

Original Research Article

A retrospective analysis of clinical spectrum and risk factors of perinatal asphyxia in neonates admitted in Special Newborn Care Unit of Central India.

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ABSTRACT

Background:

WHO has defined birth asphyxia as failure to initiate and sustain breathing at birth. perinatal Asphyxia is an insult to the newborn due to lack of oxygenation and perfusion. Early identification and control of the determinants and risk factors of perinatal asphyxia can reduce the newborn hospitalizations and mortality. The goal of the study was to analyze the clinical spectrum of perinatal asphyxia and to evaluate the risk factors associated with birth asphyxia.

Methods: The study was conducted at Special Newborn Care Unit (SNCU), Bundelkhand Medical College, Sagar, during the study period from May 22 to May 23. All neonates who fulfilled the inclusion criteria and were diagnosed as perinatal asphyxia (history of delayed cry or Apgar score of less than 7 in 5 minutes) (n=190) were included in the study. The data was collected retrospectively from SNCU records, including the maternal and neonatal risk factors.

Results: During the study period, there were 8290 live births, of whom 1711 neonates were admitted to SNCU. Among them 190 neonates were diagnosed with birth asphyxia. The cases of perinatal asphyxia accounted for 11.10 % of the SNCU admissions and 22.91/1000 live births. Among them, 78(41.1%) were females and 112(58.9%) were males. 122(64.21%) had birth weight more than 2.5kg, 131(68.9%) were born full term and 158(83.2%) were born intramurally. 34 (17.89%) mothers were having hypothyroidism. 131(68.95%) neonates were born by spontaneous normal vaginal delivery, whereas 59(31.05%) neonates were delivered by caesarean section. Most 99(52.11%) neonates were delivered after uneventful course, 60(31.58%) had prolonged second stage of labor and whereas 31(16.32%) neonates were delivered after obstructed labor. The common co-morbidities present were respiratory distress in 34(17.9%) neonates, low birth weight<1800gm in 10(5.3%) neonates and sepsis in

8(4.2%) neonates. Although less common, 3(1.6%) neonates each also additionally presented with apnea, meconium aspiration and neonatal hyperbilirubinemia.

Conclusion: Perinatal Asphyxia is one of the commonest causes of admission in SNCU. Most newborns were intramural, full term, >2.5kg with male preponderance. Maternal conditions associated with perinatal asphyxia were prolonged second stage of labor, obstructed labour and institutional delivery at the study centre, as also maternal hypothyroidism. Birth asphyxia is commonly associated with co-morbidities like respiratory distress, low birth weight <1800gm and sepsis.

Keywords; Clinical spectrum, Risk factors, Perinatal Asphyxia, Birth Asphyxia, Special newborn care unit (SNCU)

1. INTRODUCTION

Perinatal asphyxia is a common neonatal problem and contributes significantly to neonatal morbidity and mortality globally amounting to 23% of the total neonatal deaths, closely after sepsis (28%) and prematurity (26%) [1]. WHO has estimated that 4 million newborns die during the neonatal period every year. This further implies that perinatal asphyxia amounts to about a million neonatal deaths every year [1, 2]. India contributes to one fifth of global live births and more than a quarter of neonatal deaths. Of the total 6.3 million children who died before age 5 years, around 2.76 million were neonates, the highest for any country in the world. [2]

As the perinatal asphyxia is a perinatal condition, by implementing safe antenatal care, deliveries and safe neonatal resuscitation programs, there is a unique window of opportunity in preventing perinatal asphyxia in children. Hence, the study was planned to analyze the clinical spectrum of perinatal asphyxia and to evaluate the risk factors associated with birth asphyxia.

World Health Organisation has described Birth Asphyxia as “the failure to initiate and sustain breathing at birth.” [3] National Neonatology Forum of India has defined birth asphyxia as “gasping and ineffective breathing or lack of breathing 1 minute after birth”. [4] Perinatal asphyxia is also defined a condition during the first and second stage of labor in which impaired gas exchange leads to fetal hypoxemia and hypercarbia. It is identified by fetal acidosis as measured in umbilical arterial blood [5].

