ISSN : 1001-1781
Journal of Clinical Otorhinolaryngology, Head, and Neck Surgery

THE USE OF CRANIAL ULTRASONOGRAPHY IN THE ASSESSMENT OF BRAIN DAMAGE IN PRETERM INFANTS

Dr.Abhishek.N.A
3rd Year Resident, Department of Radiodiagnosis, SBKS MI & RC, Vadodara (1st author)

Dr.Ashutosh Patel
Assistant professor, Department of Radiodiagnosis, SBKS MI & RC, Vadodara
(corresponding author)

Dr.Janvhi Gugale
3rd Year Resident, Department of Radiodiagnosis, SBKS MI & RC, Vadodara

Dr.Pradip Jhala
Professor and Head, Department of Radiodiagnosis, SBKS MI & RC, Vadodara

Dr.Sanjana S Sharoff
3rd Year Resident, Department of Radiodiagnosis, M.S.Ramaiah Medical college, Bengaluru

ABSTRACT

Introduction: Intracranial haemorrhages, perinatal hypoxia, and congenital defects increase the likelihood of neurological disorders in preterm newborns. Appropriate care of these disorders depends on early detection. At the bedside, cranial ultrasonography can be utilised to diagnose certain kinds of illnesses.

Goal: The current study was conducted to identify and categorise brain injuries using neurosonograms and to assess whether or not these findings might be used to predict prognosis and outcome at the conclusion of the investigation.

Materials and Methods: This was a prospective study carried out at Dhiraj general Hospital,Gujarat over a period of 6 months.This study involved 60 preterm infants who had possible neurological damage. Within a week after delivery, a neurosonogramwas performed and a follow-up scan was completed a month later.

Findings: In our current study,18.3%(n=11) of preterm newborns had abnormal CUS.Of the neonates,38.3% were females and 61.6% were males.Of these,3% had periventricular echogenecity, 1.6% had ventriculomegaly, 1.6% had periventricular leukomalacia and 11.6% showed signs of cerebral haemorrhage. Seizures were the most frequent clinical presentation which was followed by lethargy and lack of sucking. The majority of newborns with brain damage were born before 32 weeks.

Conclusion: The most effective way to look at potential neurological damage in preterm babies is via a neurosonogram. For preterm babies, it is recommended to perform neurosonogram

investigations within the first week of life and a follow-up scan at the end of the first month. It is inexpensive, easily accessible, repeatable, non-invasive and non-ionizing.

INTRODUCTION

The phrase "preterm neonates" refers to babies born before 37 full weeks of pregnancy. Premature babies are more likely than term babies to experience intraventricular haemorrhage,respiratory disorders,patent ductus arteriosus,sepsis and visual abnormalities such as retinopathy of prematurity. Neurodevelopmental delays are more common in these newborns. Cranial ultrasonography is a non- invasive method of diagnosing brain problems and can be performed bedside. It may identify the majority of cerebral infections, calcifications, hemorrhagic, ischemic and cystic brain lesions, as well as significant structural abnormalities in both full-term and preterm newborns [1]. It may be beneficial to optimise the infant's care both during the newborn period and subsequently in neonates who survive with cerebral injury [2]. Nowadays, a critical component of newborn care is cranial sonography, especially for high-risk and unstable premature infants.

Present-day ultrasonography technology completely eliminates risk while enabling quick assessment of newborns in critical care units [3].Numerous imaging modalities, such as computed tomography, magnetic resonance imaging and ultrasound are currently available to identify potential intracranial anomalies in these newborns. On the other hand, cranial ultrasonography has the advantages of being readily available,inexpensive,simple to use,rapid,repeatable,and radiation- free. Therefore, the purpose of this study is to assess the diagnostic utiliy of cranial ultrasonography for different types of brain abnormalities in preterm infants.

