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# EVALUATION OF CHILDREN WITH DEVELOPMENTAL DELAY USING MRI

**DR. ISHAN PRANAY** | Resident, ROOM NO-507,PG HOSTEL,MGM MEDICAL COLLEGE, KAMOTHE, SECTOR-18, NAVI MUMBAI

**DR. ASHUTOSH CHITNIS** | Professor, 701 SHANKAR THAKUR SADAN,PLOT -21 22 23,SEC-20,NEERUL (W),NAVI MUMBAI - 400706

**ABSTRACT**

**Introduction:**Developmental delay is diagnosed when there is delay in features of development such as: gross motor, fine motor, speech and language, cognition, and social/personal development.
Etiology of developmental delay has a spectrum from specific diseases to sequelae of ischemic insult and magnetic resonance imaging is the modality of choice
**Aim:** To study Mri findings in children with development delay.
**Materials and Methods:**Imaging studies of 35 developmentally delayed children between the ages of 1 month to 15 years who presented to MGM Hospital, Navi Mumbai for brain Mri during JUNE 2016 to NOVEMBER 2016
**Results:** Of the 35 children abnormal findings were present in 22 of which most of them had features sequelae to ischemia
**Discussion:** Mri is the modality of choice for study of developmental delay
**Conclusion:** Mri is non ionizing radiation and high degree of resolution and imaging

**KEYWORDS** | Developmental delay, Hypoxic ischemic encephalopathy, MRI

## Introduction

The prevalence of developmental delay in children is 5- 10%. Developmental delay is diagnosed when there is a significant delay in two or more of features of development such as: speech and language , gross motor, cognition, fine motor and social/personal development.

Developmental delay is age specific with delay in learning and normal adaptation [1].

Development can be assessed most effectively by Denver Developmental Screening Test II.

Denver Developmental Screening Test has been the standard for developmental screening for children aged between 2 weeks to 6 years of age. However, the etiology of developmental delay cannot be identified on the basis of history and physical examination alone hence additional studies are required to determine the cause [2].

Myelination and synapses are the correlates of this developmental process and have been studied extensively. Any delay in neurodevelopment is likely to have a biological correlate [3]. The Myelination and synapse correlate can be studied using neuroimaging techniques, particularly magnetic resonance imaging.

Magnetic resonance imaging is the modality of choice in investigating infants and children with developmental delay [4].
MRI has the most significant role in diagnosis in patients with hypoxic ischemic injury [5].Previous studies have also shown that 60% of the patients have abnormal brain MRI [3].
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**The most common causes being :**
Genetic(Down's syndrome, tuberous sclerosis, neurofibromatosis , etc.),
Metabolic (phenylketonuria, urea cycle disorders),
Endocrine (congenital hypothyroidism),
Traumatic,
Environmental causes
Perinatal or congenital neuroinfections (cytomegalovirus, toxoplasmosis)
Toxins (fetal alcohol syndrome) and perinatal asphyxia

## Materials and methods

A study was conducted in MGM Hospital , Navi Mumbai , where in thirty five consecutive children aged between 1 month to 15 years with clinical diagnosis of developmental delay, who were referred for magnetic resonance imaging of the brain were included in the study. The study was conducted between the months of JUNE 2016 to NOVEMBER 2016. Informed consent had been obtained prior to the imaging study. Intravenous sedation using midazolam in appropriate doses were administered when required.

### Inclusion Criteria

Children aged between 1 months to 15 years who presented with developmental delay were included in the study.

### Exclusion Criteria

Children aged <1months and >15 years
Children with known genetic disorder, such as Down's syndrome, Turner's syndrome, etc., associated with delayed developmental milestones
Contraindication to magnetic resonance imaging- claustrophobia, cochlear implant,.
History of head injury and non-cooperative sick patients

### Methods

Clinical data such as (age, sex), birth history, history of admission and history of seizures were taken along with findings of physical examination included weakness of limbs, abnormal posturing, hypo/hypertonia of limbs,, language and speech deficits and particulars of developmental milestones attained. Significant biochemical and serological information was also noted.

Imaging Protocol and categorization of imaging findings: MRI of the brain was performed using 0.3T (centurion) imaging system. The sequences used were-
Axial T1, T2
FLAIR FSE, T1
Sagittal FSE, T2
Coronal FSE,
DWI,
Gradient axial.

The imaging findings were categorized into the following groups :
I. Normal
II. Neurovascular diseases like hypoxic ischemic injury and others such as delayed Myelination, hypoplasia of corpus callosum,

ventriculomegaly.
III. Structural malformations- corpus callosum agenesis, Schizencephaly, Chiari malformations.

**Results**

In this study, 35 children with developmental delay were studied. Of the 35 children, 16 (46%) were male and 19 (54%) were female.

Patients were divided into four age groups: 1months to 4 years, 5 to 8 years, 9 to 12 years and 13 to 15 years.

Brain MRI findings were reported as normal in 13 cases (37%) and abnormal findings were seen in 22 cases (62%).

