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EVALUATION OF THE ROLE OF NEUROSONOGRAPHY,CRANIAL DUPPLEX DOPPLER AND CRANIAL CT IN NEONATAL (NON-HAEMORRHAGIC) HYPOXIC-ISCHEMIC – ENCEPHALOPATHY IN RAJAH MUTHIAH MEDICAL COLLEGE CHIDAMBARAM

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ABSTRACT

Background : Hypoxic ischemic encephalopathy(HIE) is characterized by clinical and laboratory evidence of acute or subacute brain injury due to asphyxia(i.e,hypoxia,acidosis)Most often the exact timing and underlying cause remain unknown.HIE can be fatal.Brain cells can begin dying after four minutes without oxygen.The incidence of Hypoxic-Ischemic encephalopathy is 1-4 cases per 1000 births.**AIMS AND OBJECTIVES:**1)To evaluate and assess the role of Neurosonography,cranial duplex Doppler and cranial CT in neonatal and cranial CT in neonatal(non-haemorrhagic) hypoxic ischemic encephalopathy2)To identify the image patterns in term and preterm eonates **MATERIALS AND METHODS:**This study was done among 60 neonates(20 preterm and 40 term) with clinical features and provisional diagnosis of nonhaemorrhagic hypoxic ischemic encephalopathy in radio diagnosis department of Rajah Muthiah Medical College.Neonates with apgar score less than 7 at 5minutes is the inclusion criteria.All neonates were subjected to ultrasonography of the cranium duplex Doppler study of the intracranial vessels and Cranial CT.Neonates who have haemorragic features as diagnosed by cranial CT were excluded from the data.**RESULTS:**Of the 20 preterm neonates studied, 13 had periventricular leukomalacia(PVL) and 7 had normal intracranial study.On duplex Doppler examination,9 patients had low RI.7patients had RI within normal limits and 1 patient had high RI.Of the 40 Term infants examined 22 had white matter lesion.On duplex Doppler examination,20 patients had low RI, 15 had normal RI , 5 had High RI.**CONCLUSION:**Although intervention is limited and mostly supportive this time, it is still important to promptly and accurately identify neonates who have sustained a hypoxic-ischemic brain injury to facilitate optimal management.

Keywords: Neurosonography, Neonatal,Preterm,Term,Hypoxic ischemic encephalopathy,Resistive index.

1.INTRODUCTION

Neonatal encephalopathy may result from a variety of conditions. When caused by diffuse hypoxic-ischemic brain injury, it has been called hypoxic-ischemic encephalopathy (HIE). HIE is one of the most common causes of cerebral palsy and other severe neurological deficits in children, occuring in two to nine of every 1000 live births (Hull J. et al 1992).[1]. Treatment has traditionally been primarily supportive, aimed at correction of the underlying cause of the hypoxia and ischemia. New emerging therapies, such as hypothermia and calcium channel blockers, are directed at the processes of ongoing injury.[2]

2.MATERIALS AND METHODS:

This study was conducted in Department of Radiodiagnosis RMMCH between September 2012 to October 2014.

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Neonates with Apgar score less than 7 at 5 minutes were included in the study. Those neonates who had haemorrhagic features as diagnosed by cranial CT were excluded from the data.

IMAGING

- Neurosonography
- Cranial Doppler
- Cranial CT

Sonographic Technique

Currently, most brain sonographic examinations are performed through the anterior fontanelle in both the coronal and sagittal planes. It is very important to use colour doppler to evaluate fluid collections because some cylix areas are actually vessels

In the new born, axial scanning is used in evaluation of the posterior fossa through the mastoid fontanelle and in transcranial color doppler imaging to evaluate the circle of willis. The anterior fontanelle remains open until approximately years of age, but is suitable for scanning only until above 12 to 14 months[3].

Standard brain scanning includes sagital and coronal planes through the anterior fontanella.We also routinely obtain two axial views: through the posterior fontanelle an the mastoid fontanelle. Coronal scans may be useful in the posterior fontanelle and the mastoid fontanelle. Coronal scans may be useful in the posterior fontanelle as well as order to compare ventricular size[4]

CRANIAL DOPPLER

Technique
Transcranial Approaches

Three different scanning approaches have worked well, each with its own advantages. The anterior fontanelle approach is the easiest and most commonly used. The temporal bone approach is best for the middle cerebral artery, as it is parallel to flow.[5] The transducer is placed in axial orientation approximately 1cm anterior and superior to the tragus of the ear. In most premature infants,both middle cerebral arteries can be easily isolated from one side of the head.

