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Study Of Neurosonographic Evaluation of Intracranial Injuries in Preterm Neonates at a Tertiary Care Hospital

KEYWORDS

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ABSTRACT *Introduction: Preterm infants, especially those younger than 32 weeks gestation, are prone to intracranial injuries like periventricular/ intraventricular haemorrhages and ischemic white matter injuries. Since intracranial haemorrhages and cerebral ischemia are important causes of mortality and short and long term morbidity in preterm infants, routine cranial ultrasound examinations are most valuable for this group. Therefore early recognition of these conditions are important for proper management.*

Aims and objectives: The main objective of the present study is to detect intracranial lesions in the preterm neonates by using cranial ultrasound and to evaluate the possible use in determining the prognosis and outcome at the end of the study.

Materials and Methods: This was a prospective study conducted over a one year period in the NICU of J.L.N. Medical college Hospital Bhagalpur. A total of 56 preterm babies with suspected neurological injuries were included in this study. Neurosonogram was carried out within 1 week of birth and at the end of 1 month follow-up scan was done.

Results: The present study revealed abnormalities in cranial ultrasound in 26.7% of preterm neonates. 12.5% of those had evidence of intracranial haemorrage, 7.1% with transient periventricular echogenicity (TPVE), 1.7% had ventriculomegaly , 3.5% had periventricular leukomalacia and 1.7% had cystic lesion. Intracranial injuries were found mostly in babies born before 32 weeks. The most common abnormality was GMH (about 26.7%).

Conclusion: Neonatal cranial ultrasonography is the non-invasive, easiest and most ideal investigation for preterm babies in evaluation of suspected intracranial injuries to prevent mortality as well as short and long term morbidity.

INTRODUCTION

Preterm infant's brain is vulnerable to both haemorrhagic and ischemic injury during the late second and early third trimesters. This is due to vascular, cellular and anatomical features of the developing brain, and the tendency for preterm infants to experience periods of physiological instability at a time when they have limited cerebral circulatory auto regulation. Periventricular and intraventricular haemorrhages and cerebral ischemia are important causes of mortality and short and long term morbidity in preterm infants. These neonates are more prone to have neuro developmental delay including motor dysfunction; delayed cognitive development; visual impairment and epilepsy. Cerebroventricular haemorrhage, the most common lesion, originates in the germinal matrix, a structure located beneath the ependymal lining of the ventricles and in the groove between the head of the caudate nucleus and the thalamus. It is a highly vascular structure with little supporting tissue. It is a source of neuroblasts which migrate peripherally during the development of the fetal brain. The germinal matrix is largest at 24-32 weeks gestation and then involutes so that it is much smaller in full term infants than preterm1. Intraventricular haemorrhage occurs in 40% of preterm neonates who weigh less than 1500g ; 90% of haemorrhages occur within first 3 postnatal days and the remainder by 10 days. Intraventricular haemorrhage is usually clinically occult and detection requires a diagnostic screening. Currently many imaging modalities are available like ultrasonography, computed tomography and Magnetic Resonance Imaging to detect the probable intracranial abnormalities in these neonates. CT scan has many advantages but it is an expensive investigation, rather cumbersome to be done in a sick newborn. Cranial Ultrasonography on the other hand is a rapid and accurate method of diagnosing many intracranial lesions. Cranial USG are widely used to identify preterm neonates at risk for brain injury and subsequent neurodevelopmenal defects, most commonly as a consequence of severe intraventricular haemorrhage (IVH) and cystic periventricular leukomalacia (PVL). Because preterm infants, especially those younger than 32 weeks gestation, are prone to both GM and/or IVH and ischemic white matter injuries, routine cranial ultrasound examinations are most valuable for this group. Therefore, the present study is undertaken to evaluate the role of cranial ultrasonography in preterm neonates, in the diagnosis of various intracranial lesions.

Materials and Methods

This was a prospective study, conducted from April 2015- April 2016 over a period of one year in the Neonatal Intensive Care unit of pediatrics department of J.L.N. Medical college Hospital Bhagalpur , a tertiary care teaching hospital in Bihar. Fifty six preterm neonates admitted to neonatal intensive care unit were selected as per the inclusion criteria and were subjected to neurosonography on selected days. If cranial ultrasonography revealed various findings, neurosonogram were repeated to follow-up sequelae if any. The institutional ethical committee approved the study.

