OUTCOME OF VERY LOW BIRTHWEIGHT NEONATES IN A DEVELOPING COUNTRY: EXPERIENCE FROM A LARGE MALAYSIAN MATERNITY HOSPITAL

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ABSTRACT

Between January 1989 to April 1990 (16 months), a prospective observational study was carried out on 329 consecutive very low birthweight (VLBW) ≤ 1500 grams) Malaysian neonates born in the Maternity Hospital, Kuala Lumpur before their first discharge from the hospital. The objectives of the study were to determine the common causes of early morbidity and mortality of this group of Malaysian neonates. The study shows that the incidence of Malaysian VLBW neonates was 9.9 per 1000 livebirths (95% confidence intervals 9.0 to 10.8). The mean duration of stay in the hospital was 19.3 days (SD=21.4). One hundred and ninety-six (59.6 percent) of the VLBW neonates died. They accounted for 60 percent (196/334) of all neonatal deaths in the hospital during the study period. Mortality was significantly higher in neonates of birthweight less than 1000 grams (p<0.01) and of gestation of less than 33 weeks (p<0.001). The three most common clinical problems were respiratory distress syndrome (RDS) (72.6 percent), septicemia (28.0 percent) and intraventricular haemorrhage (IVH) (21.9 percent). Death occurred in 71.1 percent of the septicemic patients. The most common causative organisms of septicemia were multiresistant klebsiella (52.3 percent) and multiresistant acinetobacter (14.7 percent). RDS (33.2 percent), septicemia (29.6%) and IVH (17.9 percent) were the three most common causes of death. Improvement in the nursing staff situation and basic neonatal care facilities in this hospital and prevention of premature delivery could help to decrease morbidity and mortality in this group of neonates.

Keywords: Very low birthweight neonates, Malaysian, Outcome.

SINGAPORE MED J 1992; Vol 33: 33-37

INTRODUCTION

In the last four decades, with advances in knowledge and technology of care of sick neonates, the mortality and morbidity of the very low birthweight (VLBW) ≤1500 grams) neonates in the developed countries have decreased markedly[1-12]. In the developing countries, although the overall, as well as the VLBW, neonatal mortality rates have decreased to a certain extent, these mortality rates are generally still very high[13-14].

In the Kuala Lumpur Maternity Hospital in Malaysia, the mortality of the VLBW neonates in the last 10 years has remained between 50% to 60% of the total VLBW livebirths. Deaths of VLBW neonates contributed to 40 to 55 percent of all neonatal deaths although VLBW neonates accounted for less than 1 percent of the total livebriths. Data from the Malaysian Statistics Department show that this hospital handles about 55 percent of the annual deliveries in Kuala Lumpur. This hospital acts both as the national referral centre in Malaysia and a service hospital for the residents of Kuala Lumpur. It currently has an annual livebirths of around 25,000 (Fig 1).

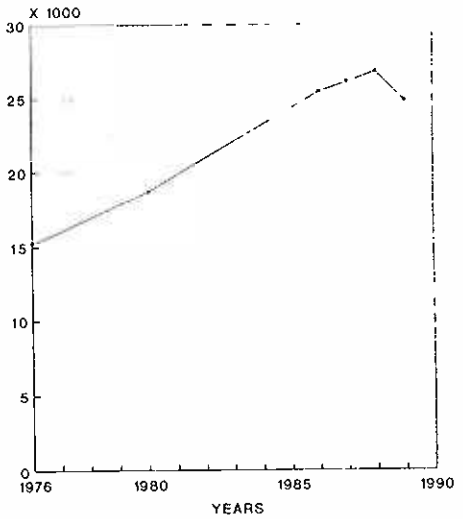
The objectives of this study were to determine the common causes of morbidity and mortality of Malaysian VLBW neonates born in this hospital. The ultimate objective was to identify areas of priority for improvement while awaiting all round upgrading of facilities to cope with the increasing number of deliveries.

METHODS

As part of an on-going project in perinatal data collection, the basic data of all VLBW neonates born in this hospital were entered into a personal computer soon after the baby's birth. The patient's case records were reviewed and the final diagnoses were keyed in after death or discharge. Gestation assessment was based on the Ballard's scores[15].

