine treatment may do much to reduce neonatal morbidity and mortality.

References

- 1 World Health Organisation. *The prevention of perinatal morbidity and mortality*. Geneva: WHO, 1981.
- 2 World Health Organisation. *Maternal mortality. World health statistics report*. Vol 30, No 4. Geneva: WHO, 1977.
- 3 Barns TEC. Obstetrics in the third world with particular reference to field research into delivery of maternal care to the community. In: Stallworthy J, Bourne G, eds. *Recent advances in obstetrics and gynaecology*. London: Churchill Livingstone, 1979:109-36. (No 13.)
- 4 Anonymous. Why retain traditional birth attendants? *Lancet* 1983;ii:223-4.
- 5 Mangay-Maglasas A, Pizurki H, eds. *The traditional birth attendant in seven countries: case studies in utilisation and training*. Geneva: WHO, 1981.
- 6 Bella H, Ebrahim GJ. The village midwives of the Sudan. An enquiry into the availability and quality of maternity care. *J Trop Ped* 1984;30:115-8.
- 7 Verderese M de L, Turnbull LM. *The traditional birth attendant in maternal and child health and family planning*. Geneva: WHO, 1974.
- 8 Gopalan C. Effect of nutrition on pregnancy and lactation. *Bull WHO* 1962;26:203.
- 9 Puffer RR, Serrano CV. *Patterns of mortality in childhood*. Washington DC: Pan American Health Organization, 1973:81-90.
- 10 McGregor JD, Avery JG. Malaria transmission and foetal growth. *Br Med J* 1974;iii:433-6.
- 11 Rowland MGM, Paul A, Prentice AM, et al. Seasonability and the growth of infants in a Gambian village. In: Chambers R, Longhurst R, Pavey A, eds. *Seasonal dimensions to rural poverty*. London: Francis Pinter, 1981:164-74.
- 12 Bantje H. Seasonal variations in birth weight distribution in Ikwiriri Village, Tanzania. *J Trop Ped* 1983;29:50-4.
- 13 World Health Organisation. Expanded programme of immunisation. Prevention of neonatal tetanus. *Weekly Epidemiological Record* 1982;No 18:127-42.
- 14 Anonymous. Prevention of neonatal tetanus. *Lancet* 1983;ii:1253-4.
- 15 Claviano NR. Mode of feeding and its effect on infant mortality and morbidity. *J Trop Ped* 1982;28:287-93.
- 16 Pomerance JJ, Ukrainski CT, Ukso T, et al. Cost of living for infants weighing 1000 g or less at birth. *Pediatrics* 1980;61:908-10.
- 17 Davies PA, Russell H. Later progress of 100 infants weighing 1000 to 2000 g at birth fed immediately with breast milk. *Dev Med Ch Neur* 1968;10:725-35.
- 18 Hey EN. Thermal regulation in the newborn. *Br J Hosp Med* 1972;8:51-64.
- 19 Barron AJ, Tasker M, Lieberman EF, Helier VF. Impact of improved perinatal care on the causes of death. *Arch Dis Child* 1984;59:199-207.
- 20 Robertson NRC. Developments in neonatal paediatric practice. In: Hull D, ed. *Recent advances in paediatrics*—6. London and Edinburgh: Churchill Livingstone, 1981:17.