 DOI: 10.18231/2455-6793.2017.0017

Maternal antenatal profile and immediate neonatal outcome in very low birth weight babies

Vinayak K. Patki[1, *], Jennifer V. Antin[2]

[1]Professor, Institute of Medical Education & Research, Vidyagiri, Maharashtra, [2]Senior Consultant Dept. of Pediatrics, Wanless Hospital, Miraj, Maharashtra

***Corresponding Author:**
Email: patkivinayak@gmail.com

Abstract

Objective: To find out maternal risk factors associated with VLBW babies and study maternal risk factors associated with morbidity and mortality of VLBW babies.

Materials and Method: The study was a prospective cohort analysis of case records of 110 inborn VLBW babies admitted in Neonatal intensive care unit, of a Teaching hospital during the period of 1 year. Pregnant mother after 24 weeks of gestation were followed up till delivery to report outcome and impact of maternal antenatal profile on VLBW. For calculation of neonatal mortality or morbidity, delivered babies were to be followed up to discharge or death. Morbidity and mortality were compared according to birth weight and gestational age of baby. Only those causes of morbidity where statistical significance with relation to such maternal antenatal factors could be drawn, were studied by using Chi-square test.

Results: Majority (81.82%) mothers of VLBW babies had adverse risk factors. Anemia, PROM >=12 hours and PIH were the commonest adverse maternal factors associated with very low birth weight babies. Majority (75.45%) VLBW babies developed one or other kinds of morbidity. The commoner morbidity in VLBW were neonatal sepsis (30%), RDS (19.09%) and NNH (18.18%). The mortality in VLBW babies was only 21.81%. RDS (50%) was the commonest cause of death in VLBW, followed by sepsis (16.6%).The mortality was highest in babies weighing less than 750 gram and less than 28 weeks of gestation. Both morbidity and mortality decreased significantly in babies with higher birth weight. APH, multiple pregnancy and LSCS had statistically significant association ($p<0.001$) with RDS in VLBW babies. Presence of PROM >=12 hours and maternal fever increased the risk of neonatal sepsis. Presence of PIH, abnormal presentation, multiple pregnancies and meconium staining of liquor were significantly associated with asphyxia.

Conclusion: In our study, various adverse maternal factors were associated with very low birth weight and their morbidities. The identification of adverse maternal factors and its appropriate management can lead to better outcome of the baby.

Keywords: VLBW, antenatal factors, RDS, Asphyxia Neonatorum, Neonatal Hyperbilirubinemia, Hypoglycemia

Introduction

The birth weight is an indicator which gives us an idea about the quality of life, the socio-economic status, health awareness and nutritional status of the community. The birth weight in all population groups is the single most determinant of the chances of the newborn to survive and experience normal growth and development.(1) Very low birth weight has been defined as birth weightless than 1.5kg, birth weight being taken preferably within first hour of life before significant weight loss occurs. In India around 3% babies are VLBW babies.(2)

VLBW can be caused by either a short gestational period or retarded intrauterine growth or a combination of both. Prematurity is usually defined as gestational age less than 37 weeks and small for gestational age (SGA) or small for date (SFD) babies are those with birth weight less than 10th percentile for their gestational age.(2) As babies weighing less than 2kg are more vulnerable to increased morbidity and mortality, they deserve priority in admission to special care nurseries and by this criterion alone, 10% of newborn babies in India qualify for admission to special care nurseries.(3)

The common causes of morbidity and mortality in VLBW babies include birth asphyxia, respiratory problems of prematurity, neonatal infections, hyperbilirubinemia, hypoglycemia, hypothermia, etc. which should be recognized early and promptly managed. VLBW infants weigh <1500gm and are predominantly premature. The VLBW rate is an accurate predictor of infant mortality rate. VLBW infants account for over 50% of neonatal deaths and 50% of handicapped infants, their survival is directly related to birthweight, with approximately 20% of those between 500 and 600 gm and over 90% of those between 1250 and 1500 gm surviving.(5, 6) Perinatal care has improved the rate of survival of VLBW infants. When compared with term infants, VLBW infants have a higher incidence of re hospitalization during the 1st year of life for sequel of prematurity, infections, neurologic complications and psychosocial disorders.(4)

