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Management of Complicated Cholesteatomas: A Series of 109 Cases

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Abstract

Goal: To analyze the epidemiological, clinical, paraclinical, and therapeutic features of complicated cholesteatomas of the middle ear.

Materials and Methods: A retrospective study was conducted at the Department of Otorhinolaryngology and Cervicofacial Surgery of Mohammed VI University Hospital in Marrakech, over an 18-year period from January 2005 to December 2023, involving 109 patients operated on for complicated middle ear cholesteatomas. Patients with uncomplicated cholesteatomas, non-cholesteatomata's chronic otitis media, and incomplete medical records were excluded.

Results: The mean age of patients was 47.6 years (range: 2–65), with a male predominance (sex ratio 1.37). The most affected age group was 16–30 years (46.79%). All patients presented with fetid otorrhea, and 77.1% had associated hearing loss. The leading complications were otomastoiditis (41.3%), peripheral facial nerve paralysis (23%), labyrinthine fistula (9.2%), lateral sinus thrombophlebitis (8.3%), meningitis (7.3%), Bezold abscess (5.5%), labyrinthitis (1.8%), brain abscess (1.8%), and meningoencephalitis (1.8%). CT scan revealed aggressive soft tissue opacification in 100% of cases, with ossicular chain lysis in 72.4%, facial canal erosion in 40.3%, and semicircular canal lysis in 24.7%. An open (canal wall down) tympanoplasty technique was performed in 82.5% of patients, while a closed (canal wall up) technique was used in 17.4%. Oculoplasty was performed in 42.2% of cases. Postoperative hearing was improved in 30% and preserved in 65% of patients. Facial nerve recovery was complete in 70% of affected patients.

Conclusion: Complicated cholesteatomas remain a significant health concern, particularly in developing countries where delayed consultation is common. Early diagnosis, appropriate imaging, and timely combined medical and surgical management are essential to improve functional outcomes and prevent potentially fatal intracranial complications.

Keywords: Cholesteatoma; Complications; Tympanoplasty; Mastoidectomy; Facial Paralysis; Lateral Sinus Thrombosis; Labyrinthine Fistula; Intracranial Complications

1. Introduction

Cholesteatoma is a form of chronic otitis media characterized by the presence of keratinized squamous epithelium within the middle ear cleft. Despite its benign histological nature, it exhibits a locally destructive behavior through enzymatic lysis, osteoclastic activity, and inflammatory mediating processes, leading to progressive erosion of surrounding bony structures [1,2]. Its incidence has been estimated at approximately 9–12.6 per 100,000 adults in European populations, while data from developing countries suggest potentially higher rates due to delayed diagnosis and limited access to healthcare [3].

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The aggressive behavior of cholesteatoma places both the functional and vital prognosis of the patient at risk. Complications are classically divided into extracranial (or infratemporal) and intracranial categories. Extracranial complications include otomastoiditis, peripheral facial nerve paralysis, labyrinthine fistula, labyrinthitis, and Bezold abscess. Intracranial complications encompass meningitis, brain abscess, meningoencephalitis, epidural abscess, and lateral sinus thrombophlebitis [4,5]. Although the incidence of these complications has declined significantly in developed countries with the advent of antibiotics and improved healthcare access, they remain a substantial clinical challenge in developing nations [6,7].

The diagnosis of complicated cholesteatoma relies on clinical examination, audiometry, and imaging modalities including high-resolution computed tomography (HRCT) and magnetic resonance imaging (MRI). Treatment is fundamentally surgical, with the choice between canal wall up (CWU) and canal wall down (CWD) techniques remaining a topic of ongoing debate in the literature [8,9]. The management of each specific complication follows distinct therapeutic algorithms that require multidisciplinary coordination.

The aim of this study was to analyze the epidemiological, clinical, paraclinical, and therapeutic features of complicated cholesteatomas in a series of 109 patients managed at a tertiary referral center in Marrakech, Morocco, and to discuss the current evidence and guidelines governing the management of each type of complication.

2. Materials and Methods

2.1. Type of study

This was a retrospective study conducted at the Department of Otorhinolaryngology and Cervicofacial Surgery of Mohammed VI University Hospital in Marrakech, Morocco, over an 18-year period from January 2005 to December 2023.

