



Exudative Otitis Media in Children

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Abstract: This article presents these results of studying the diagnosis and treatment of exudative otitis media in children. Exudative otitis media is a disease of the middle ear characterized by the presence of exudate in the cavities of the middle ear and hearing loss, occurring without pain, with an intact eardrum.

Key words: exudative otitis media, children, hearing.

Introduction. In recent years, the number of patients with non-suppurative middle ear diseases has increased, among which exudative otitis media (EOM) accounts for 75.1—80% [1]. Research by S.L. Kovalenko et al. [2, 3] has shown that in the territory of the Russian Federation, EOM is the main cause of hearing loss in children aged 2 to 7 years (30.2% of cases were detected during mass examinations of children in this age group).

Purpose. EOM was first identified as an independent condition by A. Politzer in 1862 (quoted in [4]), and throughout its more than 100-year history, it has undergone over 55 changes in nomenclature depending on the authors' perspectives on the predominant etiology and pathogenesis of the disease [5]. Synonyms for this term can be found, such as secretory otitis media, non-suppurative otitis media, "glue ear," etc. [6]. EOM is a middle ear disease characterized by the presence of exudate in the middle ear cavities and a decrease in hearing, occurring without pain syndrome, with an intact tympanic membrane [7]. In the etiology of EOM, many general and local factors are significant: Acute and chronic inflammatory diseases of the nose, paranasal sinuses, and nasopharynx with the spread of inflammation to the mucous membrane of the auditory tube [8]; Systemic vasomotor dysfunction of the mucous membrane of the upper respiratory tract of neurovegetative and allergic nature [9]; Dysfunction of muscles opening the auditory tube [10]; Local and systemic immunodeficiency with disruption of mucociliary, secretory, and phagocytic components of the protective function of the mucous membrane of the auditory tube [11, 12];

Material and Methods. Mechanical impairment of auditory tube patency due to adenoid vegetations, hypertrophy of tonsils, benign and malignant neoplasms of the nasopharynx, or scar changes of various origins. In childhood, the first two factors are encountered much more frequently [13];

Pathophysiology. Pathology of the external and middle ear, improper use of antibiotics, and insufficiently active tactics of an otolaryngologist in the treatment of acute otitis media. It is known that antibiotics contribute to the death of bacterial flora, as a result of which the process in the middle ear can proceed as aseptic inflammation. Rare cases of EOM due to persistent mycotic external otitis with manifestations of myringitis have been described [14]; Anatomical and physiological features of auditory tube development in childhood [15].

Predisposing factors for the development of EOM may include prematurity and low birth weight of the child, artificial feeding, attendance at childcare facilities, recurrent upper respiratory tract infections, low socioeconomic status of the family, and others [16]. Passive smoking, the presence of gastroesophageal reflux in the child, and genetic predisposition are also considered predisposing factors for EOM [17]. Thus, in most cases, the initiating mechanism in the development of EOM is



dysfunction of the auditory tube, which develops against the background of the listed conditions [18]. Evidence of this can be seen in experiments involving the injection of botulinum toxin into the soft palate muscles, resulting in paralysis of the tubal musculature, obstruction of the auditory tube, and the development of EOM [19]. Many authors emphasize that middle ear inflammation in children often begins with a respiratory viral infection. However, viruses are merely the triggering factor in the etiology of middle ear inflammation, as cocci flora is already noted by the 4th day of the illness, accompanied by the disappearance of the virus from the exudate [20].

Most often, influenza viruses A, B, and C; parainfluenza viruses 1-3, 4A, and 4B; types A and B of RS virus; 47 serotypes of adenoviruses; and over 100 serotypes of rhinoviruses, which have the greatest affinity for the mucous membrane of the upper respiratory tract, are cultured from the discharge from the tympanic cavity. In children under 2 years of age, the leading etiological factor of acute otitis media and respiratory distress syndrome is respiratory syncytial virus [21]. Due to the cytopathogenic action of viruses on the mucociliary system of the middle ear, auditory tube dysfunction occurs, and mucus evacuation is impaired [22—24]. Some authors have found fungal flora in the exudate of patients with EOM in 100% of cases [25].