Inclusion criteria:

1. Preterm neonate born prior to 32 weeks of gestation, with abnormal neurological presentation e.g. seizures, lethargy, apnea, increase in muscle tone, bulging anterior fontanel.

Exclusion Criteria:

1. Baby with congenital malformation,
2. Baby with severe infections.

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Informed consent was obtained from the parents/guardian regarding inclusion of the neonate in the study. Assessment of factors placing the neonate in a high risk category was done taking detailed antenatal history reviewing antenatal records. All perinatal details were recorded and detailed clinical examination was done. Vital parameters were recorded within 24-48 hrs of admission and complete neurological examination was done during baby's stay in NICU. Gestational age was assessed as per modified Ballard's scoring method for all preterm neonates. Basic routine investigations like sepsis screening, random blood sugar, ionized calcium, chest X-ray for respiratory symptoms and lumbar puncture was done for suspected meningitis. Cranial ultrasound was done for all preterm neonates included in the study. IVH grading was done by using Volpe staging method. Clinical correlation with USG finding was done. Neonates were followed till recovery and discharge from NICU. Statistical analyses were performed by social package for statistical science (SPSS) version 16.

RESULTS

In the present study a total 56 preterm neonates were enrolled. Among them abnormal neurosonogram was found in in 26.7% of preterm neonates. There were 64.2 % male and 35.8 % female neonates, There was no significant correlation of incidence of abnormal cranial ultrasound findings in male and female. Correlation of gestational age with cranial ultrasound findings was statistically significant. Of the high risk neonates with preterm gestation, 83.9% had normal and 17.7% had abnormal neurosonogram. Among the abnormal neurosonogram 12.5% had evidence of Germinal matrix haemorrhage, 7.1 % had transient periventricular echogenicity, 1.7% had enlargement of ventricles 3.5% % had periventricular leukomalacia and 1.7 % had solitary cystic lesion. Correlation between findings of neonates with prematurity was statistically significant (p=0.015). There was also statistically significant correlation between gestational age of high risk neonate and day of life at which cranial ultrasonography was done (p=0.001).

Table 1: Types of Intracranial lesions found in neonates on neurosonography

Findings on Cranial ultrasound		Number of neonates (n=56)	%
Normal Cranial USG		41	73.2 %
Abnormal Cranial USG		15	26.7 %
	Germinal matrix haemorrage	7	12.5%
	Flaring / Transient PVE	4	7.1 %
	Ventricular enlargement	1	1.7 %
	Periventricular Leucomalacia (PVL)	2	3.5 %
	Solitary cystic lesion	1	1.7 %

