A 2-YEAR STUDY OF NEONATAL MORTALITY IN A LARGE MALAYSIAN HOSPITAL

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ABSTRACT

A 2-year study was carried out in the Maternity Hospital, Kuala Lumpur to determine the neonatal mortality rates. This Hospital functions both as the local service centre as well as the national referral centre in Malaysia. Its neonatal services, however, were equipped and manned at those below Level III perinatal centre.

During the study period 52, 877 livebirths took place in the Hospital. In 1987 and 1988 respectively, the low birthweight (<2500 gm) rates were: 112.8 and 101.9 per 1000 livebirths, very low birthweight (<1500 gm) rates: 11.1 and 8.8 per 1000 livebirths, neonatal mortality rates: 12.5 and 10.7 per 1000 livebirths and neonatal mortality risk ratio: 1.15 and 1.27.

There was significant difference in mortality rates among the Malay, Chinese and Indian babies born in this hospital: the Indians had the highest and the Chinese the lowest rates. Babies delivered by breech or lower segment Caesarean section (LSCS) also had significantly higher mortality than those delivered by other modes of delivery.

Low birthweight neonates constituted less than 45% of the total special care nursery admission but contributed to more than 70% of the total neonatal deaths. The common causes of neonatal deaths were problems of prematurity, infection, asphyxia and congenital malformations. Preterm and low birthweight neonates died primarily from problems of prematurity or infection. Term and larger neonates died mainly from asphyxia. More than 75% of the neonatal deaths occurred before 7 days of life. Improvement of antenatal care in the community and upgrading of perinatal services in this Hospital could help to lower the morbidity and mortality due to preventable causes.

Keywords : Neonatal mortality, Malaysian

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INTRODUCTION

The Maternity Hospital, Kuala Lumpur with deliveries of more than 25,000 a year served both as a service centre for the residents of Kuala Lumpur and a Level III perinatal referral centre in Malaysia. According to data obtained from the Malaysian Statistics Department, in 1986 and 1987 respectively, this hospital handled 50.8% (25,436 out of 50,083) and 52.7% (26,124 out of 49,537) of the total livebirths which took place in Kuala Lumpur. Based on the data obtained from other hospitals in Malaysia and South East Asia, this hospital had the largest number of deliveries in this part of the world during this period.

Despite the large number of deliveries it had to cope with and the expectation that it functions as a Level III perinatal centre, its neonatal services were equipped and manned at those below Level III perinatal centre[1,2]. In its neonatal special care nursery (SCN), which catered for only in-born neonates, there were only four ventilators and one cardiorespiratory monitor to cater for all the in-born neonates who required ventilatory support and/or intensive care. There were only four sets of oxygen monitors. There was no transcutaneous oxygen monitor or pulse oximeter in this nursery. The nurse to patient ratio in its intensive area was 1:4 to 1:6. There were two neonatologists in the hospital. Only the sick neonates were admitted to the SCN. Well neonates and neonates with minor problems, such as mild jaundice, were admitted to the postnatal wards.

Healthy neonates born in this hospital were usually discharged home with their mothers at the age of 6 hours and 12 hours if their mothers were multigravida and primigravida respectively. This hospital policy of early discharge was made because of shortage of beds for both mothers and babies. Upon returning home, the mother and child were to be looked after by the local Maternal and Child Health Services which provided home visits.

The objectives of this study were to determine the neonatal mortality in this hospital under the present circumstances and to identify the common causes of neonatal deaths among such a large number of Malaysian neonates.

MATERIALS AND METHODS

This is a prospective ongoing study which was commenced in the Maternity Hospital, Kuala Lumpur since May 1986. All live-born infants weighing 500 gm or more delivered at the

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hospital were included in the study.

Data of all deliveries and stillbirths occurring in the hospital, the birthweights of the babies, racial origins of their mothers and modes of deliveries were collected daily by the obstetricians and tabulated manually.

