Causes of Neonatal Deaths at Patan Hospital

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Abstract

Introduction	Neonatal mortality rate (NMR) is an important health indicator. South Asia being the most highly populated region has the highest number of neonatal deaths. Over the years gradual decrease in the (NMR) has been observed at Patan Hospital.
Objectives	This study was to analyze the causes of early and late neonatal deaths at Patan Hospital and to compare our results with other studies and literature figures.
Methods	Retrospective hospital based study. The data was collected from the monthly perinatal audit reports and the patient record files of two years.
Results	During the two-year period (15/1/2000- 13/1/2002) there was total number of 12456 deliveries at Patan Hospital. The Early and Late neonatal mortality rates for this period were 7.85 and 1.62/1000 live births respectively. The most common causes of Early neonatal deaths were respiratory distress syndrome (30%), Infections (25%), congenital abnormalities (16%) and perinatal asphyxia (13%). Among the causes of Late neonatal deaths sepsis was on the top (55%) followed by necrotising enterocolitis (15%). We had very few positive blood cultures in early neonatal deaths due to sepsis and pneumonia (12.5%) while in late onset neonatal deaths due to sepsis blood culture was positive in 54.5% cases.
Conclusion	A large proportion of neonatal deaths is still due to infectious etiology and it affects mainly the premature and low birth weight babies. Among the deaths due to culture positive sepsis gram-negative organisms top the list and a significant number of blood culture positive late onset neonatal sepsis are of fulminant nature.

Keywords Neonatal mortality rate, Retrospective hospital based study, Patan Hospital

Introduction

Neonatal mortality rate (NMR) is an important health indicator. Africa has the highest NMR but South Asia being the most highly populated region has the highest number of neonatal deaths. There have been various efforts locally and globally to decrease the rate of neonatal deaths. In 1996 Nepal had NMR of 63/1000 live births (Nepal Family health survey report 1996) which over a 5 year period has come down to 38.6/1000 live births (Nepal Family health survey reports 2001).

Patan Hospital is one of the city hospitals at Kathmandu where over 500 deliveries per month are being conducted and we have a level II neonatal nursery. The number of deliveries is increasing day by day. Over the years gradual decrease in the Neonatal mortality rate has been observed at Patan Hospital.

Materials and Methods

This is a two-year retrospective hospital based study between 15/1/2000 to 13/1/2002 (Magh 2056 to Poush 2058). The data was collected from the monthly perinatal audit reports and the patient record files. The history, clinical findings and the investigation results were reviewed and tried to identify the most likely cause of death in each case. Neonatal deaths within the first seven days of life were labeled as early neonatal deaths (END) and those between seven to twenty-eight days of life were labeled as late neonatal deaths (LND). All the live births beyond 28 weeks of gestation were included while those below 28 weeks were included if they survived the initial 4 hours of births.

Results

The total number of deliveries during the study period was12456and the average per month was 520. There were 12341 live births and 115 stillbirths. The early and late neonatal mortality rates were 7.85/1000 and 1.62/1000 live births respectively.

Upon analyzing the causes of neonatal deaths, the most common cause of END was found to be

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respiratory distress syndrome (most likely due to hyaline membrane disease) attributing to 29.89% followed by infections (sepsis and congenital pneumonia) 24.74%, congenital malformations (16.49%) and perinatal asphyxia (13.4%).

Table I: Causes of Early Neonatal Deaths

Causes of Early neonatal deaths	Number	Percentage
Respiratory distress syndrome (HMD)	29	29.89
Sepsis	15	15.46
Congenital pneumonia	9	9.2
Congenital anomalies	16	16.49
Perinatal asphyxia	13	13.4
Meconium aspiration syndrome	5	5.15
Apnea of prematurity	2	2.06
Necrotisig enterocolitis	2	2.06
Severe hypothermia	1	1.03
Hypovolumic shock due to internal bleed	1	1.03
Severe hemolytic anaemia (non- iso-immune)	1	1.03
Recurrent seizures with? intracranial bleed	1	1.03
Meconium peritonitis	1	1.03
Unknown	1	1.03

Most cases of deaths due to respiratory distress syndrome (RDS) was found in babies born between 28-30 weeks of gestation. Of all the deaths due to RSD 85.71% died within the first 24 hours.