The risk of neurodevelopment handicaps is increased 3-fold for LBW babies and 10-fold for VLBW babies (<1500gms). Long term follow-up studies of infants with a birth weight of 1500 gm and less have revealed 15 to 20 percent incidence of neurological handicaps in the form of cerebral palsy, seizures, hydrocephalus, microcephaly, blindness due to retinopathy of prematurity, deafness and mental retardation.(5-7) India being a developing country, many

expectant mothers don't get regular obstetric services due to low socio-economic status. To overcome these problems, attention has to be directed towards MCH services as a whole, and to get a healthy baby, the mother should be healthy. To study the risk factors affecting birth weight, our approach need to be a thorough one. Due to poverty, illiteracy, unawareness of health, it is difficult to supervise and treat all such risk factors.

The incidence of VLBW babies can be reduced if pregnant women at risk are identified and steps are taken to reduce the risk. It is clear from the multiplicity of risk factors that there is no universal solution. Presently attention is being given to the ways and means of preventing VLBW through good antenatal care and intervention program, rather than treatment of VLBW infant. We can give best chances of survival and normal development to VLBW babies by giving them best possible neonatal care in well set up nurseries.

Materials and Method

This study was carried out at Neonatal Intensive Care Unit, of a tertiary care hospital, (Wanless Hospital, Miraj, Maharashtra) over a period of one year from February 2015 to January 2016. During this period, a total of 110 inborn VLBW babies (birth weight less than 1500 grams admitted to neonatal intensive care unit were studied. The study was a prospective cohort analysis of case records of these VLBW babies Pregnant mother after 24 weeks of gestation were followed up till delivery to report outcome and impact of maternal antenatal profile on VLBW. For calculation of neonatal mortality or morbidity, delivered babies were to be followed up to discharge or death Details regarding obstetric history and antenatal complications were recorded as per in the proforma.

The following maternal data were analyzed: parity, antenatal care status, anemia, pregnancy induced hypertension (PIH), ante partum hemorrhage (APH), previous preterm delivery, other medical complications including infection and heart disease during pregnancy. Mother was considered as booked if she had minimum three visits in our antenatal Out Patient Department and as un-booked if she had less than 3 visits. Mother was considered as anemic if her hemoglobin was less than 10 gm%. Mother having fasting blood sugar level > 95 mg% and 2Hr post GTT>155 mg% was considered to have gestational diabetes. Mother having history of previous spontaneous or induced abortion or still birth was considered to have bad obstetric history Mothers who were delivered by assisted methods like forceps, breech or vacuum were considered to have difficult delivery. The gestational age of babies was determined by physical and neurological examination of newborn using Modified New Ballard scoring immediately after birth or within 72 hrs.

All babies were weighed on Phoenix, electronic type of weighing scale having accuracy up to ±10gms. Birth weight and gestational age by Modified New Ballard score was plotted on a birth weight gestational age graph and babies were classified as small for gestational age (SGA), appropriate for gestational age (AGA), large for gestational age (LGA) accordingly. Head circumference, mid-arm circumference, and crown to heel length were recorded. Detail physical examination was done at admission. Age at admission and rectal temperature at admission were recorded. Temperature less than 35^0C was considered as hypothermia. All babies were admitted to NICU (Neonatal Intensive Care Unit). Routine investigations like complete blood count, blood sugar, serum calcium, C - reactive protein, serum bilirubin, chest X-ray and special investigations like Cerebrospinal fluid analysis, blood culture, arterial blood gas analysis (ABG), ultrasonography, and echocardiography were done wherever indicated. Persistence of APGAR score between 0 to 3 for longer than 5 minutes was considered as birth asphyxia. Cessation of respiration for longer than 20 seconds or shorter duration in presence of cyanosis or bradycardia was considered as apnea. Necrotizing enterocolitis was considered in babies having perinatal risk factors and presence of any two of following criteria: Prefeed gastric aspirate volume of more than 25 percent of the last feed volume or abdominal distension (increase in abdominal girth >2 cm), Frank or occult blood and/or reducing substance in stools, Radiological evidences of pneumatosis intestinalis/portal air/free air under the diaphragm.