Data of all sick neonates who required SCN admission were collected by the neonatologist (NYB). Those neonates who died in the labour rooms shortly after birth were included as neonates who required SCN admission. The following data were collected from each of these neonates: date of birth, race, sex, birthweight, gestation based on Ballard's score[3], mode of delivery, Apgar scores at one and five minute of life, diagnosis, date of discharge or death, and cause of death. Shortly after admission, the data of each neonate were entered into an IBM-compatible personal computer installed in the SCN. Upon discharge or death, the case notes were reviewed and the diagnoses were keyed in. Causes of all neonatal deaths were discussed in the neonatal unit's fortnightly meeting and the final diagnosis was made based on all the data available.

Steps were taken to ensure that no data of neonates who died were missed. In the SCN, an assistant nurse helped to daily check any deaths which had occurred on the previous day in the hospital, whether in the labour rooms or the SCN. A list of the names of the babies who died was compiled daily and the case notes were kept for discussion. Babies who were transferred to other parts of the hospital, such as the general Intensive Care Unit, paediatric surgical unit or neurosurgical unit were followed up by the neonatologists till they were discharged home or died. Information on the death of each neonate was checked independently by the obstetricians and the neonatologist.

Autopsy was carried out to determine the causes of deaths whenever parental consent was obtained. Intracardiac blood culture was routinely done on all neonates who died to rule out death due to septicemia. Neonatal deaths were categorised according to a modified version of the classification by Butler and Bonham[4]. This classification was used consistently for all patients:

a) Congenital malformations

All deaths were considered to be caused by congenital malformations when the malformations were incompatible with life. In the presence of this condition, this cause of death took precedence over all other pathological abnormalities.

b) Asphyxia

This group consisted of all patients whose death was attributed to perinatal asphyxia which resulted in the manifestation of foetal distress and a neonate with poor Apgar score at birth. Deaths due to birth trauma, prolapse cord, anterpartum haemorrhage and pregnancy induced hypertension were included.

c) Problems of premature birth

This group included neonates whose death was the result of immaturity of one or more organs and their functions, such as idiopathic respiratory distress syndrome, intraventricular haemorrhage, and bronchopulmonary dysplasia. Intraventricular haemorrhage was diagnosed by ultrasound, postmortem intraventricular tap or autopsy findings. The diagnosis was made when no other dominant disease process was evident.

d) Infection

This group consisted of neonates who manifested clinical evidence suggestive of infection which was confirmed by laboratory tests before or at the time of death and when infection was not preceded by the appearance of necrotising enterocolitis. A diagnosis of septicemia was made when pathogen was cultured from the patient's blood.

e) Necrotising enterocolitis

This group consisted of neonates whose death occurred following the emergence of clinical and radiological evidence of necrotising enterocolits as was indicated by the presence of pneumatosis intestinalis, whether or not the terminal event was complicated by septicemia.

f) Miscellaneous

This group consisted of causes of deaths not already mentioned above.

The dBase III program (Ashton-Tate) was used to store the neonatal data. Thirty-five programs were written by two of us (NYB and SKC) to retrieve and analyse the data.

All data collected by the perinatal team were counter-checked by the members before presentation at the monthly hospital perinatal mortality meeting.

The Chi-square test was used to test statistical significance of categorical variables. P value of less than 0.05 was considered significant.

RESULTS

Data of neonates born between January 1987 and December 1988 are presented here. During this 2-year period 52,877

Table I. Overall Perinatal and Neonatal Data in Maternity Hospital, Kuala Lumpur, 1987-88.