2. MATERIALS & METHODS

Study design: A hospital based retrospective cross-sectional observational study was conducted amongst the neonates admitted with the diagnosis of perinatal asphyxia during the study period. The data was collected retrospectively from SNCU records, including the maternal details (antenatal visits, type of delivery, place of delivery, presentation as vertex, breech, transverse or compound, course of labour, mode of transport, delivery attended by health personnel or at home etc.) and neonatal details (gender, gestational age, birth weight, source of admission, any co-morbidities etc.).

Setting: The study was conducted at Special Newborn Care Unit (SNCU), Bundelkhand Medical College, Sagar, Madhya Pradesh, India.

Study Period: The study was performed for the period of one year from 1st May 22 to 1st May 23.

Inclusion Criteria: All newborn babies admitted with a clinical diagnosis of birth asphyxia (history of delayed cry or Apgar score of less than 7 in 5 minutes) were included in the study.

Exclusion Criteria: Babies born with major congenital malformations or suspected inborn error of metabolism were excluded from the study.

Study Size: A total of 190 neonates, both intramural and extramural, admitted in the Special newborn Care Unit who fulfilled the inclusion criteria were included in the study. The data was collected retrospectively from SNCU records.

Statistical Methods: The statistical analysis was performed using SPSS 21.0 software. Proportion and percentage were calculated for qualitative data. Mean and median were calculated for quantitative data.

Ethical Approval: The study was conducted after approval from the Institutional Ethical Committee.

3. RESULTS

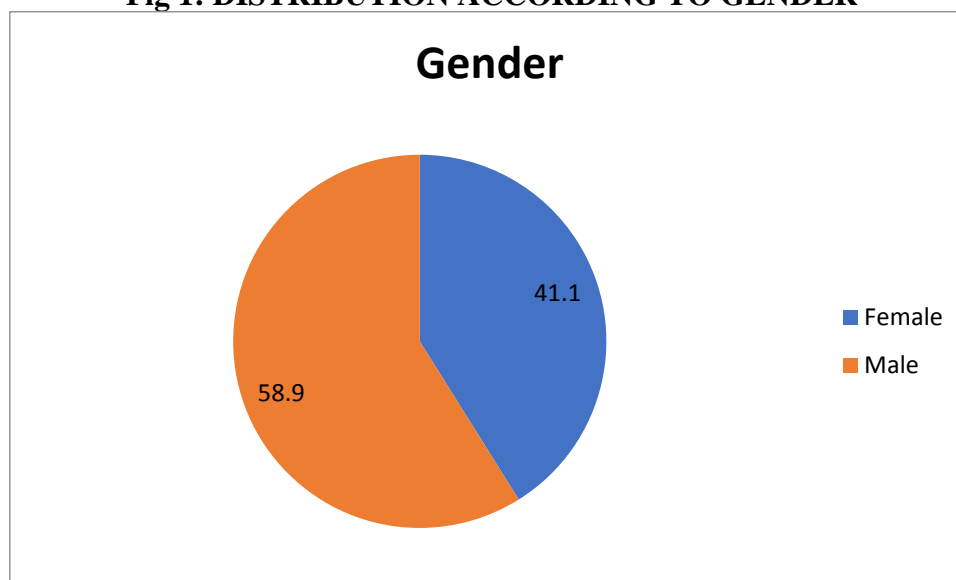
During the study period, there were 8290 live births, of whom 1711 neonates were admitted to SNCU. Among them 190 neonates were diagnosed with birth asphyxia. The cases of perinatal asphyxia accounted for 11.10 % of the SNCU admissions and 22.91/1000 live births.