A diagnosis of probable sepsis was made in babies who had perinatal risk factors and whose sepsis screen was positive. [TLC<5000/cmm or >20, 000/cmm, blood C-Reactive Protein positive, band count more than 15%, two of these criteria positives]. Babies whose blood cultures were positive or who had clinical evidences of sepsis were considered to have definite sepsis. Blood sugar less than 40 mg% was taken as neonatal hypoglycemia. Serum bilirubin > 15 mg% in preterm and >12 mg% in term babies at 48 hours after birth was considered as neonatal hyperbilirubinemia. Total serum calcium levels <7 mg/dl was considered as hypocalcemia. Respiratory distress starting any time within first six hours of birth and persisting beyond 24 hours of birth was considered as idiopathic respiratory distress syndrome (RDS) after excluding other causes. Mild tachypnea settling within 24 hours of birth was considered as transient tachypnea of newborn.

Complications developed during hospital stay were considered as morbidity and sole cause of death was recorded to count mortality figures. Some babies had more than one kind of morbidity but one of them which were responsible for death was considered in mortality. Morbidity and mortality were compared according to birth weight and gestational age of baby. Only those causes of morbidity whose statistical significance with

relation to maternal antenatal factors, could be drawn were studied. Neonatal morbidity like neonatal sepsis, asphyxia, RDS was studied with respect to maternal factors whose associations are well documented.

Chi square(X^2) test was used to determine the significance.

Observations

Out of 110 cases, 5.45% babies were <=750 grams, 10.91% were between 751-1000 grams, 23.64% were between 1001-1250 grams and 60% babies were between 1251-1500 grams birth weight. 17.27% babies were <=28 weeks, 20% babies were between 29-30 weeks, 25.46% were between 31-32 weeks, 23.64% were between 33-34 weeks 10.90% were between 35-36 weeks and 2.73% were >=37 weeks of gestational age. The male to female ratio was 0.96. Eighty-three (75.45%) babies developed some kind of morbidity while 24 (21.81%) babies expired.

Incidence of morbidity in babies below 1000 grams was 100%. Morbidity rate in the 1001-1250 grams group and 1251-1500 grams group was 84.61% and 65.15% respectively. Morbidity according to gestational age was 100% in <=28 weeks, 86.36% in 29-30 weeks, 71.42% in 31-32 weeks, 53.84% in 33-34 weeks, 66.66% in 35-36 weeks and 100% in term VLBW babies Out of 110 VLBW babies 30 (33%) had neonatal sepsis, 21(19.09%) had RDS, 20 (18.18%) had NNH, 14(12.72%) had asphyxia neonatorum and apnea of prematurity each, 13 (11.81%) had congenital heart disease, 11 (10%) had neonatal hypoglycemia and 10(9.09%) had necrotizing enterocolitis. There were 6 (5.45%) cases each of transient tachypnea of newborn, neonatal hypocalcemia and Intraventricular hemorrhage. Beyond that 2(1.81%) cases each of meconium aspiration syndrome and hemorrhagic disease of newborn and 1 (0.9%) case of congenital anomaly was present. Out of 13 cases of CHD, 9 had PDA, 3 had ASD and 1 had TGA.(Fig. 1, 2, 3)

