

IMPROVEMENT OF DIAGNOSTIC METHODS AND SURGICAL TREATMENT IN PATIENTS WITH ATYPICAL FORMS OF MASTOIDITIS

Shodiev Jasur Rabbimkul ugli

*Clinical Resident, department of Otorhinolaryngology No. 1,
Samarkand State Medical University*

Mansurova Gulnoza Muyinjonovna

*Teacher at the Siab Technical School of Public Health
named after Abu Ali Ibn Sina*

Berdikulov Azim Sukhrovich

*2nd year student of the faculty of General Medicine,
Samarkand State Medical University*

Abstract. *Atypical forms of mastoiditis present significant diagnostic and therapeutic challenges due to their unusual clinical manifestations and delayed recognition. This study aims to improve diagnostic approaches and optimize surgical management strategies in patients with atypical mastoiditis. A retrospective and prospective analysis of 42 patients diagnosed with atypical mastoiditis was conducted. Advanced imaging techniques, including high-resolution computed tomography (HRCT) and magnetic resonance imaging (MRI), were evaluated alongside clinical findings. Surgical techniques were modified based on anatomical variations and disease spread. The implementation of improved diagnostic protocols and individualized surgical approaches significantly reduced postoperative complications and shortened hospital stay. Early use of advanced imaging and tailored surgical intervention improves treatment outcomes in atypical mastoiditis.*

Key words: *atypical mastoiditis, diagnosis, surgical treatment, HRCT, mastoidectomy, otolaryngology.*

Annotatsiya. *Atipik mastoidit shakllari o‘ziga xos klinik belgilari va kech aniqlanishi sababli diagnostika hamda davolash jarayonida jiddiy qiyinchiliklar tug‘diradi. Ushbu tadqiqotning maqsadi atipik mastoidit bilan og‘rigan bemorlarda diagnostika usullarini takomillashtirish va jarrohlik davolash strategiyalarini optimallashtirishdan iborat. Atipik mastoidit tashxisi qo‘yilgan 42 nafar bemorda retrospektiv va prospektiv tahlil o‘tkazildi. Klinik ko‘rsatkichlar bilan bir qatorda*

yuqori aniqlikdagi kompyuter tomografiyasi (HRKT) va magnit-rezonans tomografiya (MRT) kabi zamonaviy tasvirlash usullari qo'llanildi. Jarrohlik usullari anatomik o'zgarishlar va kasallik tarqalish darajasiga qarab modifikatsiya qilindi. Takomillashtirilgan diagnostik protokollar va individual jarrohlik yondashuvni joriy etish operatsiyadan keyingi asoratlarni kamaytirish va shifoxonada davolanish muddatini qisqartirish imkonini berdi. Zamonaviy tasvirlash usullarini erta qo'llash va individual jarrohlik aralashuv atipik mastoiditni davolash natijalarini yaxshilaydi.

Kalit so'zlar: atipik mastoidit, diagnostika, jarrohlik davolash, HRKT, mastoidektomiya, otorinolaringologiya.

Аннотация. Атипичные формы мастоидита характеризуются необычными клиническими проявлениями и поздней диагностикой, что создает значительные трудности в лечении. Целью данного исследования явилось совершенствование диагностических подходов и оптимизация хирургической тактики у пациентов с атипичным мастоидитом. Проведен ретроспективный и проспективный анализ 42 пациентов с установленным диагнозом атипичного мастоидита. Наряду с клиническими данными использовались современные методы визуализации, включая высокоразрешающую компьютерную томографию (HRKT) и магнитно-резонансную томографию (МРТ). Хирургическая тактика модифицировалась с учетом анатомических особенностей и распространенности патологического процесса. Внедрение усовершенствованных диагностических протоколов и индивидуализированного хирургического подхода позволило снизить частоту послеоперационных осложнений и сократить сроки госпитализации. Раннее применение современных методов визуализации и индивидуальный хирургический подход улучшают результаты лечения атипичных форм мастоидита.

Ключевые слова: атипичный мастоидит, диагностика, хирургическое лечение, HRKT, мастоидэктомия, оториноларингология.

Introduction. Mastoiditis is one of the most serious complications of acute otitis media and remains a significant clinical problem in otolaryngology despite advances in antimicrobial therapy. The widespread use of antibiotics has altered the clinical course of middle ear infections, often masking classical symptoms and

contributing to the emergence of atypical and subclinical forms of mastoiditis. These atypical variants frequently present with subtle or non-specific symptoms, making early diagnosis particularly challenging.

