Perinatal mortality in rural India: intervention through primary health care. II Neonatal mortality.

USHA SHAH, A K PRATINIDHI, AND P V BHATLAWANDE

From the Department of Preventive and Social Medicine, B J Medical College, Pune, Maharashtra, India.

SUMMARY Early neonatal mortality is unacceptably high in most developing countries. A large majority of births in rural areas of these countries occur at home, attended by relatives or traditional birth attendants and without easy access to skilled professional care. Under these circumstances cause of death has to be based on lay descriptions of terminal events. Analysis of cause of death shows that 74% of the early neonatal deaths are amenable to intervention. Admittance to hospital of the “at risk” neonates is not practicable. Intervention through primary health care can be effective if based on scientific principles and offered through female community health workers. Objectives of domiciliary care given by these workers should be to educate and guide the mother to protect the delicate newborn from the effects of adverse environmental conditions, to ensure adequate nutrition, and to prevent infections. Interventions supporting beneficial traditional cultural practices as well as simple techniques for care of the newborn are discussed.

Survival of the newborn during the first week of life is determined by the stresses of intrauterine life and the birth process, as well as by the adjustment to a new environment, nutrition, and infection. Therefore the early neonatal period is the most hazardous period of life. Various studies of perinatal mortality, based mainly on hospital¹⁻³ or urban communities^{4,5} have considered early neonatal mortality as a component of the perinatal mortality. Some estimates have been based on analysis of vital statistics from rural field practice areas attached to medical colleges.^{5,6}

Prospective studies based on rural communities can give a more realistic idea of the extent of the problem. The causes of death based on lay reporting can suggest interventions, possible in existing rural conditions, in order to reduce early neonatal deaths.

This paper presents early neonatal deaths as observed in a prospective study of perinatal mortality in 22 villages served by the Rural Training Centre, Sirur, B J Medical College, Pune. The study was supported by the South East Asia Regional Office of WHO as a part of an intercountry study of perinatal mortality and low birth weight.

Method of study

STUDY COMMUNITY

The entire population of over 47 000 living in 22 villages served by the Rural Training Centre, Sirur

(Dist Pune, Maharashtra State), formed the community base for investigation.

All births and all perinatal deaths were studied.

DATA COLLECTION

To ensure that every pregnancy was detected and its termination reported, 20 village women between the ages of 25 and 55 were selected to be trained as community health workers. Criteria for their selection were their willingness to work, acceptability by the villagers, and ability to learn simple technical skills and keep records. Some of them were already working as traditional birth attendants (dais). These women were specially trained to be the peripheral workers to collect primary information and liaise between the villagers and health staff.

Each community health worker was supplied with A calendar giving Indian (Hindu) and corresponding English dates.

A Salter spring balance to weigh the newborn and under 5s.

CuSO₄ solutions to support Hb 8 g and 10 g, pricking needle, and denatured spirit.

Iron and folic acid tablets.

Printed registers and necessary stationery.

Each community health worker covered a population of 2500–3000. As a member of the same village community she was able to report every pregnancy termination.

Every birth and death was reported to the centre within 48 hours. This enabled the field medical officer to visit the family where a perinatal death had occurred to obtain details that would help in assessing the cause of death.

The local Indian (Hindu) calendar is based on lunar months. Each month is divided into two halves, and the villagers can specify dates relating to this calendar. Several religious rituals and fasts are observed on specific days of each half of every month. Cultural practice prevents a menstruating woman from taking part in any routine household activities and she has to remain isolated. (Anyone even accidentally touching her has to bathe immediately for purification before being allowed to participate in routine activities.) On the fourth day of the menstruation cycle, after the woman has bathed and washed her hair, she is allowed to terminate her isolation. Hence the last menstrual period is accurately remembered by the women.

Results

During the study period from August 1977 to July 1979, 3129 singleton births and 22 twin births were recorded. Of these, 85 of the singletons and five of the twin births were still born. The 67 deaths among singletons during the first week of life gave an early neonatal mortality rate (ENMR) of 22.0/1000 live births. During the same period, 15 early neonatal deaths occurred among twins giving an early neonatal mortality rate of 385 (table 1).

Table 1 *Early neonatal mortality among singleton and twin births*

<i>Births and deaths</i>	<i>Singletons</i>	<i>Twins</i>
Total babies	3129	44
Live births	3044	39
Early neonatal deaths	67	15
Neonatal deaths	106	15
ENMR/1000		
Live births	22.01	385

ENMR = Early neonatal mortality rate.

AGE AT DEATH

In the first 24 hours 33 (40%) of these 82 babies died; after the first day there was a sharp decline and then a further decline after five days. By the time they were 5 days old, 72 of the 82 babies (82%) were already dead (table 2).

