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# PATHOMORPHOLOGICAL CHARACTERISTICS OF THE THYMUS IN SEPSIS IN CHILDREN

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## ABSTRACT

*The formation and functional development of Gassal's bodies of the thymus normally occurs through 3 stages: construction, self-development and degeneration. Each stage of development of thymic bodies had certain morphological features in the form of cellular, glomerular, amorphous, layered, cystic and calcified formations. The qualitative and quantitative state of Gassal's bodies is of no small importance in assessing the functional activity of the thymus and developing atrophic and degenerative changes in it in sepsis.*

**KEYWORDS:** *Thymus, Reticuloepithelium, Gassal's Little Bodies, Newborn, Sepsis.*

## INTRODUCTION

**Relevance**: Difficulties in diagnosing and treating diseases associated with the pathology of the organs of the immune system in children, the duration and recurrent nature of their course, the impact on their entire subsequent life, put forward an urgent need for deep knowledge and disclosure of the subtle mechanisms of their pathogenesis and morphogenesis. Until now, the morphofunctional state of the immunity organs, in particular the central organ - the thymus, in sepsis in newborns, remains poorly understood. Especially, data on morphological changes in the thymus arising in various infectious diseases remain contradictory [1, p. 194; 2, pp. 36-39; 3, p. 88; 4, pp. 337-352].

## THE MAIN FINDINGS AND RESULTS

It is known that the qualitative and quantitative changes in Gassal's little bodies are of no less importance in assessing the functional activity of the thymus and the pathological processes developing in it. For the medulla of the thymus, the most characteristic structures are thymic bodies or Gassal's little bodies. They are concentric clusters of elongated and fusiform cells with

large nuclei and a layer of acidophilic cytoplasm [3, p. 88; 5, pp. 44-47; 6, p. 163]. The exceptional importance of thymic bodies in the homeostasis of the body is evidenced by the fact that they quickly respond to exogenous and endogenous pathological signals, which leads to an imbalance of the entire system of differentiation and proliferation of T-lymphocytes, and, consequently, the entire immune system [3, p. 88; 7, p. 600].

Considering the above, the study of the features of the morphological and morphometric parameters of thymic bodies in normal conditions and in sepsis in children makes it possible to reveal their morphological and functional significance in the immune response during the development of a systemic vascular inflammatory process in the form of sepsis.

In this work, the **goal** was to identify the morphological and morphometric features of the thymic bodies of the thymus in health and sepsis in children.

## MATERIAL AND RESEARCH METHODS

The object of the study was the thymus of 23 newborn children who died in the neonatal period from sepsis. As a control, the thymus of 16 newborns with a body weight of more than 3000 g, born at term and died from craniocerebral birth trauma, was investigated. During the autopsy, the thymus was isolated, weighed, and the thymus weight coefficient (TWC) was determined. For histological examination, pieces of thymus were fixed in 4% formalin solution in phosphate buffer and, after dehydration in alcohols, embedded in paraffin. Sections with a thickness of 5-8 μm were stained with hematoxylin and eosin, according to Van Gieson, and the PIC reaction was performed. To unify the accounting of morphological changes in the thymus in newborns and various pathologies, an algorithm for assessing morphological signs has been developed.

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In some cases, heavy-like fields of the reticuloepithelium can be found, forming associations of thymic bodies, consisting of small cells that do not exhibit form-forming and functional activity, which once again emphasizes the connection between the specialization of the cells of Gassal's bodies and the shape of the latter.

The homogeneity and uniformity of functioning bodies, their small size and moderate number is a reliable sign of the normal activity of the thymus gland in the absence of changes in it on the part of the lymphoid tissue. On the other hand, the homogeneity of the structure of thymic bodies may indicate desynchronization of their development.