CLINICAL SPECTRUM OF THE NEONATES WITH BIRTH ASPHYXIA

TABLE 1: DISTRIBUTION ACCORDING TO GENDER

Sex	Frequency(n)	Percent(%)
Female	78	41.1
Male	112	58.9
Total	190	100

Fig 1: DISTRIBUTION ACCORDING TO GENDER

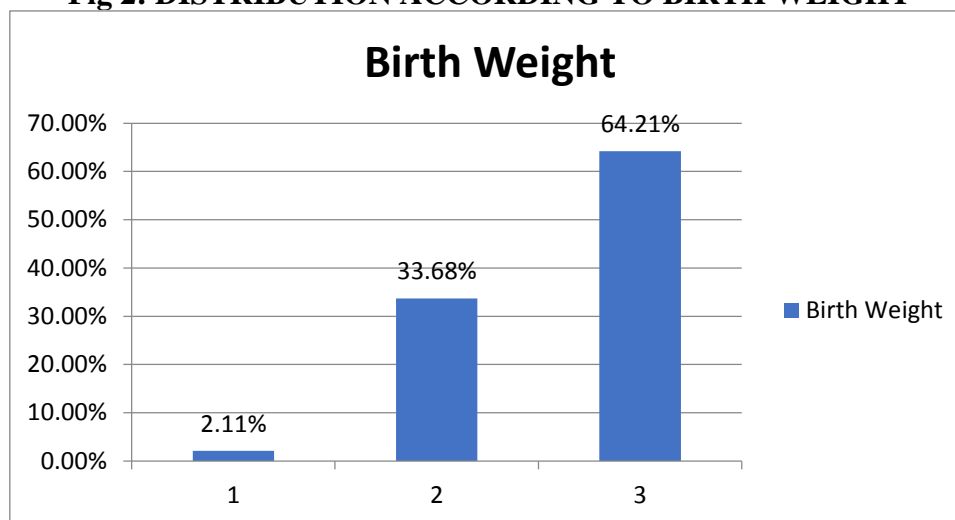


Among the 190 cases admitted in SNCU for birth asphyxia, 78(41.1%) were females and 112(58.9%) were males. Male babies were marginally higher than the females.

TABLE 2: DISTRIBUTION ACCORDING TO BIRTH WEIGHT

Birth Weight(kg)	Frequency(n)	Percent (%)
less than 1.5	4	2.11%
1.5 to 2.5	64	33.68%
more than 2.5	122	64.21%
Total	190	100%

Among the asphyxiated neonates, 122(64.21%) had birth weight more than 2.5kg, 64(33.68%) had weight between 1.5 to 2.5 kg whereas 4(2.11%) had weight less than 1.5kg.

Fig 2: DISTRIBUTION ACCORDING TO BIRTH WEIGHT**TABLE 3: DISTRIBUTION ACCORDING TO GESTATIONAL AGE**

Maturity	Frequency(n)	Percent (%)
FULLTERM (37-<42 Weeks)	131	68.9
POSTTERM (=>42 Weeks)	2	1.1
PRETERM (<37 Weeks)	57	30
Total	190	100

Among the asphyxiated neonates, 131(68.9%) were born full term, born between 37-<42 wks., 57(30%) were preterm, born before 37 weeks of gestation and 2(1.1%) neonates were post-term, born at or after 42 completed weeks.

Fig 3: DISTRIBUTION ACCORDING TO GESTATIONAL AGE

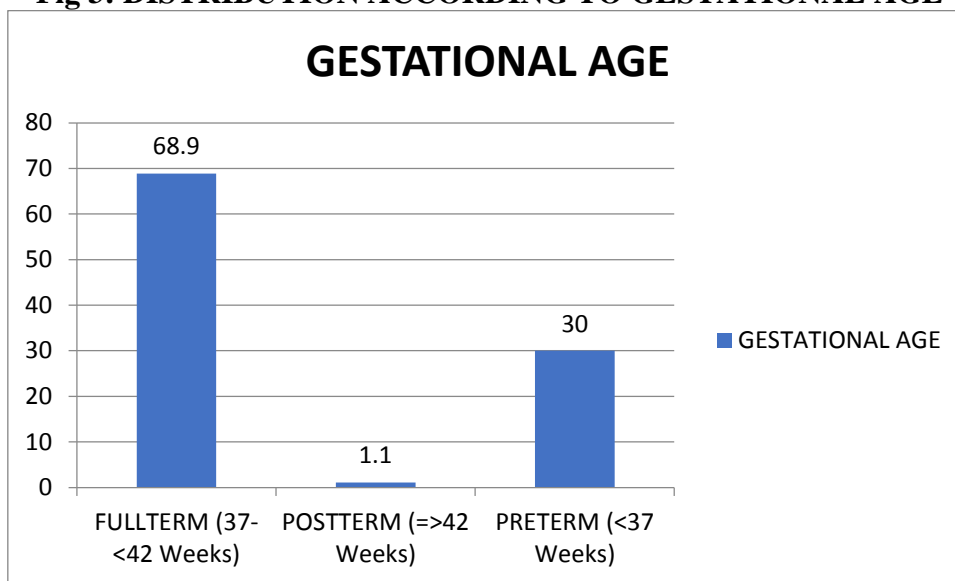


TABLE 4: DISTRIBUTION ACCORDING TO SOURCE OF ADMISSION

Type of Admission	Frequency(n)	Percent (%)
Inborn (Intramural)	158	83.2
Out born (Extramural)	32	16.8
Total	190	100

Among the asphyxiated neonates, 158(83.2%) were born intramurally i.e., neonates delivered at SNCU of Bundelkhand Medical College, Sagar whereas 32(16.8%) were born extramurally, i.e., neonates delivered outside either at other health facility or at home.

