



Hippocampal volume in childhood seizures

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ARTICLE INFO	ABSTRACT
<p>Article type Review article</p> <p>Article history Received: 18 Feb 2014 Revised: 5 Mar 2014 Accepted: 16 Mar 2014</p> <p>Keywords Children Epilepsy Hippocampus</p>	<p>Many children with hippocampal sclerosis underwent surgery for treatment. Early childhood convulsion occurs in 2 to 4% of population and its prognosis is good in majority of cases. It seems that hippocampal anomalies are common in patients with neocortical epilepsies. The theory of hippocampal sclerosis association with temporal lobe epilepsy has been proposed 100 years ago. Recent studies demonstrated that there was a correlation between memory impairments and prolonged febrile convulsion (PFC), which might be a result of hippocampal injury. Transient hippocampus swelling might happen in complicated early childhood epilepsy or status epilepticus and result in hippocampal sclerosis.</p>

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Introduction

Epilepsy is one of the common chronic neurologic disorders. It is estimated that 10% of world population will experience at least one seizure attack in their lifetime (1). Epilepsy occurs in 46 to 48 per 100000 individuals (2). Complex partial seizures (CPS) which represent underlying temporal

lobe epilepsy are the most frequent type of seizures in adults (2). Complex partial seizures were previously identified as temporal lobe seizures or psychomotor epilepsy (3). CPS might progress to generalized tonic clonic seizures; unfortunately 30% of complex partial

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seizures are poorly controlled with routine drugs (4).

Hippocampus

Hippocampus is located in temporal lobe, near to the lateral ventricle (inferior horn). The main input and output pathways of hippocampus are the entorhinal cortex and fornix, respectively. Hippocampus inputs are gathered from temporal lobe, orbital and cingulate cortex, amygdale and olfactory bulb. Hippocampus prepares information to be processed in dentate gyrus. Three major data transferring pathways for hippocampus include the perforant pathway, the mossy fiber pathway and the Schaffer collateral pathway (5).

The pyramidal cells, which are located in the middle of hippocampus, are responsible for the major electroencephalogram (EEG) waves. A synchronous discharge is called epilepsy. Some studies have demonstrated that the loss of neural cells in hippocampus could lead to temporal lobe epilepsy (3).

Hippocampus assessment with Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging (MRI) is a useful method for biometric study of amygdale and hippocampus. With MRI it is possible to distinguish hippocampal atrophy, schizophrenia and alzheimer. Diagnosing hippocampal volume reduction is important in early stage of disease. New advances in MRI provide more sections with lower thickness and better image quality (6,7).

Epilepsy and hippocampus volume

It is estimated that over 50% of epilepsies have no identified causes. Many children with hippocampal sclerosis underwent surgery for treatment. Neuronal cell destruction and gliosis in the hippocampus are called hippocampal sclerosis (HS). MRI is very sensitive in locating HS and atrophy and in-

creased T2 signal are suggestive for HS (8).

Early childhood convulsion occurs in 2 to 4% of population with high prognostic rate. It seems that hippocampal anomalies are common in patients with neocortical epilepsies (3). The theory of hippocampal sclerosis association with temporal lobe epilepsy has been proposed 100 years ago (9). Various studies demonstrated that total brain volume reduced in patients with temporal lobe epilepsy (4,5).

These studies also showed that the extent of white matter volume reduction was not associated with seizure lateralizing manifestations (5). Early onset epilepsies might relate to the lower brain volume (4). Lawson reported hippocampal asymmetry in children with intractable seizures (10). Mesial temporal lobe epilepsy with hippocampal sclerosis (MTLEHS) is the main type of drug resistant seizure (11). Table 1 shows the summarized findings of previous studies.

Discussion

Seizures are the major neurologic disorders in childhood. About 4 to 10% of children had at least one attack before the age of 16. Radiologic assessments are not necessary in all patients and computed tomography is indicated in patients with focal or persistent seizures. MRI is more sensitive in detecting intracranial lesions than other techniques but this is a time-consuming procedure, thus it would not be performed at admission (1-3).

Prolonged febrile convulsion (PFC) is characterized by seizure attack for at least 30 minutes and it is common in children younger than 5 years. Previous theories proposed that PFC could lead to mesial temporal sclerosis (MTS).

Moreover, MTS is the most common neural lesion in epileptic patients who are candidate for surgery (5). About 70% of these patients become seizure free after

Table 1. Hippocampus abnormalities in epilepsy reported in previous studies

Author (Reference)	Publication year	Patients	Type of seizure	Results
Luby (12)	1995	Children	Intractable temporal lobe seizures	Hippocampus volume could predict the response to treatment
Lawson (10)	2000	Children	Non-intractable epilepsy	Hippocampus volume reduction in children with epilepsy
Scott (9)	2003	Children	Febrile convulsion	Hippocampus asymmetry related to prolonged FC
Daley (13)	2006	Children	Complex partial seizures	Hippocampus volume reduction is related to longer duration
Provenzale (14)	2008	Children	Febrile convulsion	Hippocampus hyperintensities in febrile convulsion
Cao (15)	2010	Children	Febrile convulsion (FC)	Hippocampus enlargement in acute phase
Berg (11)	2011	Children	Refractory mesial temporal lobe epilepsy	No association between hippocampal anomalies and seizure features
Yoong (16)	2013	Children	Prolonged febrile seizures	Hippocampus damage can progress after prolonged febrile seizures

resection. Recent studies demonstrated that there was a correlation between memory impairments and PFC, which might be a result of hippocampal injury. Hippocampal asymmetry in these children might happen due to edema and enlargement or neural loss in one side in these children (9).

The association between hippocampal damage and status epilepticus has been revealed in 1985 in animal model. Lipid metabolism and myelin construction might damage during epilepsy and lead to brain white matter volume reduction (11).

In 1996, the relation of progressive intensity enhancement of hippocampal volume with status epilepticus lasted more than 6 weeks in T2 was shown in a case (9). During the aging, gray matter density in MRI reduces in children and adults. Reduction in volume of anterior hippocampus might indicate the underlying pathology in brain which is responsible for seizure (8).

Some studies have shown that infancy seizures might not lead to hippocampal sclerosis. It was also confirmed that

other neurologic anomalies were more prevalent in children with epilepsy who had hippocampal lesions. Hippocampus volume is associated with cognitive ability, which might distract in children with epilepsy (17).

Early onset seizures occur in children with smaller orbital frontal gyrus (OFG) and lower temporal lobe volume. Most of our knowledge about epilepsy and hippocampus volume has been obtained from measurements before surgery in patients with chronic seizures. Therefore, the sequence of hippocampal injury and epilepsy onset could not be exactly distinguished particularly in children (16). Transient hippocampus swelling might happen in complicated early childhood epilepsy or status epilepticus and result in hippocampal sclerosis (8).

Conclusion

With new advances in radiologic assessment, MRI might be a useful technique in temporal lobe epilepsy in

children and could be helpful in choosing the best treatment method.

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Conflict of Interest

The authors declare no conflict of interest.

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