



THE ROLE OF MAGNETIC RESONANCE IMAGING IN THE EVALUATION OF NEONATAL SEIZURES- A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Neonatal neuroimaging has gained importance because of the advances in obstetric management and neonatal intensive care leading to improved survival statistics. It plays a central role in determining etiology, extent of injury and may also provide information regarding prognosis and temporal relationship of brain injury in neonates presenting with seizures. **Aims and objectives:** The aim for our study is to study the role of MR Brain imaging in neonatal seizures and diagnose various pathologies by correlating the findings with clinical diagnosis. **Materials and methods:** We conducted our study in 150 neonates presented with seizures. The study was done on a Signa 14 HDX GE machine. **Results:** In our study majority of babies had an onset of seizures less than a week (74%). Most of the babies were delivered normally (55%). Hypoxic ischemic encephalopathy was the leading cause of neonatal seizure (47 babies). **Conclusion:** From our study we concluded that MRI depicts various pathologies associated with neonatal seizures and helps in accurate diagnosis of conditions like Hypoxic ischemic encephalopathy, infections, congenital anomalies

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INTRODUCTION

Neonatal seizures are the most frequent and distinctive manifestation of neurological dysfunction in neonates. They constitute one of the major medical emergencies in the new born period. Neonatal neuroimaging has gained importance because of the advances in obstetric management and neonatal intensive care leading to improved survival statistics. It plays a central role in determining the etiology, extent of injury and also provides information regarding the prognosis and temporal relationship of brain injury in neonates¹

In neuroimaging, MRI is considered as the best modality of choice for evaluating neonatal seizures due to its superior contrast resolution and multiplanar imaging capabilities² In the acute setting, after controlling of seizures with hemodynamically stable neonates, MRI scanning of brain is every effective in determining the presence and extent of various pathologies like hypoxic ischemic and hypoglycemic insult, intracranial infections, intracranial hemorrhage, metabolic abnormalities, dysmyelination and congenital abnormalities. It is being used very frequently to evaluate the neonatal brain because it can provide important diagnostic and prognostic information- the essential tool for optimal treatment.

However MRI scanning is practically difficult task due to various factors such as transportation of sick neonate, optimal imaging technique and difficulties in the detection of subtle changes in the unmyelinated brain. Scanning may require sedation since the time required of minimal about 15 minutes. MR imaging provides multiple sequences principally based on water and fat content of the particular organ to be imaged. This study was done to emphasize various neurological disorders encountered in neonatal period with MR imaging of brain. And also we aimed to emphasize the importance of MR imaging in early diagnosis and appropriate management of neonates.

MATERIALS AND METHODS

This prospective study was conducted in our institution after obtaining approval from ethical committee. A total of 151 neonates presented with seizures (including both preterm and term) referred for MRI brain were included in this study. A neonatologist was accompanied with neonate to MRI suite. A detailed history along with clinical findings and relevant laboratory investigation reports were noted.

The neonate was subjected to MRI brain imaging with or without sedation. The controlled ventilation was given for neonates with recurrent seizures. MR Angiogram and MR Venogram were done as and when required. The Radiologist

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actively monitored MR study as it was being performed so that additional sequences could be obtained if necessary at the same sitting. The study was done on 1.5 Tesla Signa 14 HDX GE machine using the following sequences.

- Axial T1 weighted sequence
- Axial and saggital T2 weighted sequence
- Coronal T2 FLAIR
- Axial diffusion weighted image
- Gradient Echo sequence
- 3D TOF MR Angiography
- 2D TOF MR Venogram

The MRI findings were discussed with the neonatologist to help in arriving at accurate diagnosis. Following MR study, the neonates were followed up and MR findings were correlated with final diagnosis

RESULTS

We studied a total of 151 neonates including term and preterm who presented with seizures and were referred for MR imaging of brain. The observations were recorded in excel sheet. The results are noted as percentage.