METHODSANDMATERIALS

This prospective study was carried out in Dhiraj general Hospital, tertiary care institute in Gujarat for a duration of six months. The study protocol was approved by the Institute Ethics Committee. On the basis of non-randomized purposive sampling, sixty preterm neonates who had been admitted to the neonatal critical care unit were chosen in accordance with the inclusion criteria and on particular days they underwent neurosonography.A repeat neurosonogram was performed to monitor any potential sequelae after cranial ultrasonography indicated a variety of abnormalities. This study criterion covers all preterm births born before 32

weeks of gestation, all preterm births weighing less than 1500g at birth and all preterm births with abnormal neurological presentations such as seizures, lethargy, apnoea, sudden onset pallor, increase in muscle tone, and bulging anterior fontanelle. It also excludes all cases suspected of having congenital malformations, severe infections and unsuccessful resuscitation. The parents or legal guardian gave their informed consent for the newborn to be included in the study. In order to determine which variables put the newborn in a high-risk category, prenatal data and a thorough maternal history were reviewed.Every aspect of the pregnancy was documented and a thorough clinical assessment that included anthropometric measurements was conducted. Vital signs were taken within 24 to 48 hours after the baby's admission and a thorough neurological evaluation was performed while the child was in the NICU. For every preterm newborn, the gestational age was determined using modified

Ballard's scoring system. For newborns suspected of having meningitis, standard tests such as lumbar punctures, random blood sugar testing, ionised calcium, chest X-rays for respiratory symptoms and septic screening were performed. All of the study's premature newborns had cranial ultrasounds performed on them. Volpe staging method was used for IVH grading. Clinical correlation is done with the USG findings. NICU follow-up continued until the newborns recovered and were released.Software called SPSS was used to perform statistical analysis.

RESULTS

The study included 60 preterm newborns in total. In the current study, 18.3% of preterm newborns had abnormal CUS. There was no discernible difference in the occurrence of abnormal cerebral ultrasonography findings between male and female neonates—61.6% of them were males and 38.3% were females. There was a statistically significant correlation between the results of cerebral ultrasonography and gestational age. Of these, 1.6% exhibited periventricular leukomalacia, 1.6% had ventriculomegaly, 3% had periventricular echogenecity, and 11.6% showed signs of an intracranial bleed. 81.6% of the preterm infants at high risk had normal CUS,whereas18.3% had abnormal CUS.The CUS results of preterm newborns showed a statistically significant correlation (p=0.015).

The abnormal CUS findings and the day of life the test was performed did not significantly correlate (p = 0.752). A statistically significant connection was seen between the day of life cerebral ultrasonography was done and the gestational age of high risk neonates (p=0.001). 63% of the infants with abnormal CUS findings and gestational ages younger than 32 weeks exhibited GMH. At the time of NICU discharge, 60% of the neonates enrolled had recovered, 13.3% had passed away, 18.3% had been relieved and 8.3% had been released from the NICU for a variety of reasons prior to clinical recovery (DAMA) [Table/Fig-1-3].

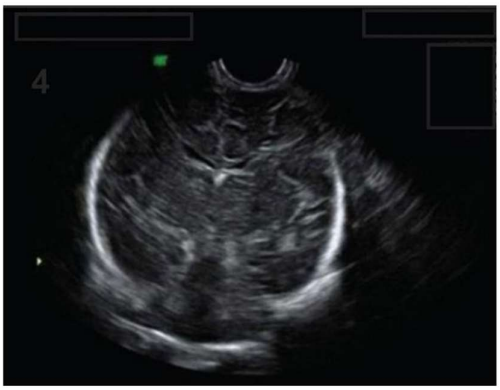
Table/figure(1)–Incidence of different CUS abnormalities in neonates

Cranial ultrasound	Number of neonates(n=60)	%
Normal	49	81.6
Abnormal	11	18.3
Germinal matrix hemorrhage	7	11.6
Periventricular echogenicity	2	3
Ventriculomegaly	1	1.6
Leukomalacia	1	1.6

