

Original article:

Study of role of MRI brain in evaluation of hypoxic ischemic encephalopathy

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Abstract:

Introduction: Birth asphyxia is one of the major causes of early neonatal mortality in India. Among the institutional births, incidence is 5% and accounts for 24.3% of neonatal deaths.¹ The incidence of birth asphyxia reported from developing countries varies from 9.4 to 299 per 1000 live births.

Materials and methods: A Hospital based prospective study of 101 cases of diagnosed/suspected HIE patients with findings in clinical variables and imaging studies.

MRI was done as a screening test.

Results : In the present study, HIE newborns were categorized into 3 different clinical stages according to Sarnat and Sarnat staging 40 (39.60%) newborns had stage I, 40 (39.60%) had stage II and 21 (20.80%) had stage III encephalopathy.

Conclusion: This study demonstrated term infants have significant involvement of basal ganglia thalamus type pattern of involvement and preterm infants have periventricular leukomalacia type of pattern of involvement.

Introduction:

Birth asphyxia is one of the major causes of early neonatal mortality in India. Among the institutional births, incidence is 5% and accounts for 24.3% of neonatal deaths.¹ The incidence of birth asphyxia reported from developing countries varies from 9.4 to 299 per 1000 live births. Although many organ systems can be affected by hypoxia-ischemia, it is the nervous system that bears the brunt of perinatal asphyxia in the long run. Cerebral palsy is the most important long-term outcome of birth asphyxia and may be accompanied by mental retardation, seizure disorder, or other associated neurological or sensory (visual, auditory) disabilities.²

Improved antenatal care will definitely bring down the incidence of birth asphyxia. Once the cerebral injury has occurred, the management is mainly supportive. Newer cerebro-protective therapies are being tried. The outcome depends on various factors. Most of the severely affected babies do not survive and the ones who do not have multi system involvement usually do well with excellent outcome.³ Since the contribution of birth asphyxia to burden of neuro disability in developing country population is still to be accurately

defined, hence the study. So also to assess the direct relationship between degree of asphyxia and severity of HIE.

MRI is the imaging modality of choice for the diagnosis and follow-up of infants with hypoxic-ischemic encephalopathy (HIE).^{4,5,6}

Materials and methods

A Hospital based prospective study of 101 cases of diagnosed/suspected HIE patients with findings in clinical variables and imaging studies.

INCLUSION CRITERIA:

MRI was done as a screening test.

Patients were selected on the basis of:-Patients were included in the study if they met all the following criteria:

- (i) Pre term or term (37-43 week's gestation);
- (ii) evidence of fetal distress;
- (iii) neurologically abnormal in the first 48 hours of life, with abnormalities of tone with or without convulsions and altered consciousness. Fetal distress was diagnosed in the presence of cardiotocographic abnormalities of bradycardia (<100/minute or late decelerations(type II dips) with or without meconium stained liquor and with low Apgar scores and the necessity for resuscitation.

Hypoxic-ischaemic encephalopathy was classified as mild, moderate, or severe (I, II, or III) according to Sarnat and Sarnat."

Equipment:

MRI was performed on " PHILIPS ACHIEVA 1.5T" MACHINE.

Standard head coil & NV coil was used for imaging.

Observations and results

Present study is a hospital based prospective study conducted for a period of one and half year.

Our study population consisted of 101 patients with suspected/known HIE, evidence of fetal distress at birth.

TABLE NO: 1 AGE DISTRIBUTION OF PATIENTS

Total population was divided into 3 groups. Maximum number of children were in the <1 month age group constituting 56(55.44%), followed by the age group 1 MONTH UPTO 1 YEAR constituting 44 (43.56 %) of the children. (Chart no 1).

AGE GROUP	NO OF PATIENTS	PERCENTAGE
< 1 MONTH	56	55.44 %
1 MONTH UPTO 1 YEAR	44	43.56 %
>1 YEAR	1	0.9 %
TOTAL	101	100 %

The youngest patient was 1 day and eldest was 1 year 9 month.

Maximum no of patients were less than 1 month and the mean age of study is 2.96 month.

TABLE NO: 2 SEX DISTRIBUTION OF PATIENTS: (n=101)

In our study group out of the 101 patients, 63 (62.4%) were males and 38(37.6%) were females. Males formed majority of cases in our group (Chart no.2).

