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# Clinical Diagnostic Features of the Course and Treatment of Otogenic Intracranial Complications

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**Abstract:** The analysis of specific clinical and instrumental examination results enabled the assessment of the peculiarities in the course of otogenic intracranial complications associated with chronic suppurative otitis media. This study presents the outcomes of comprehensive treatment in 46 patients with chronic suppurative otitis media and intracranial complications. Isolated complications were identified in 47.9% of cases, while combined complications occurred in 52.1%. The findings underscore that MSCT and MRI of the temporal bones and brain, otomicroscopy, and cerebrospinal fluid analysis facilitate the early detection of otogenic intracranial complications. Patients with such complications require urgent open radical middle ear surgery. The proposed integrated system of emergency surgical intervention and intensive therapy significantly improves treatment outcomes and reduces mortality in patients with otogenic intracranial complications.

**Keywords:** chronic suppurative otitis media, otogenic intracranial complications, diagnosis, surgical intervention.

**Relevance of the problem.** Chronic suppurative inflammatory diseases of the middle ear remain among the most significant and challenging conditions in otorhinolaryngological practice. An increasing trend in the exacerbation of chronic suppurative otitis media (CSOM) has been observed, often resulting in severe intracranial complications that pose a direct threat to the patient's life [1, 3, 7, 12].

Despite advancements in comprehensive measures, including early diagnosis, intensive therapy, and surgical intervention, mortality rates for purulent intracranial complications of chronic suppurative otitis media (CSOM) remain at 15% or higher. The primary cause of fatal outcomes is typically the development of ventriculitis and meningoencephalitis, accompanied by brainstem compression, cerebral edema, and herniation of the brainstem into the foramen magnum [8, 10, 11, 12, 14].

In some cases, patients with general cerebral and meningeal symptoms are mistakenly admitted to non-specialized medical facilities. Others are directly referred to neurosurgical departments with suspected brain hematomas or tumors. Therefore, all patients with suspected intracranial pathology must undergo otorhinolaryngological examination. Otolaryngologists and neurosurgeons should collaborate to develop unified treatment strategies for patients with combined inflammatory pathologies. If the diagnosis is established in a timely manner, sanitizing surgery to address the purulent focus in the middle ear should be performed during the initial stage of treatment.

At present, due to timely implementation of comprehensive measures, the outcomes of treatment for purulent-inflammatory complications of otogenic origin have significantly improved [1, 3, 15]. This improvement is attributed to the development of more advanced diagnostic and therapeutic methods, including the use of new medications and innovative surgical strategies.

In all cases of otogenic intracranial complications, urgent surgical intervention is required to eliminate purulent content from the site of inflammation. Common surgical approaches for treating brain abscesses include puncture treatment, abscess drainage, and excision with capsule removal. Combined

methods are also employed, such as puncture combined with extirpation, as well as stereotactic aspiration techniques.

Intensive comprehensive therapy is administered both before and after surgical intervention. This includes antimicrobial, detoxification, anti-inflammatory, dehydration, antifungal, and general strengthening treatments.

In addition to pharmacological therapy, extracorporeal methods, such as plasmapheresis (PA), are now widely used and have secured a prominent place in the treatment of various diseases. PA is employed in patients with pronounced metabolic disorders, including lipid metabolism, carbohydrate metabolism, purine metabolism, and associated disturbances in blood rheology and microcirculation [3, 7, 8, 11, 13, 14].

Plasmapheresis involves the targeted quantitative and qualitative modification of the cellular, protein, water-electrolyte, enzymatic, and gas composition of blood by processing it outside the body [4, 5]. For effective detoxification of the internal environment, 3–5 sessions of PA are typically required, with intervals of 1–2 days between procedures. Under this regimen, even when plasma is replaced solely with an isotonic sodium chloride solution, no significant shifts occur in the key components of the internal environment (proteins, fats, carbohydrates, electrolytes, hormones, etc.).

In recent years, reports have emerged regarding the potential application of plasmapheresis in the treatment of purulent-inflammatory diseases of ENT organs [4, 6, 16].

The aim of our study was to examine the clinical characteristics, early diagnosis, and comprehensive treatment strategies for otogenic intracranial complications.