CAUSE OF DEATH

In villages most deliveries are conducted by untrained birth attendants (traditional birth attendants and female relatives). During the terminal

Table 2 *Early neonatal death by age at death*

<i>Age at death</i> <i>(day)</i>	<i>Deaths</i>	
	<i>No</i>	<i>%</i>
<1	33	40.2
1	9	11.0
2	10	12.2
3	12	14.6
4	8	9.8
5	4	4.9
6-7	6	7.3
Total	82	100.0

illness the baby is hardly ever seen by a physician or even a nurse. Hence the cause of death has to be assessed by careful scrutiny of descriptions given by the mother or relatives and without the benefit of postmortem examination. The possibility of interventions to reduce neonatal mortality, therefore, has to be based on lay reporting of cause of death (table 3).

Table 3 *Early neonatal deaths by underlying cause of death*

<i>Underlying cause of death</i>	<i>Early neonatal deaths</i>	
	<i>No</i>	<i>%</i>
Low birth weight	41	50.0
Feeding problems in the newborn	12	14.6
Fetal asphyxia during labour	7	8.5
Birth injury	6	7.3
Neonatal infections	4	4.9
Congenital anomalies	4	4.9
Other respiratory problems after birth	3	3.7
Other	5	6.1
Total	82	100%

Low birth weight

Among the 3083 live births 629 (20.4%) weighed less than 2500 g, of whom 57 died within the first week of life. As in 41 of these there was no other apparent cause of death low birth weight was considered to be the underlying cause of death. In this group 39 babies were also gestationally preterm. Extreme maternal malnutrition could have been responsible for gross retardation of growth in utero in one and the effect of twinning in four babies, who weighed from 1500 g to 1600 g at 38 to 42 weeks.

Proportions of low birthweight and preterm delivery were 20% and 7% among all live births as compared with 70% and 54% among early neonatal deaths (tables 4 and 5).

Among preterm babies, the early neonatal mortality rate for those weighing under 2500 g was 38/1000 live births as compared with 25.4/1000 for those weighing 2500 g or more. The additional risk of early natal death due to low birth weight is therefore

extremely high (relative risk 15.2 and population attributable risk 87%). Thus low birth weight due to preterm delivery was the most important underlying or associated cause of death in the first week of life.

Table 4 *Distribution of live births and early neonatal deaths by birth weight*

Birth weight (g)	Live births		Early neonatal deaths	Early neonatal mortality rates
	No	%		
<1500	34	1.1	23	676.5
1500-1999	76	2.4	24	315.8
2000-2499	519	16.8	10	19.3
2500-2999	1492	48.4	19	12.7
3000-3499	764	24.8	3	3.9
≥3500	190	6.2	2	10.5
Not recorded	8	0.3	1	125.0
	3083	100.0	82	26.6

Table 5 *Distribution of live births and early neonatal deaths by gestation*

Gestation (weeks)	Live births		Early neonatal deaths	Early neonatal mortality rates
	No	%		
<37	224	7.3	44	196.4
37-41	2756	89.4	37	13.4
≥42	103	3.3	1	9.7
Total	3083	100.0	82	26.6

Feeding problems in the newborn

Feeding problems in the newborn were responsible for 12 (15%) deaths. This group included failure of lactation (4), inability to suck (4), and regurgitation/vomiting/aspiration of milk (4). Two babies were singletons and two were twins among the group where failure of lactation was present. In all these cases the babies were offered inadequate quantities of sweetened but extremely diluted milk. Deaths occurred from the fourth to seventh day of life.

In three of four babies inability to suck was due to weakness resulting from low birth weight. The fourth was a full term normal baby, who developed thrush on the fourth day. Artificial feeding could not be maintained adequately by the mothers in these cases.

Two full term normal weight babies without any other problem died due to aspiration during feeding. One baby aspirated while being breast fed and died within minutes. The second baby aspirated regurgitated milk during vomiting and died immediately. There was also a history of regurgitation of milk in two premature twins who died on the seventh day.

Fetal asphyxia during labour

Fetal asphyxia during labour was the cause of death in seven babies. One had been delivered by forceps after a prolonged labour and one had a short cord. In two cases labour was prolonged owing to uterine inertia. Reason for asphyxia in the remaining three cases could not be ascertained.

Birth injuries

Five of the six babies with birth injuries were first born, term, babies weighing from 2500 to 3500 g. All had big caput succedaneum after prolonged labour. Three babies died within a few hours of birth; one had bleeding from the mouth, two developed convulsions, and one respiratory difficulty. All these were delivered at home by untrained birth attendants.