Among the cases with abnormal brain MRI, 16 (72.7%) had findings that were categorized as group II and constituted the largest group [Table/Fig-1a-1c]. The patients belonging to this group had neurovascular diseases and non-specific findings of delayed neurodevelopment and was the largest group in each age group and in both genders. For example, among 19 (54%) children aged 3 months to 4 years (68%) belonged to group II.

Among 16 male patients with developmental delay, 10 (62.5%) had abnormal brain MRI and among 19 female patients 12 (58%) had abnormal brain MRI.

Group III includes patients with structural malformations of the brain. 6 (17%) patients had structural brain malformations.

| AGE | I | II | III |
|---|---|---|---|
| 1 MONTH- 4 YEARS | 6 (46%) | 11 (68%) | 2 (33%) |
| 5 YEARS-8 YEARS | 3 (23%) | 3 (18%) | 2 (33%) |
| 9 YEARS - 12 YEARS | 3 (23%) | 1 (6%) | 1 (16%) |
| 13-15 YEARS | 1 (7%) | 1 (6%) | 1 (16%) |
| TOTAL | 13 (37%) | 16 (45%) | 6 (12%) |
| MALE | 6 (37%) | 8 (50%) | 2( 12%) |
| FEMALE | 7 (43%) | 10 (52%) | 2 (10%) |

TABLE 1

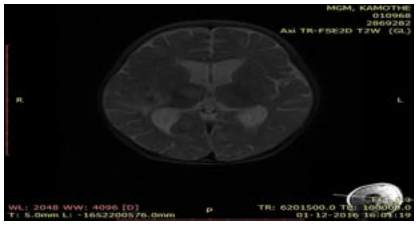

Figure 1 shows encephalitis changes in right parietal lobe

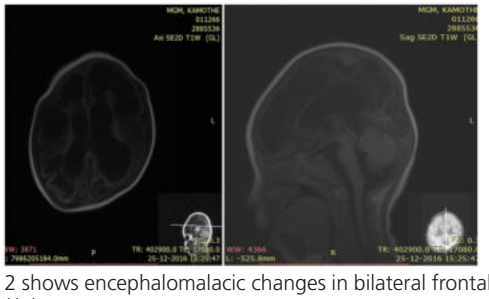

Figure 2 shows encephalomalacic changes in bilateral frontal and parietal lobes

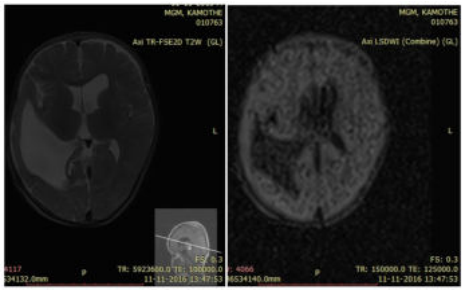

figure 3 shows closed lip Schizencephaly

**Discussion**

The prevalence of Developmental delay is 5-10% of children.. The causes of developmental can be classified as genetic (Down's syndrome.), metabolic, endocrine (congenital hypothyroidism), traumatic, environmental causes perinatal or congenital neuroinfections (cytomegalovirus, toxoplasmosis), toxins (fetal alcohol syndrome) and perinatal asphyxia [6,7].

The determination of cause is important for adequate diagnosis, appropriate treatment and prevention of disability and appropriate counseling[7].

Clinical history, physical examination, neuroimaging are important in the etiologic diagnosis of these developmentally delayed children. The results of neuroimaging is highly variable ranging from 9 to 80%. However, the efficacy of a neuroimaging study increases when it is done for specific problems such as seizure disorder or focal neurologic deficit [8].

In a study on pre-school children by Tikaria S et al., conducted in a tertiary care hospital in India, it was found that a stepwise approach yielded the diagnosis in 73% of the cases.. They found that chromosomal disorders, hypoxic ischemic encephalopathy, and multiple malformation syndromes were the most common causes. They also emphasized that a stepwise approach is useful in developing countries [9].

Similar study was conducted by Fayyazi A et al., with an etiological yield of 75% [10].

Of the 35 patients who presented to us, 22 (62%) had abnormal findings on brain MRI, other studies have shown variation in the percentage of patients with abnormal findings on brain MRI. [9].

Most of the patients with abnormal brain MR had findings that could be classified as group II (68% of all children) and neurovascular sequelae to ischemic insult. other causes of congenital malformations and neurodegenerative diseases of the brain can also lead to delayed development which are diagnosed early on brain MRI.

The frequency of normal and abnormal brain MRI was higher in 1 month - 4 year age group age groups , children with developmental delay were identified more frequently when they are younger and also findings such as delayed Myelination are recognized earlier in younger children.

No gender significant difference was observed between normal and abnormal brain MRI.

| | |
|---|---|
| Present Study | 62% |
| Ali AS et al,(6) | 68% |
| Momen et al (3) | 58.6% |
| Bouhadiba et al (11) | 71.8% |

Table/Figure 5 for Comparision of present study with other studies of Abnormal brain MRI

**Conclusion**

Magnetic resonance Imaging is an important line of investigation in children with delayed developmental milestones , in our study there was a high proportion of abnormal brain MRI. Magnetic resonance imaging due to soft tissue resolution and helped in reaching to a diagnosis in many cases.

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