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HIPPOCAMPAL SCLEROSIS: PATHOGENISIS AND IMAGING

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Abstract:

Hippocampal sclerosis (HS) is the most common (60-85%) pathological substrate in patients with refractory temporal lobe epilepsy and is encountered in 65% of adult temporal lobectomy specimens. Although its pathophysiology is not completely understood, neuronal loss and accompanying astrogliosis of the hip- pocampal formation constitute the main histopathological features of HS. The CA1 sector principally and secondly the CA3 sector and the hilus of the dentate gyrus are the most severely affected parts of the hippocampal formation.

Keywords:

hippocampal sclerosis, neuropathology, temporal lobe epilepsy

Introduction

The association between hippocampal sclerosis (HS) and epilepsy has been known for almost two centuries. Mesial temporal lobe epilepsy (MTLE) is the most common form of focal epilepsy. The role of symptomatic temporal lobe epilepsy in the etiology of epilepsy has been proven. One of the main etiological factors of the disease is mesial temporal sclerosis. The prevalence of temporal lobe epilepsy is quite high in adults and children and reaches 1/4 of all cases of epilepsy, and among symptomatic focal forms - up to 60%. The onset of paleocortical TE due to MTS is usually observed at the end of the first - beginning of the second decade of life (8-15 years, on average - 9 years), in the prepubertal and early pubertal period. In 88% of cases, TE will debut before the age of 16. The onset of TE in MTS has 3 peaks: at 6, 15, and less often at 27 years. Patients with paleocortical TE are characterized by a high frequency (up to 50%) of normal EEG results in the interictal period. Hippocampal sclerosis (HS) is the most common histopathological abnormality found in patients with drug-resistant TLE. Possible causes of hippocampal sclerosis include prolonged febrile convulsions in childhood, traumatic brain injury, and infections occurring at any age. Japanese authors consider the occurrence of this pathology as a consequence of an autoimmune process (the presence of neuronal autoantibodies). According to their study, one-quarter of the examined patients are seropositive for various neuronal antigens, especially the voltage-gated potassium channel complex (eng. VGKC-complex). British researchers do not exclude the role of genetics in the development of hippocampal sclerosis, namely, mutations in the SCN1A gene. Hippocampal sclerosis is histopathologically seen as segmental pyramidal cell loss in CA1, CA3, and CA4 regions, whereas CA2 pyramidal and dentate gyrus granule cells are most seizure resistant.Neuronal cell loss is associated with reactive astrogliosis causing tissue stiffening, which has been traditionally termed as "Ammon's horn sclerosis."Some of the proposed pathological mechanisms include disruption of neuronal circuitries, causing aberrant mossy fiber sprouting and molecular rearrangement/plasticity of ion channel and neurotransmitter receptor expression. Several classification systems

have been proposed for HS. The most widely used is the ILAE classification system, which divides HS into three types based on a semi-quantitative survey of segmental cell loss within hippocampal subfields. International League Against Epilepsy (ILAE) type 1 has both CA1 and CA4 loss; ILAE Type 2 has predominant CA1 loss, and ILAE Type 3 has predominant CA4 loss.

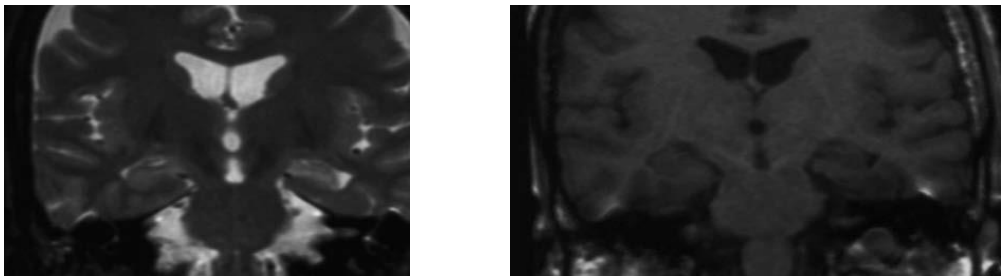
Diagnosis

Diagnosis of epilepsy caused by hippocampal sclerosis is based on three main principles. The first one is detailed analysis of the sequence of symptoms in epileptic seizures, or its semiology, which varies based on the areas of the brain affected by epileptic activity [17]. The second one is the analysis of EEG data and their comparison to semiology of the attack. The third one is identification of epileptic lesions on MRI.

