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Spectrum Of Mr Imaging In Children With Developmental Delay

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ABSTRACT

Introduction Gross or significant delays in multiple developmental domains are referred to as developmental delays. Numerous aetiology such as genetic, metabolic, endocrine, vascular, malformation syndromes, traumatic, infectious, toxic, and environmental factors are linked to them. The purpose of the study is to evaluate MRI brain's effectiveness in treating developmental delay in children.

Materials and method This observational and descriptive study included 50 paediatric patients with developmental delay, who were referred to the Radiology department. All the patients were subjected MRI brain study, acquired in 1.5 Tesla Siemens Magnetom.

Results In the total sample size, 42 cases showed abnormal morphological appearances. Out of the 42 patients, 5 had prominent Virchow-Robin spaces and aberrant basal ganglia; 8 had hypoxic ischemic encephalopathy (HIE); 13 had congenital and developmental defects. 6 patients had cerebral atrophy along with encephalomalacia and 10 patients had ventriculomegaly and corpus callosum hypoplasia.

Conclusion MRI brain aids in the diagnosis of developmental delay aetiologies, which leads to suitable care and parental guidance. MRI brain with functional MRI, MR spectroscopy, diffusion tensor imaging, and tractography can boost the likelihood of a more accurate diagnosis, particularly in children whose brains are anatomically normal..

Introduction

Developmental delay is a symptom or clinical manifestation rather than an illness or diagnosis. The diagnosis of developmental delay is made during infancy or the early years of childhood rather than right away after birth. A diagnosis is often made as soon as the child starts school. Significant delay in one or more developmental domains is termed as developmental delay. The patient's ability to fully participate in family, school, and community life is severely hampered by the diagnosis. In these situations, the clinician's capacity to identify and diagnose the underlying reason using a multimodality approach, which invariably involves neuroimaging. Genetic, metabolic, endocrine, vascular, malformation syndromes, traumatic, infectious, toxic, and environmental factors are only a few of the many aetiologies. In most of the cases, clinical diagnosis remains insufficient, hence an MRI of the brain is required to obtain an exact picture of the abnormality, which aids in the accurate diagnosis and prompt treatment. The purpose of this study was to describe the structural abnormalities of the brain in mental retardation and the correlation between the degree of mental retardation and these abnormalities. The study's goal is to determine the effectiveness of MRI brain imaging in treating

patients, who exhibit signs of developmental delay, as well as the prevalence of both normal and abnormal MRI in children presenting with developmental delay.

Material and Methods

This observational and descriptive study included fifty paediatric patients between 2 month to 12 years of age, who are clinically diagnosed to have developmental delay had been referred to the Radiology department, in Vinayaka mission's kirupananda variyal medical college, salem. Patients who are diagnosed with Turner's syndrome, Down syndrome, metabolic disorders such as rickets and scurvy, protein energy malnutrition (PEM), infections such as tonsillitis, pneumonia, or any other communicable disease in an active stage are not included in the study.

A thorough medical history is elicited in all the patients after which MRI brain is acquired in 1.5 Tesla Siemens Magnetom. The children are sedated or put to sleep so that an MRI of the brain could be performed. Sagittal T1 TSE, Coronal T1 TIRM, Coronal T2TSE, Axial DWI, Axial T2 TIRM, Axial PD TSE, Axial T1 TSE, Axial T2 TSE, and Axial T2 FLAIR were the sequences that were acquired.

The MRI brain pictures are assessed using the Widjaja et al. technique and the following structures were methodically assessed in terms of:
1. Size and morphology of the ventricles
2. Thickness and morphology of cortex callosum.
3. Gray and white matter - Gray matter's sulcation and gyration.
4. Structure of the basal ganglia.
5. Morphology of the brain stem.
6. Morphology of the Cerebellum - Cerebellar atrophy / dysplasia.

MRI findings are classified into 6 categories as follows:
1. Normal brain.
2. Neurovascular and Traumatic diseases.
3. Disorders related to development and birth.
4. Neurodegenerative and metabolic diseases.
5. Neoplasms.
6. Nonspecific findings such as delayed myelination, enlarged subarachnoid spaces, ventriculomegaly, etc.

Interpretation of data was done using descriptive statistics such as mean and percentages. Statistical analysis was done using SPSS software.