	1987	1988
Total deliveries	26,481	27,182
Stillbirths	402	384
(per 1000 deliveries)	(15.2)	(14.1)
Total livebirths	26,079	26,798
Low birthweight (<2500 gm)		
No.	2,942	2, 732
(per 1000 livebirths)	(112.8)	(101.9)
Very low birthweight (<1500 gm)		
No.	289	235
(per 1000 livebirths)	(11.1)	(8.8)
Neonatal and postneonatal deaths		
No.	330	299
(per 1000 livebirths)	(12.7)	(11.2)
Early Neonatal Deaths*		
No.	263	237
(per 1000 livebirths)	(10.1)	(8.8)
Late Neonatal Deaths**		
No.	62	51
(per 1000 livebirths)	(2.4)	(1.9)
Postneonatal Deaths***		
No.	5	11
(per 1000 livebirths)	(0.2)	(0.4)
Neonatal mortality rate per 1000 livebirths	12.5	10.7
*Neonatal mortality risk ratio***	1.12	1.22
Perinatal mortality rate per 1000 deliveries	25.1	22.8

* Early neonatal death = death occurred at 0 to 6 days of life.
** Late neonatal death = death occurred at 7 to 27 days of life.
*** Postneonatal death = death occurred at >27 days of life.
**** Neonatal mortality risk ratio = Neonatal mortality rate/VLBW rate.

Table II. Racial distribution of total livebirths, neonatal and postneonatal deaths in Maternity Hospital, Kuala Lumpur, 1987-88

	Malay	Chinese	Indian	Others	Total	X^{2**}	p value
Livebirths							
1987							
No.	15,025	5,939	3,872	1,243	26,079	-	-
(%)	(57.6)	(22.8)	(14.8)	(4.8)	(100)	-	-
1988							
No.	15,063	6,570	3,640	1,325	26,798	-	-
(%)	(56.6)	(24.7)	(13.7)	(5.0)	(100)	-	-
Deaths							
1987							
No.	208	57	57	8	330		
(%)*	(1.4)	(1.0)	(1.5)	(0.6)	(1.3)	6.9	<0.05
1988							
No.	180	54	60	5	299		
(%)*	(1.2)	(0.8)	(1.6)	(0.4)	(1.1)	13.9	<0.001

(%)* : percentage of each respective racial group born in the same year.

X^{2**} : chi square test of significance of the three racial groups, Malays, Chinese and Indians.

livebirths were delivered in the hospital. Table I provides the overall perinatal and neonatal data of 1987 and 1988. 20/330 (6.1%) and 30/299 (10.0%) of the neonatal deaths in 1987 and 1988 respectively occurred in the labour rooms shortly after birth. More than 79% of all the neonatal deaths happened before 7 days of life. Autopsy was performed on only 9/330 (2.7%) and 14/299 (4.7%) of the neonatal deaths in 1987 and 1988 respectively.

The Malays constituted more than 55% of the total livebirths in the Hospital (Table II). In 1987, there was no significant difference in mortality rates between the Malays and Indians (X^2=0.11 with Yates's correction, df=1; p=0.735) while the Chinese had significantly lower mortality rates than the Malays and Indians (X^2=5.43 with Yates's correction, df=1; p=0.020 and X^2=4.92 with Yates's correction, df=1; p=0.027 respectively). In 1988, the Indian babies had significantly higher mortality rates than both the Malays and the Chinese (X^2=4.76 with Yates's correction, df=1; p=0.036 and X^2=13.75 with Yates's correction, df=1; p<0.001 respectively). When compared with the Chinese, the mortality rates of the Malay babies were significantly higher too (X^2=5.61 with Yates's correction, df=1; p=0.018).