The functional activity of Gassal's bodies is primarily evidenced by the appearance of nuclear-free cells and the homogeneity of the amorphous substance (Fig. 1). As already noted, one of the

signs of vigorous activity is the concentric structure of the bodies. However, this state was not limited to the presence of only such structures. Very often it was possible to detect Gassal's little bodies in the form of microcysts (Fig. 2), the lumens of which are either filled with an amorphous mass or empty, but their outer layer consists of cells predominantly with preserved nuclei. This layer was like a capsule.

The content of the cystic cavities differed in nature, but in most cases, SHIK-positive substances were detected in it, the presence of which increased with the aging of Gassal's bodies.

Already at the stage of functional activity of Gassal's bodies, calcium salts can be deposited in them, which lead to partial or complete calcification of the cell-free masses (Fig. 3), but with the relative safety of the outer cell layer.

The final stage of histogenesis of thymic bodies is the phase of their degenerative changes. At the same time, even at this stage of development, it is far from always possible to draw a clear boundary between it and the previous stages. The degenerative nature of the changes in Gassal's bodies is evidenced by a noticeable increase in non-nuclear cells, up to the complete disappearance of cells with preserved nuclei, which is preceded by an increase in their cytoplasm from the side of the boundaries between individual cellular elements and the formation of an amorphous mass (Fig. 4). In this case, the process is not limited only to the center of the thymic bodies, but also captures their outer layer. In this phase, attention is drawn to the variety of morphological forms of Gassal's bodies, which concerns, first of all, their structure and size, and, to a lesser extent, their shape. The latter usually has rounded or oval outlines, especially when the thymic bodies are enlarged. To a lesser extent, this applies to small bodies. And this has its own explanation, which serves as an indirect confirmation of the secretory ability of these structures. By a generally accepted law, the accumulation of contents in the lumens of hollow organs or structures leads to their uniform expansion. With a further increase in the content and this is possible only when it is produced by the cells of Gassal's bodies, the shape of the structures takes on a rounded shape. Difficulty in acquiring a rounded shape may be associated with an increase in the viscosity of the contents or an uneven deposition of calcium salts.