Classical mastoiditis typically manifests with postauricular pain, swelling, erythema, fever, and protrusion of the auricle. However, atypical forms may lack these hallmark signs and instead present with persistent otalgia, headache, low-grade fever, isolated hearing loss, or deep cervical pain. In some cases, the disease progresses silently until severe extracranial or intracranial complications develop. Such atypical forms include masked mastoiditis (latent mastoiditis), zygomatic mastoiditis, petrositis, and Bezold's abscess. Each of these variants is characterized by specific anatomical patterns of infection spread and may require different diagnostic and surgical approaches.

Masked mastoiditis, for instance, may occur in patients who have received partial antibiotic treatment, resulting in suppression of acute inflammatory signs while the infectious process continues within the mastoid air cells. Petrositis can manifest with Gradenigo's syndrome, characterized by persistent otorrhea, retro-orbital pain, and abducens nerve palsy, although the full triad is not always present. Bezold's abscess develops when infection spreads through the mastoid tip into the deep neck spaces, potentially leading to life-threatening complications. Zygomatic mastoiditis involves the extension of infection into the zygomatic air cells and may present primarily with facial swelling.

Delayed or inaccurate diagnosis of atypical mastoiditis significantly increases the risk of complications such as facial nerve paralysis, sigmoid sinus thrombosis, epidural or brain abscess, meningitis, and deep neck infections. Therefore, reliance solely on clinical examination is insufficient in many cases. Modern radiological imaging techniques, particularly high-resolution computed tomography (HRCT) of the temporal bone and magnetic resonance imaging (MRI), have become indispensable tools in the evaluation of suspected mastoiditis. HRCT provides detailed visualization of bony structures and mastoid air cell destruction, while MRI is superior in detecting soft tissue involvement and intracranial extension.

Materials and methods. In addition to diagnostic challenges, surgical management of atypical mastoiditis requires careful planning. The extent of mastoid pneumatization, anatomical variations, disease spread, and proximity to critical structures such as the facial nerve, sigmoid sinus, and dura mater must be considered.

Advances in surgical techniques, including modified mastoidectomy approaches and intraoperative facial nerve monitoring, have contributed to improved safety and outcomes.

Given the increasing frequency of atypical presentations and the potential severity of complications, there is a need to refine diagnostic algorithms and optimize surgical strategies. Early identification through advanced imaging combined with individualized surgical intervention may significantly reduce morbidity, recurrence rates, and length of hospital stay.

The objective of this study was to improve diagnostic methods and enhance surgical treatment strategies in patients with atypical forms of mastoiditis through comprehensive clinical and radiological assessment and tailored operative management.

A combined retrospective and prospective clinical study was conducted at the Department of Otolaryngology of a tertiary referral center between January 2021 and December 2025. The study aimed to evaluate and improve diagnostic and surgical management strategies in patients with atypical forms of mastoiditis. The retrospective phase included analysis of medical records from 2021–2023, while the prospective phase (2023-2025) involved implementation of an improved diagnostic algorithm and individualized surgical planning protocol.

The study was performed in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from all patients or their legal guardians prior to inclusion in the prospective phase of the study.

A total of 42 patients diagnosed with atypical mastoiditis were included in the study. Confirmed diagnosis of mastoiditis with atypical clinical presentation. Age between 5 and 65 years. Radiological confirmation of mastoid involvement by HRCT and/or MRI. Patients requiring surgical intervention. Exclusion Criteria:

- Classical acute mastoiditis with typical postauricular signs;
- Chronic otitis media without evidence of acute mastoid inflammation;
- Previous mastoid surgery;
- Severe systemic comorbidities contraindicating surgery.

Patients were stratified according to the type of atypical mastoiditis: masked mastoiditis, Bezold's abscess, zygomatic mastoiditis, and petrositis. All patients underwent a standardized otolaryngological assessment, including. Detailed medical history focusing on previous episodes of otitis media, prior antibiotic therapy,



duration of symptoms, and neurological complaints. Physical examination with emphasis on postauricular region, deep cervical spaces, and cranial nerve function. Otoscopy and microscopic ear examination. Pure tone audiometry to assess hearing thresholds. Tuning fork tests (Rinne and Weber tests). Particular attention was paid to subtle signs such as persistent otalgia, deep temporal or retro-orbital pain, neck swelling, low-grade fever, and cranial nerve deficits. Laboratory evaluation included:

Complete blood count (CBC);

C-reactive protein (CRP);

Erythrocyte sedimentation rate (ESR);

Blood cultures (in febrile patients).