Table III shows that babies delivered by breech, instrumentation or lower segment Caesarean section (LSCS) had two to four times higher risk of morbidity (according to their need for SCN admission) than babies delivered by spontaneous vertex delivery (X^2=1055.5, df=4; p<0.001 and X^2=989.9, df=4; p<0.001 in 1987 and 1988 respectively). However, the highest mortalities were among the neonates delivered by either breech or LSCS than those delivered by other modes of delivery (X^2=386.6, df=4; p<0.001 and X^2=315.2, df=4; p<0.001 in 1987 and 1988 respectively). Among neonates who died following breech delivery, only 7/50 (14%) in 1987 and 7/48 (14.6%) in 1988 had congenital malformations, while 16/50 (32%) in 1987 and 14/48 (29.2%) in 1988 weighed less than 1000 gm. Among the babies who died following delivery by LSCS, 11/82 (13.4%) in 1987 and 12/72 (16.7%) in 1988 had congenital malformations while 10/82 (12.2%) in 1987 and 6/72 (8.3%) in 1988 weighed less than 1000 gm. Thus, babies delivered by either breech or LSCS in this hospital had significantly high rates of mortality in 1987 and 1988 when compared with other modes of delivery even after excluding those neonates with congenital malformations (X^2=291.2. df=4; p<0.001 and X^2=229.4, df=4; p<0.001 in 1987 and 1988 respectively) or birthweight less than 1000 gm (X^2=196.0, df=4; p<0.001 and X^2=186.2, df=4; p<0.001 in 1987 and 1988 respectively).

Table III. Frequency distribution of total livebirths, SCN admission, neonatal and postneonatal deaths according to modes of delivery in the Maternity Hospital, Kuala Lumpur, 1987-88

Mode of delivery	Year	Livebirths No.	SCN admission No. (%)*	Deaths No. (%)*
SVD	1987	22,174	1,373 (6.2)	188 (0.8)
	1988	22,492	1,281 (5.7)	171 (0.8)
Breech	1987	590	172 (29.2)	50 (8.5)
	1988	674	149 (22.1)	48 (7.1)
Forceps	1987	768	88 (11.5)	7 (0.9)
	1988	758	98 (12.9)	5 (0.7)
Vacuum Extraction	1987	370	107 (28.9)	3 (0.8)
	1988	327	60 (18.3)	3 (0.9)
LSCS	1987	2,177	530 (24.3)	82 (3.8)
	1988	2,547	604 (23.7)	72 (2.8)

SCN : Special Care Nursery
SVD : spontaneous vertex delivery
LSCS : lower segment Caesarean section
(%)* : percentage of total number of babies born by each mode of delivery in the same year.

Although low birthweight (<2500 gm) and very low birthweight (VLBW) (<1500 gm) neonates constituted less than 45% of the SCN admission in both years, 77.9% and 71.6% of the total neonatal deaths in the hospital in 1987 and 1988 respectively were low birthweight neonates. In fact, Table IV shows that the lower the birthweight, the higher the mortality ($p<0.001$ in 1987 and 1988 respectively).

Table IV. Birthweight-specific neonatal morbidity and mortality in Maternity Hospital, Kuala Lumpur, 1987-88

Birthweight (gm)	1987		1988	
	Total liveborns No.	Deaths No. (%)	Total liveborns No.	Deaths No. (%)
500-999	77	66 (85.6)	58	55 (94.8)
1000-1499	212	101 (47.6)	178	78 (43.8)
1500-1999	499	54 (10.8)	489	53 (10.8)
2000-2499	2,154	36 (1.7)	2,045	28 (1.4)
2500-2999	8,158	29 (0.4)	8,071	38 (0.5)
3000-3499	10,339	26 (0.3)	11,021	34 (0.3)
3500-3999	3,925	14 (0.4)	4,185	9 (0.2)
≥ 4000	715	4 (0.6)	751	4 (0.5)

The common causes of neonatal deaths were those due to problems of prematurity, infection, asphyxia and congenital malformation (Table V). The most common causes of death among preterm and low birthweight neonates were idiopathic

Table V. Causes of Neonatal and Postneonatal Deaths in the Maternity Hospital, Kuala Lumpur, 1987-88