The criteria for diagnosing the different clinical conditions are as follows: respiratory distress syndrome (RDS) (clinical and radiological evidence after other causes of respiratory distress had been excluded); intraventricular haemorrhage (IVH) (ultrasound evidence or clinical findings of increasing pallor and bulging anterior fontanelle, or lumbar puncture yielded uniformly blood-stained cerebral spinal fluid); septicemia (clinical evidence of infection which was confirmed by positive blood culture); necrotising enterocolitis (based on the criteria of Bell's)[16]; bronchopulmonary dysplasia (BPD) (based on the criteria of Tooley)[17]; congenital rubella syndrome (positive rubella specific IgM in the serum); congenital syphilis (positive IgM-FTA-ABS test of serum). Necrotising enterocolitis was considered to be the cause of death when death occurred following the emergence of clinical and radio-

Fig 1 - Annual Livebirths in the Maternity Hospital, Kuala Lumpur



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logical evidence of this condition whether or not the terminal event was complicated by septicemia. All deaths were considered to be caused by congenital malformations when the malformations were incompatible with life. Asphyxia was diagnosed to be the cause of death when there was history of perinatal asphyxia which resulted in the manifestation of foetal distress and low Apgar score (less than 6 at 1 or 5 minutes). Thus deaths due to birth trauma, prolapsed umbilical cords, antepartum haemorrhage and pregnancy-induced hypertension were included in this category. Age of onset of septicemia was defined as the age when the baby first manifested signs suggestive of sepsis which was confirmed by positive blood culture taken on the same day of onset. Septicemia was the cause of death when intracardiac blood culture at the time of death yielded positive results in the presence of clinical signs after exclusion of necrotising enterocolitis as the predisposing cause.

The data of VLBW livebirths born between 1st January 1989 and 30th April 1990 (16 months) in this hospital are presented here. Survival was recorded for infants who were discharged home.

Chi-square test was used for analysis of all categorical variables. P values of less than 0.05 are considered to be significant.

RESULTS

During the study period, 33,241 livebirths were delivered in this hospital. There were 329 VLBW neonates (9.9 per 1000 livebirths, 95% confidence intervals 9.0 to 10.8). 95.7 percent (315/329) of the VLBW were of preterm gestation (less than 37 weeks). Two hundred and eighty-nine (87.8 percent) of the VLBW neonates were singletons while 40 (12.2 percent) were products of twin pregnancy.

VLBW neonates occurred most commonly in Indian babies. The incidence of VLBW neonates in Indians was significantly higher than the Chinese (χ^2 = 6.77, p<0.01), but not significantly higher than the Malays (χ^2 = 1.93, p=0.17). There was no significant difference in incidence of VLBW between the Malays and Chinese (χ^2 = 3.38, p=0.07) (Table I).

Table I - Incidence of VLBW in Malaysian Neonates According to Ethnic Distribution

Ethnic groups	Total livebirths in Hospital	Very Low Birthweight Neonates		
	no.	no.	(%)	95% confidence intervals
Malays	20,089	214	(1.1)	0.9% to 2.0%
Chinese	5,987	47	(0.8)	0.6% to 1.0%
Indians	4,471	59	(1.3)	1.0% to 1.7%
Others	2,694	9	(0.3)	0.1% to 0.5%

The mean duration of stay of the VLBW neonates in the hospital was 19.3 days (sd = 21.4 days, range = 1-127 days). One hundred and ninety six (59.6 percent) of the VLBW neonates died. They accounted for 60 percent (196/334) of all the neonatal deaths in this hospital during the study period. Fig 2 to 5 show the frequency distribution of the basic characteristics and mortality of the VLBW neonates. Mortality of the neonates with birthweight of less than 1000 grams was significantly higher than those with birthweight between 1000 to 1190 grams (p<0.001), and the mortality of this latter group was significantly higher than those with birthweight of 1200 grams and above (p<0.01). Babies with gestation of less than 33 weeks had significantly higher mortality than the more mature neonates (p<0.01). However, there was no significant difference in the mortality rates between neonates of gestation of 33 to 34 weeks and those of gestation of more than 34 weeks (p=0.75).

