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Children with developmental delay or epilepsy: A MRI based study

Radiology

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ABSTRACT

Children who presented with either developmental delay or with history of epilepsy or both were enrolled into the study. Any significant delay in one or more of the developmental domains (more than 2 standard deviations below mean) is known as developmental delay. Chronic condition resulting in recurrent seizures unprovoked by an acute systemic or neurologic insult is known as epilepsy. MRI is the modality of choice to investigate these patients.

Introduction

Early identification of affected children, is important so that they can be benefited from early interventional programs when there is underlying brain abnormality. This can provide essential information regarding the possible pathogenesis, prognosis, risk recurrence and specific medical and surgical intervention required. 40-60% of cases presenting with developmental delay will have an abnormality [1-4]. Few studies have systemically examined structural brain abnormalities in children at seizure onset. Berg and colleagues reported 448 children in Connecticut of whom 63.3% of all patients had an MRI in newly diagnosed epilepsy. 62 children (12.7% of the total who underwent imaging) had significant abnormality in at least 1 scan [5].

Materials and Methods

Study settings and time period: Patients referred to the Department of Radiodiagnosis, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu for evaluating developmental delay or epilepsy by Magnetic Resonance Imaging. This study was conducted for one year.

Inclusion criteria

- Male and female children of age group from 1 year to 13 years who had history of epilepsy
- Developmental delay

Exclusion criteria

- Children having claustrophobia
- Cardiac pacemaker
- Cochlear implant or any other metallic implant
- Children with uncontrolled seizures after giving sedation
- Children were excluded if their seizure resulted from an acute situational etiology such as toxin, infection or trauma
- Children with history of birth asphyxia and premature neonates were also excluded

Procedure

Imaging was done with 1.5T (Siemens Magnetom Essenza) machine after making the child sleep or sedated.

Technique

Multiple sequences were taken with routine sequences & epilepsy protocol was followed. Sequences used in our study: T1 W.I, T2 W.I, FLAIR, GRE, DWI, ADC & rapid gradient echo images. T1FS with contrast were taken in indicated cases.

This present study included 40 children (23 male and 17 female) who underwent MRI with complaints of epilepsy or developmental delay.

Results

Normal MRI findings were seen in 35% (14 cases) of children presenting with complaints of epilepsy and developmental delay. These children were advised further evaluation and workup. Abnormal morphological pattern was seen in the remaining 65% (26 cases). Most frequent MR finding was grey matter heterotopia (band and nodular), focal cortical dysplasia followed by the rest as listed below (Table-1 and Image-1-9).

Discussion

The aim of investigating was to reach an etiologic diagnosis. Evaluation of developmental delay or epilepsy was done in 40 children from age group of 1-13 years referred to the Department of Radiodiagnosis. The proportion of children having abnormal MRI findings in our study of 40 cases could get a definitive diagnostic yield of 65% (26 cases). The diagnostic yield for children with complaints of developmental delay has been similar in several studies reported by Momen et al [6] Pandey et al, [7] Koul et al, [8] and Shevell et al [9-10] who had yield of 58.6%, 63.8%, 71.8% and 65.5% respectively. Males were slightly more in number than females with abnormality in our study, although there was no considerable difference.

The 26 cases with abnormal MRI were evaluated for involvement of various anatomical structures. Heterotopia being 10% of the total cases was the most common abnormality found. Three cases of nodular heterotopia showed abnormal grey matter in periventricular white matter. Another case of band heterotopia was seen in a 9 year girl who showed two concentric bands of grey matter parallel to bilateral lateral ventricles. Chiari malformation of types I with tonsillar peg of 6.2mm and syrinx was seen. Arnold Chiari type II was seen with small posterior fossa and myelomeningocele. A case of Sturge Weber syndrome in a 13 year old boy was seen which showed cortical & subcortical areas of blooming (calcification) in left parieto-occipital region with ipsilateral enlargement of left choroid plexus. Tuberous sclerosis was seen with child of 1 year old presenting with epilepsy showed multiple subependymal nodules along bilateral lateral ventricles and few cortical tubers.

Epidermoid cyst was another case seen in a 10 year old boy with diffusion restriction on & no enhancement on post contrast images. Case of neurofibromatosis was seen with bilateral vestibular schwanommas as shown above and whole spine study showed multiple schwannoma and a meningioma. A rare case of septo-optic - dysplasia in a 13 year old boy was seen who presentated to us with developmental delay and decreased in vision bilaterally. The MRI study revealed absent septum pellucidum with hypoplasia of bilateral optic nerves. The congenital and developmental anomalies have distinct clinical and radiological findings, and their identification is crucial in order to prevent recurrences and to help in parent counseling. All possible efforts were made to exclude cases of antenatal infective insults and preterm delivery patients.