CRANIAL CT

Sectional Anatomy

CT scans are reviewed from the caudal lo cephalic levels: The scans are obtained al a 15- to 20-degrec angulation to the canthomeatal line. MRI scans are generally obtained parallel to this line.

Posterior Fossa Cuts
Four slices from the foramen magnum to the suprasellar region are now reviewed.
Above the Foramen Magnum Level
The cerebellar tonsils can be seen lateral to the medulla. Most of the structures in the anterior and middle fossa are components of the base of the skull and the orbits. In the middle fossa, the foramen ovale and spinosum can be visualized if a wide window setting is used. They transmit the third branch of the fifth cranial nerve and the middle meningeal artery, respectively, The inferior portion of the cistema magna outlines the posterior aspect of the cerebellar hemispheres.
Level of the Fourth Ventricle

The lower pons is seen in front of the fourth ventricle, connecting to the cerebellar hemispheres by the middle cerebellar peduncles.

Above the Fourth Ventricular Level

The superior cerebellar surface is seen with separation of the two hemispheres by the superior vermis. With contrast studies, the transverse sinuses can be seen joining together in the torcula. In the middle fossa, the temporal lobes are separated from the frontal lobe by the sylvian fissure. The medial aspect of the temporal lobes bounds the Supra sellar cistern and contains the internal carotid artery, the optic chiasm, the infundibulum, the mammillary bodies, and the top of the basilar artery.

Tentorial level

The V-shaped enhancement of the tentorial notch outlines the superior vermis and junction of the pons to the midbrain. In axial scans, it is sometimes difficult to separatate an infratentorial lesion from a supratentorial lesion because of partial averaging. If the lesion is lateral to the tentorial notch, it is probably supratentorial.

SUPRATENTORIAL CUTS

Third ventricular level

The most inferior aspects of the frontal lobes can be seen with part of the posterior inferior interhemispheric fissure medial to them. The third ventricle (a midline structure) is seen as a slit like cavity.

Low ventricular level

The superior portion of the frontal horns is seen outlined by the head of the caudate nuclei. Anteriorly, the frontal horns are shaped by indentation of the genu of the corpus callosum. The pineal gland and the vein of Galen are in the large subarachnoid space formed by the juncture of the supracerebellar cistern, the cephalic portion of the quadrigeminal cistern, and the interpositum cistern. The posterior horns of the lateral ventricles, including the atrium, are seen at this level.

Midventricular Level

The superior extension of the sylvian fissure and the superior temporal gyrus are seen. The central sulcus, slightly anterior to the sylvian fissure, separates the temporal lobe from the parietal lobe. The posterior portion of the cingulate sulcus, separating the cingulate gyrus from occipital lobe, can be seen connecting to the posterior interhemispheric fissure.[6]

Above the Ventricular Level

The scans mainly include the frontal the parietal, and a small portion of the occipital lobes. Because it is deep, the central sulcus can be identified in the. mid portion of the scan. Precentral and postcentral sulci outline motor and sensory cortices.

3.OBSERVATIONS

Table -1 THE TABLE SHOWING THE WHITE MATTER LESIONS IN NEONATES WITH HIE

Sl. No.	Findings	Pre-term (20)		Term (40)	
		No	%	No	%
1	Normal	7	35	18	45
2	Periventricular Echogenicity	13	65	-	-
3	Parasagittal Echogenicity	-	-	14	35
4	Diffuse Edema	-	-	8	20

Table – 2 THETABLESHOWING THEDOPPLER ABNORMALITIES IN NEONATES WITH HIE

Sl .No.	Findings	Pre-term (20)		Term (40)	
		No	%	No	%
1	High (RI)	1	5	5	12.5
2	Normal (RI)	7	35	15	37.5
3	Low(RI)	12	60	20	50

The table shows the prevalence of doppler abnormalities in HIE as detected by cranial duplex doppler .