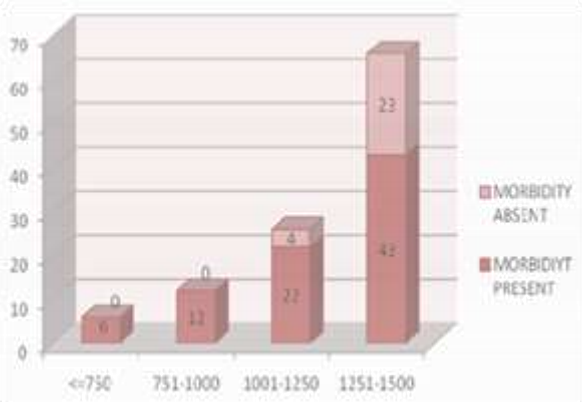

Fig. 1: Morbidity of VLBW babies according to birth weight

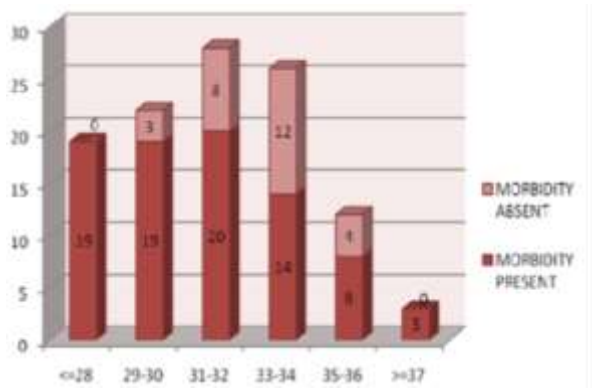

Fig. 2: Distribution of morbidity of VLBW babies according to gestational age

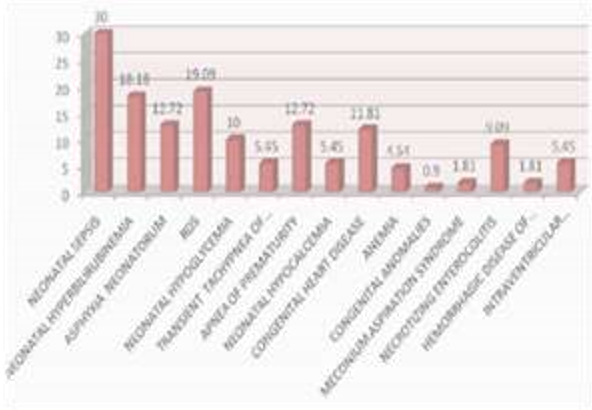

Fig. 3: Morbidity pattern of VLBW babies

Mortality rate according to birth weight were 100% in <=750 grams, 50% in 750 -1000 grams, 19.23% in 1001-1250 grams and 10.60% in 1251-1500 grams babies. Mortality according to gestational age was 68.42% in <=28 weeks, 27.27% in 29-30 weeks, 10.7% in31-32 weeks, 3.84% in 33-34 weeks, 8.33% in 35-36 weeks and no death in >=37 weeks babies. Out of 24 deaths among VLBW babies, 12 (50%) were due to RDS, 3 (12.5%) were due to HIE, 4 (16.66%) were due to sepsis, 2(8.33%) were due to pneumonia and 1 (4.16%) each due to pulmonary hemorrhage, NEC and kernicterus.(Fig. 4)

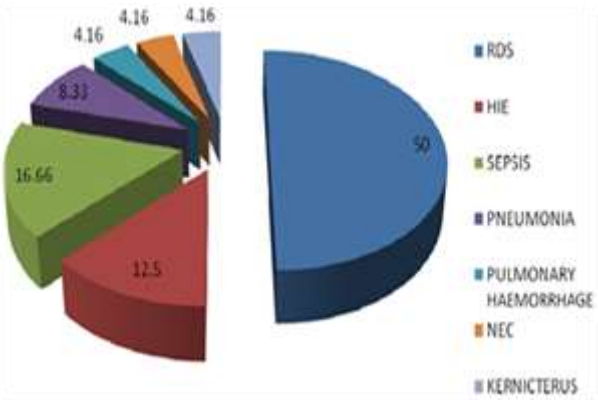

Fig. 4: Mortality pattern of VLBW babies

One or more adverse maternal risk factors were present in 90 (81.81%) cases while 20 (18.18%) had no risk factor. Commonest risk factors were anemia and PROM>=12 hours which were present in 38 (34.54%) and 26 (23.63%) cases respectively, followed by PIH in 20 (18.18%) cases, prior LSCS in 16 (14.5%) cases, meconium staining of liquor in 16 (14.5%) cases, BOH in 12 (10.9%) cases, multiple pregnancy in 8 (7.27%) cases, maternal infection in 8(7.27%) cases, APH in 6(5.45%) cases, heart diseases in 6 (5.45%) cases and chorioamnionitis in 2 (1.81%) cases. Out of 8 cases of maternal infection, 6 cases of hepatitis and 1 case each of Urinary tract infection and HIV were present.(Table 1)

Table 1: Incidence of adverse maternal factors in VLBW babies

Maternal factors	No of cases	Percentage
Past obstetric history		
BOH	12	10.9
Prior LSCS	16	14.5
Present obstetric		
PIH	20	18.18
PROM(>=12hrs)	26	23.63
Meconium staining of liquor	16	14.5
APH	6	5.45
Multiple pregnancy	8	7.27
Chorioamnionitis	2	1.81
Medical diseases of pregnancy		
Anemia	38	34.54
Heart diseases	6	5.45
Other maternal infection	8	7.27
No factor	20	18.18

