International Journal of Contemporary Pediatrics
Mehkarkar N et al. Int J Contemp Pediatr. 2018 Sep;5(5):1869-1874
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20183522

Original Research Article

A study of early neonatal mortality in a tertiary hospital of Maharashtra, India

Nitin Mehkarkar[1], Vijay Baburao Sonawane[2]*

[1]Department of Pediatrics, S.M.B.T. Medical College, Dhamangaon, Tal. Igatpuri, Dist. Nashik, Maharashtra, India
[2]Department of Pediatrics, D. Y. Patil Medical College and Hospital, Kamothe, Maharashtra, India

Received: 01 June 2018
Accepted: 29 June 2018

***Correspondence:**
Dr. Vijay Baburao Sonawane,
E-mail: vijay_ltm@yahoo.co.in

ABSTRACT

Background: India has a high Neonatal Mortality Rate (NMR) of 31 per 1000 live births and rural being 34 whereas urban being 17 (2011). Two thirds of the newborn deaths usually occur in the first week of life. Newborn survival has become an important issue to improve the overall health care goals. This study is carried out to identify primary causes of early neonatal deaths and to ascertain the factors affecting early neonatal mortality.
Methods: This is a prospective study of all the early neonatal deaths in tertiary hospital of Maharashtra over two years. Details of each early neonatal death were filled in the standard perinatal death proforma.
Results: Out of the 2073 total births, there were 75 early neonatal deaths (END) which is nearly 36.18 per 1000 live births. The important causes of END were severe birth asphyxia, respiratory distress syndrome and septicemia. About 50% of deaths were observed in mothers with age < 20 years, 25% deaths observed in mothers of age group 20-29 years, and similar percentage is with age >30 years. Most of the early neonatal deaths were due to Birth asphyxia and RDS was the second most important cause of early neonatal deaths. 70% of ENDs were among LBW babies. Prevention of premature delivery, proper management of very low birth weight babies and early detection and appropriate management of perinatal hypoxia have become important interventional strategies in reducing early neonatal deaths.
Conclusions: Early Neonatal Mortality (ENM) at Tertiary Hospital is fairly high. In present study, early neonatal death rate of 36.18 per 1000 live births is observed which significantly higher than reported in literature.

Keywords: Birth asphyxia, END, NMR, RDS

INTRODUCTION

Early Neonatal Mortality Rate (ENMR) is defined as neonatal deaths of babies weighing over 1000gms during first 7 days per 1000 live births. It is a part of perinatal mortality which includes both late fetal deaths (still births) and early neonatal deaths. Nearly 25% of neonatal deaths occur within first 24 hours of life. The overall ENMR is 76 in rural areas whereas it is 39 in urban areas per 1000 live births at tertiary level hospitals in our country which is very high when compared with developed countries.[1] During recent years there is downward trend in post neonatal mortality (deaths in infants 1-12 months of age) but practically no change in neonatal mortality rate is evident.[2,3] The purpose of this study is to find out the causes of early neonatal mortality deaths in babies born in tertiary hospital of Maharashtra as it is one of the important and sensitive indicators of the availability, utilization and effectiveness of the health services in the community. A study of neonatal deaths

would help in finding appropriate strategies to reduce the present high neonatal mortality in the country.

The objectives of this study were to identify primary causes of early neonatal deaths in correlation with clinical details of mother and infant, to ascertain the early neonatal mortality in relation to various gestational ages and birth weights and to evaluate the significant etiological factors responsible for early neonatal mortality and relative contribution of these factors to early neonatal mortality.

METHODS

A prospective study is carried out in a tertiary hospital of Maharashtra over a period of two years. Data was collected in the form of complete maternal history in predesigned proforma. Details of past obstetrics history regarding antepartum hemorrhage, previous preterm delivery, any previous fetal or neonatal deaths and their probable causes were noted. Any complaint of pregnancy pointing towards any risk factor in the mother as well as fetus is considered. Complete general and systemic examination to look for any medical or surgical disorder in mother was done. All routine and specific laboratory investigations of the mother were checked.

Details of baby after the birth with regard to date of birth, time of birth and birth weight were recorded. Gestational age was calculated and recorded at 1 minute, 5 minutes and 10 minutes. Resuscitation efforts required for the baby were recorded. Details of babies who expired within 7 days of life were reviewed.