Fig 4: DISTRIBUTION ACCORDING TO SOURCE OF ADMISSION

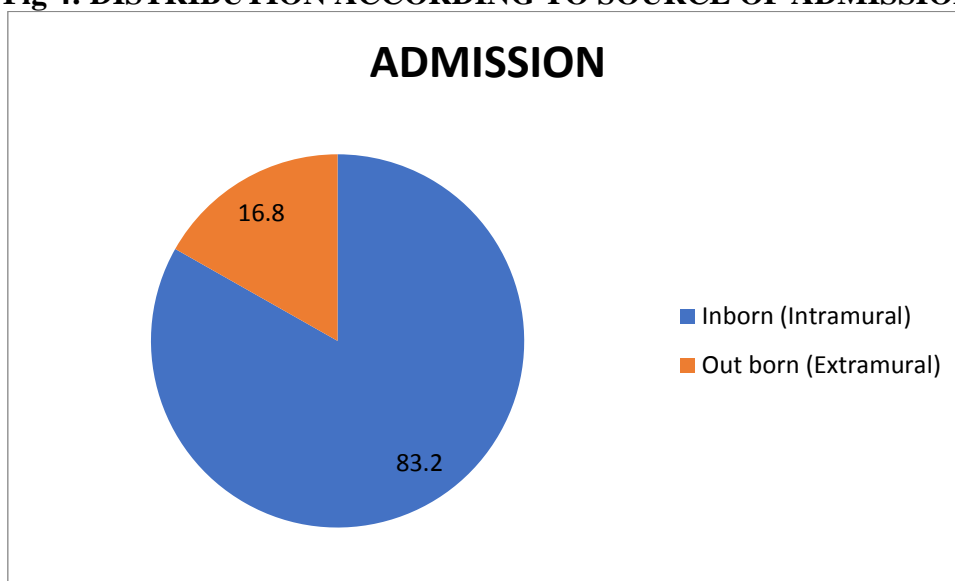


TABLE 5: DISTRIBUTION OF DETERMINANTS ASSOCIATED WITH BIRTH ASPHYXIA

DETERMINANT	CATEGORY	FREQUENCY(n)	PERCENTAGE(%)
Source of Admission	Inborn	158	83.2%
	Out born (Health Facility Referred)	32	16.8%
Region of Delivery	Sagar	164	86.3%%
	Other	26	13.7%
Mode of Transport	Govt. Provided	130	68.4%
	Self-Arranged	60	31.6%
Place of delivery	MC, BMC Sagar	158	83.16%
	Other Govt. Hospital	14	7.37%
	Private Hospital	18	9.47%
ANC Visits	1	2	1.05%
	2	23	12.11%
	3	70	36.84%
	4 or more	95	50.00%
Thyroid	Euthyroid (N)	14	7.37%
	Hypothyroid	34	17.89%
	Not Known	142	74.74%
Presentation	Breech	11	5.79%
	Transverse	2	1.05%
	Vertex	177	93.16%
Labour	Induced	59	31.05%
	Spontaneous	131	68.95%
Course of Labour	Obstructed	31	16.32%
	Prolonged 2nd Stage	60	31.58%
	Uneventful	99	52.11%
Delivery attended by	Doctor	179	94.21%
	Nurse	11	5.79%
	Total	190	100%

Most of the neonates 164(86.3%) were from urban area, Sagar city as compared to lesser 26(13.7) from rural area.

The mode of transport was government provided ambulance for 130(68.4%) neonates; whereas 60(31.6%) neonates were brought by self-arranged vehicles.

158(83.16%) neonates with asphyxia were born intramurally at the study centre; whereas 18(9.47%) neonates were brought from Private Hospitals and 14(7.37%) were referred from other Government Hospitals.