Neonatal infections

Three babies refused feeds after establishment of breast feeding. They also developed low grade fever and died within 48 hours. Only one of them had rigidity and convulsions on the day of death. These deaths occurred on the fourth, fifth, and seventh day of life. None of the mothers has received antenatal tetanus toxoid and all were home deliveries conducted by untrained birth attendants, the cords being cut by sickles. Hence they are considered to be deaths due to neonatal septicaemia, possibly due to tetanus.

Diarrhoea of presumed infectious origin developed in a 3 day old baby, who was given prelacteal feeds of sweetened water. Death occurred within 24 hours of onset of diarrhoea.

Congenital anomalies

Four babies had external congenital anomalies. Two had anencephalus; one of them also having cleft lip and meningocoele. One baby had a leaking meningocoele, and another had an imperforate anus and absence of both eyeballs. These anomalies being incompatible with life, all the babies died within 72 hours of birth.

Respiratory problems of the newborn

All three babies in this group were delivered spontaneously at home by untrained birth attendants. The cause of respiratory distress could not be determined in the absence of postmortem examination.

Other causes

Haemorrhagic disease of newborn was seen in two cases. One baby who had to be resuscitated at birth developed haematuria and haematemesia on the third day and died within 10 minutes. The second one was a twin premature baby with a birth weight of

1500 g who developed haemorrhages and died on the fifth day.

Anuria developed on the fifth day in one baby who was born at term weighing 1500 g. Death occurred on the same day.

One of the twin babies developed convulsions on the second day and died within a few hours. The baby was premature and weighed 1500 g.

Unexpected sudden death: a full term girl weighing 3000 g at birth was found dead on the fourth day after birth. There was no problem at the time of delivery, lactation was well established, and the condition of the baby was good before death. Hence this single death was classified as sudden or cot death.

Discussion

Under the existing rural conditions in India when 70% of deliveries occur at home, mostly conducted by untrained birth attendants, and skilled obstetric care is not easily accessible, it is necessary to attempt to reduce early neonatal deaths through health education and primary health care. Analysis of cause of early neonatal death in the present study suggests that 21 out of 82 (26%) deaths were unavoidable: birth weight <1000 g (9), congenital malformations (4), respiratory distress (3), haemorrhagic disease of newborn (2), sudden death (1), anuria (1), and convulsions (1).

Among the remaining 61 (76%) deaths amenable to intervention, low birth weight (<2500 g) due to prematurity is the most common underlying cause of death. Substantial reduction in preterm deliveries is not feasible under the present conditions and available resources as the causes of preterm delivery are still obscure. Hence efforts need to be concentrated towards survival of the low birthweight baby. In the absence of easy access to medical care these efforts must necessarily consist of measures that may be carried out by a village level worker at home.

Admittance to hospital of these high risk babies is not a solution at the present time because:

(1) Neonatal nurseries are few and are located in teaching hospitals in cities not easily accessible.

(2) The risk of infection and stress of travelling in overcrowded public transport endangers the baby's life.

(3) The disruption in the family routine, especially the problem of caring for other children, makes it difficult for the parents to accept admittance to hospital.

(4) Owing to difficulties and cost of transport it is not practicable to take the baby to the hospital.

(5) Though admittance to hospital in government institutions is free, the cost of staying in the city for an extended period for the mother and an additional

member of the family is prohibitive.

When the possible advantages of admittance to hospital are weighed against the problems mentioned above domiciliary care of the at risk baby is perhaps the most practical alternative.

Objectives of domiciliary care should be to educate and guide the mother to protect the delicate baby from the effect of adverse environmental conditions, such as cold, to ensure adequate nutrition, and to prevent infection. This may be done by supporting beneficial traditional cultural practices as well as introducing new techniques feasible within the villages.

The tradition of keeping a "sigri" of burning coals under the "charpai" (a cot with wooden frame and woven rope) should help to maintain the atmospheric temperature of the room and protect against cold weather.

To ensure adequate humidity in the room in a dry climate a kettle of water may be kept on a stove.

Wrapping the baby in a clean used soft cotton saree or dhoti folded in several layers can help to maintain the body temperature of the baby.

It is a common practice to start breast feeding on the third day after delivery when lactation begins. Colostrum is considered unsuitable for the baby, hence it is often extracted and thrown away. During these first two or three days, the baby is given water, sweetened with sugar or honey, by letting him suck on a small ball of cloth soaked in it. No attempt is made to give milk during this period. Thus the baby gets no proteins at all and much lower calories than needed. Interestingly, though this method of giving sweetened water to the baby is a high potential hazard of infective diarrhoea, only one baby among the 3044 live births died of diarrhoea in the first week. Advice given to the mother to ensure adequate nutrition of the baby should be feasible and culturally acceptable. In a predominantly farming community such as the study population, it is possible to explain the need to start breast feeding within a few hours of birth by giving analogy of animals. As colostrum is thick it is believed to be difficult to digest. This resistance, however, may be countered by explaining that the thick colostrum is protection against infection and gives more nutrition in smaller quantities, which the newborn is able to suck. Such advice from the community health workers is well received.