Fig 2 - Frequency Distribution of VLBW babies according to ethnic origins

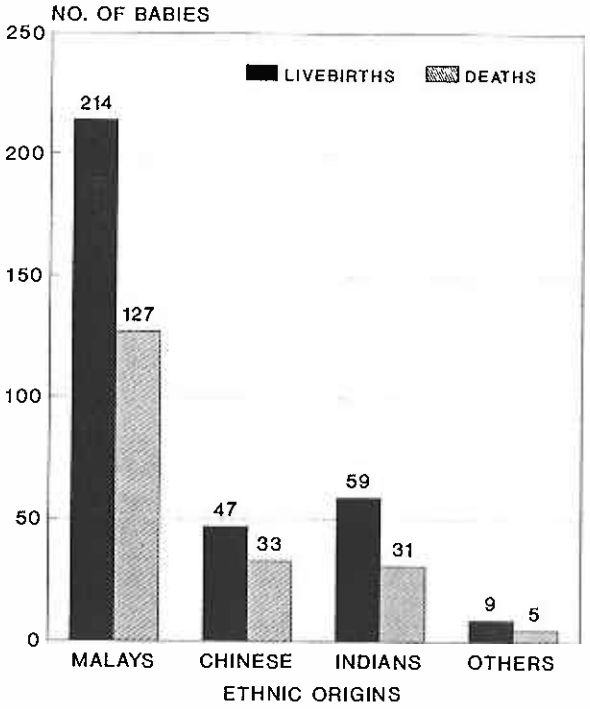
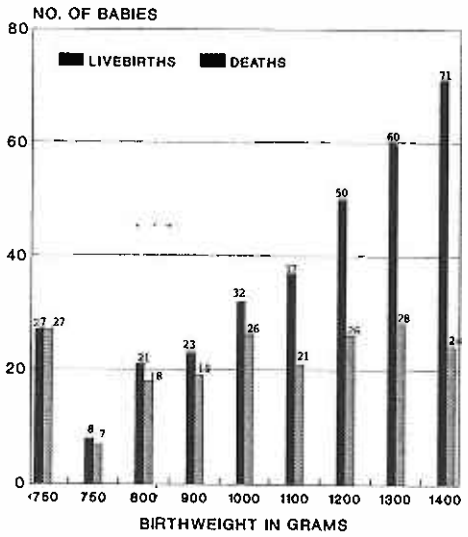


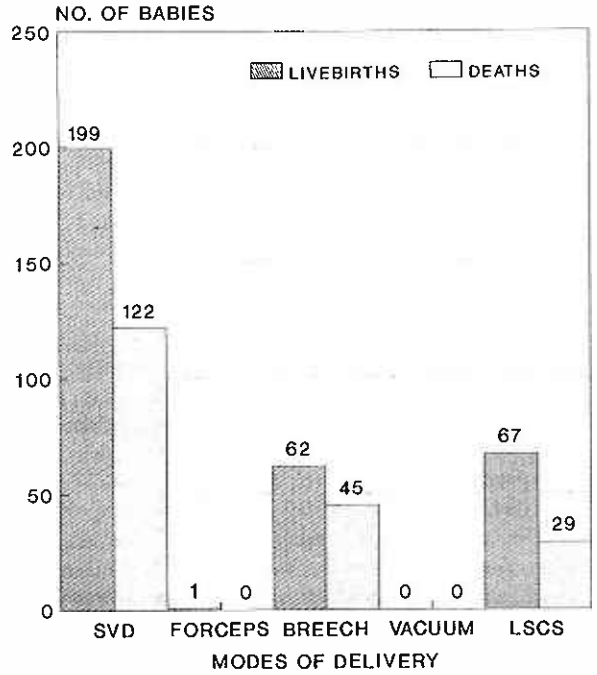
Fig 3 - Birthweight Distribution of VLBW babies



The most common types of clinical problems affecting the VLBW neonates were: RDS, septicemia and IVH (Table II). There were 159 neonates who required respiratory support either because of severe respiratory distress syndrome or apnea. Ventilatory support was given to 127 (79.9 percent) of them while 32/159 (20.1 percent) of them were not ventilated because there was no extra ventilator available in the hospital at the time when they required it.