Microbiological culture and sensitivity testing of middle ear discharge or intraoperative specimens. Inflammatory markers were used to assess severity of infection and monitor postoperative recovery. Radiological imaging was a key component of the diagnostic algorithm. All patients underwent HRCT of the temporal bone with thin-section (0.5-1 mm) axial and coronal reconstructions. HRCT was used to evaluate:

Mastoid air cell opacification;

Bony septal destruction;

Erosion of mastoid cortex;

Involvement of sigmoid sinus plate;

Petrous apex involvement;

Zygomatic air cell extension

HRCT findings were considered diagnostic when bone destruction and loss of air cell architecture were identified. MRI with contrast enhancement was performed in patients with suspected intracranial or deep neck extension.

Early decision-making for surgical intervention based on imaging findings rather than clinical deterioration alone. All 42 patients underwent surgical treatment under general anesthesia. Data were analyzed using statistical software. Quantitative variables were expressed as mean \pm standard deviation (SD), while categorical variables were presented as percentages.

Results. A total of 42 patients with atypical mastoiditis were included in the study. The mean age of patients was 27.6 ± 14.3 years (range: 6–63 years). Of these, 24 (57.1%) were male and 18 (42.9%) were female. Pediatric patients (≤ 18 years) accounted for 16 cases (38.1%), while 26 patients (61.9%) were adults. Among the study population: 18 patients (42.8%) were diagnosed with masked mastoiditis, 10

patients (23.8%) had Bezold's abscess, 8 patients (19.0%) had zygomatic mastoiditis, 6 patients (14.4%) had petrositis.

Masked mastoiditis was more common in patients who had received prior incomplete antibiotic therapy (83% of masked cases). Bezold's abscess was predominantly observed in young adults (mean age 29.4 years). The most common presenting symptoms were:

Persistent otalgia – 35 patients (83.3%)

Headache – 21 patients (50%)

Fever – 18 patients (42.8%)

Hearing loss – 29 patients (69.0%)

Neck swelling (in Bezold's abscess) – 10 patients (23.8%)

Retro-orbital pain (in petrositis) – 5 patients (11.9%).

Classical postauricular swelling was absent in 31 patients (73.8%), confirming the atypical nature of the disease. Cranial nerve involvement was observed in 4 patients (9.5%): Abducens nerve palsy – 2 cases, Facial nerve paresis (preoperative) – 2 cases.

Elevated inflammatory markers were observed in the majority of patients: Increased CRP (>10 mg/L) – 34 patients (81%), Elevated ESR – 30 patients (71.4%), Leukocytosis – 28 patients (66.6%).

Microbiological cultures were positive in 29 cases (69%). The most commonly isolated pathogens were: *Streptococcus pneumoniae* – 11 cases (26.2%), *Pseudomonas aeruginosa* – 7 cases (16.6%), *Staphylococcus aureus* – 6 cases (14.3%), Mixed flora – 5 cases (11.9%).

HRCT demonstrated mastoid air cell opacification in all 42 patients (100%). Additional findings included: Bony septal destruction – 40 patients (95%), Cortical bone erosion – 18 patients (42.8%), Sigmoid sinus plate thinning – 6 patients (14.3%), Zygomatic air cell extension – 8 patients (19%), Petrous apex involvement – 6 patients (14.4%), The overall diagnostic accuracy of HRCT in detecting bony involvement was 95%. MRI was performed in 15 patients (35.7%) with suspected intracranial or deep neck complications. MRI detected:

Epidural abscess – 3 patients (7.1%)

Sigmoid sinus thrombosis – 2 patients (4.7%)

Meningeal enhancement – 2 patients (4.7%)

Deep neck abscess extension – 5 patients (11.9%). MRI demonstrated superior sensitivity in detecting intracranial complications compared to HRCT. All patients underwent surgical intervention. The distribution of surgical procedures was as follows: Modified cortical mastoidectomy – 19 patients (45.2%), Canal wall-up mastoidectomy – 11 patients (26.2%), Canal wall-down mastoidectomy – 7 patients (16.6%), Mastoidectomy with deep neck abscess drainage – 5 patients (11.9%), Intraoperative facial nerve monitoring was used in 14 high-risk cases (33.3%). Complete removal of granulation tissue and necrotic bone was achieved in all patients. No intraoperative major vascular injuries occurred.

Postoperative complications were observed in 3 patients (7.1%): Transient facial nerve paresis – 2 cases (resolved within 4 weeks), Wound infection – 1 case (successfully treated with antibiotics), No cases of permanent facial paralysis, intracranial abscess progression, or mortality were recorded.

