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MORPHOLOGICAL CHANGES IN THE GRAY MATTER CORTEX IN CHILDREN WITH CEREBRAL PALSY AND SEIZURE SYNDROME

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Abstract: This research investigates the morphological alterations in the cerebral cortex gray matter of children with cerebral palsy accompanied by seizure syndrome. The study employed comprehensive morphological, histological, and morphometric methods to analyze brain tissue samples from 47 autopsy cases performed. Particular attention was focused on cortical layer architecture, neuronal distribution patterns, and glial proliferation in cases presenting with epileptic manifestations.

Keywords: cortex, neurons, astrocytes, gliosis, pyramidal, degeneration, atrophy, morphometry, epilepsy, pathology

Cerebral palsy represents one of the most common causes of childhood disability, affecting approximately two per thousand live births. When accompanied by seizure syndrome, which occurs in up to sixty-five percent of cases, the clinical manifestations become significantly more severe and the prognosis worsens considerably. The cortical gray matter undergoes substantial pathological changes in these cases, yet the specific morphological characteristics remain incompletely understood. Understanding these changes is crucial for comprehending the pathogenesis of seizure development in cerebral palsy patients. The aim of this study was to characterize the morphological alterations in cortical gray matter in children with cerebral palsy and concomitant seizure syndrome using advanced morphometric techniques.

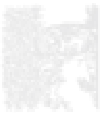
Macroscopic examination revealed cortical atrophy with thinning of gyri and widening of sulci in the majority of cases. Asymmetry between hemispheres was frequently observed, particularly in hemiplegic forms. Microscopic analysis demonstrated disrupted cortical lamination with absence or significant reduction of neurons in superficial layers. The external acellular zone showed marked expansion reaching two hundred ten point four plus minus six point three micrometers in seizure cases compared to controls. Neuronal density decreased significantly across all cortical layers, with the most pronounced reduction occurring in the internal pyramidal layer where counts decreased from thirty point two plus minus one point five to twenty-eight point four plus minus one point three neurons per microscopic field. Pyramidal neurons displayed various dystrophic changes including shrinkage, deformation, and loss of apical dendrites. Nissl substance distribution appeared irregular and reduced in cytoplasm. Astrocyte density increased substantially, particularly in layers three and four, rising from seventy-one point three plus minus four point six to eighty point six plus minus six point nine cells per field. The astrocytic index, representing the ratio of astrocytes to neurons, increased from normal values of approximately one point three five to three point zero in pyramidal layers, indicating pronounced gliosis. Perivascular gliosis was prominent throughout affected cortical regions.

The cortical gray matter in cerebral palsy patients with seizure syndrome exhibits distinctive morphological alterations including neuronal loss, disrupted lamination, pronounced astrogliosis, and vascular pathology. These changes correlate with seizure severity and represent the morphological substrate for epileptogenesis. The morphometric parameters provide objective evidence of cortical damage severity and may serve as indicators for prognostic assessment.

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