Birth weight is hardly ever recorded in rural areas. Hence birth weight cannot be used as an indicator of risk. Instead, wherever weighing the newborn is not possible, "inability to suck at the breast" may be used as a proxy for low birth weight and all such babies should be considered as "high risk" babies for special care, guidance, and support to the mother. Such

babies need to be visited by a female primary health care worker every day to train the mother to express her own breast milk manually and feed it to the baby through a dropper. Simultaneously, the worker should encourage the mother to put the baby on the breast every day to see if he is able to feed there. Even under current village conditions 63 of 110 (57%) live born babies weighing less than 2000 g at birth could survive. Saving of this group may be improved by preventing deaths due to feeding problems of the newborn as mothers learn to ensure adequate nutrition of the baby by dropper feeding.

Since breast feeding is traditionally practised without exception, it is taken for granted that every mother knows the technique. In practice, however, one often sees the need for guidance. Care of the nipples during pregnancy and correct technique of breast feeding need to be explained by the field worker.

Burping of the baby is another useful technique not always practised by the mother and which needs to be popularised. The correct technique of breast feeding followed by burping can prevent regurgitation of feeds and deaths due to aspiration.

Primary health care to prevent birth injury, asphyxia, and neonatal infections can further improve survival of the newborn.

The tendency of untrained birth attendants to wait for unduly long periods after rupture of membranes for delivery of the baby contributes heavily to fetal asphyxia leading to either stillbirth or death in the early neonatal period.

Since 62% of deliveries are conducted by an untrained birth attendant, a female relative, or a neighbour, it is not enough to train only the traditional birth attendants. Dissemination of information about the following measures among the women of child bearing age is necessary.

(1) Transfer of the mother to an institution during delivery in case of uterine inertia or slow progress of labour after rupture of membranes.

(2) Techniques for resuscitation of the newborn.

(3) Use of a sterile instrument for cutting the cord.

A new shaving blade that is available in every village at a cost within the reach of even the poorest can serve the purpose if used after boiling. Turmeric, a common household condiment used traditionally as antiseptic for most wounds, may be used for dressing the cord. This would help to replace the undesirable and hazardous practice of applying ash or cowdung to the cord.

The traditional practice of isolating the mother and the newborn baby for 40 days either in a separate room or in a curtained off portion of a single room tenement helps to protect the baby from infections by limiting contact with family members and visitors. The universal practice of breast feeding also helps to protect the baby from infections.

Thus by disseminating information regarding simple care to protect the baby from environmental stress, maintain adequate nutrition, and prevent infections the risk to the newborn may be reduced. Female community health workers are best suited to provide guidance to the mother in managing the at risk newborn as she shares the life style of the community and is accessible at all times. She needs to be specifically trained in basic care of the newborn feasible at village level. Hence only practical interventions based on the cause of death are suggested.

Efforts of the community health worker need to be supported by the nurse midwife of the primary health centre. Her routine home visiting, however, will need to be reorganised to provide for more frequent visits to the at risk baby.

A little support as suggested, especially in preventing asphyxia, neonatal infections, and maintaining adequate nutrition till they can suck vigorously at the breast will certainly help more of these babies over the most hazardous period of their life.

References

- ¹Burron JL. Perinatal mortality and birth weight in Makassar, Indonesia. *Journal of Obstetrics and Gynaecology in the British Commonwealth* 1974; **81**: 187-95.
- ²Mitra PK, Bajpal PC, Tripathi TK, Gupta R, Kutty D. Perinatal mortality—a hospital study. *Indian Pediatr* 1973; **10**: 545-50.
- ³Menon MKK. Perinatal mortality in India. In: *Proceedings of fifth Asian conference of obstetrics and gynaecology held at Jakarta, Indonesia, 1971*. 31-8.
- ⁴Hooja V, Madhavan S, Ahmad SH, and Ghosh S. Outcome and survival of a birth cohort in a community of south Delhi. *Indian Pediatr* 1972; **9**: 495-505.
- ⁵Rao PSS, Inbaraj SC. Extent of perinatal loss in south Indian urban and rural populations. *Indian Pediatr* 1975; **12**: 221-7.
- ⁶Shah PM, Udani PM. Analysis of vital statistics from the rural community—Palghar II; perinatal, neonatal and infant mortalities. *Indian Pediatr* 1969; **6**: 651-68.