After implementation of the improved diagnostic protocol in the prospective phase: Mean hospital stay decreased from 12.4 ± 2.1 days to 8.1 ± 1.7 days ($p < 0.05$), Time from admission to surgery decreased from 3.6 days to 1.8 days, Recurrence rate decreased from 9% (retrospective group) to 2% (prospective group), Only one recurrence (2%) was observed during the 6-month follow-up period, requiring revision mastoidectomy.

Preoperative conductive hearing loss was present in 29 patients (69%). Postoperative audiometric evaluation showed: Hearing improvement (>10 dB gain) – 28 patients (67%), No significant change – 11 patients (26.2%), Mild deterioration – 3 patients (7.1%), Patients undergoing canal wall-up procedures demonstrated slightly better hearing outcomes compared to canal wall-down procedures.

Comparison between retrospective and prospective phases demonstrated statistically significant improvements in: Diagnostic delay reduction ($p < 0.05$), Hospital stay duration ($p < 0.05$), Recurrence rate ($p < 0.05$). Implementation of early HRCT and individualized surgical planning was associated with improved overall clinical outcomes and lower complication rates.

Discussion. Atypical mastoiditis represents a complex and diagnostically challenging form of temporal bone infection. Unlike classical acute mastoiditis, atypical variants often lack characteristic postauricular inflammatory signs, which may delay diagnosis and increase the risk of serious complications. The present

study highlights the importance of early radiological assessment and individualized surgical planning in improving treatment outcomes.

One of the most significant findings of our study is the high proportion of masked mastoiditis (42.8%), which supports the growing clinical observation that partial or inappropriate antibiotic therapy may suppress acute inflammatory manifestations without eliminating the underlying infection. This phenomenon leads to a subclinical progression of mastoid inflammation and explains why classical signs such as postauricular edema and erythema were absent in 73.8% of patients.

Persistent otalgia and headache were the most frequent symptoms, confirming that clinicians should maintain a high index of suspicion in patients with prolonged ear pain despite medical treatment. Similar observations have been reported in recent otolaryngology literature, where atypical mastoiditis is increasingly recognized as a consequence of widespread antibiotic use altering disease presentation.

Our findings demonstrate that reliance solely on clinical examination is insufficient in atypical cases. Early implementation of HRCT significantly reduced diagnostic delay and allowed accurate identification of mastoid air cell destruction in 95% of cases. HRCT remains the gold standard for evaluating bony involvement, cortical erosion, and anatomical variations of the temporal bone.

MRI played a crucial complementary role in detecting intracranial and deep neck complications. In our cohort, MRI identified epidural abscess, sigmoid sinus thrombosis, and meningeal enhancement in 16.6% of patients. These findings emphasize that MRI should be promptly performed when neurological symptoms, cranial nerve deficits, or severe headache are present. The combined use of HRCT and MRI improves diagnostic precision and prevents underestimation of disease extent.

All patients in the study required surgical intervention, underscoring the aggressive nature of atypical mastoiditis. Conservative therapy alone is often insufficient due to persistent infection within poorly ventilated mastoid air cells and potential bone destruction.

Individualized surgical planning based on imaging findings proved to be essential. Modified cortical mastoidectomy was sufficient in localized disease, whereas canal wall-down procedures were necessary in extensive involvement. In cases of Bezold's abscess, combined mastoidectomy and deep neck abscess drainage were mandatory to prevent mediastinal spread.

A key aspect of our surgical strategy was wider exposure of mastoid air cells and meticulous removal of granulation tissue and necrotic bone. This approach likely contributed to the low recurrence rate (2%) observed during follow-up. Intraoperative facial nerve monitoring, used in high-risk cases, reduced the incidence of permanent nerve injury. Only transient facial nerve paresis (7.1%) was observed, with complete recovery in all cases. These findings support current surgical principles advocating early and sufficiently radical intervention to prevent disease progression and intracranial complications.

Implementation of an improved diagnostic protocol during the prospective phase significantly influenced clinical outcomes. The reduction in hospital stay from 12.4 to 8.1 days and the decrease in recurrence rate from 9% to 2% demonstrate the effectiveness of early imaging and prompt surgical decision-making.

Early HRCT performed in patients with persistent otalgia beyond five days allowed timely detection of mastoid involvement before complications developed. This proactive approach contrasts with traditional strategies that delay imaging until overt complications appear. The reduction in time from admission to surgery further contributed to improved outcomes, minimizing inflammatory spread and tissue destruction. These results align with contemporary evidence suggesting that early surgical management reduces morbidity in complicated mastoiditis.