Table 1 Baseline characteristics

Characteristics	No.of babies	Percentage
MRI Findings		
Normal	30	20%
Abnormal	121	80%
Neonate gender		
Male	96	65%
Female	55	35%
Neonatal period		
Term	98	65%
Preterm	53	35%
Mode of delivery		
Normal	83	55%
LSCS	68	45%
Onset of symptoms		
Less than a week	112	74%
More than a week	39	26%

Various pathologies have been identified among 121 abnormal findings. Of which HIE (47 babies) was the leading cause of neonatal seizures

Table 2 Etiological factors

Etiological factors	No. of cases
Hypoxic ischemic encephalopathy	47
Hypoglycemia	09
Infection	21
Congenital anomalies	09
Hemorrhage	31
Acute infarct	03
Dysmyelination	01

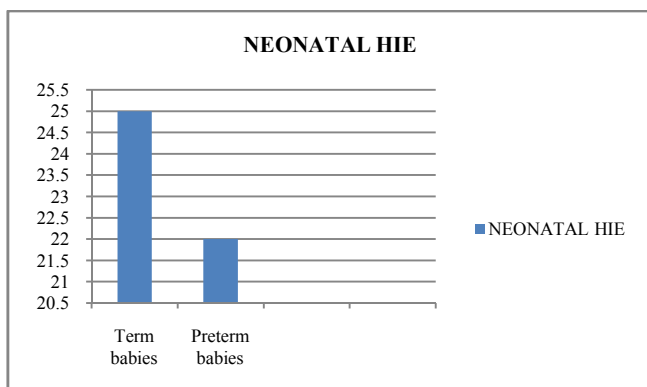


Figure 1 Neonatal HIE

HIE in Term: Preterm- 25:22

Hypoxic Ischemic Encephalopathy (44 babies) was the leading cause of neonatal seizures. Among 98 term neonates, 25 (25%) were diagnosed to have HIE and among 53 preterm neonates, 22 (44%) were diagnosed to have HIE

DISCUSSION

Neonatal seizure is a symptom of brain dysfunction which requires detailed evaluation to identify the underlying cause and for appropriate management. We studied a total of 151 neonates which includes both 98 term and 53 preterm presented with seizures. Neonates presented with seizures were referred for MRI brain. MRA and MRV were done in selected babies where clinically indicated. Majority of neonates included in our study revealed the presence of abnormalities in MRI brain(80%) i.e.121 out of 151. A few neonate underwent electroencephalogram (EEG) prior to MR imaging. During seizure episode, there may not be any ictal activity on EEG. Serial EEGs or continuous EEG monitoring are of beneficial in the assessment of electrical activity (focal or multifocal spikes or sharp waves and focal monorhythmic discharges). Out of 151 neonates, 23 had EEG done of which 5 neonates showed significant dysfunction.

Manohar *et.al* stated that to interpret the findings accurately, specific knowledge is needed about the normal MR imaging such as appearance of the physiologic process of myelination, cell migration and sulcation as well as patterns of injury ³Diffusion-weighted MR imaging and MR spectroscopy depict abnormalities earlier than conventional MR imaging sequences. Out of various abnormalities, hypoxic ischemic encephalopathy (47 neonates) was the major cause of neonatal seizures in our study. This was well correlated with the findings of Christine P *et.al* who also stated that HIE is one of the major causes for cerebral palsy and other severe neurologic deficits in children (2-9 per 1000 live births)⁴⁻⁶

Benjamin *et.al* stated that the imaging findings of HIE in term neonates can be subdivided based on the severity of injury (Severe versus mild to moderate asphyxia). Severe asphyxia events in term neonates usually occurs in actively myelinating areas of brain. It results in a primarily central pattern of injury involving the deep grey matter (putamina, ventrolateral thalami, hippocami, dorsal brainstem and lateral geniculate nuclei)⁷⁻⁹.A study conducted by Charlotte M *et.al* described white matter abnormalities occurred in neonates presented with hypoglycemia. Almost all neonates had some evidence of white matter abnormalities with majority (80%) being classified as moderate to severe and with a predominant posterior parasagittal distribution^{10,11}

In our study we encountered 31 neonates had intracranial hemorrhage, all of which were related to birth asphyxia/perinatal trauma. In our study 25 neonates had intraparenchymal hemorrhage, 3 babies had SDH and two had intraventricular hemorrhage. Mary Rutherford *et.al* described the classification of hemorrhagic lesion according the site of bleed. The age of parenchymal bleed is very well evaluated with the use of MRI^{12,13}

CONCLUSION

We conclude that MR imaging of brain is a powerful tool for diagnostic evaluation of neonatal seizures and helps in arriving at accurate diagnosis of various pathologies. MRI depicts the extent of brain involvement as well as the regions involved in conditions like HIE, hypoglycemic brain injury. The accurate

diagnosis makes us to provide appropriate therapeutic options to be identified. MR imaging findings not only helpful in diagnosing and planning adequate therapeutic options but also useful for Neonatologist in providing appropriate parental counseling. A close interaction between the radiologist and neonatologist is highly useful in arriving at correct diagnosis and clinical management of neonates presenting with seizures.

Conflict of interest: Nil

Acknowledgement: None declared

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