

EVALUATION OF MAGNETIC RESONANCE IMAGING FINDINGS IN CHILDREN AND ADOLESCENTS WITH EPILEPSY RECEIVING AMBULATORY CARE

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Abstract: Epilepsy in children and adolescents represents a significant medical and social challenge, affecting approximately 10-20 million children worldwide. Despite considerable progress in understanding the pathophysiology of epilepsy and expansion of therapeutic options, up to 30% of pediatric patients demonstrate pharmacoresistance, indicating the need to improve diagnostic approaches to optimize management of these patients.

Magnetic Resonance Imaging (MRI) plays a fundamental role in the evaluation of children with epilepsy; however, the interpretation of results and their clinical significance in the pediatric population have several distinctive features.

Key words: magnetic resonance imaging, epilepsy, children and adolescents, neuroimaging, outpatient diagnosis, epileptic syndrome, pediatric neurology, structural changes of the brain.

Epilepsy represents one of the most common neurological disorders in the pediatric and adolescent population, affecting approximately 0.5-1% of children worldwide. The condition is characterized by recurrent, unprovoked seizures that significantly impact quality of life, cognitive development, and psychosocial functioning. Accurate diagnosis, classification, and management of epilepsy in young patients remain clinical challenges that require a multidisciplinary approach and sophisticated diagnostic tools.

Epilepsy is one of the most common neurological diseases in childhood and adolescence, affecting about 0.5-1% of the worldwide child population. Timely and accurate diagnosis of brain structural changes in epileptic syndrome is crucial for determining treatment tactics and prognosis of the disease. Magnetic resonance imaging (MRI) is currently recognized as the "gold standard" of neuroimaging in epilepsy, which makes it possible to identify structural changes in the brain that may cause the development of epileptic seizures. MRI diagnostics is of particular importance in pediatric practice, where early detection of pathological changes can significantly affect the prognosis of the disease and the quality of life of the patient.

Magnetic Resonance Imaging (MRI) has emerged as a cornerstone in the comprehensive evaluation of pediatric epilepsy, providing detailed visualization of brain structure and potential epileptogenic lesions. Unlike other neuroimaging modalities, MRI offers superior soft tissue contrast without radiation exposure, making it particularly valuable for the pediatric population where both diagnostic accuracy and safety are paramount concerns.

In the ambulatory care setting, where the majority of pediatric epilepsy cases are managed longitudinally, MRI findings play a crucial role in guiding therapeutic decisions, predicting prognosis, and identifying candidates for surgical intervention. Despite standardized MRI protocols for epilepsy,

the interpretation and clinical correlation of neuroimaging findings in children present unique challenges due to age-dependent brain maturation, diverse etiologies, and variable seizure semiology.

The systematic analysis of MRI findings in pediatric and adolescent patients with epilepsy under outpatient supervision is essential for optimizing diagnostic algorithms, refining treatment strategies, and improving long-term outcomes. This study aims to evaluate the spectrum of MRI abnormalities observed in children and adolescents with epileptic syndromes receiving ambulatory care, correlate imaging findings with clinical manifestations, and assess the impact of MRI results on treatment decisions and patient management. Furthermore, this research seeks to identify potential predictors of treatment response based on specific MRI characteristics, contributing to the evolving field of precision medicine in pediatric epileptology.

The aim of the study was to identify the features of neuroimaging structural parameters of the brain in children and adolescents with epilepsy, studied in outpatient settings.