Although the term EOM implies a chronic course, a chronic condition is considered to have a duration of more than 8 weeks, a subacute condition from 3 to 8 weeks, and an acute condition up to 3 weeks [26]. Depending on the dynamics of the inflammatory process and the corresponding pathomorphological changes in EOM, certain stages of clinical manifestations of this disease are distinguished. Thus, D.I. Tarasov et al. [27] describe three stages of EOM. In the first stage, which is short-lived, transudation occurs; clinical symptoms are weakly expressed and mainly related to tubal dysfunction. In the second stage - secretory - secretion, mucus accumulation, and mucosal hyperplasia prevail. The third stage, terminal, is characterized by the development of degenerative processes in the middle ear. The most significant in the classification of EOM are the stages of the disease formed according to the pathogenesis of this condition. M. Tos et al. [28] also distinguish 3 clinical stages of EOM development: I. Primary, or stage of initial metaplastic changes in the mucous membrane of the tympanic cavity (against the background of functional occlusion of the auditory tube). II. Secretory (increase in the activity of goblet cells and metaplasia of the mucous membrane epithelium of the tympanic cavity). III. Degenerative (decrease in secretion and development of adhesive processes in the tympanic cavity). O.V. Stratieva et al. [4] proposed the following classification of EOM: I. Initial exudative stage (stage of initial catarrhal inflammation). II. Pronounced secretory stage, subdivided depending on the nature of the secretion into serous, mucous (mucoïd), serous-mucous (serous-mucoïd). III. Productive secretory stage (with predominance of secretory process). IV. Degenerative-secretory stage (with predominance of fibrotic-sclerotic process), subdivided by form into fibro-mucoïd, fibrocystic, fibroadhesive (sclerotic) stages.

Stages. N.S. Dmitriev et al. [7] provide a similar classification of the stages of EOM, but these authors distinguish four stages of the disease. Stage I - catarrhal stage - is characterized by impaired ventilation function of the auditory tube with the formation of negative pressure in the tympanic cavity, which creates conditions for the appearance of transudate. Clinically, this is manifested by retraction of the tympanic membrane, a change in its color from cloudy to pink, and a decrease in hearing (air conduction thresholds do not exceed 20 dB, while bone conduction thresholds remain normal). The duration of the catarrhal stage is up to one month.

Stage II - secretory stage - is characterized by the appearance of metaplastic changes in the mucous membrane of the middle ear in the form of an increase in the number of secretory glands and goblet cells, leading to the formation of mucous content (exudate) in the tympanic cavity. Signs of fluid in the tympanic cavity may be detected otoscopically, and air conduction thresholds increase to 20-30 dB. The duration of the secretory stage can range from 1 to 12 months.

Stage III - mucous stage - is characterized by the content in the tympanic cavity becoming thick and viscous. There is more pronounced conductive hearing loss (with thresholds up to 30-50 dB), and in



some cases, bone conduction thresholds may also increase. The mucous stage develops with a duration of the disease from 12 to 24 months.

Stage IV - fibrotic stage - is characterized by the predominance of degenerative processes in the mucous membrane of the tympanic cavity. Mucus production decreases, and then completely stops, followed by fibrotic transformation of the mucous membrane involving the auditory ossicles. Mixed conductive hearing loss progresses.

Currently, there is a hypothesis about genetic predisposition to the development of adhesive processes in the middle ear. For instance, the formation of connective tissue largely depends on the acetylator status, which is determined based on the activity of N-acetyltransferase [29]. Typically, the fibrotic stage develops with a duration of EOM of more than 24 months.

It should be noted that in some cases, the disease may have a resorptive course with cessation of development at any stage, but recurrence of EOM is possible in a patient with already formed adhesive otitis.

As a rule, the disease is characterized by a prolonged course - over 6 months [27]. The probability of resolution of EOM, which occurred due to an episode of acute otitis media, is high (approximately 75-90%) within 3 months, while spontaneous resolution of the process at the 3rd month in patients with recently diagnosed EOM with unknown preceding duration is about 28%, and at the 12th month is about 31% for bilateral EOM with a duration of 3 months and more [30].

If active inflammatory processes do not resolve or there is a disruption of immune regulation, EOM may transition to a chronic form [31]. It is believed that the chronicization of the process is associated with proliferative changes in the tissues of the middle ear, especially in the mucous membrane of the tympanic cavity. Goblet cells produce and release mucins, which contribute to the viscosity of the exudate and are an important component of the mucociliary transport system of the middle ear [32].

Patients with recurrent EOM present a significant and as yet unresolved problem for pediatric otolaryngologists. Recurrence of EOM is often observed in children with reduced immune reactivity, which is associated with a low level of IgM production, a low number of T-helper cells, leading to insufficient effectiveness of anti-infectious immunity, prolonged persistence, and periodic activation of microflora [33]. The diagnosis of EOM is based on complaints, medical history data, and examination results, which, in addition to the traditional examination of ENT organs, usually include endoscopy of the nasal cavity and nasopharynx, otoscopy, microscopy, and otoscopy, acoustic impedance audiometry (tympanometry and acoustic reflexometry), otoacoustic emission testing, tonal threshold audiometry (if the child's age allows), tuning fork examination, and, if indicated, computer tomography of the temporal bones (suspected anomalies or destruction of middle ear structures, recurrent EOM, etc.).