Inclusion criteria

Neonates born in tertiary hospital who expired within 7 days of life.

Exclusion criteria

Babies not born in the tertiary hospital.

RESULTS

During the study period, there were 2073 live births out of which 1150 (55.47%) were males whereas 923 (44.52%) were females. There was a male preponderance with ratio of 1.88:1. Male preponderance in same ratio i.e. 1.79:1 was observed by Ravikumara M and Bhat BV which is similar to the present study.[1]

In this study it is observed that birth asphyxia and respiratory distress syndrome accounted for deaths in first 3 days while deaths from septicemia were mostly after 3 days of life (Table 1).

This study reveals that severe birth asphyxia, respiratory distress syndrome and septicemia were the major causes of early neonatal deaths (Table 2). Out of the 75 early neonatal deaths, birth asphyxia is the commonest cause of death (28) followed by respiratory distress syndrome (19), septicemia (18), congenital anomalies (7), necrotizing enterocolitis (2) and head injury (1).

Ravikumara and Bhat BV observed birth asphyxia in 39.4%, hyaline membrane disease in 14.7%, congenital anomalies in 13.8% and sepsis in 10.4% of neonatal deaths.[4]

Table 1: Causes of early neonatal deaths and their relationship with age at death.

Cause of death	Age at death (days)						
	1st	2nd	3rd	4th	5th	6th	7th
Birth asphyxia	13	3	8		2		2
Respiratory distress syndrome	8	6	3		1	1	
Septicemia	1	1	2	7	3	3	1
Congenital anomalies	3	1			1	2	
Necrotizing entercolitis						1	1
Head injury		1					

Table 2: Causes of early neonatal mortality.

Causes	Early neonatal deaths	
	No. of cases	Percentage
Severe birth asphyxia	28	37.33
Respiratory distress syndrome	19	25.33
Septicemia	18	24
Congenital anomalies	7	9.33
Necrotizing enterocolitis	2	2.66
Head injury	1	1.33

Similar observations were made by Kameswaran C et al birth asphyxia was responsible for 33.4%, hyaline membrane disease 16%, septicemia 7.4% and congenital anomalies for 9.9% of early neonatal mortality.[5]

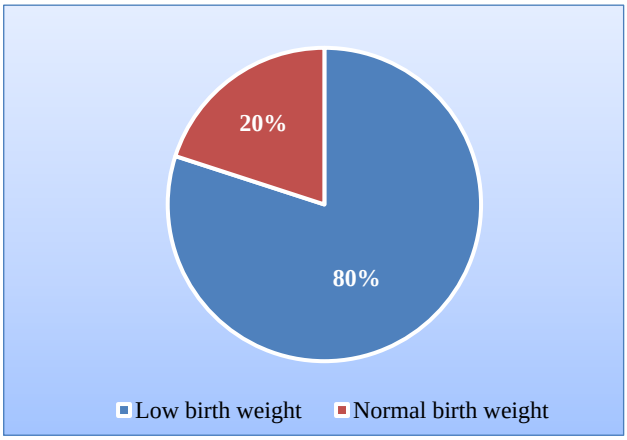

Figure 1: Contribution of low birth weight babies to early neonatal mortality.

Table 3: Birth weight and early neonatal death rate.

Weight (gm)	Total live births	Early neonatal deaths	Early neonatal death rate per 1000 live births
≤2499	945	60	63.49
≥2500	1128	15	13.29

In present study there were 75 early neonatal deaths out of total live births 2073 giving early neonatal death rate of 36.18 per 1000 live births. Death rate in this study was comparable with 32 per 100 live births observed by Verma M in her seven years hospital study.[6] Early neonatal death rate in rural hospital was more compared to 26.6 in an intramural birth cohort at tertiary care hospital observed by Ravikumara M andBhat BV which is contrast to the present study.[4] The present study reveals early neonatal death rate of 63.49 in low birth weight neonates and 13.29 per 1000 live births in infants with normal birth weight (Table 3).