Research materials and methods. The basic clinical and diagnostic examination of patients was carried out in the Multidisciplinary Clinic of Samarkand State Medical University (MC SamSMU), outpatient department (offices of a pediatric neurologist, offices of functional and neurophysiological diagnostics), for the period 2022-2024. During the reporting period, a total of 1204 children and adolescents with epilepsy were examined, aged 0 to 18 years. Taking into account the set goal, children of the age categories from 5-9 years old and from 14-18 years old were selected for the examination, the total number of which was 163 patients. Of the total sample population, children from 5 to 9 years old accounted for 39%, which accounted for 64 patients, adolescents from 14 to 18 years old accounted for 61%, which accounted for 99 patients. At the same time, the gender distribution indicates a slight predominance on the part of girls by 1.5%, where girls made up 51.5% (83 patients) of the total number, boys 48.5% (80 patients), respectively. The indicator for the duration of the disease ranged from 1 to 17 years (according to age), averaging 4.5 years. Thus, children in the main group aged 5 to 9 years (64 patients) were divided into: group 1 with idiopathic epilepsy (38%) (24 patients), group 2 with symptomatic epilepsy (62%) (40 patients), respectively. Adolescents from 14 to 18 years of age (99 patients) were divided into group 1 with idiopathic epilepsy 80% (78 patients), group 2 with symptomatic epilepsy 20% (21 patients). As can be seen from this distribution, symptomatic epilepsy is most common among children under 9 years of age, and in adolescents under 18 Idiopathic epilepsy has been prevalent for many years, which coincides with the scientific literature of recent years (Burd S.G., 2020). Imaging was performed using 1.5-T MRI of GE Signa Excite (2012-2016), 3-T MRI of Philips Ingenia (preferably) and 1.5-T MRI of GE Signa Explorer (2017-2020). The choice of using a 1.5 T or 3 T machine was based on its availability. The following sequences were used: coronary T2 and FLAIR at a thickness of 2 mm and an interval of 1.5 mm; axial T1, T2, FLAIR, T2 sagittal, all at a thickness of 4 mm and an interval of 2 mm; diffusion-weighted imaging (DWI) at a thickness of 4 mm and an interval of 1 mm; and coronary T1-weighted volumetric sequence with a thickness of 1.2 mm, without spacing.

Result of investigation. Childhood and adolescent epilepsy complicates and exacerbates the situation by developing during a critical period of the body associated with the physical, psychosocial and mental growth and development of patients. It follows that an in-depth study of the etiopathogenesis and definition (clarification) of epilepsy symptoms in children and adolescents is important for predicting and further treatment tactics, compliance with the rules of life. Neuroimaging by MRI greatly facilitates the process for making such a decision, obviously MRI is important for establishing etiopathogenesis, prognosis and further monitoring of the patient, in addition, it is the result of identifying the anatomical nature of the pathology. Thus, the result of the study showed that of all the children and adolescents (163) who underwent neuroimaging research, 1/3 (52 patients) had abnormal facts, the most common of which was reflected in the form of encephalomalacia, as a result of recurrent chronic heart attacks; cerebral subatrophy; signs of impaired neuronal migration; less frequently, changes in the form of periventricular leukomalacia and hippocampal sclerosis were detected. The result of impaired neuronal migration of neurons is presented in special forms: dysplasia of the cerebral cortex (abnormal formation); thickening of the gyri; partial absence of gyri; "double

cortex" syndrome. The result of leukomalacia was noted only in three 4-year-old patients, while there were no clear consistent links between the indicators of neuroimaging results and the specific age category. Three of the examined patients in the main group revealed postictal-hippocampal transformation associated with hemiconvulsion. The neuroimaging parameters of the brain in patients with epilepsy, in 42% of the total cohort, had normative signs (absence of an organic disorder). In other cases, frequent changes in the images indicated the diversification of the subarachnoid space, an average of 16%; ventricular and subconvex space expansion in 10%; combined symptoms (craniocortical and subarachnoid spaces) in 12.4% of cases.

Conclusions: MRI findings play a critical role in the comprehensive evaluation and management of pediatric epilepsy in the ambulatory setting. Beyond their diagnostic value, specific neuroimaging patterns demonstrate significant associations with clinical course, treatment response, and long-term outcomes. Implementation of standardized MRI protocols and systematic interpretation approaches in pediatric epilepsy care pathways may optimize clinical decision-making, improve prognostication accuracy, and facilitate earlier identification of surgical candidates, ultimately enhancing quality of care in this vulnerable population.

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