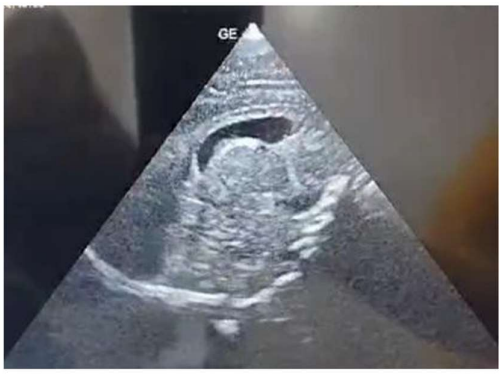
Table/figure(2)–Cranial ultrasound findings correlating with days of life

Cranial ultrasound	Number of neonates (n=60)	Days of life of CUS		
		<24hrs (n=5)	24-72 hrs (n=29)	>72hrs (n= 26)
Normal	49	5 (100%)	21(72.4%)	23(88.4%)
Abnormal	11	0	8(27.5%)	3(11.5%)
-GMH	7	0	6	1
-periventricular echogenecity	2	0	1	1
-ventriculomegaly	1	0	1	0
-leukomalacia	1	0	0	1

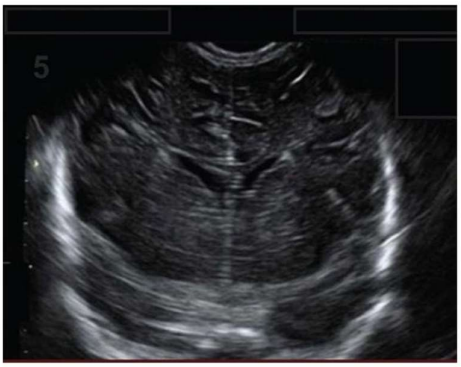
Table/figure(3)–Clinical outcome of highrisk neonates enrolled in the study		
Outcome	Number of neonates(n=60)	%
Relieved	11	18.3
Cured	36	60
Death	8	13.3
Dama	5	8.3



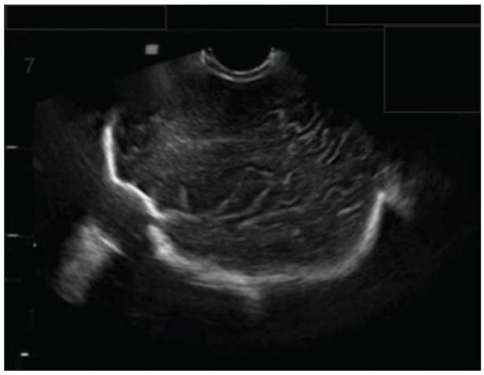
Table/figure(4)-Coronal section through sylvian fissure



Table/figure(6)-Midsagittal section



Table/figure(5)-Coronal section through foramen of munro



Table/figure(7)-Parasagittal section

DISCUSSION

For the initial examination of a newborn's brain, CUS is the perfect instrument. When an infant is too unstable to be transported, ultrasound provides a low-cost, radiation-free method for identifying brain abnormalities at bedside.Therefore,the purpose of this study is to assess the use of neurosonograms in the diagnosis of different types of lesions in preterm newborns.

The current study found that 18.3% of high-risk infants had abnormal CUS. There was no statistically significant difference in the occurrence of abnormal cranial ultrasonography findings between male and female infants(61.6% male and 38.3% female). In their study of 50 preterm newborns, of which 42% were female and 58% were male, ChoudharyV et al. [4] found that 6% of the preterms had cerebral haemorrhage and 12% had brain pathology. Of the 16.1% with cerebral disease in the current investigation, 11.2% had GMH. According to Soni