Hearing preservation is a critical goal in mastoid surgery. In our study, postoperative hearing improvement was observed in 67% of patients, particularly in those undergoing canal wall-up procedures. This finding highlights the importance of preserving middle ear structures whenever feasible.

However, in advanced cases requiring canal wall-down mastoidectomy, hearing outcomes were less favorable due to the extent of disease and structural damage. Therefore, early diagnosis not only reduces complications but also improves functional outcomes.

Conclusion. In summary, the study demonstrates that atypical mastoiditis requires a proactive diagnostic approach and individualized surgical management. Early use of HRCT and selective MRI significantly improves diagnostic accuracy. Tailored surgical techniques reduce complications, shorten hospitalization, and lower recurrence rates.

The combination of improved diagnostic algorithms and optimized surgical strategies represents an effective approach to managing atypical forms of mastoiditis and preventing potentially life-threatening complications.

Atypical forms of mastoiditis require a high index of suspicion and early use of advanced imaging techniques. HRCT is the gold standard for diagnosis, while MRI is essential for detecting intracranial involvement. Individualized surgical approaches, based on detailed radiological assessment, significantly reduce complications and recurrence rates.

Improved diagnostic algorithms combined with optimized surgical strategies lead to better clinical outcomes and shorter hospitalization in patients with atypical mastoiditis.

List of references:

1. Bluestone CD, Klein JO. Otitis Media in Infants and Children. 5th ed. Shelton: PMPH-USA; 2007.
2. Nadol JB Jr. Histopathology of acute mastoiditis. *Ann Otol Rhinol Laryngol.* 1985; 94 (4 Pt 1): 381-385.
3. Migirov L. Acute mastoiditis in children: The role of imaging. *Int J Pediatr Otorhinolaryngol.* 2011;75 (9):1159-1161.
4. Luntz M, Brodsky A, Nussem S, Kronenberg J. Acute mastoiditis – the antibiotic era: a multicenter study. *Int J Pediatr Otorhinolaryngol.* 2001;57(1):1-9.
5. Psarommatis IM, Voudouris C, Douros K, Giannakopoulos P, Carabinos C. Algorithmic management of pediatric acute mastoiditis. *Int J Pediatr Otorhinolaryngol.* 2012; 76(6):791-796.
6. Groth A, Enoksson F, Hulcrantz M, Stalfors J, Hermansson A. Acute mastoiditis in children aged 0-16 years – a national study of 678 cases in Sweden. *Eur Arch Otorhinolaryngol.* 2011; 268(4): 507-512.
7. Pastuszek A, Voss L. Bezold’s abscess: a rare complication of acute mastoiditis. *ANZ J Surg.* 2013;83(7-8):568-569.
8. Yorgancılar E, Yildirim M, Gun R, Bakir S, Tekbas G, Topcu I. Complications of chronic suppurative otitis media: a retrospective review. *Eur Arch Otorhinolaryngol.* 2013; 270(1): 69-76.
9. Swartz JD, Harnsberger HR. *Imaging of the Temporal Bone.* 4th ed. New York: Thieme; 2009.

10. Mafee MF, Levin BC, Applebaum EL. Imaging of acute mastoiditis and its complications. *Otolaryngol Clin North Am.* 1988;21(2):295-312.
11. Penido NO, Chandrasekhar SS, Borin A, Maranhão AS, Testa JR. Complications of otitis media – a potentially lethal problem still present. *Braz J Otorhinolaryngol.* 2016; 82(3): 253-262.
12. Leskinen K, Jero J. Acute mastoiditis in children: a 10-year retrospective study of 50 patients. *Int J Pediatr Otorhinolaryngol.* 2005; 69(6): 793-798.
13. Axmedov A.A., Karimov B.K. O‘rta quloq yallig‘lanish kasalliklarining asoratlari. *Otorinolarinologiya xabarnomasi.* 2018; 3: 25-29.
14. Yuldashev R.M., Tursunov Sh.N. Mastoiditning klinik va jarrohlik davolash xususiyatlari. *Tibbiyot va amaliyot.* 2020;2: 45-49.
15. Rasulov S.H. *Otorinolarinologiya.* Toshkent: Yangi asr avlodi; 2019.
16. Iskandarov J.A., Mamatkulov B.A. Temporal suyak kasalliklarida KT diagnostikasi. *O‘zbekiston radiologiya jurnali.* 2021;1: 33-37.
17. Usmonov F.U., Abdullayeva N.S. Bolalarda o‘tkir mastoidit va uning asoratlari. *Pediatrica va bolalar xirurgiyasi.* 2017; 4:52-56.

Research Science and Innovation House