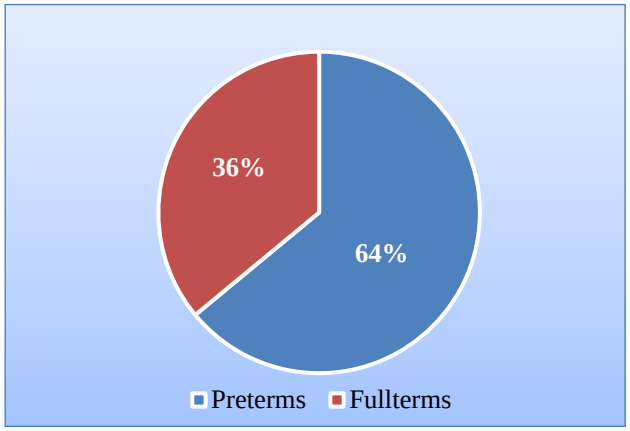

Figure 2: Contribution of preterm/full terms to early neonatal mortality.

Early neonatal deaths observed in low birth weight babies were 60 out of 945 live births as compared to 15 deaths out of 1128 births in case of normal birth weight. The low birth weight babies contributed about 80% of early neonatal deaths in the present study. The contribution by low birth weight babies of 75.8% was shown by Ravikumara M which is similar to the present study.[4] It is evident that early neonatal mortality is significantly more in low birth weight (LBW) babies. This shows that LBW babies contributed about 4 times more to early neonatal mortality as compared to babies with normal birth weight.

In this study, gestational age had inverse relation with early neonatal mortality. Preterm babies contributed 64% of early neonatal deaths (Figure 2). There were 48 preterms out of 75 early neonatal deaths. Ravikumara M observed 53.5% of early neonatal deaths in preterm babies.[4] The early neonatal mortality was more i.e. 36% in preterm small for date babies. The causes of this higher mortality in premature and low birth weight babies were complicated labor, and resuscitation which were more common in this group compared to full term and average for gestational age babies. This indicates that preterm small for dates babies contributed more to early neonatal deaths. It also indicates that preterm and low birth weight babies together contribute a very large proportion of early neonatal deaths.

Table 4: Predisposing maternal factors for early neonatal mortality.

Factors	Number
Teenage pregnancy	37
Toxemia of pregnancy	19
Advanced maternal age	19
Meconium stained liquor	14
Premature rupture of membranes (> 12 hrs)	12
Multifetal pregnancy	9
Malpresentation	7
Rhesus incompatibility	7
Antepartum haemmorhage	4
Oligohydramnios	3
Urinary tract infection	2
Heart disease	2
Viral hepatitis	1
Postdatism	1
HIV infection	1
Syphilis	1

Obstetric complications like hypertensive disorder of pregnancy, antepartum haemorrhage and multifetal pregnancy played a significant role in the present study of early neonatal mortality. 37 early neonatal deaths were observed in teenage pregnancy. Toxemia of pregnancy, advanced maternal age, meconium stained liquor and PROM together contributed 52. This shows that inappropriate maternal age, toxemia of pregnancy, meconium stained liquor and premature rupture of membranes were the leading predisposing factors for early neonatal morality (Table 4). It shows that early neonatal deaths were maximum i.e. 49.33% in case of teenage pregnancies.

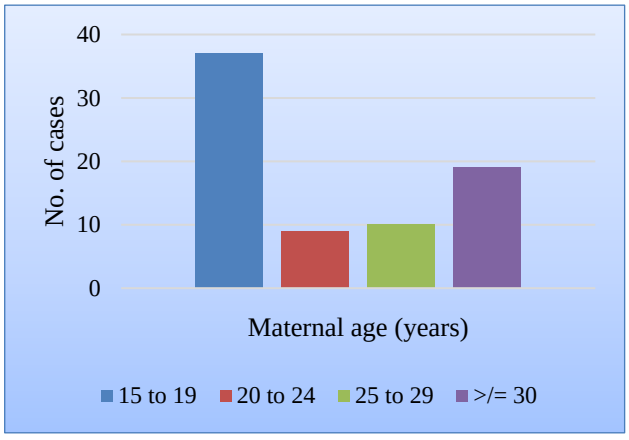

Figure 3: Maternal age and early neonatal mortality.

Near about 50% of deaths in the present study were observed in mothers with age <20 years about twice the deaths observed in mothers of age group 20-29 years. Deaths observed in mothers with age >30 years were significantly more (Figure 3).