Causes	1987 No. (%)		1988 No. (%)	
Asphyxia and trauma	54 (16.4)		44 (14.7)	
Problems of prematurity				
RDS	56		57	
IVH	35	92 (27.9)	34	91 (30.4)
BPD	1		0	
Congenital malformation	51 (15.5)		59 (19.7)	
Infection	81 (24.5)		55 (18.4)	
Necrotising enterocolitis	16 (4.8)		10 (3.3)	
Miscellaneous	36 (10.9)		40 (13.4)	
Total	330 (100.0)		299 (100.0)	

RDS = idiopathic respiratory distress syndrome
IVH = intraventricular haemorrhage
BPD = bronchopulmonary dysplasia

respiratory distress syndrome, intraventricular haemorrhage, bacterial septicemia and necrotising enterocolitis. On the other hand, the common causes of death among the term and larger neonates (2500 gm and above) were asphyxia and congenital malformations.

Table VI shows that more than 90% of neonatal deaths due to asphyxia or problems of prematurity occurred before 7 days of life. More than 40% and 75% respectively of neonatal

Table VI. Causes of early, late and postneonatal deaths in Maternity Hospital, Kuala Lumpur, 1987-88

Cause of death	Year	Early neonatal death* No. (%)	Late neonatal death** No. (%)	Postneonatal death*** No. (%)
Asphyxia & trauma				
	1987	49 (90.7)	4 (7.4)	1 (1.9)
	1988	43 (97.7)	1 (2.3)	0 (0.0)
Problems of prematurity				
	1987	87 (94.6)	0 (0.0)	5 (5.4)
	1988	88 (96.7)	3 (3.3)	0 (0.0)
Congenital malformation				
	1987	46 (90.2)	5 (8.1)	0 (0.0)
	1988	44 (74.6)	12 (20.3)	3 (5.1)
Infection				
	1987	46 (56.8)	33 (40.7)	2 (2.5)
	1988	24 (43.6)	27 (49.1)	4 (7.3)
Necrotising enterocolitis				
	1987	4 (25.0)	11 (68.8)	1 (6.3)
	1988	2 (20.0)	4 (40.0)	4 (40.0)
Miscellaneous				
	1987	31 (86.1)	4 (11.1)	1 (2.8)
	1988	36 (90.0)	4 (10.0)	0 (0.0)

* Early neonatal death = death at 0 to 6 days of life
** Late neonatal death = death at 7 to 27 days of life
*** Post-neonatal death = death at >27 days of life

deaths due to infection and necrotising enterocolitis occurred after the 6 days of life. A considerable proportion of the neonates with birthweight between 1000 gm and 2499 gm died after 6 days of life (Table VII). The common causes of death in this group of neonates were septicemia and necrotising enterocolitis.

DISCUSSION

One of the purposes of producing this paper was to show how data could be collected under relatively difficult circumstances. The most difficult part of this ongoing project was the need to continue with the data collection inspite of our heavy clinical and teaching commitments. As this study was not sponsored

Table VII. Relationship between birthweight and age of death in the Maternity Hospital, Kuala Lumpur, 1987-88

Birthweight (gm)	Year	Age when neonate died * 0 -6 days No. (%)	7 - 27 days No. (%)	> 28 days No. (%)	Total No. (%)
<1000	1987	56	8	2	66
		(84.8)	(12.1)	(3.0)	(100)
	1988	51	3	1	55
		(92.7)	(5.5)	(1.8)	(100)
1000-1499	1987	70	28	3	101
		(69.3)	(27.7)	(3.0)	(100)
	1988	57	16	5	78
		(73.1)	(20.5)	(6.4)	(100)
1500-2499	1987	77	13	0	90
		(85.6)	(14.4)	(0.0)	(100)
	1988	53	24	4	81
		(65.4)	(29.6)	(4.9)	(100)
2500-3999	1987	56	13	0	69
		(81.2)	(18.8)	(0.0)	(100)
	1988	72	8	1	81
		(88.9)	(9.9)	(1.2)	(100)
>4000	1987	4	0	0	4
		(100)	(0.0)	(0.0)	(100)
	1988	4	0	0	4
		(100)	(0.0)	(0.0)	(100)
Total	1987	263	62	5	330
		(79.7)	(18.8)	(1.5)	(100)
	1988	237	51	11	299
		(79.3)	(17.1)	(3.7)	(100)