**Materials and Methods.** Over the past 10 years, 46 patients with otogenic intracranial complications were under observation in the ENT departments of hospitals in Samarkand. The age distribution was as follows: 16 patients aged 17–30 years, 19 patients aged 30–50 years, and 11 patients over 50 years old.

Patients were admitted in moderate, severe, and extremely severe conditions, with body temperatures reaching 39–40°C, and presenting with complaints of severe headaches, dizziness, unsteady gait, nausea, and vomiting.

Prior to hospitalization, all patients had undergone self-treatment or treatment by local physicians for 2 to 30 days, which included the use of antibiotics, analgesics, antihistamines, warm compresses applied to the affected ear, physiotherapy, and, in some cases, infusion therapy. Among those admitted to the ENT clinic, 8 patients were referred on days 6–7 after the onset of symptoms of purulent otitis media and otogenic complications, 12 on days 9–10, 14 on days 16–20, and 12 on days 28–30

In the hospital, patients presented with pronounced general cerebral and meningeal symptoms, including altered consciousness, stupor, and, in some cases, coma. Cerebrospinal fluid (CSF) pressure during lumbar puncture in patients with meningoencephalitis ranged from 190 to 240 mm water column. Total protein levels varied from 0.66 to 6 g/L, with markedly positive Pandy and Nonne-Apelt tests. CSF pleocytosis reached up to 3,000 cells per cubic millimeter ($mm^3$).

Within the first hours of admission, all patients underwent a comprehensive examination, including otorhinolaryngological evaluation, radiography of the mastoid process using Schüller and Mayer projections, MSCT and MRI of the brain and mastoid processes, as well as laboratory and microbiological studies. Immediate consultations with neurologists, neurosurgeons, ophthalmologists, anesthesiologists-resuscitators, therapists, and infectious disease specialists were conducted.

Upon diagnosis of intracranial complications, urgent surgical intervention on the mastoid process was required as a first-line approach. This intervention aimed to eliminate the purulent focus from the middle ear and cranial cavity within the earliest possible time frame—usually within the first hours or up to 24 hours after admission. Patients underwent open radical cavity surgery with exposure of the meninges in the middle and posterior cranial fossae. In cases where an abscess was detected, a second-stage surgery was performed in collaboration with neurosurgeons.

In the postoperative period, the surgical site was irrigated daily with antiseptic solutions, including decasan and 1% dioksidin solution (10.0 mL), with local administration of antibiotics into the cavity.

Alongside surgical intervention, a comprehensive treatment regimen was implemented, including antibiotic therapy, intensive anti-inflammatory, dehydration, detoxification, desensitization, and general strengthening therapies.

Antibiotic administration began empirically upon the patient's admission to the hospital. After the elimination of the purulent focus from the middle ear and cranial cavity, therapy was adjusted based on the antibiotic susceptibility of the isolated microflora. The most commonly used antibiotics were third- and fourth-generation cephalosporins and beta-lactams, with macrolides used less frequently. It is worth noting that antibiotics were often administered in combination and delivered intravenously or endolumbar in cases of meningitis. Treatment decisions were based on the patient's overall condition and clinical and laboratory findings.

In severe cases, high doses of beta-lactam antibiotics and cephalosporins were administered intravenously. Antibiotic therapy was supplemented with antifungal agents at doses of 1–3 mg/kg of body weight. Lumbar punctures were performed as needed, with their frequency determined by the patient's condition and cerebrospinal fluid composition.

In cases of secondary perifocal meningoencephalitis, intracranial hypertension, cerebral edema, and diffuse purulent meningitis, vomiting was frequently observed. To ensure adequate nutrition and detoxification, patients underwent general strengthening and stimulatory therapy. Intravenous administration included 300–500 mL of native plasma, 500 mL of 5–10% glucose solution with added 4.0 mL of 5% ascorbic acid and 2.0 mL of cocarboxylase, as well as up to 200 mL of 15% albumin solution.

Dehydration and diuretic agents were also utilized, including 20.0 mL of 40% glucose, 10.0 mL of 40% urotropin, and 30.0 mL of 20% mannitol intravenously. Magnesium sulfate (25%, 10.0 mL) and Lasix (2.0 mL) were administered intramuscularly. Oral prescriptions included 50% medical glycerin (1 teaspoon three times a day) and Diacarb (0.25 mg, one tablet daily). As part of the treatment protocol, plasmapheresis (PA) was performed. The number of procedures ranged from 3 to 5, with intervals of 24–48 hours. Removed plasma volumes were replaced with crystalloid solutions (1,000–1,200 mL). Each procedure lasted an average of 40 minutes.