Among the maternal factors, APH in mother and multiple pregnancy had statistically significant association (p<0.001) with RDS in babies. Also, LSCS had significant association with RDS. Breech, forceps and vacuum delivery had significantly higher incidence of asphyxia than LSCS and normal delivery. Maternal PIH, multiple pregnancy, abnormal presentation and meconium staining of amniotic fluid was significantly associated with asphyxia neonatorum. Incidence of asphyxia was not significant in relation to the parity of mother. ANC care and maternal APH had no significant association with asphyxia. Maternal fever and PROM>=12 hours had significantly high incidence of neonatal sepsis (p<0.001) while ANC care had no significant association with the incidence of sepsis.(Table 2, 3, 4)

Table 2: Adverse maternal factors associated with RDS

Factor	Cases	RDS Present	RDS Absent	Significance
APH Present	6	4(66.66)	2(33.33)	
APH Absent	104	17(16.34)	87(83.65)	p<0.001
LSCS	60	7(11.66)	53(88.33)	
NO LSCS	50	14(28)	36(72)	P<0.01
Multiple Pregnancies	8	5(62.5)	3(37.5)	
Single Pregnancy	102	16(15.68)	86(84.31)	P<0.001

Table 3: Adverse maternal factors associated with asphyxia Neonatorum

Factors	Cases	Asphyxia Present	Asphyxia Absent	Significance
	N=110	**N=14**	**N=96**	
Booked	85	10(11.76)	75(88.23)	NS
Unbooked	25	4(16.00)	21(84.00)	
Meconium Stained Liquor				
Present	16	5(31.25)	11(68.75)	P<0.01
Absent	104	9(8.65)	85(90.42)	
APH	6	2(33.33)	4(66.66)	NS
No APH	104	12(11.53)	92(88.46)	
PIH	20	6(30.00)	14(70.00)	P<0.001
No PIH	90	8(8.88)	82(91.11)	
Multiple Pregnancy	8	4(50.00)	4(50.00)	P<0.01
Singleton Pregnancy	102	10(9.80)	92(90.19)	
Abnormal Presentation	6	4(66.66)	2(33.33)	P<0.001
Normal Presentation	104	10(9.61)	94(90.38)	
Type of Delivery				
i. Normal	39	2(5.13)	37(94.87)	

ii. LSCS	60	8(13.33)	52(86.67)	P<0.001 i+ii Vs iii+iv+v
iii. Breech	6	3(50.00)	3(50.00)	
iv. Forceps	4	1(25.00)	3(75.00)	
v. Vaccum	1	1(100)	0(0)	
Parity				
i.1	75	7(9.33)	68(90.67)	I Vs ii+iii+iv NS
ii.2	27	5(18.52)	22(81.48)	
iii.3	6	2(33.33)	4(66.67)	
iv.>=4	2	0(0)	2(100)	

Table 4: Adverse maternal factors associated with Neonatal sepsis

Factor	Cases (N=110)	Sepsis present(N=33)	Sepsis absent(N=77)	Significance
PROM	26	13(50.00)	13(50.00)	P<0.001
NO PROM	84	20(23.80)	64(76.20)	
Unbooked	25	6(24.00)	19(76.00)	NS
Booked	85	27(31.76)	58(68.24)	
Maternal Fever	26	22(84.61)	4(15.38)	P<0.001
No Maternal Fever	84	11(13.09)	73(86.90)	

Discussion

Very low birth weight babies constitute approximately 4-7% of all live births.[7,8] Preterm deliveries of babies weighing less than 1500 grams (VLBW) are of major concern because of maximum perinatal morbidity and mortality found in this group.[8] The prospective cohort analysis of maternal antenatal profile in our study conducted for a period of 1 year at Level II Neonatal Intensive Care Unit of a tertiary hospital, represents the various high-risk factors responsible for morbidity and mortality of VLBW babies.

18.18% mothers of VLBW babies in our study had associated PIH. Similar observation was found by Roy et al and Long et al.[5,8] Bhaumik et al, Nadkarni et al and Habli et al stated that PIH is major factor responsible for prematurity and IUGR.[10-12] Sehgal et al and Karmar et al found significant association of PIH with preterm labor.[6,7] Our findings are consistent with earlier studies. Eight 8(7.27%) mothers of VLBW babies had twin pregnancy. Doctor et al, Norwitz et al and Young Mi Lee et al found significant association of multiple pregnancy with preterm births [13-15] like us.