Conclusion

Developmental delay or epilepsy or children presenting with both constitute a wide spectrum of abnormalities having various clinical findings and MRI findings ranging from completely normal to abnormal. The present study established various morphological appearances on MRI and further characterized into various abnormalities or group of spectral disorder.

Table-1: Spectrum of disorders detected on MRI is listed below which was single entity, combined entity or complex syndromes

Type of anomaly	Number and Percentage (%)
Heterotopia (Nodular & Band)	10 (4)
Focal Cortical Dysplasia	7.5 (3)
Dyke-Davidoff Mason syndrome	5 (2)
Bilateral schizencephaly	5 (2)
Lissencephaly	2.5 (1)
Hemimegalencephaly	2.5 (1)
Epidermoid cyst	2.5 (1)
Rasmussen encephalitis	2.5 (1)
Chiari Malformation - 1	2.5 (1)
Chiari Malformation - 2	2.5 (1)
Tuberous Sclerosis	2.5 (1)
Lobar holoprosencephaly	2.5 (1)
Neurofibromatosis type 2	2.5 (1)
Septo-Optic-Dysplasia	2.5 (1)
Dandy- Walker Malformation	2.5 (1)
Sturge Weber Syndrome	2.5 (1)
Joubert syndrome	2.5 (1)
Rhombencephalosynapsis	2.5 (1)
Corpus callosum agenesis	2.5 (1)

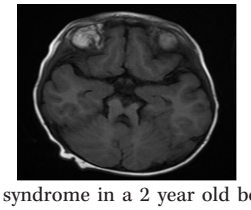
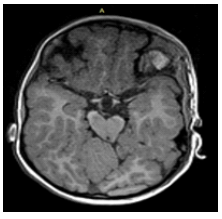


Image-1: Joubert syndrome in a 2 year old boy T1W axial image showing molar tooth sign



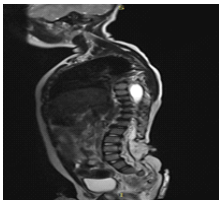


Image-2&3: Chiari 2 malformation in 4 year old male on axial SPGR images shows heart shaped incisura. Lumbar spine saggital T2W images shows myelomeningocele with syrinx

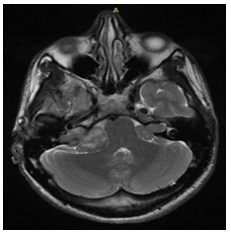


Image-4: Case of Neurofibromatosis-II in a 12 year old boy axial T2W images showing bilateral

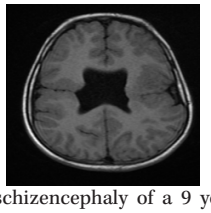


Image-5: Bilateral schizencephaly of a 9 year girl on axial T1W images shows bilateral grey matter lined cleft (closed lip) extending from ventricle to the cortex.

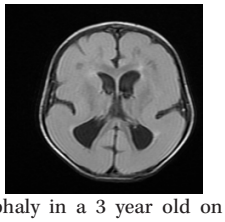


Image-6: Lissencephaly in a 3 year old on axial images shows smooth brain surface

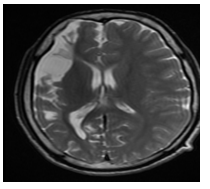


Image-7: Dyke Davidoff Mason syndrome in 11 year old boy on axial T2W images shows right hemicerebral atrophy.

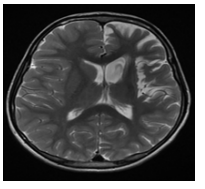


Image-8: Rasmussen Encephalitis in a 8 year old boy on axial and sagittal T2W images showed unilateral cortical atrophy with ex-vaco ventricular dilatation with few hyperintense areas involving left cortex.

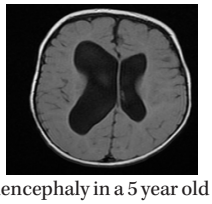


Image-9: Hemimegalencephaly in a 5 year old girl axial FLAIR image shows dilated right lateral ventricle with shallow sulci and enlarged gyri.

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