JP et al.'s research [5], CUS is sensitive and specific for identifying different kinds of ICH (SAH, IVH,and PVL).Eleven high-risk newborns underwent CUS and among them, 25% experienced intracranial haemorrhage(ICH) within 120hours of delivery.11.6% of the 18.3% of preterm children in the current study who had abnormal cranial ultrasonography findings also had GMH. Preterms younger than 32 weeks had the highest incidence of GMH (41.2%). According to Rehan N. et al.'s research, IVH was discovered in 47.5% of premature newborns [6].According to Arti Maria et al. [7], CUS is still a crucial bedside diagnostic technique for PVL. Within the current investigation, a preterm newborn receiving routine CUS developed findings that could indicate cystic PVL. According to a neurosonogram, 3% of the high-risk newborns in this study had periventricular echogenicity findings. In their research, Hannah C. et al. [8] found that 3.8% of premature newborns experienced clinical seizures. All of these neonates had abnormal CUS, which was reliable in identifying IVH and PVL. Of all the high-risk newborns in this study who presented with seizures, 47.6% had normal CUS and 52.4% had abnormal CUS. A statistically significant connection was seen between the 5.2% of infants with elevated CRP and the 16.1% of neonates with abnormal CUS. In the current investigation, there was a statistically significant link between abnormal CUS findings and neonates with elevated CRP and low platelet counts. The results ofthe abnormal CUS were uncorrelated with the levels of Hb, PCV, TLC, reticulocyte count, positive culture, serum electrolytes, serum bilirubin, and CSF analysis. At the time of NICU discharge, 60% of the neonates enrolled had recovered, 13.3% had passed away, 18.3% had been relieved, and 8.3% had been released from the NICU for other reasons prior to clinical recovery (DAMA).

LIMITATIONS

The sample size in our study is typical when compared to previous research. The opinions of the radiologists determined what was found on cranial ultrasonography.The interpretation of USG results could be biassed. In our study, abnormal CUS preterm patients did not receive neurodevelopmental follow-up.
Such newborns must be followed upon.

RESULTS

The most reliable and quick imaging technique for identifying brain damage in preterm newborns is still the neurosonogram. When it comes to identifying periventricular leucomalacia and germinal matrix haemorrhage, this method is both sensitive and specific. The most effective way to look into potential brain damage in preterm babies is with a neurosonogram. Neurosonogram tests should ideally be carried out on preterm infants during the first week of their lives, with a follow-up scan after a month. It is inexpensive, broadly accessible, repeatable, non-invasive, and non-ionizing.

References

[1] Wezel-MeijlerGV.Cranial Ultrasonography: Advantages and Aims Part1, Neonatal Cranial Ultrasonography, 1st edn. Berlin: Springer, 2007: 3-4.
[2] Veyrac C,Couture A,Saguintaah M,Baud C. Brain ultrasonography in the premature infant. Pediatr Radiol. 2006; 36(7): 626–35.

[3] Rumak CM,Drose JA,Neonatal and infant brain imaging in:Diagnostic ultrasound. 4th edn. Philadelphia, Elsevier, Mosby; 2011.p.1558-63.
[4] Chawdhury V,Gulati P,Arora S et al.Cranial sonography in preterm infants. Indian Pediatrics. 1992;29: 411-15.
[5] Soni BD,Gupta M,Soni M,Gupta D,Dabi R.Sonography in highrisk neonates. Indian Pediatrics. 1995; 32: 45259.
[6] Rehan N,Farooqui R,Niazi M,Niazi A,Khan R.Significance of cranial ultrasound in detection of intraventricular www.ijnmr.net haemorrhage in prematures. Ann Pak Inst Med Sci. 2009; 5(4): 255-58.
[7] Maria A,Gupta A,Aggarwal RV,Sreenivas VK,Deorari AK. Incidence of periventricular leucomalacia among a cohort of very low birth weight neonates (<1500 g). Indian Pediatrics. 2006;43:210-16.
[8] Glass HC, Bonifacio SL. MRI and ultrasound injury in preterm infants with seizures. J Child Neurol. 2009;24(9): 1105–11.