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CHRONIC EXUDATIVE OTITIS MEDIA IN CHILDREN, CYTOLOGICAL ASPECTS OF DISEASE STAGE CONFIRMATION

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Anotation: The article presents a description and scientific substantiation of cytological aspects of confirming the stages of chronic exudative otitis media (CEOM). Pathophysiological mechanisms leading to the formation of exudate in the middle ear cavity are presented. The nature of changes in the cellular landscape in accordance with the stage of the disease is substantiated. Based on the study, cytograms were analyzed that reflect a certain stage of the disease. Each type of cytogram allows for a reliable assessment of the degree of degenerative changes in the mucous membrane of the tympanic cavity. The proposed cytological study of exudate in CEOM allows for determining the type of inflammatory process in the tympanic cavity, and also contributes to the final establishment of the stage of the process from the standpoint of morphofunctional classification according to N. S. Dmitriev et al. (1996), classification of M. Tos (1976). At present, a cytological classification of exudate in CEOM depending on the stage of the disease has not been developed, which complicates the clinical and instrumental diagnostics of the features of the disease in question. The ability to assess the state of local immunity (cytological examination of the middle ear secretion) allows us to predict the clinical course of the disease with subsequent optimal selection of personalized treatment tactics in a hospital setting and during outpatient treatment.

Key words: CEOM, HESO, T-suppressors, T-helpers.

Introduction

Chronic exudative otitis media (CEOM) is a non-purulent inflammatory disease of the middle ear, pathogenetically associated with dysfunction of the auditory tube (ET) and manifested by the accumulation of exudate (serous, mucous, mucoid nature) in its cavities, which leads to the formation of a certain symptom complex, the main component of which is slowly progressing hearing loss of conductive or mixed nature. According to the WHO classification, chronic exudative otitis media ranks 3rd in the world among all middle ear diseases. In the structure of non-purulent diseases of the middle ear, CEOM accounts for 75.1–80% of all non-purulent diseases, which, according to many authors, depends on the age of children (up to 1 year - 35%, 3–5 years - 10–30%, 6–7 years - 3–10%, 9–10 years - 1–3%) [1–5]. Matroskin A. G. et al. noted a high proportion of exudative otitis media in premature (from 26 to 59%) and full-term (58%)

children up to 6 months, as well as in the first year of life (26–52%). In 10% of the subjects, the disease required further surgical treatment [6].

The World Health Organization predicts that by 2030 the number of people with socially significant hearing impairments will increase by more than 30% [7].

Three theories of the formation of HESO are described in world literature. The following theories are considered the main ones.

1. « Hydrops ex vacuo », proposed by A. Politzer in 1867, according to which the resulting dysfunction of the auditory tube prevents the equalization of extra- and intratympanic pressure. Oxygen is resorbed from the intratympanic space, thus the intratympanic pressure decreases (to –100...–450 mm H2O), causing the retraction of the eardrum. The smooth drop in the “air reservoir” in the intratympanic and retrotympanic spaces ensures a smoother transition of pressure between the middle ear and the external environment. Already at an intratympanic pressure of –40 mm H2O, hyperemia of the mucoperiosteum, oozing of the liquid part of the blood through the capillary wall to the outside and the formation of a transudate occur.

2. "Inflammatory theory", according to which inflammation from the nasal part of the pharynx spreads to the tympanic cavity, capturing the mucoperiosteum. Edema of the mucous membrane causes blockage of the auditory tube and a decrease in intratympanic pressure. Congestion in the mucoperiosteum increases transudation and inflammation, leading to metaplasia of the integumentary epithelium and the release of characteristic inflammatory components into the lumen of the tympanic cavity. Long-term inflammation of the mucoperiosteum contributes to the formation of a jelly-like consistency of exudate.

3. "Secretory theory", in which the main role is played by hyperplasia of goblet cells and mucous glands [9]. Thus, the predictor of the development of CESOD is the violation of the protective, drainage and ventilation functions of the ST. Tubal dysfunction is caused by systemic changes in the mucous membranes of the nasal cavity, paranasal sinuses and nasopharynx, adenoid vegetations, infectious and allergic diseases of the upper respiratory tract, sudden changes in atmospheric pressure, tumors of the nasopharynx, injuries, cicatricial changes, including iatrogenic, congenital defects and anatomical features of the structure (congenital narrowness of the nasal passages, curvature of the nasal septum, tubal location of the nasopharyngeal tonsil, disruption of the nasal valve, hypo- and aplasia of the pharyngeal opening of the auditory tube, craniofacial anomalies) [9-11].