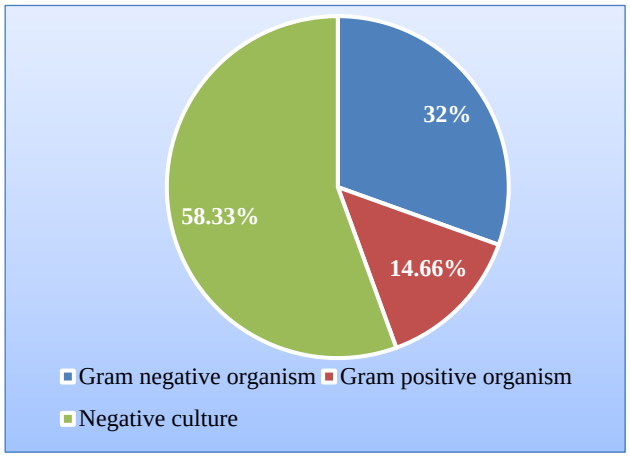

Figure 4: Distribution of cases in relation with the isolated organisms.

Extremes of maternal ages were associated with higher early neonatal death rate. Ramesh P and R. K. Kapoor also reported similar results regarding maternal age.[7,8] This study also shows that Gram Negative Sepsis is more common with increasing mortality (Figure 4).

Table 5: Clinical presentation of new-born.

Clinical features	No. of cases
Convulsions	48
Respiratory distress	47
Abnormal temperature	40
Icterus	36
Sclerema	35
Evidence of bleeding tendency	34
Buldging anterior fontanelle	30
Cyanosis	26
Vomiting	26
Abdominal distension	24

The commonly observed clinical features in the present study were convulsions (48), respiratory distress (47), abnormal temperature (40), icterus (36), sclerema (35), bleeding tendency (34), bulging anterior fontanalle (30), cyanosis (26), vomiting (26) and abdominal distension (24) (Table 5).

DISCUSSION

This prospective study is carried out at a tertiary hospital of Maharashtra, India over a period of two years reveals that there were 2073 live births including 1150 males and 923 females. In present study there were 75 early neonatal deaths out of total live births 2073 giving early neonatal death rate of 36.18 per 1000 live births. Death rate in this study was comparable with 32 per 1000 live births observed by Verma M in her seven years hospital study.[6] Early neonatal death rate in rural hospital was more compared to 26.6 in an intramural birth cohort at tertiary care hospital observed by Ravikumara M and Bhat BV.[4] Death rate in this study was very much close to 39.3 given by Puri RK.[8] Early neonatal death rate observed by Gupta PK was 28.4, Kameswaran C and Bhatia BD 22.7 per 1000 live births.[9,5] As most of the studies including the present one are hospital based, there is wide variation in the results. There was a male preponderance with ratio of 1.88:1. Male preponderance in same ratio i.e. 1.79:1 was observed by Ravikumara M and Bhat BV.[4] Ratio of 1.62:1 showing male predominance was presented by Kapour RK.[8] Pradeep M observed 55.9% early neonatal deaths in males.[10]

The present study revealed early neonatal death rate of 63.49 in low birth weight neonates and 13.29 per 1000 live births in infants with normal birth weight. The low birth weight babies contributed about 80% of early neonatal deaths in the present study. Results of present study were comparable with that of Pradeep M who showed the same i.e. 80% of early neonatal deaths in low birth weight babies.[10] The contribution by low birth babies of 75.8% and 70% to early neonatal deaths was shown by Ravikumara M and Shah U respectively.[4,11] Study done by Santhakrishnan BR revealed the maximum deaths in low birth weight babies.[12]

Gestational age had inverse relation with early neonatal mortality in the present study. Preterm babies contributed 64% of early neonatal deaths. Shah U noticed 54% of early neonatal deaths in preterm babies.[11] Results in present study are in concurrence with Pradeep M, Singh M et al and Ravikumara M who observed 78%, 66% and 53.5% of early neonatal deaths in preterm babies respectively.[4,10] All of them observed more than 50% of deaths in preterm babies. Santhanakrishnan BR observed only 35% of deaths in preterm babies which is in contrast with this study.[11]

The early neonatal mortality was more i.e. 32% in preterm small for date babies. Pradeep M proved that preterm and low birth weight babies contribute more to early neonatal mortality.[10] The causes of this higher mortality in premature and low birth weight babies were complicated labor, and resuscitation which were more common in this group compared to full term and average for gestational age babies.