Most of the antenatal women, 95(50%) had attended antenatal checkups 4 or more times, 70(36.84%) antenatal women attended antenatal checkups thrice, 23(12.11%) attended antenatal checkups twice whereas 2(1.05%) antenatal women had attended the antenatal checkup only once.

Although most antenatal women, 142(74.74%) did not undergo the thyroid test reports, many 34(17.89%) were having hypothyroidism whereas 14(7.37%) were euthyroid.

In the present study, 131(68.95%) neonates were born by spontaneous normal vaginal delivery, whereas 59(31.05%) neonates were delivered by caesarean section. The presentation was vertex presentation in most 177(93.16%) neonates, followed by breech delivery in 11(5.79%) and transverse lie presentation in 2(1.05%). About 99(52.11%) neonates were delivered after uneventful course of labour, whereas 60(31.58%) neonates were delivered following prolonged second stage of labour and 31(16.32%) neonates were delivered after obstructed labour. The delivery was attended by doctor in 179(94.21%) deliveries and by nurse in 11(5.79%) deliveries.

TABLE 6: NEONATAL CO-MORBIDITIES IN CASE OF PERINATAL ASPHYXIA

NEONATAL CO-MORBIDITY IN CASES OF PERINATAL ASPHYXIA	FREQUENCY	PERCENT (%)
Perinatal Asphyxia alone	124	65.3
Apnea/Gasping	3	1.6
Bleeding	1	0.5
Low Birth Weight <1800 gm	10	5.3
Meconium Aspiration	3	1.6
Neonatal Jaundice	3	1.6
Necrotizing Enterocolitis	2	1.1
Prematurity <34 weeks	2	1.1
Respiratory Distress (Rate>60 or Grunt/Retractions)	34	17.9
Sepsis	8	4.2
Total	190	100

124(65.3%) neonates had only perinatal asphyxia as a presentation. Table 6 suggests the various co-morbidities that were diagnosed in neonates suffering from birth asphyxia. The common co-morbidities present were respiratory distress in 34(17.9%) neonates, low birth weight<1800gm in 10(5.3%) neonates and Sepsis in 8(4.2%) neonates. Although less commonly, 3(1.6%) neonates each also additionally presented with apnea, meconium aspiration and neonatal hyperbilirubinemia. Necrotizing enterocolitis and prematurity below 34 weeks were observed in 2(1.1%) neonate each. 1 neonate (0.5%) also had bleeding as a manifestation.

4. DISCUSSION

Although perinatal asphyxia is a very significant and common cause of mortality and hospitalization in newborns, the true burden of the disease is difficult to estimate [6]. One reason is that different definitions are used in various studies, based on respiratory efforts, respiratory distress, Apgar score at 1 minute or 5 minute and umbilical arterial pH [3, 4, 5]. Also, perinatal asphyxia and intrapartum-related conditions not only lead to neonatal deaths, but account for a significant proportion of stillbirths apart from long term impact on neurodevelopmental morbidity.

The reported incidence varies from 2 to 16.2% in community-based studies [7]. About 2.8 and 5.6% of all live births had moderate and severe asphyxia, respectively, in a large hospital-based study [8].

Among the 1711 neonates admitted in SNCU, there were 190 neonates (both intramural and extramural) with birth asphyxia, accounting for 11.10 % of all SNCU admissions. Similar observations of 8.8% and 8.3% have been reported by Yelamali [9] and Muthuswamy et al[10]. Lower incidence of 5.1% has been reported in a study by Siva Saranappa et al.[11] Higher incidence of 20% has been reported by Rathi Y.[12]

During the study period, there were 8290 live births, among them 190 neonates were diagnosed with birth asphyxia. The cases of perinatal asphyxia accounted for 22.91/1000 live births. In a Swedish study, lower incidence of 5.4/1000 live births have been reported, whereas incidence of 21.7/1000 live births have been reported by Rasanja et al[14] and 22/1000 live births have been reported in an Indian study by Chandra et al, although they also found total asphyxia rate including still births to be as high as 36.3/1000 births. [15].