Results

In the total sample size, 8 of the paediatric patients who presented with developmental delay had normal brain MR image. It was suggested that these patients undergo additional testing to determine the cause of their developmental delay. The study contained 30 male and 20 female patients. The remaining 42 cases exhibited abnormal morphological appearances. 5 patients exhibited non-specific abnormalities like abnormal basal ganglia and prominent perivascular (Virchow-Robin) spaces. In the current study, trauma and neurovascular diseases, such as hypoxic ischemic encephalopathy (HIE), accounted for 8 cases which was the commonest abnormality found. The following syndrome complexes were present in the 13 cases who had congenital and developmental anomalies of the brain: Holoprosencephaly, cerebellar hemisphere hypoplasia (Figure 1), Dandy Walker variant (Figure 2, 3 & 4), open and closed lip schizencephaly(Figure 5). 6 cases had encephalomalacia with cerebral atrophic changes (Figure 6). 10 patients showed ventriculomegaly and corpus callosum hypoplasia.

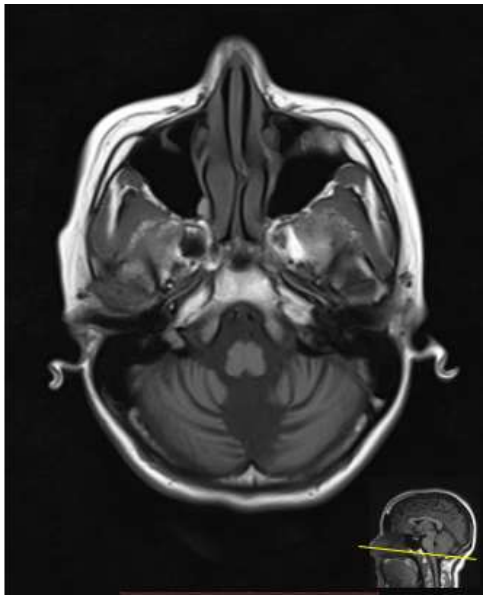

Figure-1: *Cerebellar hypoplasia***.** Axial T1 weighted images show a prominent cerebellar foliae and dilated 4th ventricle indicating significant hypoplasia of the cerebellar hemispheres.

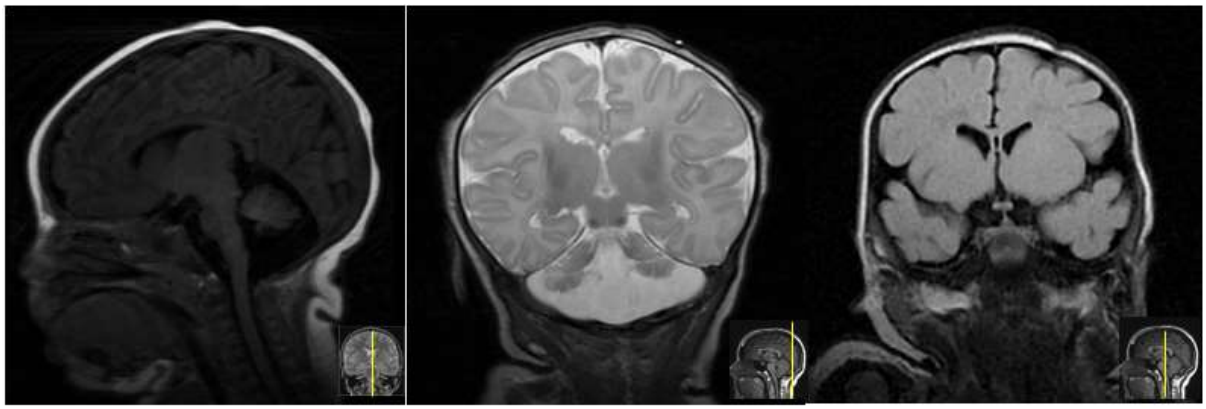

Figure- 2, 3 & 4: *Dandy Walker Variant***.** Sagittal T1 and Coronal T2 MRI images demonstrating normal ventricular system and midline structures. A large posterior fossa is noted with cerebellar hypoplasia notably in the left cerebellar hemisphere with enlargement of the retro cerebellar subarachnoid space that communicates with the 4th ventricle. There is no evidence of pontine or brainstem hypoplasia.