Additional anticoagulant therapy was provided, with intravenous fibrinolysin (20,000 IU in 250 mL isotonic sodium chloride solution) combined with 10,000 IU of heparin, Clexane, and oral aspirin (0.5 g three times daily).

Patients received meticulous care, high-calorie enteral nutrition (via feeding tube if necessary), and symptomatic therapy as indicated.

Comprehensive intensive therapy was conducted both preoperatively and postoperatively in the neuro-intensive care unit under the close supervision of otorhinolaryngologists, neurosurgeons, neurologists, and neuro-intensivists.

**Results and Discussion**

Patients were admitted to the hospital in varying conditions: 12 patients (26.0%) in moderate severity, 21 patients (45.6%) in severe condition, and 13 patients (28.4%) in critical condition.

The causes of otogenic complications were acute suppurative otitis media (ASOM) in 11 patients (23.9%) and chronic suppurative otitis media (CSOM) in 35 patients (76.1%). Among those with CSOM, the specific types were as follows: chronic suppurative epitympanitis in 28 patients, chronic suppurative mesotympanitis in 10 patients, and chronic suppurative epimesotympanitis in 8 patients.

The intracranial complications identified among the studied patients included:

- Otogenic purulent meningitis in 11 cases,

- Otogenic brain abscess in 7 cases,
- Otogenic cerebellar abscess in 5 cases,
- Epidural abscess in 10 cases,
- Otogenic sinus thrombosis in 4 cases, and
- Perisinus abscess in 9 cases.

Isolated complications (e.g., meningitis, sinus thrombosis, sepsis, brain abscess) were diagnosed in 47.9% of cases, while combined complications (e.g., meningitis + brain abscess, meningoencephalitis, sinus thrombosis + sepsis) were observed in 52.1% of cases.

Among all forms of intracranial complications, the most common were meningoencephalitis, sigmoid sinus thrombosis, perisinus abscess, and extradural abscess of the temporal lobe.

Bacteriological examination of ear discharge, abscess cavity contents, and cerebrospinal fluid revealed the following microorganisms:

- S. epidermidis in 33.0%,
- S. aureus in 29.1%,
- P. aeruginosa in 17.2%.

Less frequently, obligate anaerobes were identified (8.9%), with peptostreptococcus being the most common.

Pathogenic fungi were not isolated as a sole pathogen; however, in bacterial-fungal associations, Candida spp. predominated (7.7%). In 4.1% of cases, no microbial growth was observed.

This data highlights the complex etiology and polymicrobial nature of otogenic intracranial complications, underlining the importance of timely diagnosis and targeted treatment.

After surgical debridement of mastoid cells, drainage of brain abscesses, removal of thrombi from the sigmoid sinus, and implementation of intensive comprehensive therapy with the inclusion of plasmapheresis, the patients' overall condition began to improve gradually by the 7th day. Sequential normalization of clinical and biochemical parameters was observed, providing objective evidence of the treatment's effectiveness. Key clinical improvements included:

- Normalization of body temperature,
- Reduction in headache and dizziness, and
- Gradual disappearance of generalized, focal, and meningeal symptoms.

In patients with otogenic meningoencephalitis, cerebrospinal fluid pressure gradually decreased to normal levels.

Despite the intensive treatment, 2 patients succumbed to their conditions. However, 61 patients were discharged with recovery, and 1 patient with an otogenic abscess in the left temporal lobe experienced residual right-sided hemiparesis.

**Conclusions**

The study demonstrated that combined complications were diagnosed in 52.1% of cases, while isolated complications occurred in 47.9% of patients with otogenic intracranial complications (OICs).

The proposed integrated diagnostic and treatment system, which includes simultaneous emergency surgery, debridement of suppurative foci in the middle ear and brain, urgent intensive therapy, and coordinated efforts among otorhinolaryngologists, neurosurgeons, neurologists, and critical care specialists, significantly improved treatment outcomes. This multidisciplinary approach reduced the mortality rate and improved recovery in patients with otogenic intracranial complications.

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