International Journal of Medical and Pharmaceutical Research
Website: https://ijmpr.in/ | Print ISSN: 2958-3675 | Online ISSN: 2958-3683
NLM ID: 9918523075206676
Volume: 4 Issue:3 (May-June 2023); Page No: 101-105

Original Article

IJMPR
Copyright@IJMPR

Study of Cranial Ultrasound Findings in Neonates with Perinatal Risk Factors and It's Clinical Profile: A Descriptive Study

Dr. Sneha Bobade[1], Dr.Sambhaji Wagh[2], Dr. Deepa Phirke[3]

[1]Resident, Department of Pediatrics, Government Medical College Miraj, Pandharpur Road, Maji Sainik Vasahat, Miraj, Maharashtra-416410, INDIA
[2]Associate Professor, Department of Pediatrics, Government Medical College Miraj, Pandharpur Road, Maji Sainik Vasahat, Miraj, Maharashtra-416410, INDIA
[3]Professor and HOD, Department of Pediatrics, Government Medical College Miraj, Pandharpur Road, Maji Sainik Vasahat, Miraj, Maharashtra-416410, INDIA

ABSTRACT

Background: Cranial ultrasonography is an easily accessible, well-accepted, first-line imaging modality that is widely used to screen preterm and high-risk infants for brain injury in the neonatal period. The present study was undertaken to determine the frequency of cranial ultrasound abnormalities in neonates in the first week of life and study the association between abnormal cranial ultrasound findings in neonates with perinatal risk factors in regard to the immediate clinical outcome in the form of mortality. **Method**: A total 150 neonates of both the genders from day 0 to day 28 of life with perinatal risk factors who had undergone cranial USG in first week of life were included in the study. Cranial ultrasound of these neonates was done. The cranial ultrasound findings, other demographic parameters, perinatal risk factors, clinical status and immediate outcome were noted. **Results**: The frequency of cranial ultrasound abnormalities in neonates in the first week of life was 28%. Among subjects with abnormal findings, all were studied in 24 to 72 hrs. of life. Pregnancy induced hypertension (47.83%) and prelabour rupture of membranes (34.78%) was high among subjects with abnormal cranial findings. Germinal matrix haemorrhage (GMH) was high among subjects with abnormal cranial findings (61.9%) with observed high perinatal risk factor being prematurity with low birth weight (1.5-2kgs) (59.5%). Among 42(28%) abnormal neonates, 35 (83.3%) were recovered and 6(14.28%) were discharged on request/DAMA and 1(2.38%) had mortality. **Conclusion**: The study concludes that cranial ultrasonography is critical as an investigatory modality in NICU and effectively documents morphology of brain damage.

Key Words: *Cranial; Ultrasonography; Mortality; Germinal matrix haemorrhage; Prematurity; Neonates*

***Corresponding Author**
Dr Sneha Dattatraya Bobade
Resident, Department of Pediatrics, Government Medical College Miraj, Pandharpur Road, Maji Sainik Vasahat, Miraj, Maharashtra-416410, INDIA

INTRODUCTION

Cranial ultrasonography (CUS) has become an essential diagnostic tool in modern neonatology for depicting normal anatomy and pathological changes in neonatal brain. In the neonate, many sutures and fontanelles are still open, and these can be used as acoustic windows to "look" into the brain [1]. Any neonate, regardless of birth weight, gestational age who has a greater than average chance of morbidity or mortality due to fetal, maternal, or placental anomalies or otherwise compromised pregnancy especially within first 28 days of life is categorised as high-risk neonates [2].

CUS plays an important role in assessing neurological prognosis of these high-risk infants. It can be easily performed at the bedside with a portable ultrasound machine, conveniently in the NICU which meets the definition of point-of-care testing (POCT). It is also cost effective, radiation free and its safety is well established in infants [3]. It is cheap, easy to perform, non-invasive and can be initiated at a very early stage even immediately after birth. It can be repeated as often as necessary and thereby enables visualisation of ongoing brain maturation and the evolution of brain lesions. In addition, it can be used to assess the timing of brain damage [1]. As a result of ongoing development in ultrasonography, image quality is high nowadays, provided optimal settings and techniques are applied. Using additional acoustic windows can significantly augment the diagnostic power of CUS [4].

In seriously ill neonates and in neonates with serious cerebral abnormalities either congenital or acquired, it plays a role in decisions on continuation or withdrawal of intensive treatment. In neonates surviving with cerebral injury, it may help to optimize treatment of the infant both during the neonatal period and thereafter [5]. Most newborn intensive care unit centres perform serial cranial ultrasound evaluations early in the course of hospitalization for premature infants and

often a follow up examination is done at later age. These evaluations are done to document the presence of intracranial haemorrhage to guide choice of therapies that may exacerbate risk of further haemorrhage and to counsel families about neurodevelopment outcomes [6].