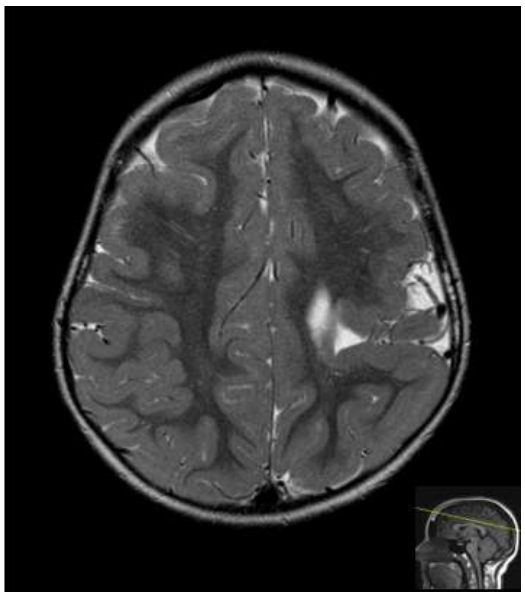

Figure-5: *Closed lip schizencephaly***.** Axial T2 WI shows a grey matter lined cleft extending through the frontoparietal region on the left down to the lateral ventricles with the sides of the cleft in places appose each other.

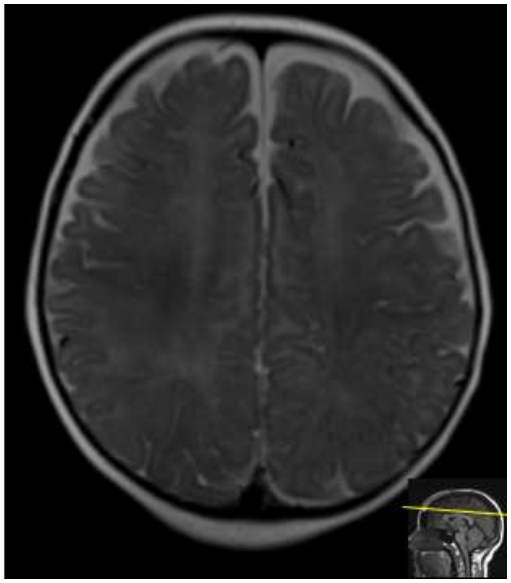

Figure- 6: *Cerebral atrophy with encephalomalacia***.** Axial T2 WI showing cerebral atrophy and encephalomalacic changes mainly in bilateral frontal & parietal lobes.

Discussion

According to reports, children under the age of 2 in India have a 1.5–2.5% prevalence of developmental delay. These disabilities affect the child, the family, and society at large by increasing the expense of medical care, educational support, and treatment services. This study provides supportive evidences that treating developmental abnormalities early in life improves children's outcomes and lowers societal expenditures.

Of all 50 patients, 8 had normal brain MRI results. A study conducted in Korea from 1993 to 1991 on 34 children who had developmental delays revealed that 23.5% of patients had normal brain MRI findings, whereas 76.5% of patients had abnormal findings.

8 patients with traumatic/neurovascular diseases (hypoxic ischemic brain injury) were ranked top followed by congenital and developmental disorders. Marked radiological findings were seen in the patients who presented with developmental and congenital abnormalities. When a complete medical history was obtained, patients who had congenital and developmental abnormalities were linked to religious beliefs.

According to a study by Momen et al., there was a somewhat greater incidence in their study, which may have been caused by the patients' adherence to religious views prohibiting pregnancy termination for antenatally identified abnormalities.

10 patients in our study had abnormal corpus callosum and ventricles, a different study by Widjaja et al. discovered that the corpus callosum and ventricles were the most often affected structures. Given the ease with which many particular aetiologic and pathophysiologic disorders that cause developmental delay can be identified, MR imaging is a crucial component of the thorough evaluation of children who exhibit developmental delay.

There were more males than females. Momen et al.'s study found similarity in sex incidence and age of presentation.

Sadly, no patients with white matter degeneration, metabolic disorders, or neoplasms were received. 5 cases in our study had non-specific findings like abnormal basal ganglia and prominent perivascular (Virchow-Robin) spaces which was similar to another study by Althaf S. Ali et al., where 3 cases had these non-specific findings.

Conclusion

MRI brain aids in the diagnosis of developmental delay aetiologies. There is a broad range of aetiology for developmental delays, from normal to pathological. MRI brain also aids the clinician in making an accurate diagnosis, which then leads to suitable care and parental guidance. Along with MRI brain imaging, other imaging modalities such as functional MRI, MR spectroscopy, diffusion tensor imaging, and tractography can boost the likelihood of a more accurate diagnosis, particularly in children whose brains are anatomically normal.

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