Out of the 75 early neonatal deaths birth asphyxia ranked as the commonest cause of death (37.33%) followed by respiratory distress syndrome (25.33%), septicemia (24%) and congenital anomalies (9.33%). Santhanakrishnan BR and Gopal S also ranked birth asphyxia as a commonest cause in 44.3% of early neonatal deaths.[12] In the study done by Kameswaran C birth asphyxia was responsible for 33.4%, hyaline

membrane disease 16.1%, septicemia 7.4% and congenital anomalies for 9.9% of early neonatal deaths.[5] Ravikumara M and Bhat BV observed birth asphyxia in 39.4%, hyaline membrane disease in 14.7%, congenital malformations in 13.8% and sepsis in 10.4% of neonatal deaths.[4] The result of study done by Pradeep M was birth asphyxia as a cause of death in 43%, septicemia in 16%, hyaline membrane disease in 15% and congenital malformations in 15% of cases.[10] Kapoor RK during his study reported birth asphyxia in 42.1% of deaths.[8] Maximum deaths which were due to birth asphyxia, respiratory distress syndrome and congenital malformations occurred in the first 3 days of life and that due to sepsis occurred later. Sane SY et al stated that nearly 86.3% of deaths due to respiratory distress syndrome occurred in first week of life and of these 28.9% were within 24 hours of life.[13] Kameswaran C quoted 3 major causes of early neonatal deaths, severe birth asphyxia, respiratory distress syndrome and meconium aspiration syndrome and nearly 92% of deaths were within the first 72 hours of life.[5]

In the present study a total of 66.66% (50/75) of the early neonatal deaths occurred within the first 3 days with 33.33% (25/75) occurring within first 24 hours. In her study Usha Shah noticed 40% babies died within first 24 hours and 78% within 3 days of life.[11] Kameswaran C reported about 92% of early neonatal deaths in first 72 hours.[5] Obstetric complications like hypertensive disorder of pregnancy, antepartum haemorrhage and multifetal pregnancy played a significant role in the present study of early neonatal mortality.

Sociobiological factors like low maternal age also contributed a large number of deaths. Swain SS reported a perinatal loss of 38.66% associated with eclampsia.[14] Near about 50% of deaths in the present study were observed in mothers with age <20 years about twice the deaths observed in mothers of age group 20-29 years (25.33%). Deaths observed in mothers with age >30 years were significantly more. Kapoor RK also reported similar results regarding maternal age.[8] The same inference was drawn by Puri RK.[8] Extremes of maternal ages were associated with higher early neonatal death rate.

The commonly observed clinical features in the present study were convulsions (48), respiratory distress (47), abnormal temperature (40), icterus (36), sclerema (35), bleeding tendency (34), bulging anterior fontanalle (30), cyanosis (26), vomiting (26) and abdominal distension (24) which were comparable with Tallur et al and Uddin N et al.[15,16] The vague clinical presentation of neonates may delay the institution of early and effective therapy, so a high index of suspicion should be kept while treating a sick neonate.

The present study revealed 46.66% positivity of blood culture (35 cases) out of which 24 cases showed isolation of Gram negative and in 11 cases Gram positive organism which was comparable with the study of Jaswal RS where organisms were isolated in 42% cases.[17] This study is not in variance with the study of Tallur et al and Uddin N et al where organisms were isolated in 64.87% and 35% cases respectively.[15,16] Abnormal level of hemoglobin in 23 cases, total leucocyte count in 58, platelet count in 7, abnormal CSF findings in 32 cases out of 40. C reactive protein was positive in 55 cases out 73. Liver and renal function tests were abnormal in 30 and 27 cases respectively. Blood sugar and serum calcium levels were below the normal level in 28 and 20 cases respectively. X-ray was diagnostic in 33 cases while neurosonography and ultrasonography of abdomen were diagnostic in 4 and 3 cases respectively. As a single test they have less predictive accuracy but if combined together they may be useful in detecting the sick neonate who requires effective treatment.

CONCLUSION

The study of 'early neonatal mortality' was carried out in tertiary Hospital for a period of two years. Total live births during this period were 2073. Early neonatal deaths of 75 comprised the study group.