Thirty-eight (34.54%) mothers of VLBW babies had anemia. Our findings are consistent with Malhotra et al, Malviya et al, Little et al and Allen L. H. et al[16-19] who reported a high incidence of anemia in mothers of VLBW infants. APH was found in 6(5.45%) of mothers of VLBW babies in our study. Roy et al, Crane et al and Harger et al found strong association of ante partum hemorrhage with VLBW babies.[5,20,21] like our study.

In our study, 6(5.45%) of mothers of VLBW babies were found to have heart disease. All had rheumatic heart disease. No one had any congenital heart disease. Mane et al, Chia YT et al and Siu SC et al observed that maternal heart disease was associated with VLBW babies.[22-24] Our findings are consistent with above studies. 10.9% of mothers of VLBW babies in our study had one or more obstetric complication. These mothers were found to have abortion, still birth or previous preterm delivery. Roy et al, Harger et al and De Hass et al found strong association of spontaneous abortion with VLBW babies.[5,20,25] like us. Youssef. et al[26] states that previous preterm birth is important predictor of likelihood of VLBW babies. Our findings are consistent with his study**.** In our study, 22.73% mothers of VLBW babies had not received proper antenatal care where as only 77.27% mothers had 3 or more antenatal visits and 7.27% cases had maternal infection out of which 75% cases had Hepatitis, 12.5% cases had urinary tract infection and HIV infection each.

Sepsis - Relation to maternal Factors: Association of sepsis with PROM >=12 hours is well documented by many authors like Stoll et al, Roy et al, Schuchat et al and Kerur et al.[4,5,27,28] Association of sepsis with genitourinary infection like chorioamnionitis is documented by Stoll et al,[4] while Agarwal et al[29] observed significant association between sepsis and unbooked mother. In our study, lack of antenatal care was not significantly associated with morbidity due to sepsis which is consistent with the above studies. Influence of factors like maternal genitourinary infection, prolonged labour and multiple pelvic examinations independently on sepsis could not be determined due to small number of cases. Stall et al, Roy et al, Schuchat et al, Kerur et al and Makhoul et al[4,5,27,28,30] found strong association of sepsis with prematurity and low birth weight. In our study preterm babies and babies with lower birth weight had significantly higher incidence of neonatal sepsis.

Birth asphyxia- relation with maternal factors:

The significant higher incidence of asphyxia in assisted deliveries in our study is consistent with Batra et al and Lee et al[31,32] who found significant association of PIH, APH, multiple pregnancy, abnormal presentation, meconium stained liquor with birth asphyxia. Our findings are consistent with them except for maternal APH which was not significantly associated with asphyxia in our study.

RDS –Relation with Maternal Factors: Roy et al, Usher et al, Thomas et al and Dudell et al[5,33-35] found incidence and mortality rates due to RDS were inversely related to gestational age. Our findings are consistent with these reports. Dudell et al, Albrecht et al and Eric Shinwell et al[35-37] documented strong association of multiple pregnancy with RDS. Crane et al and Lin et al[38,39] found that placenta previa was strongly associated with RDS. Dudell et al[35] reported association of RDS with cesarean section and our findings support the above studies. Association of RDS with maternal diabetes is reported by Usher et al and Dudell et al.[33-35] However we could not be study maternal diabetes as there were less cases of maternal diabetes in our study.

Nenatal Hyperbilirubenemia (NNH) -Relation with maternal factors: Out of 20 cases of NNH, 100% were preterm. The higher incidence of NNH in preterm is well documented by Vales et al, Anil Narang et al and Venkataseshan et al.[40-42]

With the knowledge of different factors influencing the birth of VLBW babies and their morbidity and mortality, preventive measures can be undertaken to reduce the rate of VLBW births and to improve the fate of the baby through strengthening MCH services and interventional programmes during pregnancy and adopting "at risk "approach both for pregnant mother and the newborn baby.

The limitation of our study was small sample size. Still lots of studies involving large number of cases are needed to prove or disprove the association of different maternal factors which decide the fate of VLBW baby.

