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Main Causes of Exudative Otitis Media Development in Children and Effective Treatment Methods

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Abstract: Otitis media, including its exudative form, is known to be one of the most prevalent diseases among children. In infants and preschool-aged children, the disease often progresses with minimal or no clinical symptoms, which may lead to unnoticed hearing decline and, consequently, delayed diagnosis. Even a minimal degree of hearing impairment can negatively affect the development of auditory perception, speech abilities, and higher cortical functions in a child.

Since pediatricians are the first specialists to regularly monitor children, they most frequently encounter the initial manifestations of exudative otitis media. Therefore, it is essential for them to have a comprehensive understanding of the mechanisms, primary causes, and risk factors contributing to the development of this disease. The initial part of this literature review highlights the main theories of exudative otitis media pathogenesis, the participation of viral and bacterial microflora, obstruction of the auditory tube due to nasopharyngeal neoplasms, craniofacial and chromosomal anomalies, allergic conditions, rhinosinusitis, and the role of adenoiditis.

Key words: *children, exudative otitis media, etiology, risk factors.*

Introduction

Otitis media, particularly its exudative type, is one of the most common childhood diseases, affecting more than 80% of children under four years of age [1]. Although the 10th revision of the International Classification of Diseases (ICD-10) adopted in 1990 does not specifically classify "exudative otitis media" as a separate entity (its various forms fall under categories such as "H65. Non-suppurative otitis media", "H66.9 Unspecified otitis media", and "H67"), specialists widely use the term in clinical practice. Due to its recurrent and prolonged course, the condition may lead to hearing limitations. Even minor auditory deficits during critical periods of speech development can result in speech disorders as well as delays in language and cognitive function formation [2, 3].

Because exudative otitis media may progress almost asymptomatically during early childhood, timely diagnosis and treatment become crucial for ensuring a child's full development. The pediatrician is the first clinician who may suspect its early manifestations.

Exudative otitis media is a non-suppurative disease characterized by the accumulation of serous, mucous, or mucoid fluid in the middle ear cavity, leading to conductive or mixed hearing loss. It is a polyetiological condition, often associated with a combination of local and systemic contributing factors [4].

Historically, several theories explain the formation of exudative otitis media:

"Hydrops ex vacuo" theory: Dysfunction of the auditory tube results in negative pressure in the middle ear cavity, increasing vascular permeability.

Inflammatory theory: Exudate formation is linked to inflammatory changes in the mucous membrane of the middle ear.

Secretory theory: Increased activity of goblet cells and mucous glands is central to pathogenesis [5].

These mechanisms collectively contribute to the development of the disease, forming different links in the same pathological chain. The majority of tympanal inflammations—including exudative otitis media—are associated with impaired drainage and ventilation due to dysfunction of the auditory tube [6, 7].

Morphological features of the middle ear—such as the structure of the tympanic cavity, pneumatization of the mastoid process and attic, proportional relationships of epitympanum structures, and congenital narrowing of the auditory tube—may predispose children to the condition [5].

The most common cause of exudative otitis media is mixed obstruction of the auditory tube, frequently developing after acute respiratory viral infections (ARVI). Viral infections serve as a triggering factor in pathogenesis [9]. Approximately 70% of middle ear inflammatory diseases in children occur as complications of ARVI [5].

Respiratory viruses induce diffuse mucosal swelling throughout the upper respiratory tract, auditory tubes, and middle ear cavities. The swelling is particularly pronounced in regions such as the osteomeatal complex and the nasopharyngeal orifice of the auditory tube, resulting in mechanical obstruction. Viruses also exert cytopathic effects, suppressing mucociliary clearance and disrupting natural evacuation of secretions.

Viruses with high tropism to upper airway mucosa include:

– respiratory syncytial virus types A and B,

– adenoviruses,

– rhinoviruses,

– influenza A, B, and C viruses,

– parainfluenza virus types 1–3, 4A and 4B.

These viruses may persist in the middle ear effusion, contributing to acute, subacute, or chronic disease progression [10–12].

In approximately 75% of cases, the microbiome of the middle ear effusion consists of Haemophilus influenzae, Moraxella catarrhalis, and Streptococcus pneumoniae. Recently, Staphylococcus aureus and coagulase-negative staphylococci have become more common. These organisms are frequently found in biofilms. Alloiococcus otitidis, identified in 10–41% of cases—especially unilateral ones—can exist as a planktonic form or within mono- or polymicrobial biofilms. It may modify antibiotic susceptibility of H. influenzae, promoting persistence and indirectly contributing to exudative otitis media [18, 21–23].

Anaerobic bacteria such as Fusobacteria, Porphyromonas, Prevotella, and Enterobacteria species may also be present due to the low oxygen pressure in the middle ear [19, 24].

Mechanical obstruction of the auditory tube—caused by hypertrophy of the adenoid tissue, tonsils, peritubal lymphoid tissue, or posterior pharyngeal wall structures—plays a significant role. Nasopharyngeal tumors in older children or adolescents, such as juvenile angiofibroma, retention cysts, or lymphosarcoma, may also contribute.

Other contributing factors include soft palate muscular dysfunction, postoperative scarring due to previous adenoidectomy, and congenital anomalies such as cleft palate. In cleft palate patients, 75–98% experience bilateral, persistent conductive or mixed hearing loss. Early surgical correction (6–12 months) reduces risk but does not fully eliminate recurrence [32–35].

Allergic diseases (atopic dermatitis, bronchial asthma, allergic rhinitis) may serve as background conditions. Children with significantly elevated total or specific IgE levels, eosinophilia, or positive skin tests have a higher risk. Approximately 85% of recurrent and chronic exudative otitis media cases are linked to allergic factors [20–25].

Allergic rhinitis is the primary trigger among allergic conditions. Up to 50% of children with exudative otitis media are diagnosed with allergic rhinitis [23]. Allergic inflammation leads to swelling around the auditory tube and may significantly impair ventilation mechanisms.

Allergy-related exudative otitis media justifies the use of local decongestants, antihistamines, antileukotriene agents, systemic and topical corticosteroids, and allergen-specific immunotherapy in selected children [4, 24].

Chronic adenoiditis is one of the major causes of recurrent exudative otitis media in preschool children. Biofilm-forming bacteria are identified in 73.8–100% of adenoid tissues in such patients [20]. Thus, the nasopharynx becomes a chronic reservoir of infection.

Surgical removal of hypertrophic adenoid tissue under endoscopic guidance is considered effective in eliminating the infectious source, yet some studies show conflicting data, indicating the multifactorial nature of the disease [7, 29].

Overall, literature shows that the main etiopathogenetic mechanism is impaired Eustachian tube function leading to fluid accumulation in the middle ear. Contributing factors include repeated infections, adenoid hypertrophy, allergic diseases, immunodeficiency, and craniofacial anomalies. Effective treatment requires individualized approaches combining conservative therapy, timely surgical intervention, and preventive strategies.

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