Sex	No.	Percentage
Female	38	37.6%
Male	63	62.4%
Total	101	100.0%

TABLE NO. 3 DISTRIBUTION OF RISK FACTORS AMONGST PATIENTS

In our study the risk factors are categorized according to neonatal, maternal, placental and others/not known

Risk Factors	No.	Percentage
Neonatal	53	52.5%
Maternal	22	21.8%
Placental	6	5.9%
Not Known	20	19.8%
Total	101	100.0%

TABLE NO.4 DISTRIBUTION OF TERM/ PRETERM AMONGST PATIENTS

According to history the distribution of term/preterm patients is as follows

Term/ Preterm	Percentage	No.
Term	61.4%	62
Preterm	38.6%	39
Total	100.0%	101

TABLE NO. 5 APGAR SCORE AT 1 MINUTES AMONGST THE PATIENT

Apgar Score	No.	Percentage
<= 3	16	15.8%
4 to 7	39	38.6%
> 7	46	45.5%
Total	101	100.0%

TABLE NO. 6 STANDARD INJURY PATTERNS AND NUMBERS OF PATIENTS IN EACH CATEGORY.

CATEGORY	NO OF PATIENTS
Abnormal signal intensity in Basal ganglia	32
Abnormal signal intensity thalamus	35
Abnormal signal intensity in posterior limb of internal capsule	24
Cortical Highlighting	13
Non Punctate White Matter lesion	40
Punctate White Matter lesion	22
Border zone Infarct	5
Arterial Infarcts	33
Restricted Diffusion	2

Discussion

Central nervous system dysfunction (Neonatal encephalopathy) associated with perinatal asphyxia is called Hypoxic Ischemic Encephalopathy (HIE). This is of concern in asphyxiated neonates because it can lead to serious long-term neuromotor sequelae among survivors. The type of insult, the immediate neonatal problems and the long-term neurodevelopmental outcome depend on the gestation of the neonate, the severity and duration of insult.

This study was conducted as an attempt to evaluate the distribution of risk factors to study correlation between term of pregnancy with MRI imaging findings, characterize MRI patterns of CNS involvement.

101 patients of suspected/known HIE were studied, all of them fulfilling the inclusion criteria, of which 63 (62.4%) were male and 38 (37.6%) were female babies.

Total population was divided into 3 groups. Maximum number of children were in the <1 month age group constituting 56(55.44%), followed by the age group 1 month upto 1 year constituting 44 (43.56 %) of the children.

The youngest patient was 1 day and eldest was 1 year 9 month.

Maximum no of patients were less than 1 month and the average age of patient in the study is 2.96 month.

In the study 62(61.4%) were born at the term and 39(38.6%) born the preterm patients.

This study demonstrated term infants have significant involvement of basal ganglia thalamus type pattern of involvement and preterm infants have periventricular leukomalacia type of pattern of involvement.

Study conducted by **Astra Cabaj et.al**⁷ shown the same.

The study shown distribution of risk factors as neonatal, maternal placental or unknown and it is found that the neonatal causes were found in 53 (52.5%) patients, maternal causes were found in 22(21.8%) patients, placental causes found in 6(5.9%) patients and 20(19.8%) patients no significant risk factor found.

Study conducted by **Oztekin O et al.**⁸ on 76 patients They found that most frequent perinatal risk factors were fetal distress 52 (68.4%), difficult labor 48 (63.2%) and placental pathologies 23 (30%) in the patients with HIE. 17 of the patients (22.3%) had more than one risk factors.

APGAR score at 5 minutes found to be <3 in 16(15.8%) patients, 4-7 in 39 (38.6%) patients and >7 in 46 (45.5%) patients.

The difference in the proportion of HIE following perinatal asphyxia were probably due to the lack of generally accepted definition of asphyxia. The inclusion criteria for birth asphyxia are different in different studies. It is possible that incidence of neonatal encephalopathy also depends on the sample of the newborns studied (with respect to gestational age) and the criteria used to define neonatal encephalopathy. This may be the probable reason for the variations in the occurrence of post-asphyxial HIE in different studies.

In the present study, HIE newborns were categorized into 3 different clinical stages according to Sarnat and Sarnat⁹² staging 40 (39.60%) newborns had stage I, 40 (39.60%) had stage II and 21 (20.80%) had stage III encephalopathy.

Literature has described standard injury patterns in HIE patients those are compared with other the other study conducted by **Lishya Liauw et al**⁹ they performed the MR imaging examinations within 10 days after birth on 40 neonates. From the MR imaging studies of all infants who fulfilled all of the following criteria: a) signs of fetal distress before delivery (abnormal cardiotocograph recording such as decreased variability, late deceleration, baseline bradycardia), b) an Apgar score of less than 7 after 5 minutes, c) a cord blood pH level of less than 7.2, and d) clinical signs of hypoxic-ischemic encephalopathy

Conclusion

This study demonstrated term infants have significant involvement of basal ganglia thalamus type pattern of involvement and preterm infants have periventricular leukomalacia type of pattern of involvement.

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