When recording the EEG during sleep,the frequency of detection of epileptiform changes significantly increases - up to 65%; in 10% of patients, peak-wave activity is detected exclusively during sleep.Unilateral or bilateral regional spikes,sharp waves,sharp-slow wave complexes, and continued regional deceleration are the main interictal epileptiform patterns in TE. Interictal epileptiform discharges in amygdala-hippocampal TE are in most cases limited to the anterior temporal or frontotemporal leads.In some patients, independent bilateral discharges may be observed, indicating a possible bitemporal lesion.The ictal EEG is characterized by lateralized rhythmic sinusoidal theta activity at a frequency of 4–7 Hz in most patients (“prototypic pattern” as described by Gastaut H., Tassinar C.A., 1975). Up to 70% of patients with TE have post-attack lateralized slowing. According to Holthausen (1994), the appearance of lafa-type activity in one of the temporal leads during an attack strongly indicates the presence of TE, even if the results of a routine MRI examination are normal. Localization of epileptiform patterns in amygdalo-hippocampal TE is observed more often in the anterior temporal and middle temporal leads . Discharges from the posterior cingular gyrus do not become clinically apparent until the excitation spreads to the homolateral mediobasal temporal lobe. The normal calculated sleep pattern - "14- and 6-frequency-positive spikes" - is true on the EEG with a predominance in the temporal leads. With unilateral sclerosis of the hippocampus,this pattern is recorded contralateral to the structural defect and on the ipsilateral side may disappear. Therefore,14 and 6 Hz positive spikes are considered a lateralization EG symptom in paleocortical TE. The basis of electroclinical diagnostics in hippocampal sclerosis is video EEG monitoring, which consists in simultaneous video recording of an epileptic seizure and electrical activity of the brain. Video EEG monitoring solves several problems:1. It allows you to exclude pseudo-seizures and non-epileptic paroxysms, including when they are combined with really existing epilepsy 2. It allows a detailed assessment of the semiology of an attack and its comparison with the dynamics of seizure epileptic activity: its lateralization and regional localization, 3 Long-term recording allows you to find out the lateralization and localization of interictal activity.

Neuroimaging

The main method for verifying mesial temporal sclerosis is magnetic resonance imaging (MRI). It is known that MRI signs of hippocampal sclerosis do not always correlate with the severity of epilepsy and can be detected as an incidental finding even in people who have never had seizures. Structural changes in the



A B

Figure 3 T1 and T2-weighted im-ages showing atrophy of the left hippocampus with high signal intensity on the T2 sequence.

hippocampus are better detected on coronal sections - the orientation is perpendicular to the long axis of the hippocampus. A hypointense signal is typical in T1 weighted mode and hyperintense in T2 mode and FLAIR the early 1990 s, it was recognized that magnetic resonance imaging (MRI) could detect HS. The standard MRI protocol for temporal lobe abnormalities uses coronal slices perpendicular to the long axis of the hippocampus. The MRI features of HS include reduced hippocampal volume, increased signal intensity on T(2)-weighted imaging, and disturbed internal architecture. The histopathologic diagnosis of HS is usually straightforward, with neuronal loss and chronic fibrillary gliosis centered on the pyramidal cell layer.

Purpose of the study: determination of MRI criteria for hippocampal sclerosis and analysis of the clinical manifestations of this disorder.

Materials and methods of research:
Methods used in the study- visualization and clinical-anamnestic. Statistical processing was carried out in the MS Excel 13 program. Neurological status, anamnesis of life, complaints and the presence or absence of seizures in anamnesis were also studied. Discovery MR750w3.0T" with a magnetic field strength of 3.0 Tesla. The study group consisted of 18 patients aged 18 to 48 years. Gender composition: 7 people - male, 11 people - female. MRI criteria for establishing hippocampal sclerosis are: 1) the hippocampus is reduced in size, hyperintense signal in Flair mode; 2) the lower horn of the lateral ventricle on the side of the lesion is expanded; 3) atrophy of the fornix of the brain on the side of the lesion. Results of the study and their discussion. The anamnesis of patients' lives showed: in 3 cases, a history of neuro infection, in 1 case, an encephalitic reaction to DPT vaccination, 1 patient with a hereditary burden, the remaining 13 without pathology. In patients with hippocampal sclerosis, one patient had no complaints at the time of examination (medical remission for a year). In all other cases - complaints of focal seizures of several types: 1) in the form of a feeling of fear, lack of air, thirst, which are replaced by fixation of the gaze and tension of the limbs; 2) in the form of tonic tension of the limbs, tilting the head back, arching back with loss of consciousness. The first type prevails - 13 patients. In 3 patients, the appearance of secondary generalized seizures was noted while taking anticonvulsant therapy, which can be regarded as the progression of the process. The frequency of lesions of the right and left hippocampus is the same: 50% - right hippocampus, 50% - left hippocampus.

Conclusions:

1. Currently, the standard for diagnosing morphological changes in the hippocampus is a study on a high-field magnetic resonance tomography.
2. Established MRI signs of hippocampal sclerosis were observed in 100% of the examined patients.
4. Most patients with a history of epileptic seizures complained about the presence of autonomic and cognitive symptoms during an attack.

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