Recommendations

1. In India, the majority of the deliveries are conducted in villages by basic level health workers (medical and paramedical personnel) and transport facilities are poor. Policies should be made to train these people regarding simple essential measures of maternal and neonatal care, and anticipation of premature and high-risk deliveries where expectant mothers can be referred to higher centers directly as the uterus is the best incubator for a premature baby.
2. The important aspect for the betterment of neonatal mortality is a generation of awareness among people so that they can seek early medical help.
3. Timely intervention and appropriate management of maternal high-risk factors can lead to a better neonatal outcome.
4. Neonatal Intensive Care Unit (NICU) facility leads to better neonatal survival rate hence policies should be made to increase their number in the rural parts of our country.
5. Comprehensive antenatal care and efficient Mother and child health (MCH) service as a whole can give best chances of survival and normal development of babies.

References

1. Krishnan Lalitha, Chakladar BK. Maternal risk factors and low birth weight. J Obstet Gynecol India 1989;39:52-7.
2. Singh M, editor. Nomenclature and definitions. In: Care of the newborn.6th ed. New Delhi: Sagar Publications; 2004.p. 1-11.
3. Singh M, editor. Disorders of Weight and Gestation. In: Care of the newborn.6th ed. New Delhi: Sagar Publications; 2004.p. 219-38.
4. Stoll BJ, Ira Adams-Chapman. The high risk infant. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF, editors. Nelson Textbook of Pediatrics Vol 1.18th ed. New Delhi: Elsevier; 2008.p. 698-710.
5. Roy KK, Baruah, J, Kumar S, Malhotra N, Deorari AK, Sharma JB. Maternal Antenatal Profile and Immediate Neonatal Outcome in VLBW and ELBW Babies. Indian J Pediatr 2006;73(8):669-73.
6. Sehgal A, Telang S, Passah SM, Jyothi MC. Maternal and neonatal profile and immediate outcome in ELBW babies. Pediatrics 2003;40:991-5.
7. Karmar MS. Determinants of low birth weight-Methodological assessment and Meta analysis.Bull WHO 1987;65:663-7.
8. Gera T, Ramji S. Early predictors of mortality in Very low birth weight neonates. Indian Pediatrics 2001;38:596-602.
9. Long PA, Abell DA. Fetal growth retardation and pre-eclampsia. Br J Obstet Gynecol 1980; 87:13-18.
10. Bhaumik S, Ghosh S, Haldar KK, Mitra PK, Manna B. Risk of early onset neonatal septicemia in babies born to mothers with pre-eclampsia. Indian Pediatrics 2000;37:775-9.
11. Nadkarni J, Bahl J, Parekh P. Perinatal outcome in PIH. Indian Pediatrics 2001;38:174-8.
12. Habli M, Levine RJ, Qian C, Sibai B. Neonatal outcomes in pregnancies with pre-eclampsia or gestational hypertension and in normotensive pregnancies that delivered at 35, 36or 37 weeks of gestation. Am J Obstet Gynecol 2007;197(4):406e1-406e7.
13. Doctor BA, O 'Riordan MA. Perinatal correlates and neonatal outcome of small for gestational age infants born at term gestation. Am J Obstet Gynecol 2001;185(3):652-9.
14. Normitz ER, Edusa V, Park JS. Maternal Physiology and Complications of multiple pregnancy. Seminars in perinatology 2005;29(5):338-48.
15. Lee YM, Cleary -Goldman J, D'Alton ME. Multiple gestations and late preterm deliveries. Seminars in perinatology 2006;30(2):103-12.
16. Malhotra M, Sharma JB, Batra S., Sharma S, Murthy NS. Maternal and perinatal outcome in varying degrees of anemia. Int J Obstet Gynecol 2002;79:93-100.
17. Malviya MK, Bharadvaj VK, Chansoria M, Khare S. Anthropometric profile and perinatal outcome of babies born to young women (<18 years).Indian Pediatrics 2003;40:971-6.