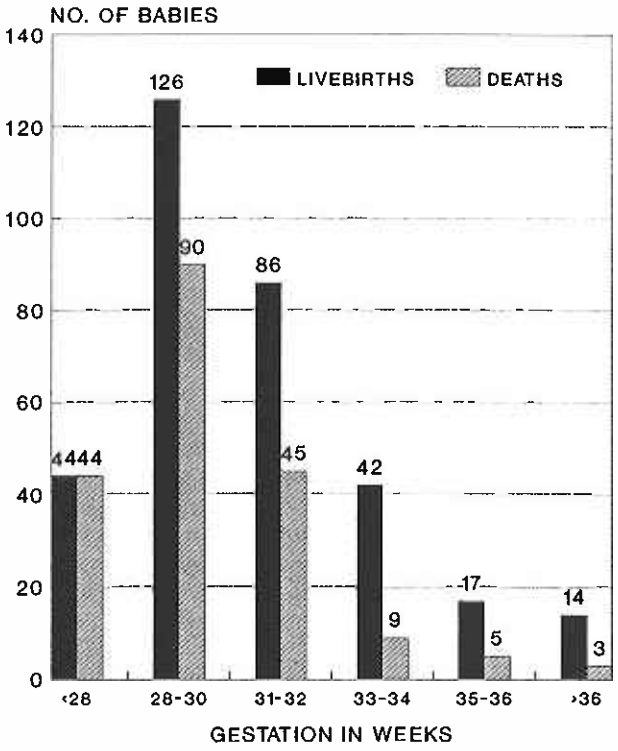
Most of the neonatal deaths occurred during the first week of life (Fig 6). The three most common causes of death were RDS (33.2 percent, 95% confidence intervals 26.6 to 39.8), septicemia (29.6 percent, 95% confidence intervals 23.3 to 36.0) and IVH (17.9 percent, 95% confidence intervals 12.5 to 23.2) (Table III).

Fig 4 - Gestation Distribution of VLBW babies



SVD - SPONTANEOUS VERTEX DELIVERY
LSCS - LOWER SEGMENT CAESAREAN SECTION

Fig 5 - Modes of Delivery of VLBW babies



Sixty-six (71.7 percent, 95% confidence intervals 62.5 to 80.9) of the 92 neonates with septicemia died (Table IV). Majority (82/92 or 89.1 percent) of these neonates were of birthweight 1000 grams and above. Seventy-six (82.6 percent) of them were of gestation beween 28 to 33 weeks. Eighty-four (91.3 percent) developed septicemia from the third day of life onwards. The most common causative organisms were multiresistant Klebsiella (52.3 percent) and multiresistant Acinetobacter (14.7 percent). Thirteen (14.1 percent) of the 92 septicemic neonates had more than one episode of septicemia of different organisms and 10/13 (76.9 percent) of them died.

Fig 6 - Age of death of VLBW babies in the Maternity Hospital, Kuala Lumpur

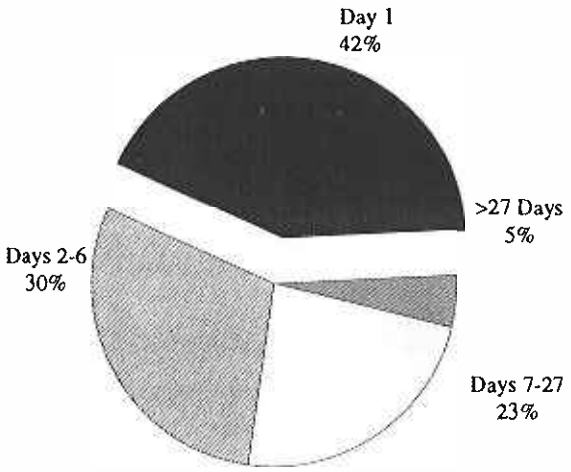


Table II - Clinical Diagnosis of the Very Low Birthweight Neonates in the Maternity Hospital Kuala Lumpur between January 1989 to April 1990