Early neonatal deaths due to sepsis were seen mostly in premature babies (<37 completed weeks of gestation) and low birth weight babies (<2.5Kg). Out of 15 END due to sepsis 11(73.33 %) were premature and 10 (66.66%) were low birth weight babies. One of them was born to HIV positive mother

Out of the15 babies 10 (66.66%) died by day four and only 5 deaths (33.33%) were between 5 and 7 days. There were 3 deaths within the first 48 hours with two babies having premature rupture of membranes for >72 hours (one mother received only one dose of penicillin prophylaxis while another had none) and one had maternal chorioamnionitis with the babies blood culture growing Proteus species. There were only 4 positive blood cultures (26.66%) and all but one were gram negative organisms. They were Proteus, Enterobacter, klebsiella and one was coagulase negative staphylococcus. A few blood cultures grew Bacillus species and micrococcus, which were considered as contaminants. Eight out of 15 babies (53.33%) had some infiltrates on chest X-ray. Cerebrospinal fluid (CSF) studies were done on only 5 babies and all were normal with negative cultures. Some babies requiring CSF study were too sick and the procedure had to be held. Total and differential leucocytes counts were within the normal range for age except in two cases with counts below 6000 and one case of high count of 34.6 thousands with 15% stabs.

There were 9 END due to severe congenital pneumonia. Seven out of 9 (77.77 %) were full term normal weight babies and more than two third (7/9) babies died within the first 48 hours. Three out of 9 (33.33%) had pneumothorax along with lung infiltrates. None of the blood cultures were positive.

We had 16 deaths due to severe congenital abnormalities or malformations. Nine out of 16 babies were born full term while 11(68.75 %) were small for dates. There were six cases of recognizable patterns of abnormality and they were: two cases of polycystic kidney disease, and one case each of conjoint twin, Patau syndrome, thanatophoric dwarf and omphalocoel.. The rest had multiple abnormalities and syndromic features but not clearly fitting into any of the recognizable syndromes.

There were 13 deaths due to perinatal asphyxia. Ten out of these 13 (76.92%) were full term babies and 9 (69.23%) babies weighed >2500gms. Most (9 out of 13) were spontaneous vaginal deliveries (SVD). Two cases presented late in third stage of labour with moderate to thick meconium stained liquor, one presented with cord prolapse and one case of twin pregnancy presented with transverse lie and hand prolapse in the second twin, the first twin delivered at home. Another case was the mother with severe congestive heart failure being admitted in the intensive care unit who delivered prematurely at 34 weeks. In these 5 cases no obstetric interventions would have made any difference in the outcome.

Eleven out of 13 had 1 minute Apgar of 3 or less implying severe birth asphyxia according to the WHO, International Classification of Diseases-10th revision. Most deaths (69%) occurred within 48 hours.

During the study period there were 47 cases of meconium aspiration syndrome (MAS) admitted in the nursery and we had 5 (10.63%) deaths out of the 47 cases of MAS. All of these babies were full term and appropriate for dates (AFD). All had thick meconium stained liquor and underwent oropharyngeal suction after the delivery of the head. Suction through endotracheal tube (ET) was done in 4 and got thick meconium below the cords in 2. All the deaths occurred within the first 48 hours.

Table II: END due to MAS

Mode of delivery	Weight in grams	Apgar score	Intervention	Age at death (in hours)
SVD	2900	3/10; 6/10	Pharyngeal suction only	45
SVD	3350	5/10; 8/10	ET suction- No meconium	23
SVD	2950	4/10; 7/10	ET suction- No meconium	12
LSCS	3850	5/10; 6/10	ET suction X 3 -meconium	30
LSCS	3000	1/10; 5/10	ET suction X 2- meconium	6

We had 2 cases of necrotising enterocolitis (NEC) leading to END. Both were premature between 28 and 29 weeks, weighed <1500 grams and died between 5 and 7 days. Similarly we had 2 cases of END due to of apnea of prematurity. They were born at 28 and 30 weeks of gestation, weighed 1000 and 1500 grams and died on day 3 and 4 respectively.