CASES

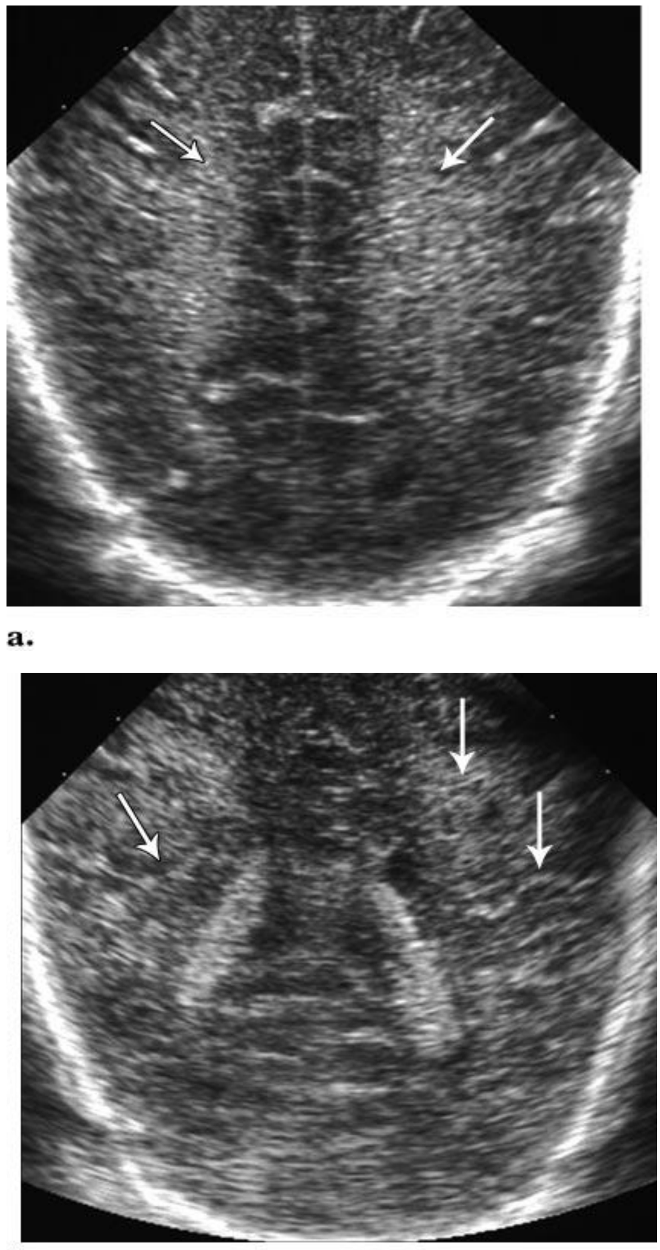

Figure: PVL in a preterm (30 weeks gestation) infant. **(a, b)** Initial coronal cranial US scans show symmetric, diffuse periventricular white matter echogenicity (arrows in **a**) and loss of regular parenchymal spacing. There are linear hyperechoic changes (arrows in **b**), findings suggestive of accompanying hemorrhage.

periventricular leukomalacia (PVL) and 7 had normal intracranial study.

On duplex doppler examination, 9 patients had low RI. (6 with PVL, 3 with normal intracranial *study),* 7 patients had RI with in normal limits. (3 with PVL, 4 with normal intracranial study) and one patient had high RI (PVL).

Of the 40 term infants examined 22 had White Matter Lesion (WML) (14 parasagittal leukomalacia (PSWML), 8 diffuse edema). On duplex doppler examination, 20 patients had low RI, (14 PSWML, 6 normal study) 15 had normal RI (3 PSWML, 12 normal study)5 had high RI (All had diffuse edema).

4.DISCUSSION

In the study conducted in RMMCH, 60 neonates (20 preterm, 40 term) were selected based on the Apgar score at 5 mins(less than 7). All 60 neonates were subjected to ultrasonography of the cranium duplex doppler study of the intracranial vessels (M2 & M3 segments of MCA) and cranial CT (non-contrast).Cranial CT was done mainly to rule out hemorrhage and congential malformations.The study included only patients with findings of non hemorrhagic HIE.Thus ultrasound, duplex doppler of the examination, CT will be helpful in the evaluation of neonate with HIE, and help in the prediction of the outcome, so that adequate supportive could be instituted early.

5.CONCLUSION

HIE is an important cause of morbidity and mortality in the neonatal period and of cerebral palsy as a late neurologic sequela in the postnatal period. Although intervention is limited and mostly supportive at this time, it is still important to promptly and accurately identify neonates who have sustained a hypoxic-ischemic brain injury to facilitate optimal management. Cranial US, CT each with its own advantages and disadvantages, show characteristic patterns of brain injury that correlate *well* with the degree of hypotension and the level of brain maturity at the time of the insult, thus excluding other causes of encephalopathy and limiting the diagnosis to HIE.

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