* in completed days

by any grant, we did not have full-time staff to help us. Ironically, it was when conditions were extremely bad in the wards, such as when there was an excessive influx of very ill neonates than we could cope with, that the determination to persist with the project was strongest. This was because we wanted to know what were the conditions that we could prevent and whether whatever measures we had undertaken had really helped to improve morbidity and mortality. It was hoped that with more data collected and presented, eventually the present conditions in the hospital could be improved to that of a Level III perinatal centre.

From the beginning, it was felt that the decision to use the computer to collect neonatal data was a wise one even though the neonatologist had to use her own money to purchase the machine. This was because with the help of the computer, we were able to analyse our data to a reasonably detailed degree. However, because the denominator database (overall hospital data) was so large and collected manually, we could not cross-analyse many of our data in as much detail as we would have liked to; such as birthweight-specific mortality and morbidity rates according to racial distribution and modes of delivery.

The dBase III program was chosen for its simplicity in data entry and retrieval as none of us, except one (CSK), had previous computing experience.

Due to religious and cultural reasons, permission obtained for autopsy was infrequent in this hospital. The causes of death assigned were based mainly on clinical evidence rather than pathological findings as was practised elsewhere[5-7]. The use of laboratory, radiological and ultrasound findings available and the routine practice of intracardiac blood culture following death had helped us to diagnose many cases of haematological, cardiac, intracranial and renal abnormalities, haemorrhage and infections. However, there was still a small group of patients, who in the absence of postmortem study, died without the causes being identified.

Although the data from this hospital were not necessarily representative of the Malaysian population, they nevertheless represented a large proportion of those in Kuala Lumpur. The results we obtained were, therefore, likely to include those at high risk.

The neonatal mortality rates and mortality risk ratios were higher in this hospital than those reported in the literature from countries with Level III perinatal centres in the 1980's[7-10]. However, in view of the fact that the Maternity Hospital, Kuala Lumpur was so understaffed and under-equipped to cope with such a large patient load which also had a high proportion of low birthweight neonates when compared with other centres[7,11,12], this difference in neonatal mortality was really not unexpected.

Our data showed that there was a significant difference in morbidity and mortality rates among the Malay, Chinese and Indian babies delivered in this hospital. Most of the Chinese mothers who utilised the facilities in this hospital were either of lower social classes or were referred here by the private obstetricians for the management of high risk pregnancies. Yet the Chinese babies had the lowest morbidity and mortality. Racial difference in neonatal mortality rates had been reported by others[13-17] although the contributing factors were not completely elucidated. Studies on Chinese population elsewhere had also noted the lower perinatal mortality among this particular race[18]. Further study is, therefore, required to identify the underlying factors which contributed to the difference in perinatal rates among the races in Malaysia.

The morbidity and mortality among babies born by breech delivery even among the larger (>999 gm) and normal babies were unacceptably high. There is a need for the obstetricians to look at the factors including techniques and indications for vaginal delivery for babies with breech presentation. Delivering all these babies by emergency LSCS may not be the ideal answer at the moment because of the high morbidity and mortality of babies born by this method. That there was only one operating theatre in this hospital to cope with all the LSCS cases was definitely an important cause for this high morbidity and mortality. Very often mothers with foetal distress had to queue for their turn to be sectioned. Our data supported the obstetricians' repeated appeals for the building of at least one more operation theatre in the hospital.

As a result of our study, working papers were submitted to the hospital authorities with recommendations to improve conditions and to reduce the preventable morbidity and mortality. Our on-going data collection also alerted us to take quick remedial actions whenever a septicemia outbreak emerged. From the data obtained, we have also identified the areas for future research in this hospital.

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