Diagnosis	No.	(%)	95% confidence Intervals
Respiratory distress syndrome	239	(72.6)	(67.8 to 77.5)
Intraventricular haemorrhage	72	(21.9)	(16.4 to 26.3)
Pulmonary haemorrhage	20	(6.1)	
Bronchopulmonary dysplasia	1	(0.3)	
Wilson Mikity syndrome	1	(0.3)	
Neonatal Infection			
Septicemia	92	(28.0)	(23.1 to 32.5)
Pneumonia	21	(6.4)	
Meningitis	1	(0.3)	
Intrauterine infection			
Congenital rubella syndrome	3	(0.9)	
Congenital Syphilis	2	(0.6)	
Necrotising enterocolitis	14	(4.3)	
Hepatitis	4	(1.2)	
Birth Asphyxia	3	(0.9)	
Pneumothorax	4	(1.2)	
Persistent Ductus Arteriosus	8	(2.4)	
Multiple congenital malformations	9	(2.7)	
Chromosomal abnormalities	3	(0.9)	
Anencephaly	2	(0.6)	

Table III - Causes of Deaths of the Very Low Birthweight Neonates born in the Maternity Hospital, Kuala Lumpur between January 1989 to April 1990

Causes of death	No.	(%)
Problems of prematurity		
Respiratory distress syndrome	65	(33.2)
Intraventricular haemorrhage	35	(17.9)
Bronchopulmonary dysplasia	1	(0.5)
Pulmonary haemorrhage	5	(2.5)
Necrotising enterocolitis	6	(3.1)
Septicemia	58	(29.6)
Congenital rubella syndrome	1	(0.5)
Birth asphyxia	3	(1.5)
Malformations		
Anencephaly	2	
Multiple malformations	8	(6.6)
Others	3	
Miscellaneous	9	(4.6)
Total	196	(100.0)

DISCUSSION

This study shows that the incidence and mortality of VLBW Malaysian neonates are generally higher than those in the developed countries in the late 1970's and early 1980's (Table V)[4,6,11,18-21]. Although the incidence of the Malaysian VLBW neonates also varied with the ethnic origins of the population as was reported by others[22,23], the difference in mortality rates between the Malaysian VLBW neonates and those born in the developed country could not be due primarily to racial factor.

Table IV - Clinical characteristics of Very Low Birthweight (VLBW) Neonates with Septicemia in the Maternity Hospital, Kuala Lumpur between 1st January 1989 to 30th April 1990

	VLBW neonates with septicemia			
	Total no.		Deaths no.	(%)
Birthweight in grams				
< 1000	10		10	(100.0)
1000-1249	33		26	(78.8)
1250-1499	49		30	(61.2)
Gestation in weeks				
24-27	3		3	(100.0)
28-30	40		32	(80.0)
31-33	36		23	(63.9)
34-36	9		5	(55.6)
>36	4		3	(75.0)
Age of onset of first septicemia in days				
1-2	8		5	(62.5)
3-7	39		29	(74.4)
>7	45		32	(71.1)
Causative Organisms				
Group B Streptococci	2	(1.8)	2	(100.0)
Staphylococcus epidermidis	7	(6.4)	4	(57.1)
Klebsiella	57	(52.3)	46	(80.7)
Proteus	1	(0.9)	0	(0.0)
Acinetobacter	16	(14.7)	8	(50.0)
Pseudomonas sp.	4	(3.7)	1	(25.0)
Enterobacter	7	(6.4)	4	(57.1)
Escherichia coli	9	(8.3)	6	(66.7)
Candida albicans	6	(5.5)	5	(83.3)

Table V - Comparison of Incidence and Mortality of Very Low Birthweight (VLBW) Malaysian Neonates with those from the Developed Countries

Country or Region	Year of study	Incidence of VLBW neonates (per 1000 livebirths)	Mortality in percentage of total no. of VLBW neonates
Malaysia (this study)	1989-90	9.9	59.6
Australia[4]	1977-80	-	26.0
U.S.A. Canada[6]	1983-84	-	15.0
England Texas[18]	1978-82	15.0	41.2
Canada[19]	1980-81	7.3	42.7
Avon, Britain[20]	1976-79	7.0	37.5
Netherlands[21]	1983	6.4	25.6