Coming to the Late Neonatal deaths (LND) the most common cause was sepsis attributing to 55 % of LND and the next on the list was NEC accounting for 15% of LND.

Table III: Causes of Late Neonatal Deaths

Causes of Late Neonatal deaths	Number	Percentage
Neonatal Sepsis	11	55
Necrotising enterocolitis	3	15
Congenital heart disease	2	10
Apnea of prematurity	2	10
Milk aspiration	1	5
Dysmorphic child with intractable seizures	1	5

Among the LND due to sepsis 9/11 (81.81%) were premature and the most common group was between 31-32 weeks. Ten out of 11 babies weighed <2500 gms. while 7 weighed <1500 gms. So most of these babies were in the hospital for supportive care. Four (36.36%) babies had the total leucocyte count of 5000 and below while 6 (54.54%) had infiltrates on chest X-ray. Those who underwent lumbar puncture all but one had normal CSF. The one case of meningitis had negative CSF gram stain and culture. Blood culture was positive in 54.54 % (6 out of 11) cases and all of the positive cultures were drawn on day 5 and later. All were gram-negative organisms and 3out of 6 grew klebsiella but had different sensitivity pattern. One urine culture was positive for klebsiella as well. Most deaths were within 8 and 14 days. All the 6 blood culture positive cases died within 72 hours from the time of illness, of which 4 deaths were within 48 hours implying very fulminant sepsis.

Table IV: LND due to culture positive sepsis

Gestational age	Weight in grams	CBC & different	Became sick on	Died on	Blood culture
30 weeks	1150	2400 (S10,N68)	Day 9	Day 9	Enterobacter
31 weeks	1050	2600 (S8, N70)	Day 14	Day15	Klebsiella
37 weeks	1900	5200	Day 9	Day 10	Klebsiella
37 weeks	2500	8900	Day 6	Day 9	Pseudomonas
35 weeks	1570	Report not available	Day 21	Day 22	E coli
31 weeks	1650	3100 (S0, N40)	Day5	Day 8	Klebsiella

There were 3 LND due to NEC and all were premature between 28 and 29 weeks, weighing < 1500 gms. and died between 9 and 21 days. Of the 2 LND due to congenital heart disease one had cyanotic heart disease and the other had congestive heart failure with a murmur. As echocardiography wasn't performed definitive structural diagnosis is not clear.

Discussion

Respiratory distress syndrome (HMD) was found to be the most common cause of END in our series. With the level II nursery to have the HMD deaths almost comparable to the literature figure of 30% could be explained by the fact that all those deliveries occurring at <28 weeks of gestation who did not survive for the first 4 hours of live were excluded from the study. Another explanation could be the possible low incidence of HMD in our set up due to a high percentage of intrauterine growth retardation (IUGR), which is yet to be verified.

Neonatal sepsis is a major cause of mortality and morbidity in newborns both in the developed and

developing countries. Indian figures (according to National Neonatal Perinatal Database 2000) say that 23% neonatal deaths are due to sepsis[1] .In our hospital based study, including only the in-hospital deliveries, if we combine both the early and late neonatal deaths 21.55% deaths are due to sepsis. The most important risk factors for neonatal sepsis are prematurity and low birth weight. We in our series found that 73.07% of neonates dying due to sepsis were premature and 76.92% were low birth weight babies. In a study at PGMR (Postgraduate Medicine and research) at Bangladesh prematurity and low birth weight were found to have high case fatality rates 71%and 30% respectively in neonatal sepsis[2].

Total leukocyte count of 5000 or below is considered as one of the indicators of neonatal sepsis. We had total count of 5000 and less in 4 cases of LND of which 3 were culture positive cases. However it is said that the positive predictive value of abnormal leukocyte counts is poor and many non-infectious conditions can give abnormal values in neonates[3].

