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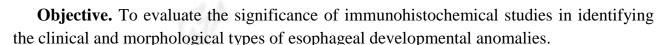
**Abstract.** In the study of various clinical and morphological forms of esophageal atresia—one of the developmental anomalies of the esophagus—immunohistochemical analysis plays a pivotal role. The chromogranin marker is used to identify neuroendocrine cells, specifically secretory neurons that indicate neuromuscular synapses, as well as to detect the ongoing synthesis of functional peptide bonds. Being a glycoprotein by nature, this marker allows for the assessment of the morpho-functional state of vesicles within the muscle layer by staining the components of neuromuscular synapses. Such analysis provides an essential foundation for planning appropriate treatment strategies based on the variant of esophageal atresia present.

**Keywords:** immunohistochemical analysis, esophageal atresia, neonates, morphology.

Relevance of the problem. Esophageal developmental anomalies are pathological processes that stem from anatomical and histological disruptions during the embryonic development of the esophagus and its structures. Globally, this condition is found in approximately 40 out of every 100,000 newborns. In countries such as the United States and across Europe, early prenatal screening allows for timely diagnosis of such anomalies, often resulting in medical recommendations for pregnancy termination. The prevalence in these regions averages between 4 and 8 cases per 100,000 live births. In the Commonwealth of Independent States (CIS), including the Russian Federation, the incidence ranges from 20 to 25 cases per 100,000. In Uzbekistan, the rate is notably higher, averaging 8 to 10 cases per 1,000 newborns, with a mortality rate of 60–78% within the first month of life.

At present, this issue remains a critical concern for pediatricians and neonatologists, particularly given the increased risk-up to 2.5 times higher-among infants born to consanguineous parents, as confirmed by international literature and clinical data. Most concerning is the mortality rate exceeding 85% in cases involving combined tracheoesophageal fistulas, where newborns often succumb to aspiration pneumonia within the first days of the early neonatal period.

**Materials and Methods.** The research material consisted of autopsy specimens taken from newborns diagnosed with esophageal developmental anomalies who had died either following surgical intervention or without surgical treatment at the Republican Perinatal Center. Esophageal tissue samples from 18 such cases were selected for immunohistochemical examination.



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**Discussion and Results.** Subsequent immunohistochemical investigations demonstrated that the chromogranin marker is instrumental in identifying neuroendocrine cells, secretory neurons associated with neuromuscular synapses, and in confirming the synthesis of functional peptide bonds. As a glycoprotein, chromogranin enables evaluation of the morpho-functional condition of neuromuscular vesicles through targeted staining within the muscle layer.

Notably, even in minimal concentrations, this marker exhibits high sensitivity—making it possible to visualize APUD (Amine Precursor Uptake and Decarboxylation) cells and vesicles within the synaptic structures. Through chromogranin staining, one can determine the maturity of APUD cells within the mucosal layer of the esophageal wall, thereby assessing morpho-functional characteristics and predicting clinical-morphological outcomes. The partial preservation of neuromuscular synaptic control by APUD cells offers insight for both diagnostic and therapeutic planning in cases of esophageal atresia, including whether to pursue conservative or surgical treatment, and allows for a prospective evaluation of expected outcomes.

The chromogranin marker showed weak positive expression only in cases of isolated (Type I) esophageal atresia. In other subtypes, the expression was weak or entirely negative. This indicates that non-isolated forms of esophageal atresia, especially those combined with other developmental anomalies, are characterized by a more severe morphological presentation and a significant reduction in the number and functionality of APUD cells in the esophageal wall.

As a complex glycoprotein, this protein marker stains the membranes of neurosecretory cells and gives a positive reaction—typically appearing as a light yellow hue in functionally active tissues. However, if expression is seen in a dark brown hue, it may suggest a high concentration of chromogranin protein, indicating increased activity in neurosecretory cells, or even the presence of a neoplastic process. In our study, this marker showed moderate intensity specifically in the Type I cases.

The low expression of chromogranin is explained by the underdevelopment of neuromuscular synapses and the presence of increased numbers of fibroblasts and histiocytes surrounding these areas. This contributes to the formation of fibromuscular tissue complexes, further disrupting functional capacity. Such findings suggest that esophageal atresias require urgent diagnostic evaluation and timely treatment planning. Failure to act appropriately and promptly—particularly in the presence of pronounced clinical-morphological indicators—can lead to a high mortality rate, reportedly as high as 90%.

Conclusion. The low expression of the chromogranin marker reflects a deficiency in the biologically active substances produced by neuromuscular synapses and APUD cells. From a clinical and morphological standpoint, this highlights the necessity of introducing such

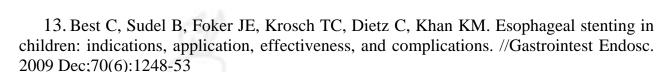
bioactive agents as part of therapeutic interventions. These findings confirm a fundamental developmental lag in the neuromuscular connectivity in various forms of esophageal atresia. Therefore, in proposing a treatment algorithm, special attention should be given to enhancing the excitability of neuromuscular synapses. Such an approach may offer a significant therapeutic advantage, with the potential to preserve life in approximately 50–92% of affected patients.

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