The results of this study show that the factors which were associated with higher mortality in the Malaysian VLBW neonates included: extremely low birthweight (≤ 1000 grams), gestation age of less than 33 weeks, RDS, IVH and septicemia. It is disturbing to find that septicemia affected more than 25 percent of the Malaysian VLBW neonates and close to three-quarters of them died in this hospital. Nosocomial septicemia was the most common problem because 67 percent of the septicemia was either due to multiresistant Klebsiella or Acinetobacter species. Furthermore, most of the babies infected were the larger (>999 grams) and/or more mature neonates (28 to 33 weeks). This means that if the recurrent outbreaks of infection in the Special Care Nursery (SCN) had been prevented from occurring, more Malaysian VLBW neonates would have survived. Outbreaks of infection in this SCN occurred whenever there was an influx of sick neonates with resultant overcrowding. Prevention of overcrowding, adequate nursing care and hand washing facilities are of paramount importance in the prevention of septicemia outbreaks in the SCN[24]. Thus, in the developed countries, with improvement of neonatal care facilities in recent years, septicemia is no longer a common cause of morbidity and mortality among VLBW neonates[18,25]. In our hospital, there was some improvement in the hand-washing facilities in the SCN recently. However, the problems of shortage of nursing staff and overcrowding remain. This hospital was built 25 years ago to cater for annual deliveries of 10,000. The existing facilities and manpower in this hospital are very strained to cope with the present large number of deliveries. An average of 8 to 10 percent of neonates born in the hospital require admission to its SCN. Furthermore, between 55 to 60 percent of the sick neonates admitted to the SCN are of normal birthweight (2500 grams or more). Consequently, the VLBW neonates born in this hospital have to compete with the bigger babies for the limited number of intensive care beds (total number of 5) in the SCN which is manned by a very limited number of nursing staff. In 1990, for instance, there were only three to five staff nurses per 8-hour-shift for the whole nursery which on the average had between 45 to 65 babies at any one time. There was also a constant shortage of incubators with the consequence that, sometimes, up to 30 percent of the VLBW neonates in the SCN were nursed in cots. There were only three radiant warmers in the ward to help keep the hypothermic neonates warm.

Based on the results of this study, in order to reduce the morbidity and mortality of the VLBW neonates in this hospital, factors which aggravate the common problems of prematurity (namely: RDS, IVH and septicemia) should be urgently minimised. The steps required urgently to reduce these problems should include improvement in the staffing situation and existing facilities for basic neonatal care (such as provision of adequate number of incubators and linens to keep babies warm) as well as facilities for the neonatal intensive care. Under the present circumstances in the SCN, the best way to reduce the high morbidity and mortality rates among the VLBW neonates in the hospital is to prevent premature delivery of the VLBW neonates till 33 weeks gestation when survivals are much higher[26].

ACKNOWLEDGEMENT

I would like to thank Professor B A K Khalid, the Dean of the Faculty of Medicine, National University of Malaysia for giving me permission to publish the data.

REFERENCES

1. Stewart AL, Reynolds EOR, Lipscomb AP. Outcome for infants of very low birthweight: survey of world literature. Lancet 1981; i: 1038-40.