Early identification of brain abnormalities by using cranial ultrasound would allow early interventions to improve long-term outcome. However cranial ultrasound has limitations as quality of imaging depends upon skills and experience of ultrasonographer, some areas are difficult to visualize, and several abnormalities remain beyond its scope [1, 7].

CUS examination should be performed soon after birth and further examinations depending on clinical symptoms and previous CUS findings in critically ill full-term neonates and full-term neonates with congenital anomalies [8]. Sonography of the brain is now an integral part of care in the neonate, among unstable premature and high-risk infant. Therefore, this study aimed to evaluate the diagnostic value of CUS in high-risk neonates.

Materials and Methods

After obtaining Institutional Ethical Committee approval and written informed consent from all the parents/guardians, this prospective observational study was conducted in the neonatal intensive care unit (NICU) of a tertiary care hospital during a period of 18 months from March 2021 to September 2022. A total 150 neonates of both the genders from day 0 to day 28 of life with perinatal risk factors who had undergone cranial USG in first week of life were included in the study. Patients who went DAMA or Discharges, patients who withdrawn consent and patients with incomplete data were excluded from the study.

Records of all neonates admitted to NICU who underwent neuro-sonography was collected. Duration based of all admissions in NICU during the above period was reviewed. Case records of all babies admitted was analyzed. We have focus on the early cranial USG abnormalities. The cranial ultrasound findings, other demographic parameters, perinatal risk factors, clinical status and immediate outcome was obtained from the case records. The study was including all neonates with perinatal risk factors whose cranial ultrasound was performed in the first week of life. Participant information sheet was given. After reporting the data was analysed as per study.

Statistical Analysis

Continuous variables were summarized using means while categorical variables were summarized using percentages.

Observations and Results

A total of 150 neonates were included in the study. The incidence of abnormal CUS findings in the high-risk neonates was 28%. Out of 150 neonates, 64 (42.7%) were females and 86(57.3%) were males. All the abnormal 42(28%) findings on CUS were picked up during 24-72 hours of life.The majority of 75(50%) neonates belong to more than 36 weeks of gestation with mean gestation was 36±2.60 weeks. However, majority of neonates 61(40.67%) were between 1.5 – 2 kg birth weight with mean birth weight of neonates was 1.8±0.54 kg, (Table 1).Out of 150 neonates, mode of delivery was normal vaginal for 75(50%) neonates and 75(50%) via LSCS for various reasons.

Table 1: Demographic profile of the neonates

Demographic data		Normal	Abnormal
Gender	Female	48 (44.4%)	16 (38.1%)
	Male	60 (55.6%)	26 (61.9%)
Hours of life	< 24 Hrs	19 (17.59%)	00 (0.0%)
	24 to 72 Hrs	50 (46.29%)	42 (100.0%)
	72 and above	39 (36.11%)	00 (0.0%)
Weeks of gestation	<32	18 (16.66%)	12 (28.57%)
	33 to 36	32 (29.62%)	13 (30.95%)
	>36	58 (53.70%)	17 (40.47%)
Birth Weight	<1	11 (10.18%)	09 (21.42%)
	1 to 1.5	11 (10.18%)	04 (9.52%)
	1.5 to 2	47 (43.51%)	14 (33.33%)
	2 to 2.5	25 (23.14%)	09 (21.42%)
	2.5 to 3	14 (12.96%)	06 (14.28%)

Among 108 normal patients, 35 patients were observed with maternal risk factors and among 42 abnormal patients, 23 patients were observed with maternal risk factors. Pregnancy induced hypertension and Prelabour rupture of membranes was high among subjects with abnormal cranial findings as depicted in figure 1.