The rate of positive blood culture in neonatal sepsis was 51.34% in one study[4] while we had blood culture positive in 38.46% (10 out of 26) cases of neonatal deaths due to sepsis. We did not have any blood culture positive for group B Streptococcus (GBS) that is the commonest organism for early onset neonatal sepsis (within the first 72 hours of life) in western countries. This raises the possibility that GBS may not be a common organism in our part as it is said that GBS is not a problem in neonatal ICU in India[1].Another explanation is that our hospital Lab. might not be growing GBS and this could be the possible reason for our low blood culture positivity in END due to sepsis and pneumonia. Klebsiella was the most common organism grown in our series attributing to 40% of blood culture positive sepsis (4 out of 10 positive blood cultures). Similar figure have been reported in one Indian study with klebseilla being the most frequently isolated pathogen (31.2%) in neonatal sepsis[1] while another study found that klebsiella was second most common after Staph. aureus[4].

Gram negative organisms were found responsible in 69% of fulminant late onset sepsis (lethal within 48 hours) in one study conducted in Children's hospital at Verginia[4].In our series we had 7 blood cultures positive late onset sepsis due to gram negative organisms and 5 out of the 7 (71%) were fulminant sepsis dying within 48 hours of illness. The same study found the organisms for fulminant late onset sepsis as Pseudomonas (42%), Klebsiella (8%), Enterobacter (8%), E coli (10%) and Coagulase negative staph (8%). Our finding was Klebsiella (60%), Enterobacter (20%) and E coli (20%) as the organisms for fulminant late onset sepsis. However as we had a very small number of blood culture positive fulminant late onset sepsis the figures could be misleading.

None of the blood cultures were positive among the death due to congenital pneumonia which raises the suspicion of possible developmental abnormality of lungs in some of these cases as our diagnoses were only clinical and no post mortem studies were conducted.

Perinatal asphyxia is known to be responsible for 20 % of perinatal deaths and we had 13.4% END due to perinatal asphyxia. According to Indian national neonatal forum (NNF) 1995, 24% of neonatal deaths are due to birth asphyxia in community based studies while in a hospital study at Lahore, Pakistan it was found that asphyxial deaths were responsible for 34% of all neonatal deaths[2]. Congenital abnormalities are another important cause of neonatal deaths. We had 19 deaths (16 END and 3 LND) due to congenital abnormalities that accounts for 16% of all neonatal deaths. One of the factors for this low figure could be the early referral for possible surgery of a few cases of congenital abnormality to another hospital and under reporting of the deaths if occurred in the other hospital.

Meconium aspiration syndrome accounted for 5.14% of END in our series and it was 10.63% of all MAS.In literature the deaths due to MAS is estimated to be between 5 and 10 % of all MAS while 30% cases of MAS require mechanical ventilation[2]. Our figure of 10.63% is not bad in the absence of ventilatory facilities. In a multicentric study it was found that the thicker the consistency of meconium the more likely the development of MAS and other respiratory disorders[6]. All the MAS deaths we had were babies born through thick meconium stained liquor.

The single greatest risk factor for NEC is thought to be prematurity and all 5 deaths in our series (2END and 3 LND) were premature babies between 28 and 30 weeks.

The causes of deaths in our series were only on clinical judgement and might not always be correct, as autopsy studies are not practiced in our setup. As shown in one study autopsy changed or added to the clinical diagnosis in 59.5% of cases[7].

Conclusions and Recommendations

1. A large proportion of neonatal deaths are still due to infectious etiology and it affects mainly the premature and low birth weight babies. Among the deaths due to culture positive sepsis gram-negative organisms top the list and a significant number of blood culture positive late onset neonatal sepsis are of fulminant nature.

2. The identification of the infecting organism, especially in early neonatal deaths needs further workup. Improvement in the laboratory facilities could be one of the steps towards it.
3. Post mortem studies, which are yet to be introduced in our hospitals, would be very helpful on exploring the exact etiology of deaths.
4. Upgrading the neonatal nursery to level III care with the introduction of ventilators could be an answer in decreasing neonatal deaths among the few full term, good weight babies dyeing of respiratory failure due to severe pneumonia and meconium aspiration syndrome.
5. A significant number of asphyxial deaths are occurring in term infant Prevention of such deaths remains as a present day challenge and should receive a top priority.

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