2. Koops BL, Morgan LJ, Battaglia FC. Neonatal mortality risk in relation to birthweight and gestational age: Update. J Pediatr 1982; 101: 969-97.
3. Kitchen WH, Yu VYH, Lissenden JV, Bajuk B. Collaborative study of very-low-birthweight infants: techniques of perinatal care and mortality. Lancet 1982; i : 1454-7.
4. Philip AGS, Little GA, Polivy DR, Lucey JF. Neonatal mortality risk for the eighties: the importance of birth weight/gestational age groups. Paediatrics 1981; 68:122-30.
5. Yu VYH, Watkins A, Bajuk B. Neonatal and postneonatal mortality in very low birthweight infants. Arch Dis Child 1984; 59:987-9.
6. Kraybill EN, Kennedy CA, Teplin SW, Campbell SK. Infants with birth weights less than 1001 g: Survival, growth and development. Am J Dis Child 1984; 138:837-42.
7. Horbar JD, McAuliffe TL, Adler SM et al. Variability in 28-day outcomes for very low birth weight infants: an analysis of 11 neonatal intensive care units. Paediatrics 1988; 82:554-9.
8. Hack M, Fanaroff AA. Outcomes of extremely-low-birth-weight infants between 1982 and 1988. N Engl J Med 1989; 321: 1642-7.
9. Wood B, Katz V, Bose C, Goolsby R, Kraybill E. Survival and morbidity of extremely premature infants based on obstetric assessment of gestational age. Obstet Gynecol 1989; 74:889-92.
10. Svenningsen NW, Stjernoqvist K, Stavenow S, Hellstrom-Westas L. Neonatal outcome of extremely small low birthweight liveborn infants below 901 g in a Swedish population. Acta Paediatr Scand 1989; 78:180-8.
11. Ehrenhaft PM, Wagner JL, Herdman RC. Changing prognosis for very low birth weight infants. Obstet Gynecol 1989;74:528-35.
12. Tsoumaka-Bakoula C, Lekea-Karanika V,Matsaniotis NS, McCarthy BJ, Golding J. Birthweight specific perinatal mortality in Greece. Acta Paediatr Scand 1990; 79:47-51,
13. Siregar H, Hasibuan B, Raid N, Siregar Z. Perinatal mortality and morbidity at Dr Pirngadi Hospital Medan, Indonesia. J Singapore Paediatr Soc 1987; 29:61-5.
14. Wong HB. Overview of the problems of small birth weight babies in Singapore. J Singapore Paediatr Soc 1986; 28:104-11.
15. Ballard JL, Novak KK, Driver M. A simplified score for assessment of fetal maturation in newly born infants. J Pediatr 1979; 95:769-74.
16. Bell MJ, Temberg JL, Feigin RD et al. Neonatal necrotising enterocolitis: therapeutic decision based upon clinical staging. Ann Surg 1978; 187:1-7.
17. Tooley WH. Epidemiology of bronchopulmonary dysplasia. J Pediatr 1979; 95:851-8.
18. Brans YW, Escobedo MB, Hayashi RH, Huff RW, Kagan-Hallet KS, Ramamurthy RS. Perinatal mortality in a large perinatal center: five-year review of 31,000 births. Am J Obstet Gynecol 1984; 148: 284-9.
19. Johnson MA, Cox M, McKim E. Outcome of infants of very low birth weight: a geographically based study. Can Med Assoc J 1987; 136:1157-65.
20. Mutch LMM, Brown NJ, Speidel BD, Dunn PM. Perinatal mortality and neonatal survival in Avon: 1976-9. Br Med J 1981; 282:119-22.
21. Verloove-Vanhorick SP, Verwey RA, Brand R, Gravenhorst JB, Keirse MJNC, Ruys JH. Neonatal mortality risk in relation to gestational age and birthweight. Results of a national survey of preterm and very-low-birthweight infants in the Netherlands. Lancet 1986; i:55-7.
22. Low Birthweight - United States, 1975-1987. JAMA 1990; 263:1904.
23. Fung KP, Lau SP. An analysis of perinatal mortality statistics of Hong Kong and China. J Singapore Paediatr Soc 1987; 29:55-7.
24. Lubart S, D'Apolito K. Overview of nursing practice. In: Avery GB, ed. Neonatology, pathophysiology and management of the newborn. J B, Lippincott Co., Philadelphia, 1987: 67-83.
25. Hoskins EM, Elliot E, Shennan AT, Skidmore MB, Keith E. Outcome of very low-birth weight infants born at a perinatal center. Am J Obstet Gynecol 1983; 145:135-40.
26. Goldenberg RL, Nelson KG, Davis RO, Koski J. Delay in delivery: Influence of gestational age and the duration of delay on perinatal outcome. Obstet Gynecol 1984; 64:480-4.

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