Results and Discussion. Additional investigations are conducted to determine the cause of the disease. For older children, X-ray examination of the paranasal sinuses is recommended. Microbiological, allergological, gastroenterological, immunological, genetic, and other studies may also be performed [7, 14, 34]. Methods of endoscopy of the tympanic cavity with the introduction of a thin fibroscope through the pharyngeal orifice of the auditory tube have also been described [35]. Differential diagnosis is conducted with developmental anomalies of the auditory ossicles, otosclerosis, glomus tumors, rupture of the ossicular chain, local manifestations of systemic diseases [7, 34]. Early diagnosis of EOM and timely treatment significantly improve the prognosis of the disease. Conservative and surgical methods are available for treating EOM depending on the stage of the disease. The initial step in EOM treatment involves upper respiratory tract sanitation and restoration of nasal breathing, which undoubtedly positively affects the function of the auditory tube. In children, upper respiratory tract sanitation often involves adenoidectomy, adenotonsillectomy [36]. Surgical interventions in the nasopharynx in children are preferably performed under general anesthesia [37–39]. During the catarrhal stage of EOM, upper respiratory tract sanitation (URT) and a



course of conservative therapy aimed at correcting auditory tube dysfunction are conducted. If surgical intervention for URT sanitation is performed, audiological examination is repeated after 1 month. If hearing impairment and type C tympanogram persist, a repeat course of conservative treatment for auditory tube dysfunction is initiated [4, 7, 34]. Conservative treatment for EOM in children typically includes Politzerization, anemization of auditory tube orifices, kinesiotherapy, application of modern topical corticosteroids, treatment with fluctuating currents, physiotherapy (endaural electrophoresis with potassium iodide, acetylcysteine), pneumatic massage of the tympanic membranes. Catheterization of auditory tube orifices is mainly performed in older school-age children [40]. During the secretory stage of EOM, URT sanitation is also conducted (if not previously performed), myringotomy with evacuation of exudate, and possible insertion of a ventilation tube. If surgical sanitation of the URT (adenoidectomy, etc.) is not indicated, a course of conservative treatment for EOM may be administered with consideration of surgical treatment if it proves ineffective. The stage of EOM is definitively verified during the operation. In the second stage, exudate is easily and completely removed from the tympanic cavity via myringostomy [41].

If surgical sanitation of the URT was previously performed and conservative treatment is ineffective, tympanic cavity shunting is indicated [7, 34]. As previously noted, due to the intense growth of lymphoid tissue compared to adult patients, especially during the period of active formation of the immune system up to the age of 5 years, hypertrophy of the adenoids is often observed in children [13]. This is most commonly seen in children who have previously undergone adenoidectomy [18]. In such cases, correction of the adenoids is recommended [16, 18].

During the mucosal stage, if not previously performed, upper respiratory tract sanitation (URT) is conducted along with simultaneous tympanic cavity shunting and myringotomy with revision of the tympanic cavity. Indications for simultaneous myringotomy include the inability to remove exudate through myringostomy due to its increased viscosity [4, 6, 34].

In the fibrotic stage, the treatment approach is similar to that of the mucosal stage but supplemented with the removal of tympanosclerotic foci and mobilization of the ossicular chain [4, 6, 34].

Not all authors recognize traditional shunting methods as highly effective and propose various alternative options such as laser tympanostomy [42], retro-tympanic shunting [42, 43, 45], and so on. With the aim of surgically intervening in the cartilaginous part of the auditory tube in cases of its chronic obstructive dysfunction, a transnasal endoscopic laser intervention called "Laser Eustachian Tuboplasty" (LETP) has been developed. The essence of the method lies in the selective destruction (vaporization) of edematous tissues in the region of the posterior wall of the auditory tube [46]. Despite this, tympanic cavity shunting, as a classical method in the surgical treatment of EOM, remains one of the most common operations in children, performed under general anesthesia [47–49].

Conclusion

Children with EOM require regular follow-up care. After treatment, children with stages I, II, III, and IV of EOM undergo examination and audiological testing after 1 month, followed by evaluations every 6 months for 2 years. For stage II, in case of shunting, an examination is recommended after 2 weeks, followed by monthly evaluations for 6 months; audiological testing is conducted once every 3 months during the first year and once every 6 months during the second year. However, it is essential to remember that the treating physician determines the final follow-up strategy based on the specific needs of each individual child.

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