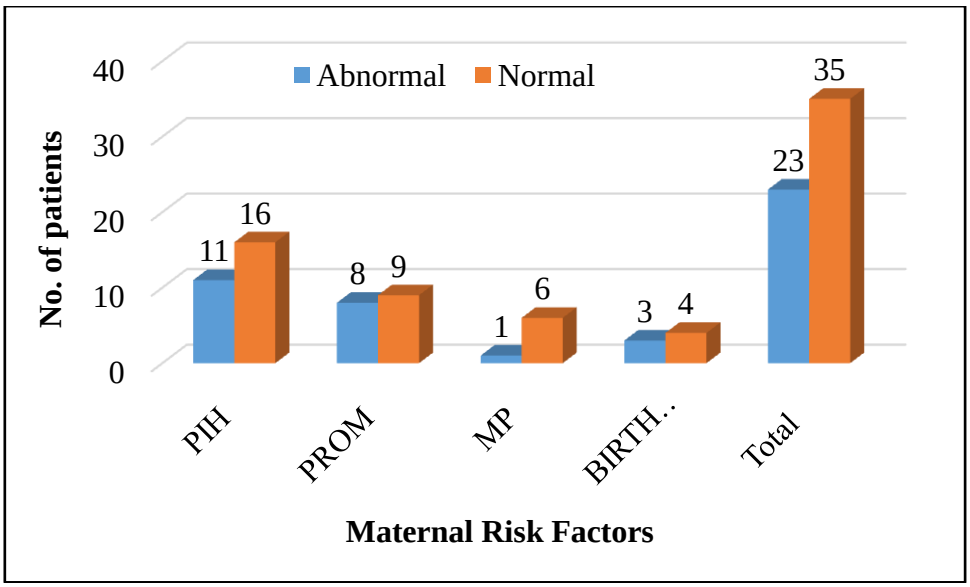

Figure 1: Distribution of patients as per maternal risk factors

Prematurity was the most common fetal complications followed by respiratory distress in normal and abnormal cranial findings as shown in table 2.

Table 2: Distribution of patients as per fetal complications

Fetal Complications	Normal	Abnormal
Prematurity	50 (46.3%)	25 (59.5%)
Birth asphyxia	44 (40.7%)	14 (33.3%)
Birth trauma	04 (3.7%)	03 (7.1%)
Neonatal sepsis	30 (27.8%)	12 (28.6%)
Respiratory distress	54 (50.0%)	20 (47.6%)
Neonatal seizures	15 (13.9%)	12 (28.6%)
Hypoglycemia (RBS-<40mg%)	09 (8.3%)	06 (14.3%)
Hypocalcemia (serum calcium <7mg/dl)	04 (3.7%)	05 (11.90%)

Germinal matrix haemorrhage (GMH) was high among subjects with abnormal cranial findings followed by TH as depicted in figure 2.

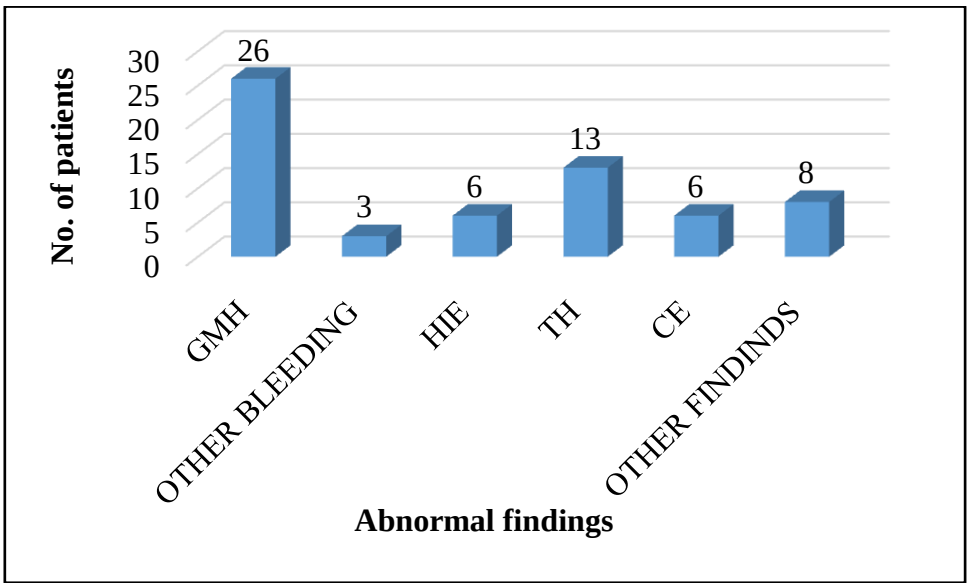

Figure 2: Distribution of patients as per abnormal finding with cranial ultrasound findings

HIE-Hypoxic Ischemic Encephalopathy; CE: Cerebral oedema

Among 42(28%) abnormal neonates, 35 (83.3%) were recovered and 6(14.28%) were discharged on request/DAMA and 1(2.38%) had mortality as shown in table 3.