18. Little MP, Brocard P, Elliot P, Steer PJ. Hemoglobin concentration in pregnancy and perinatal mortality: A London based cohort study. Am J Obstet Gynecol 2005;193(1):220-6.
19. Allen LH. Anemia and iron deficiency: effects on pregnancy outcome. Am J Clin Nutr 2000;71:1280s-84s.
20. Harger JH, Hsing AW, Tuomala RE, Gibbs RS, Mead PB, Eschenbach DA et al. Risk factors for preterm premature rupture of fetal membranes-A multicentre case control study. Am J Obstet Gynecol 1990;163:130-7.
21. Crane JM, Van den Hof MC, Dodds L, Armson BA, Liston R. Neonatal outcomes with placenta previa. Obstet Gynecol 1999;93:541-4.
22. Mane SV, Gharpure VP, Merchant RH. Maternal heart disease and perinatal outcome. Indian J Pediatr 1993;30:140-1.
23. Chia YT, Yeoh SC, Viegas OA, Lim M, Retnam SS. Maternal congenital heart disease and pregnancy outcome. J Obstet Gynecol Res 1996;22:185-91.
24. Siu SC, Sermer M, Hawser DA. Risk and predictors for pregnancy related complications in women with heart disease. Circulation 1997;96:2784-94.
25. De Haas I, Harlow BL, Cramer DW, Frigoletoo FD. Spontaneous preterm birth: A case control study. Am J Obstet Gynecol 1991;165:1290-6.
26. Youssef A, Eissa AI, Hassan S, Ba'Aqeel. Risk factors for spontaneous preterm birth in a Saudi Population. European J Obstet Gynecol and Reprod Biolo 1994;57:19-24.
27. Schuchat A, Zywicki SS, Dinsmoor MJ, Mercer B, Romeguera J, O'Sullivan MJ. Risk factors and opportunities for prevention of early onset neonatal sepsis. Pediatrics 2000;105(1):21-26.
28. Kerur BM, Vishnu Bhat B, Harish BN, Habeebullah S, Udaykumar C.. Maternal Genital bacteria and surface colonization in early onset sepsis. Indian J Pediatr 2006;73(1):29-32.
29. Agarwal M, Chaturvedi P, Dey SK, Narang A. Coagulase negative staphylococcal septicemia in newborn. Indian Pediatrics 1990;27:163-9.
30. Makhoul IR, Sujov P, Smolkin T, Lusky A, Reichman B. Epidemiological, clinical and microbiological characteristics of late onset sepsis among Very low birth weight infants in Israel. Pediatrics 2002;109(1):34-9.
31. Batra A, Gupta AS, Kumar A, Das SK, Bhargava SK.A Study of asphyxia neonatorum. J Obstet Gynecol India 1988;38:162-6.
32. Lee AC, Mullony LC, Tielsch JM, Katz J, Khatry SK, LeClerqetal. Risk factors for neonatal mortality due to birth asphyxia in southern Nepal: A prospective community based cohort study. Pediatrics 2008;121(5):1381-90.
33. Usher RH, Allen AC, Melean FH. Risk of respiratory distress syndrome related to gestational age, route of delivery and maternal diabetes. Am J Obstet Gynecol 1971;111:828-31.
34. Thomas S, Verma IC, Singh M, Menon PSN. Spectrum of respiratory distress syndrome in newborn in North India: A prospective study. Indian J Pediatr 1981;48:61-5.
35. Dudell GG, Stoll BJ. Respiratory tract disorders. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF, editors. Nelson Textbook of Pediatrics Vol 1.18th ed. New Delhi: Elsevier; 2008.p. 728-52.
36. Albrecht JL, Torich PG. The maternal and neonatal outcome of triplet gestations. Am J Obstet Gynecol 1996;174(5):1551-6.
37. Shinwell ES. Neonatal morbidity of Very Low Birth Weight Infants from multiple pregnancies. Obstet Gynecol Clin N Am 2005;32(1):29-38.
38. Crane JM, Van den Hof MC, Dodds L, Armson BA, Liston R. Neonatal outcomes with placenta previa. Obstet Gynecol 1999;93:541-4.
39. Lin CH, Wang ST, Hsu YC, Lin YJ, Yeh TF, Chang FM. Risk for respiratory distress syndrome in preterm infants born to mothers complicated by placenta previa. Early Human Development 2001;60(3):215-24.
40. Vales T, Petmezaki S, Henschke C, Drummond GS. Control of jaundice in preterm newborns by inhibitor of bilirubin production. Pediatrics 1994;83:1-3.
41. Narang A, Kumar P, Kumar R. Neonatal jaundice in Very low birth weight babies. Indian J Pediatr 2001;68(41):307-9.
42. Venkataseshen S. Hyperbilirubinemia in preterm neonates –management guidelines. Journal of Neonatology2007;21(3):170-4.