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Role of Neurosonogram in Detecting Neurologic Abnormalities of preterm Neonates

KEYWORDS

Cranial ultrasonography, Germinal matrix haemorrhage, Intra ventricular haemorrhage, Periventricular leukomalacia, Preterm neonates.

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ABSTRACT

Preterm neonates, defined as childbirth occurring at less than 37 completed weeks or 259 days of gestation, is a major determinant of neonatal mortality and morbidity and has long-term adverse consequences for health. Children who are born prematurely have higher rates of cerebral palsy, sensory deficits, learning disabilities and respiratory illnesses compared with children born at term. The morbidity associated with preterm birth often extends to later life, resulting in enormous physical, psychological and economic costs. Early recognition of these conditions is important for proper management. Cranial ultrasonography can be used to diagnose such conditions at the bedside and that too non-invasively.

AIMS AND OBJECTIVES

This study was done with following Aims and objectives To study the role of neurosonogram in preterm neonates in detection of various intracranial abnormalities like, intracranial haemorrhage, periventricular leukomalacia, ventriculomegaly and other evolutionary changes.

PATIENTS AND METHODS

This prospective study done in the Department of Radio diagnosis, ASRAM Medical college ELURU. This study comprise of 100 preterm neonates, referred to Department of Radio diagnosis for cranial ultra sonography.Ultrasound examination of the neonatal brain done through anterior fontanelle in coronal and sagittal planes at the 1st, 3rd and 7th days using PHILIPS HD 11XE ultrasound machine.

INTERPRETATION AND CONCLUSION:

Real time neurosonogram is a sensitive non-invasive initial investigation for detection of the various brain lesions in the preterm neonates. Most common lesion noted in preterm neonates is different grades of intracranial hemorrhage and are detected within first 24 hours. The non-invasive, benign nature of neurosonography results in excellent initial test for high-risk preterm infants suspected of having germinal matrix haemorrhage, intraventricular hemorrhage and the consequences like ventriculomegaly, porencephalic cystic changes.

INTRODUCTION

Preterm neonates have more likelihood of having neurological abnormalities due to intracranial haemorrhages, perinatal asphyxia and congenital anomalies.

Early recognition of these conditions is important for proper management. Cranial ultrasonography can be used to diagnose such conditions at the bedside and that too non-invasively.

Currently many imaging modalities are available like ultrasonography, computed tomography and magnetic resonance imaging for diagnosing various brain lesions. There was no significant difference in computed tomography and ultrasonography for the diagnosis of germinal matrix haemorrhage/ intraventricular haemorrhage and periventricular leukomalacia. Ultrasonography, however detected more cases of intraventricular haemorrhage (24 cases) and periventricular leukomalacia (19) cases than computed tomography which detected intraventricular haemorrhage (22 cases) and periventricular leukomalacia (16 cases).

5% of the surviving newborns who were born less than 32 weeks of gestation, developed cerebral palsy (CP). USG abnormalities were present in 92% of these infants, being major in 83% and minor in 17%. Where as, only 6% survivors in group of newborns who were born between 32-36 weeks of gestation developed CP.

US abnormalities were present in 96% of these infants (32-36 weeks), being major in 89% and minor in 11%. Considering the major USG abnormalities, a specificity of 95% to 99% and a sensitivity of 76% to 86% were found. Patients are imaged primarily to determine the severity of the injury, to estimate prognosis and therapy in the acute stage.

Sonography of the head was performed in 1955 and involved the use of A-mode to detect midline structure and obtain a crude estimation of ventricular size. (Leksell et al 1956).

Later two dimensional bi directional echoencephalogram appeared in 1963 and was a significant technical advance since it provided better information about ventricular size, as well as intracranial spatial relationship (de Vlieger M et al 1980, Kassoff G et al 1974). Now with newer technology and high resolution transducer available help in detection of various lesions of neonatal brain with more accuracy.

Neurosonogram through anterior fontanelle is best acoustic window and as useful as CT, with added advantage like ultrasonography is an excellent, non-invasive, inexpensive, rapid and safe imaging modality for the evaluation of the pathologic conditions of infants brain. Cranial sonography is also sensitive for the detection of haemorrhage, periventricular leukomalacia and hydrocephalus in asphyxiated neonates. Besides all of these it is radiation free, no need of any medication like sedation, IV contrast administration etc.

Hence this study is undertaken to evaluate the usefulness of neurosonogram in diagnosis of various lesions in preterm neonates.