Table 3: Distribution of patients as per outcome

Outcome	Abnormal	Normal	Total
Recovered	35 (83.3%)	98 (90.74%)	133 (88.66%)
DOR/DAMA	06 (14.28%)	10 (9.25%)	16 (10.66%)
Death	01 (2.38%)	00 (0.0%)	01 (0.66%)

DISCUSSION

Cranial ultrasonography is currently the primary imaging modality employed in the NICU for assessment of neonatal brain. While Daneman et al reported cranial ultrasound to be extremely useful modality in neonates, De Vries and Cowan et al have suggested that cranial ultrasound and MRI brain are complementary modalities [9]. Benefits of CUS are that it can be performed at the bedside and in the sickest infant. It allows early detection of congenital as well as hypoxic-ischemic brain injury. When neonate is unstable for transport, cranial USG findings may be sufficient for major clinical decisions [9-11].

In present study, the incidence of abnormal CUS findings in high-risk was 28%.Similarly, most of the other Indian reports have reported incidence of 25.45%, 29.8%, 36%, 38% [12-15]. However, these studies have not specified the exact time of neurosonography.

Out of 150 neonates, 64 (42.7%) were females and 86(57.3%) were males, among 64 females 16 (25%) were abnormal and 48 (75%) were found to be normal as per cranial ultrasound findings. Among 86 males 26 (30.2%) were abnormal and 60 (69.8%) were found to be normal as per cranial ultrasound findings. The majority of neonates 92(61.33%) belong to 24 to 72 hours of life, 39 (26%) neonates were noted with more than 72 hours of life and 19(12.67%) were having less than 24 hours of life. All the abnormal 42(28%) findings on CUS were picked up during 24-72 hours of life. However, the majority of 75(50%) neonates belong to more than 36 weeks of gestation, followed by 33-36 weeks of gestation with 45(30%) neonates and less than 32 weeks of gestation included only 30(20%) neonates. Among abnormal findings 12 neonates belong to less than 32 weeks of gestation, 13 neonates belong to 33 – 36 weeks of gestation and 17 neonates belong to more than 36 weeks of gestation. Mean gestation was 36±2.60 weeks. Maximum neonates 61(40.67%) were between 1.5–2 kg birth weight, followed by 2–2.5 kg with 34 (22.67%) neonates, less than 1kg was noted in 20 (13.33%) neonates, more than 2.5 kg also include 20 (13.33%) neonates and birth weight between 1–1.5 kg included on 15(10.00%) neonates. Mean birth weight of neonates was 1.8±0.54 kg. Out of 150 neonates, mode of delivery was normal vaginal for 75(50%) neonates and 75(50%) via LSCS for various reasons. Among 108 (72%) normal patients as per cranial ultrasound findings, 53(49.1%) patients were delivered by LSCS and 55(50.9%) were delivered by vaginal delivery. Among 42(28%) abnormal patients as per cranial ultrasound findings 22(52.4%) patients were delivered by LSCS and 20(47.6%) were delivered by vaginal delivery. All the above findings are in accordance with the study conducted by Prithviraj D et al [7] and Shankar P et al [16].

Among 108 normal patients, 35 patients were observed with maternal risk factors from which 16(45.71%) had PIH, 9(27.71%) had PROM, 6 (11.43%) had history of multiple pregnancy and 4(11.43%) had history of birth trauma. Among 42 abnormal patients, 23 patients were observed with maternal risk factors from which 11(47.83%) had PIH, 8(34.78%) had PROM, 1(4.35%) had history of multiple pregnancy and 3(13.04%) had history of birth trauma. Similar resultsare observed in a study conducted by KinikarU et al [17] and Choudhary S et al [18].

Among 108 normal neonates, prematurity was observed in 50 (46.3%), birth asphyxia observed in 44 (40.7%) birth trauma observed in 4 (3.7%), neonatal sepsis observed in 30 (27.8%) respiratory distress observed in 54 (50%) neonatal seizures observed in 15 (13.9%),hypoglycemia (RBS-<40mg%) observed in 9 (8.3%) hypocalcemia (serum calcium <7mg/dl) observed in 4 (3.70%) neonates. Whereas among 42 abnormal neonates, prematurity was observed in 25 (59.5%), birth asphyxia observed in 14 (33.3%), birth trauma observed in 3 (7.1%), neonatal sepsis observed in 12 (28.6%), respiratory distress observed in 20(47.6%), neonatal seizures observed in 12(28.6%), hypoglycemia (RBS-<40mg%) observed in 6 (14.3%), hypocalcemia (serum calcium <7mg/dl) observed in 5 (11.90%) neonates, respectively. Thes findings are comparable with the other studies [7, 16].