In our study, 122(64.21%) neonates had birth weight more than 2.5kg, 64(33.68%) had weight between 1.5 to 2.5 kg whereas 4(2.11%) had weight less than 1.5kg. Chikkanna et al reported 52% neonates between 1.5-2.5kg, 33% between 2.5-4kg and 15% neonates >4Kg weight.[16] Dongol et al reported 50% neonates between 2.5-3kg, 30.3% <2.5kg and 19.6% >3kg.[17]

131(68.9%) were born full term, born between 37-<42 wks., 57(30%) were preterm, born before 37 weeks of gestation and 2(1.1%) neonates were post-term, born at or after 42 completed weeks. Similar incidence of 23.5% in preterm neonates has been reported by Muthuswamy et al[10]. 19.6% incidence in preterm has been reported by Dongol et al, whereas full term reported were 76.47% and post term were 3.92% [17] Higher incidence in post term neonates of 19% have been reported by Bhandari et al, whereas premature babies reported were 20% and term babies were 61% [18].

158(83.2%) were born intramurally whereas 32(16.8%) were born extramurally. Similar preponderance of intramural neonates upto 72% have been reported by Bhandari et al[18], Muthuswamy et al reported 39% inborn and 61% outborn neonates[10].

We observed 78(41.1%) females and 112(58.9%) males amongst asphyxiated neonates in our study. Similar male preponderance has been observed in various studies, as 61.3% [10], 55.8% [17], 65% [18]. Although, Siva Saranappa observed 70% male preponderance in his study [12].

34 (17.89%) mothers were having hypothyroidism and 14(7.37%) were euthyroid, although 142(74.74%) antenatal women did not undergo the thyroid testing. Maternal hypothyroidism is a disorder with great potential to adversely affect maternal and fetal outcomes. Children born to mothers with hypothyroidism had a significantly increased risk of impairment in IQ scores, neuropsychological developmental indices and learning abilities [19].

Regarding antenatal checkups in the study, 95(50%) had attended antenatal checkups 4 or more times, 70(36.84%) antenatal women attended antenatal checkups thrice, 23(12.11%)

attended antenatal checkups twice whereas 2(1.05%) antenatal women had attended the antenatal checkup only once. In a study by Dongol S, 15.6% women had no ANC checkups during pregnancy[17].

Regarding the mode of delivery, 131(68.95%) neonates were born by spontaneous normal vaginal delivery, whereas 59(31.05%) neonates were delivered by caesarean section. Higher rates of approximately 39% Caeserean deliveries have been reported in studies by Bhandar[18]i and Dongol et al[17]. Lower rates of 5% Caeserean deliveries have been reported by few authors[11].

Most 99(52.11%) neonates were delivered after uneventful course, 60(31.58%) had prolonged second stage of labor and whereas 31(16.32%) neonates were delivered after obstructed labor. The common co-morbidities present were respiratory distress in 34(17.9%) neonates, Low birth weight<1800gm in 10(5.3%) neonates and sepsis in 8(4.2%) neonates. Although less common, 3(1.6%) neonates each also had apnea, meconium aspiration and neonatal hyperbilirubinemia. This study did not find meconium stained amniotic fluid as a risk factor in birth asphyxia, whereas 37.25% mothers of asphyxiated neonates had been reported as having thick meconium stained amniotic fluid(MSAF) by Dongol et al in their study, as also 40% thick MSAF by Siva Saranappa[17].

The most serious complication of birth asphyxia is Hypoxic ischemic encephalopathy. Kimberly et al published in 2011 that around 40-60% of asphyxiated children die by 2 years of age or have severe with chronic neurodevelopmental morbidities including cerebral-palsy, mental retardation and learning disabilities which are not only a burden to the individual and the family unit but also to the community. [20]

5. CONCLUSION

Perinatal Asphyxia is one of the commonest causes of admission in SNCU. Most newborns were intramural, full term,>2.5kg, males. Maternal conditions associated with perinatal asphyxia were prolonged second stage of labour, obstructed labour and institutional delivery at the study centre as also maternal hypothyroidism. Birth asphyxia was commonly associated with co-morbidities like respiratory distress, low birth weight<1800gm and sepsis. Universal screening for hypothyroidism might be a better option, as it is potentially treatable condition with prompt results.

There has been significant improvement in neonatal health and decline in the neonatal mortality rate in India over the decades. Still there are wide disparities in the quality and availability of regional health care delivery systems, which need to be addressed.