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coronal and sagittal planes at the 1st, 3rd and 7th days using PHILIPS HD 11XE ultrasound machine.

Selection Criteria
Inclusion criteria: Preterm neonates. (Less than 37 weeks of gestation)

Exclusion criteria:
a. Babies with gross congenital malformation
b. Twins

Indications/Contraindications[6]:
Indications for neurosonography in preterm and term neonates and infants include but are not limited to the following:

1. To screen for haemorrhage or parenchymal abnormalities in preterm infants;
2. To evaluate for haemorrhage;
3. To evaluate for hydrocephalus;
4. To evaluate for the presence of vascular abnormalities;
5. To evaluate for possible or suspected hypoxic ischemic encephalopathy;
6. To evaluate for the presence of congenital malformations;
7. To evaluate patients with signs and/or symptoms of central nervous system disorders, e.g., seizures and facial malformations;
8. For follow-up or surveillance of previously documented abnormalities, including prenatal abnormalities; and
9. For screening before surgical procedures.
There are no contraindications to neurosonography.

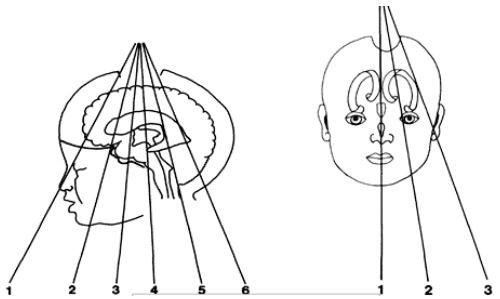

FIGURE 1: DIAGRAM REPRESENTING THE CONFIGURATION OF THE SIX CORONAL AND THREE SAGITTAL PLANES.

RESULTS:
In this prospective study of 100 neonates, 53 were male and 47 were female. Among 100 babies, 52 (52%) showed normal study and remaining 48 (48%) showed abnormal scan. Among the cases which were abnormal on scan most common finding was SEH/IVH (42%) and next commonest was periventricular echogenicity [PVE-6%) noted in six babies. Incidence of SEH/IVH is 42%.

DISCUSSION
In this prospective study of 100 neonates, 53 were male and 47 were female. Among 100 babies, 52 (52%) showed normal study and remaining 48 (48%) showed abnormal scan.

Among the cases which were abnormal on scan most common finding was SEH/IVH (42 %) and next commonest was periventricular echogenicity (PVE-6%) noted in six babies in this study.

In our study total incidence of SEH/IVH is 42%, where as in a study done by TziporaDolhn et al[1] is 31% and Malcom I et al[2] is 48%.

Out of forty two neonates with SEH/IVH, fourteen (33.3%) neonates belongs to Grade-1 haemorrhage, eleven (26.1%) belongs to Grade-2 haemorrhage, ten (23.8%) belongs to Grade-3 haemorrhage and seven (16.6%) neonate belong to Grade-4 haemorrhage. This study is compared to previous studies as shown below

Grade	Laurence A Mack et al., 1981	Tzipora Dolphin et al 1982	Carol M Rumack et al., 1985	K. Sridhar et al., 2001	Present study
Grade-1	37%	40%	32%	17.5%	33.3%
Grade-2	25.9%		32%	34.5%	26.1%
Grade-3	25.9%	19%	12%	25%	23.8%
Grade-4	11.1%		18%		16.6%

The present study correlates with the study done by Laurence A Mack et al., 1981[3].

TIMING OF INTRACRANIAL HEMORRHAGE
Out of forty two neonates almost all cases with haemorrhage were detected within 24hrs by neurosonogram.

In a study done by Tsiantos A et al[4] found that 60% of the haemorrhages took place between 15 to 48 hours of age with mean age of 38 hours. In another study done by Carol M Rumack MD et al[5] found that 64% of the haemorrhage took place within 24 hours. A study done by Leven MI et al states that most haemorrhages occurred during first two days of life. Whereas a TziporaDolfin et al study shows 25% haemorrhagewere diagnosed on first scan within first 6hours.

Follow up scan on these neonates showed ventriculomegaly on day 3 in rade-2 haemorrhage, which correlates to the study done by Carol M Rumack et al.[5]

In present study 6 neonates showed PVE, which forms 6% of the abnormal scan. This PVE lesion remained same till the time of discharge.