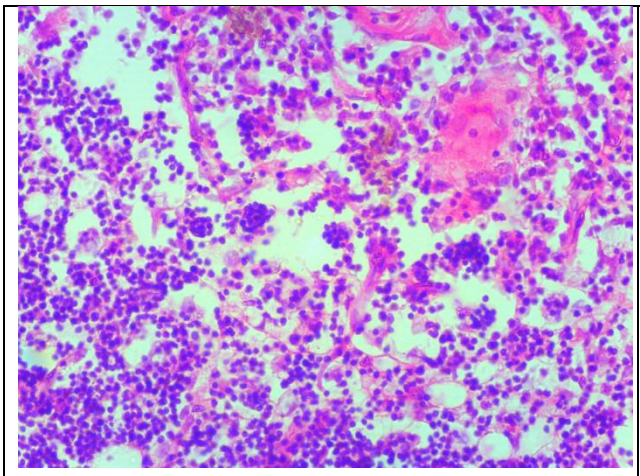

Fig 1. Formation of Gassal from pulling reticular cells. Ok: G-E. X: 10x20

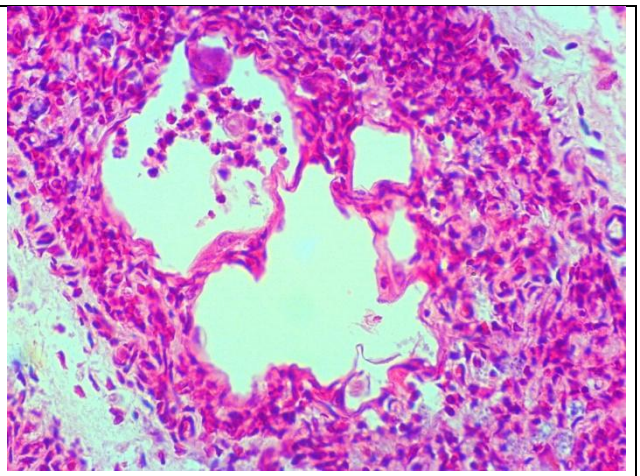

Fig 2. Formation of cysts. Ok: G-E. X: 10x20

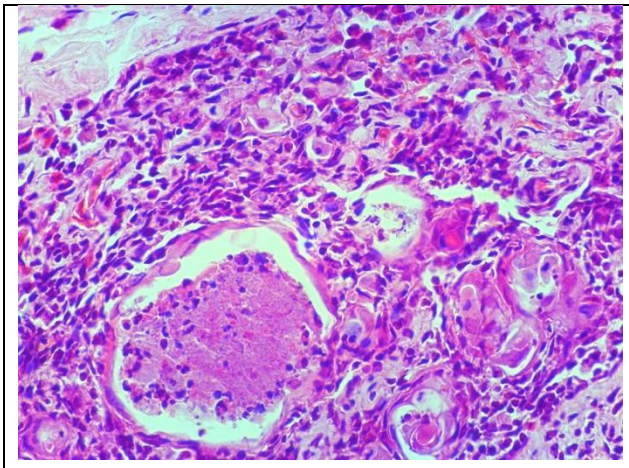

Fig 3. Filling the amorphous mass of Gassal's little body. Ok: G-E. X: 10x20

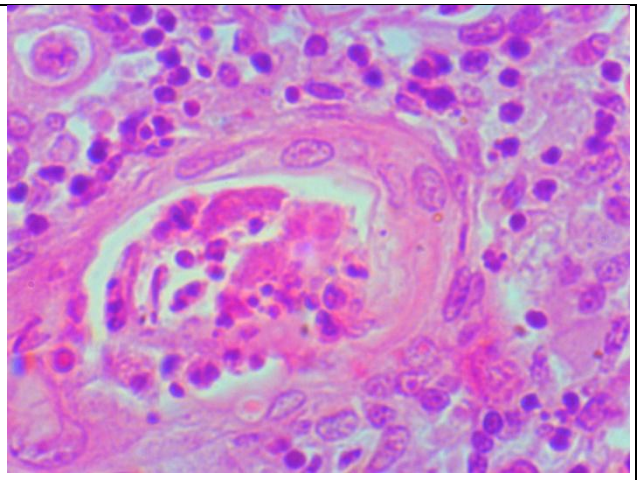

Fig 4. Dead cells and calcifications in the lumen of Gassal. Ok: G-E. X: 10x40

Thus, analyzing the morphological signs of the formation and degenerative changes of thymic bodies, it can be assumed that their active activity is largely related to the size, structure and nature of the structural composition. Taking into account all these parameters made it possible to systematize Gassal's bodies and identify their types, taking into account the phase of development; it was identified 3 stages and the nature of the structure of Gassal's bodies in the norm: 1) the stage of construction; 2) the stage of their own development and 3) the stage of degeneration. Each stage of development of thymic bodies had certain morphological features in the form of cellular, glomerular, amorphous, layered, cystic and calcified formations.

The results of studying the qualitative and quantitative characteristics of thymic bodies in sepsis showed that, along with the violation of qualitative signs, the number of thymic bodies in the stages of construction and self-development was significantly reduced, and degenerative forms were significantly increased. The size of the bodies reaches 175 microns, there are many cystic forms. The main number of bodies in the stage of degeneration is characterized by various types of structure, calcified bodies appear. The bodies lose their functional activity, the disappearance of nuclear cells is often observed, the lumen of the cysts is filled with an amorphous mass. These degenerative changes in thymic bodies are accompanied by marked delimpatization of the cortical layer. In this case, stromal reticuloepithelial cells become bare and dysplastic rearrangements develop in them.

## CONCLUSION

Thus, it can be noted that the qualitative and quantitative state of Gassal's bodies is of no small importance in assessing the functional activity of the thymus and developing atrophic and degenerative changes in it during sepsis.

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