The issue of mechanical and functional obstruction of the TS due to infection of adenoid vegetations with viral infectious agents has not lost its relevance. The most common viruses causing this type of obstruction are respiratory syncytial viruses of types A and B, adenoviruses, rhinoviruses, influenza viruses A, B and C, herpes viruses (Epstein-Barr, cytomegalovirus and human herpes virus type 6) [12, 13].

Allergic inflammation as a premorbid background can be the cause of edema of the mucous membrane of the middle ear and exudation in the cavities of the middle ear. A local inflammatory focus in the middle ear leads to the development of immunological deficiency of T- and B-cells, monocytes, macrophages, imbalance of immune globulins, as well as accumulation of neutrophils, eosinophils and plasma cells in the exudate of the tympanic cavity. Deficiency of factors of congenital or acquired nonspecific protection is associated with a violation of the barrier function of the mucous membrane and lymphoid elements of the entire tubotympanic complex, which is due to: primary or acquired pathology of the ciliated epithelium, congenital mucocellular insufficiency, lysozyme, secretory immunoglobulin A , and a violation of the phagocytic function.

In case of damage to the mucous membranes of the middle ear, cytological examination of the discharge is a first-level laboratory test [12]. Taking into account modern views on the role of local immunity in the

development of inflammatory diseases of the middle ear, the development of practical methods for using immunotubocytogram to select treatment tactics for exudative otitis media is relevant.

Purpose of the study

Evaluation of the cytology of middle ear secretions and determination of the correspondence of chronic disease stages to the cellular landscape.

Patients and research methods

The study included 30 children (54 ears) aged 2 to 17 years with chronic exudative otitis media. The study was conducted at the Clinic No. 1 of the Samara State Medical University using retrospective clinical and laboratory analysis based on the data from registration form No. 003-u. The diagnosis of chronic exudative otitis media was verified according to ICD 10 (H 65.2 , H 65.3). In this work, clinical, laboratory and instrumental diagnostic methods were used. All children underwent otomicroscopy and endoscopic examination of the nasal cavity and nasopharynx. The ventilation function of the otitis media was assessed by acoustic impedancemetry according to the ISO 8253-1 method on an Interacoustics AA 222- XP audiometer-tympanometer using the Toynbee and Valsalva barometric tests. An assessment of the cytological picture of the middle ear exudate was carried out, and a feature of the relationship between the cellular landscape of the middle ear and the stage of the ongoing disease and the process was revealed.

During surgical treatment in the scope of revision and bypass, laser tympanotomy of the tympanic cavity, material was collected using a thin drainage cannula with a volume of 0.1–0.2 ml using the “imprint” method, which made it possible to obtain material for research with a minimum volume of discharge from the tympanic cavity.

Table Cellular **composition of the studied exudate (n = 54), p < 0.05**

ESO stage	Number of ears (n = 54)	Cytogram type	Cellular composition (% of visual field)			
			Segment. neutrophils, %	Lymphocytes, %	Eosinophils, %	Charcot-Leyden crystals, %
Secretory	-	Inflammatory	-	-	-	-
	33	Inflammatory-regenerative	51	26	23	15
Mucosal	21	Regenerative	40	38	22	2

Research results

The cytogram of the exudate reflects a certain stage of the disease: the inflammatory type and the inflammatory-regenerative type correspond to the secretory stage, the regenerative type to the mucosal stage.

Each type of cytogram allows for a reliable assessment of the degree of degenerative changes in the mucous membrane of the tympanic cavity. For Patients with an inflammatory type of exudate cytogram are characterized by signs of destruction with damage to their own tissue, destruction of the basal and cellular membranes by products of active forms of neutrophils. In patients with an inflammatory-regenerative type of cytogram, a change in the destructive form of inflammation to a reparative one is noted: destruction of the surface layer and the beginning of reparation processes are observed. The cytograms studied with a regenerative type have signs of an active reparative process, proceeding towards fibrosis [15] (Fig. 1, 2).