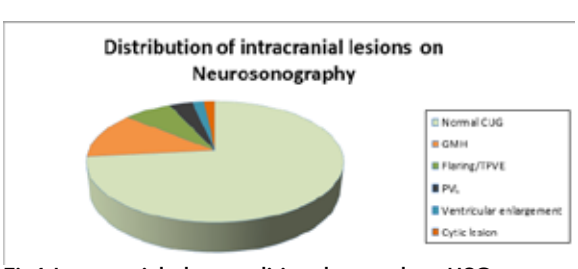

Fig1:Intracranial abnormalities detected on USG

DISCUSSION

Cranial USG are widely used to identify preterm neonates at risk for brain injury and subsequent neurodevelopmental defects , most commonly as a consequence of severe intraventricular haemorrhage (IVH) and cystic periventricular leukomalacia (PVL). Ultrasound is cheap, radiation free and useful in diagnosing brain abnormalities in bedside, when the baby is unstable for transport11. Hence, this study is undertaken to evaluate the usefulness of Neurosonogram in diagnosis of various lesion in preterm neonates. In the present study, incidence of abnormal neurosonogram in high risk neonates is found to be 26.7% there was no significant correlation of incidence of abnormal cranial ultrasound findings in male and female. In the present study 26.7% had intracranial pathology detected on cranial USG. Out of those intracranial lesions, the most common intracranial lesions detected was germinal matrix haemorrhage. In the present study 12.5% preterm neonates have evidence of intracranial bleed (GMH, IVH) all of which were picked up between 24 to 72 hours of life. Cerebroventricular haemorrhage , the most common lesion, originates in the germinal matrix, a structure located beneath the ependymal lining of the ventricles and in the groove between the head of the caudate nucleus and the thalamus. It is a highly vascular structure with little supporting tissue. The germinal matrix is largest at 24-32 weeks gestation and then involutes so that it is much smaller in full term infants than preterm. In a study done by Rehan N, et al. concluded that frequency of IVH was found in 47.5% preterm neonates. In the present study, one preterm neonate on regular follow up CUS developed findings suggestive of PVL. In the present study, 2nd most common abnormality detected was transient periventricular echogenicity (TPVE) by a neurosonogram, which subsequently became normal on follow up scan. In a study by Satish. P. B.S. et al.12 , flaring / transient PVE was found in 23.1 % of cases which was subsequently became normal after 10 to 30 days on follow up scan. Periventricular Leucomalacia (PVL) was found in 2 cases (3.5%) which were persisted even on follow up scan after 1 month. Arti Maria et al.,7 concluded CUS remains an important bedside diagnostic tool for PVL. Venriculomegaly (1.7 %) and solitary cyst (1.7%) were the other intracranial lesions detected in the our study. In the present study, there was statistically significant correlation with neonates having positive CRP, low platelet with abnormal CUS findings. Out of all the neonates enrolled in the study, 67.2% was successfully discharged from NICU after recovery, 15.6% expired and 17.2% neonates were relieved from NICU for various reasons.

CONCLUSION

Since preterm infants, especially those younger than 32 weeks gestation, are prone to intracranial injuries including GMH and/or IVH and ischemic white matter injuries .Early recognition of these conditions are important to prevent mortality as well as short and long term morbidity in preterm infants. Neonatal cranial ultrasonography is the non-invasive, easiest and most ideal investigation for preterm babies in evaluation of suspected intracranial injuries. This technique is both sensitive and specific for detecting germinal matrix haemorrhage and periventricular leukomalacia. It is relatively safe widely available, cheap and repeatable. It is best to perform neurosonography on preterm babies within 1st week of birth and follow-up scan should be done at the end of 1st month. Therefore It is a relatively sensitive and highly specific means of predicting the presence or absence of later neurodevelopmental abnormalities in preterm infants.

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REFERENCES

1. Volpe JJ. Brain injury in the premature infant. Neuropathology, clinical aspects, pathogenesis and prevention. Clin Perinatol 1997;24:567-87.
2. Wilkinson I, Bear J, Smith J, et al. Neurological outcome of severe cystic periventricular leukomalacia. J Paediatr Child Health 1996;32:445-9.
3. Paul DA, Pearlman SA, Finkelstein MS, Stefano JL. Cranial ultrasound in very low birth weight infants : do all inants need to be screened? Clin Pediatr. 1999; 38: 503-509.
4. Prelman JM, Volpe JJ . Intraventricular hemorrhage in extremely small premature infants . AJDC. 1986; 140:122-124.
5. Taylor GA. Recent advances in neonatal cranial ultrasound and doppler techniques. Clin Perinatol 1997;24:677-91.
6. Chawdhury V, Gulati P, Arora S et al. Cranial sonography in preterm in fants. Indian Pediatrics. 1992;29: 411-15.
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. Rehan N, Farooqui R, Niazi M, Niazi A, Khan R. Significance of cranial ultrasound in detection of intraventricular haemorrhage in prematures. Ann Pak Inst Med Sci. 2009; 5(4): 255-58.
9. J.P. Soni, B.D. Gupta, M. Gupta, D.R. Dabi, K.R. Nemal et al : Ultrason ic Diagnosis of Intracranial hemorrhage in high risk neonates, Indian Pediatrics ,1994; volume 32, page no. 453-459
10. John P Cloherty ,Eric Eichenwald, Stark, Hansen: Manual of Neonatal Care, 7th edition , 2012 ; 691-705
11. T.L. Gomella, M. D. Cunningham and F. G. Eyal: Neonatology Manage ment , Procedures on-call problems disease , and drugs, 7th edition 2014; 724-731
12. Satish Prasad B.S, Sreenivasa Raju N and, Surabi Chakraborty: Cranial Ultrasonography and Doppler in Preterm and Term Neonates, IOSR-JDMS, 2014; Volume 13, 27-32