SUMMARY
The present study is prospective study of "Role of cranial Ultrasonography in Detecting Neurological Abnormalities of Preterm Neonates" conducted in the Department of Radio diagnosis, ASRAM Medical College ELURU

1. Total 100 preterm neonates were studied.
2. Fifty three were male and forty seven were female.
3. In preterm neonates most common lesion noted was SEH/IVH.
4. Incidence of SEH/IVH in present study is 42%.
5. Most of the SEH/IVH is detected by Neurosonogram within first 24 hours of life.
6. Neonates, which survived with intracranial haemorrhage, showed ventriculomegaly on follow up neuroscan.
7. Incidence of Grade-l hemorrhage is 33.3%, Grade-2 haemorrhage is 26.1%,Grade-3 hemorrhage is 23.8% and Grade-4 haemorrhage is 16.6%, in present study.
8. Periventricular echogenicity was next common finding noted in preterm neonates in our study.
9. Incidence of PVE in present study is 6%.
10. In present study no subarachnoid haemorrhage was found.
11. In few cases findings were correlated with CT Scan.

INTERPRETATION AND CONCLUSION:
Real time neurosonogram is a sensitive non-invasive initial investigation for detection of the various brain lesions in the preterm neonates. Most common lesion noted in preterm neonates is different grades of intracranial hemorrhage and are detected within first 24 hours. The non-invasive, benign nature of neurosonography results in excellent initial test for high-risk preterm infants suspected of having germinal matrix haemorrhage, intraventricular hemorrhage and the consequences like ventriculomegaly, porencephalic cystic changes.

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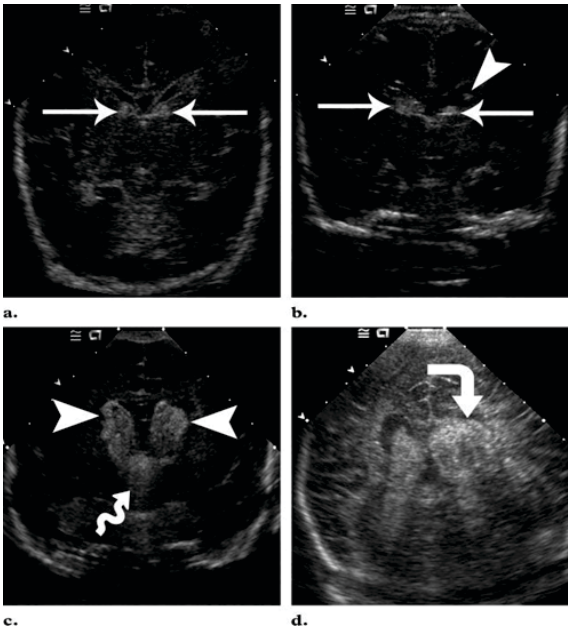

FIGURE 2: intraventricular haemorrhage. Coronal transfontanelle cranial US images obtained in four different preterm neonates show the types of intraventricular haemorrhage associated with prematurity. In grade I haemorrhage (a), small subependymalhaemorrhages are seen as hyperechoic foci in the region of the caudothalamic grooves (arrows). There is no intraventricular extension. Grade IIhaemorrhage(b) is seen in the caudothalamic grooves (arrows) with blood extending into the lateral ventricles (arrowhead). The ventricles are not enlarged. In grade III haemorrhage(c), intraventricular extension of haemorrhage is again seen, in this case involving both lateral ventricles (arrowheads) and the third ventricle (arrow). Marked ventriculomegaly is also noted. In grade IV haemorrhage (d), there is haemorrhageoriginating in the periventricular white matter (arrow) and extending into the ventricles.

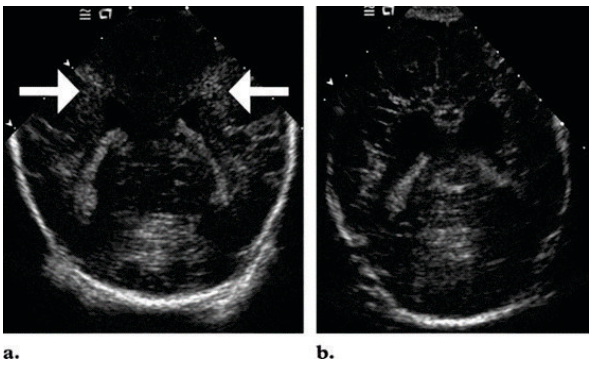

FIGURE 3 : PVL in a preterm infant. (a) Coronal head US image obtained in the 1st week of life shows increased echogenicity in the periventricular white matter (arrows). (b) Follow-up US image obtained 2 months later shows development of cystic changes in these regions and dilatation of the adjacent lateral ventricles, findings that are consistent with PVL.

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