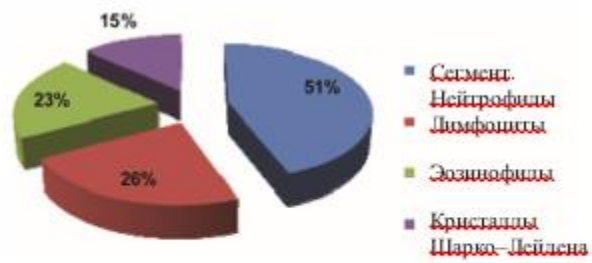

Fig. 1. Inflammatory-regenerative type of cytogram. **Fig . 1.** Inflammatory - regenerative type of cytogram .

Discussion

In 100% of cases, cytological analysis of middle ear secretion revealed inflammation markers – segmented neutrophils. After the release of a special neutrophil chemotactic factor from mast cells, the altered neutrophils migrate from the bloodstream to the tissue parenchyma, causing a late and repeated spastic effect. The chronicity of the process leads to mucosal infiltration, which in turn causes tissue disorganization with the development of destruction due to the activation of prostaglandins, leukotrienes and lysosomal enzymes. Chronic mucosal edema leading to ST obstruction, can be regarded as one of the factors in the development of CESO [16].

The main markers of the allergic process are eosinophils. As a source of EMBP (eosinophil major basic proteins) together with neutrophils they produce protease, elastase, ozone and lead to the destruction of the mucous membrane of the tympanic cavity, which is the cause of hyperproduction of secretion.

Against the background of an increase in the number of segmented leukocytes in the exudate of the middle ear, a significant number of lymphocytes is determined. Thus, the change of cell pools with the transition of the destructive phase of inflammation to the reparation phase can be regarded as a characteristic feature of the development of the exudative process in the middle ear.

In our study, we found the formation of Charcot-Leyden crystals during the destruction of eosinophils (15% of cases). In our opinion, the collected somatic anamnesis with the identified and confirmed diagnosis of bronchial asthma allowed us to assume that these patients had CESO is part of a single inflammatory process that develops according to the mechanism of a delayed-type allergic reaction.

Epithelial changes resulting from the development of bronchial asthma are characterized by pronounced production of cytokines. The stimulating effect of cytokines at all stages of the development of the inflammatory reaction in the bronchi is similar to such a mechanism in the middle ear cavity.

A study by Alikulova D. Ya. et al. is interesting . They revealed the following pattern in their work: upon admission to hospital, patients with atopic bronchial asthma showed a decrease in the relative number of T-lymphocytes, but there were no changes in the immune status of other cellular elements. A reliable increase in T-helpers and T-suppressors in the interictal period compared to the attack and post-attack periods was proven. High reactivity of T-lymphocytes in this form of bronchial asthma is similar to that in children with CESO with a history of bronchial asthma [17].

Conclusions

The main etiopathogenetic factors of CES are disorders in the humoral and mucosal immunity system, decreased ventilation and drainage functions of the nasal cavity and the duration of their recovery. The accompanying factors influencing the ventilation function of the nasal cavity include: features of the

architectonics of the intranasal structures, sinusitis, chronic rhinitis, changes in the level of thyroid hormones, paresis of the soft palate muscles, scars and neoplasms of the nasopharynx and tubotympanic region.

Despite the fact that clinical and audiological examinations allow a high probability of diagnosing exudative otitis media, the nature of the exudate can only be determined by tympanopuncture and/or myringotomy.

Currently, a cytological classification of exudate depending on the stage of the disease and the cause that caused it has not been developed, which complicates the clinical and instrumental diagnosis of the characteristics of CES.

Cytological examination of exudate in CES allows one to clearly determine the type of inflammatory process in the tympanic cavity, as well as to finally establish the stage of the process from the position of the morphofunctional classification according to N. S. Dmitriev et al. (1996), and the causes of CES.

The ability to assess the state of local immunity (assessment of cytological secretion) allows predicting the clinical course, prognosis and outcome of the disease with subsequent optimal selection of personalized tactics of treatment measures in a hospital setting and during outpatient treatment.

Thus, the relevance of the chosen topic is determined by the increasing prevalence of CESO in childhood and the need to improve diagnostic and therapeutic methods. In order to optimize the management of a patient with CESO, a comprehensive examination of the patient is necessary, identifying the most significant factors in the formation of this pathology, followed by personalization of approaches to management, including taking into account the comorbid condition, the choice of surgical treatment tactics, and predicting the dynamics of disease development.

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