The following inferences were noted:

- The early neonatal death rate was 36.18 per 1000 live births. Male outnumbered female with ratio of 1.88:1
- Early neonatal death rate in low birth weight babies was 63.49 and in babies with normal birth weight it was 13.29 per 1000 live births. Low birth weight babies contributed about 80% of early neonatal deaths.
- Preterm babies comprised 64% of early neonatal deaths which was significantly high as compared to term babies comprising 36%. There was an inverse relationship between birth weight and early neonatal deaths. Preterm small for date babies contributed more to early neonatal deaths.
- Birth asphyxia (37.33%), respiratory distress syndrome (25.33%) and septicemia (24%) were the leading causes of early neonatal deaths. Birth asphyxia and respiratory distress syndrome accounted for deaths mainly in first 3 days while deaths due to septicemia were mostly after 3 days of life.
- Major risk factors associated with early neonatal deaths were hypertensive disorder of pregnancy, teenage pregnancy, meconium stained liquor, advanced maternal age, premature rupture of membranes, multifoetal pregnancies and antepartum haemorrhage.
- Early neonatal mortality was about two times (49.33%) more in case of teenage pregnancies as compared to pregnancies in mothers with age between 21 to 29 years (25.33%). The early neonatal mortality was significantly high in mothers with age greater than 30 years.
- The presenting signs and symptoms were vague.

The commonly observed clinical features were convulsions, respiratory distress, abnormal temperature, jaundice, sclerema, bleeding tendency and bulging anterior fontanalle.

As a single, laboratory investigation has less predictive accuracy but if combined together they may be useful in detecting sick neonate who requires effective treatment.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. National Institution for Transforming India. SRS statistical report 2013. Available at http://niti.gov.in/content/neo-natal-mortality-ratenmr-1000-live-births. Accessed 10 December 2017.
2. Singh M. Care of the newborn. 6th edition. Sagar Publications; 2004:3,63.
3. Fanaroff AA, Martin RJ. Neonatal-perinatal medicine. Disease of the fetus and infant. 4th edition. Mosby; 1986.
4. Ravikumara M, Bhat BV. Early neonatal mortality in an intramural birth cohort at a tertiary care hospital. Indian J Pediatr. 1996;63:785-9.
5. Kameswaran C, Bhatia BD. Perinatal mortality: a hospital based study. Indian Pediatr. 1993;30:997-1002.
6. Manorama V, Jugesh C, Singh D. Perinatal mortality in Ludhiana, Punjab: a seven-year hospital study. Indian J Pediatr. 1992;59:561-5.
7. Ramesh P. Perinatal mortality. Incidence and effect of various maternal factors. Indian J Pediatr. 1981;49:297-304.
8. Kapoor RK, Shrivastava AK. Perinatal mortality in urban slums in Lucknow. Indian Pediatr. 1996;33:19-23.
9. Gupta PK, Gupta AP. Perinatal mortality. Indian Pediatr. 1985;22:201-5.
10. Pradeep M, Rajam L, Sudevan P. Perinatal mortality: a hospital-based study. Indian Pediatr. 1995;32:1091-4.
11. Usha S. Symposium: perinatal mortality in India. can it be reduced through primary health care? Indian J Pediatr. 1986;53:327-34.
12. Santhanakrishnan BR, Gopal S. Perinatal mortality in referral teaching hospital in Madaras City. Indian J Pediatr. 1986;53:359-63.
13. Sane SY, Patel BM. Neonatal respiratory distress syndrome. An autopsy study of 190 cases. Indian J Pediatr. 1985;52:43-6.
14. Swain S, Ojha KN, Prakash A, Bhatia BD. Maternal and perinatal mortality due to eclampsia. Indian Pediatr. 1993;30:771-3.
15. Tallur SS, Kasturi AV, Nadgir SD, Krishna BV. Clinico-bacteriological study of neonatal septicemia in Hubli. Indian J Pediatr. 2000;67(3):169-74.
16. Ahmed NU, Azad C. Clinical and bacteriological profile of neonatal septicemia in a tertiary level pediatric hospital in Bangladesh. Indian Pediatr. 2002;39:17.
17. Jaswal RS, Kaushal RK, Goel A, Pathania K. Role of C-reactive protein in deciding duration of antibiotic therapy in neonatal septicemia. Indian pediatrics. 2003;40(9):880-3.

Cite this article as: Mehkarkar N, Sonawane VB. A study of early neonatal mortality in a tertiary hospital of Maharashtra, India. Int J Contemp Pediatr 2018;5:1869-74.