6. REFERENCES

1. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE. Global, regional and national causes of child mortality in 2000-2013, with projections to inform post 2015 priorities: an updated systematic analysis. *Lancet* 2015; 385(9966): 430-440.
2. Bryce J, Boschi-Pinto C, Shibuya K, Black RE. WHO estimates of the causes of death in children. *Lancet*. 2005; 365(9465):1147-52.
3. World Health Organisation. Basic Newborn Resuscitation;A practical guide. World health Organisation: Geneva 1997.

4. Lawn JE, Couzens S, Zupan J. 4 million deaths: when? Where? Why? *Lancet* 2005; 365:891-900.
5. Eric C. Eichenwald, Anne R. Hansen, Camila R. Martin, Ann R. Stark. Chapter55: Perinatal asphyxia & Hypoxic Ischemic Encephalopathy, Cloherty 8th edition 2017.
6. Sankar MJ, Neogi SB, Sharma J, Chauhan M, Srivastava R, Prabhakar PK, Khera A, Kumar R, Zodpey S, and Paul VK. State of newborn health in India. *J Perinatol*. 2016 Dec; 36(Suppl 3): S3–S8. Published online 2016 Dec 7. doi: 10.1038/jp.2016.183
7. Daga SR, Daga AS, Dighole RV, Patil RP, Dhinde HL. Rural neonatal care: Dahanu experience. *Indian Pediatr* 1992; 29(2): 189–193.
8. National Neonatal Perinatal Database. Report for the year 2002–03. Available at http://www.newbornwhocc.org/pdf/nnpd_report_2002-03.PDF (accessed on 2 April 2016).
9. Yelamali BC, Panigatti P, Pol R, Talawar KB, Naik S, Badakali A. Outcome of newborn with birth asphyxia in tertiary care hospital - a retrospective study. *Medica Innovatica*. Dec 2014, Vol3, Issue2:59-64
10. Muthusamy R, Sengottaiyan P. Clinical Profile of Perinatal Asphyxia in a Special Newborn Care Unit at a District Hospital in South India *International Journal of Science and Research (IJSR)*. January 2020: Volume 9 Issue 1:1683-7.
11. Siva Saranappa S B, Chaithanya C Nair, Madhu G N, Srinivasa S, Manjunath MN, Clinical profile and outcome of perinatal asphyxia in a tertiary care centre. *Curr Pediatr Res* 2015 ;19(1)Pg9-12
12. Rathi Y. To study the clinical profile and early outcome of term asphyxiated newborns intramurally and extramurally in SNCU, Dr. Bram Hospital, Raipur, Chhattisgarh, India. *Pediatric Rev Int J Pediatr Res*. 2020;7(4):174-180.
13. Thornberg E, Thiringer K, Odeback A, Milson I. Birth Asphyxia; incidence, *clinical course and outcome in a Swedish population*. *Acta Paediatr* 1995; 84: 927-32.
14. Rasania, M., Patel, P., Chandna, S., Pathak, S., Shravya, G. L., Shah, B. B., & Arora, M. (2022). Clinical profile and outcome of term asphyxiated neonates in neonatal ICU of rural India. *International Journal of Health Sciences*, 6(S3), 1684-1695.
15. Chandre S, Ramji S, Thirupurum S, Perinatal asphyxia; multivariate analysis of risk factors in Hospital birth. *Indian Pediatr* 1997; 34:206-12.
16. Chikkanna S, Kavya S, Saravanan P, Nagaraj MV. Evaluation of risk factors for perinatal asphyxia in a tertiary care hospital in Bangalore: an observational prospective study. *Int J Contemp Pediatr* 2020;7:1952-6.
17. Dongol S, Singh J, Shrestha S, Shakya A. Clinical Profile of Birth Asphyxia in Dhulikhel Hospital: A Retrospective Study. *J Nep Paediatr Soc* 2010;30(3):141-146.
18. Bhandari N, Joshi N, Adhikari S, Singh PK and Shrestha N. Prevalence of perinatal asphyxia in neonates in a tertiary care center: A descriptive cross-sectional study. *World Journal of Advanced Research and Reviews*, 2022, 15(02), 557–561
19. Sahay RK, Nagesh VS. Hypothyroidism in pregnancy. *Indian J Endocrinol Metab*. 2012, May-Jun; 16(3):364-370
20. Klimberly A, Debra B. Hypoxic ischaemic encephalopathy: pathophysiology and experimental treatments. *Newborn Infant Nurs Rev*. 2011 September 1; 11(3)125-133