Out of 42 (28%) abnormal neonates among which found following abnormalities such as majority of neonates had GMH which was observed in 26 (61.9%), other bleeding observed in 3 (7.1%), HIE observed in 6 (14.28%), TH observed in 13 (30.9%), CE observed in 6 (14.28%), other findings observed in 8 (19.04%) neonates. In the present study, among 42(28%) abnormal neonates (35)83.3% were recovered and discharged, 6(14.28%) were discharged on request/DAMA and 1(2.38%) had mortality. Similar resultsare observed in a study conducted by Shankar P et al [16] and Kinikar U et al [17]. Also, another study conducted by Prithviraj Det al found that 94% of neonates enrolled had good recovery at the time of NICU discharge, 4% died and 2% discharged on request/DAMA [15].

CONCLUSION

Cranial ultrasonography is an ideal tool for the primary screening of the neonatal brain. This study highlights the convenience and diagnostic efficiency of cranial ultrasound in high-risk neonates in NICU. The study concludes that cranial ultrasonography is critical as an investigatory modality in NICU and effectively documents morphology of brain

damage. Finally, individualized protocols need to be laid down in the NICU for cranial ultrasonography based on the neonatal workload and the available resources.

REFERENCES

1. Gerda van Wezel-Meijler(2007). Cranial Ultrasonography: Advantages and Aims Part 1, Neonatal Cranial Ultrasonography, 1st edn. Berlin: Springer, 3-4.
2. Mosby's Medical Dictionary, 8th edition, Elsevier, 2009
3. Bracci R, Perrone SN, Buonocore G(2006). The Timing of Neonatal Brain Damage. Biol Neonate; 90:145–155.
4. Lara M. Leijser, Frances M. Cowan(2007). State-of-the-Art Neonatal Cranial Ultrasound. Ultrasound; 15: 6-17.
5. Veyrac C et al(2006). Brain ultrasonography in the premature infant. PediatrRadiol; 36: 626–635.
6. De Vries LS(2002). Groenendaal F. Neuroimaging in the preterm infant. Ment Retard Dev Disabil Res Rev; 8: 273–280.
7. Prithviraj D, Reddy B, Shruthi B(2016). Neurosonogram in critically ill neonates in neonatal intensive care unit. IntJ Sci Stud; 4(1):124-128.
8. El-Khuffash A, Herbozo C, Jain A, Lapointe A, McNamara PJ(2013). Targeted neonatal echocardiography (TnECHO) service in a Canadian neonatal intensive care unit: a 4-year experience. J Perinatol; 33:687-90.
9. de Vries LS, Cowan FM(2007). Should cranial MRI screening of preterm infants become routine? Nat Clin Pract Neurol;3(10):532-3.
10. Tann CJ, Nakakeeto M, Hagmann C et al(2016). Early cranial ultrasound findings among infants with neonatal encephalopathy in Uganda: an observational study. Pediatric Research;80(2):190-196.
11. Leijser LM, Vein AA, Liauw L, Strauss T, Veen S, Wezel-MeijlerGv(2007). Prediction of short-term neurological outcome in full-termneonates with hypoxic-ischaemic encephalo-pathy based on combined use of electro encephalogram and neuroimaging. Neuropediatrics;38(5):219-27.
12. Jha R, Singh A, Jha R(2017). Cranial ultrasound in high risk preterm. New Indian Journal of Pediatrics;6(1):26-32.
13. Nagraj N, Berwal PK, Srinivas A, et al(2016). A study of neurosonogram abnormalities, clinical correlation with neurosonogram findings, and immediate outcome of high-risk neonate in neonatal intensive care unit. J PediatrNeurosci;11:200-5.
14. Poornima Shankar, Nithya S.L(2014). Role of cranial ultrasound in highrisk neonates in NICU. J of Evolution Med and Dent Sci;3(15);3970-3976.
15. Prithviraj D, Reddy B, Shruthi B(2016). Neurosonogram in critically ill neonates in neonatal intensive care unit. Int J Sci Stud;4(1):124-128.
16. Shankar P, Nithya S. L(2014). Role of Cranial Ultrasound in High-risk Neonates in NICU. Journal of Evolution of Medical and Dental Sciences; 3(15): 3970-3976.
17. Kinikar U, Dhanawade S(2018). Study of cranial ultrasound its correlation with perinatal risk factors and its outcome in preterm neonates admitted to Neonatal intensive care unit. Int J Pediatr Res;5(4):169-174.
18. Choudhary S, Niranjan Nagaraj, Pramod Kumar Berwal(2016), A prospective study of correlation of gestational age, birth weight and perinatal risk factors with various cranial ultra sound findings in high-risk neonates. Indian Journal of Neurosciences;2(2): 43-45.