2.2. Inclusion and Exclusion Criteria

Included were all patients who underwent surgery for complicated middle ear cholesteatoma during the study period. Patients with uncomplicated cholesteatomas, non-cholesteatomata's chronic otitis media, and those with incomplete medical records were excluded.

2.3. Data Collection

Clinical, paraclinical, therapeutic, and follow-up data were systematically collected using a standardized data collection form. Parameters assessed included demographics, medical history, clinical presentation, otoscopic findings, audiometric results, imaging findings (CT and MRI), surgical technique, intraoperative findings, and postoperative outcomes.

2.4. Clinical Assessment

All patients underwent thorough otoscopic examination under microscopy, pure-tone audiometry, and high-resolution CT scanning of the temporal bones. MRI of the brain was performed for patients presenting with intracranial complications. Facial nerve function was graded using the House-Brackmann classification system.

2.5. Surgical Technique

Surgical management consisted of either an open technique (canal wall down tympanoplasty) or a closed technique (canal wall up tympanoplasty), depending on the extent of disease, the status of the posterior canal wall, and the presence of complications. Oculoplasty was performed when indicated. All patients with infectious complications received appropriate antibiotic therapy prior to or in conjunction with surgical intervention.

3. Results

3.1. Demographics

The study included 109 patients with a mean age of 47.6 years (range: 2–65 years). There were 63 males and 46 females, yielding a sex ratio of 1.37. The most commonly affected age group was 16–30 years, representing 46.79% of the study population. The mean time from symptom onset to consultation was 2 years.

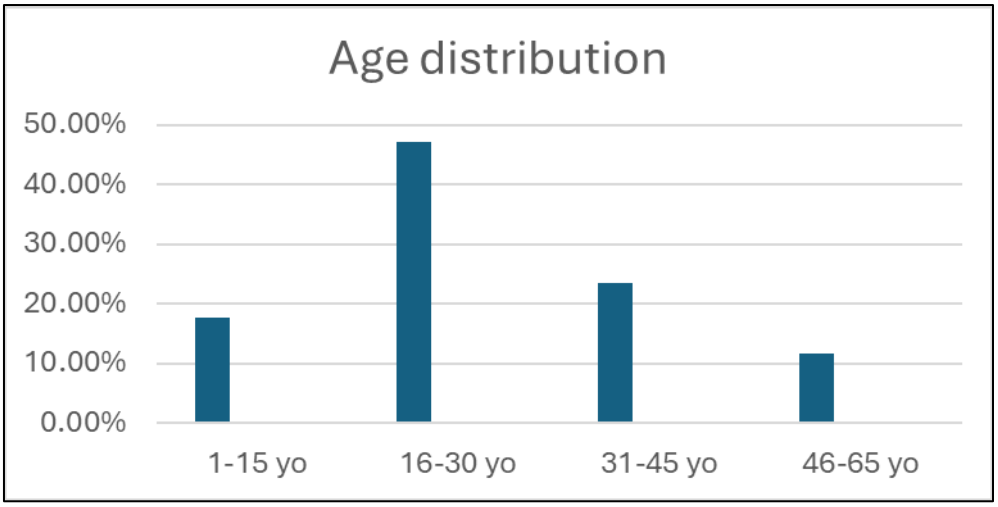

Figure 1 Age distribution (x: age of patients, y: % of patients)

3.2. Medical History

Recurrent otitis was the most common antecedent, found in 101 patients (92.7%). A history of prior otological surgery was reported in 36 cases (33%). Systemic comorbidities included diabetes mellitus (30 cases), hypertension (12 cases), and systemic autoimmune diseases (2 cases). Three patients had a history of chronic rhinosinusitis, and one patient had nasal polyposis.

3.3. Clinical Presentation

The right ear was affected in 53 cases (48.6%), the left ear in 36 cases (33%), and bilateral involvement was observed in 20 cases (18.3%). All patients presented with fetid otorrhea, and 84 (77.1%) had associated hearing loss. The complications prompting consultation were distributed as follows: otomastoiditis in 41.3%, peripheral facial nerve paralysis in 23%, vertigo in 11%, intracranial suppuration in 11%, lateral sinus thrombophlebitis in 8.3%, and Bezold abscess in 5.5%.

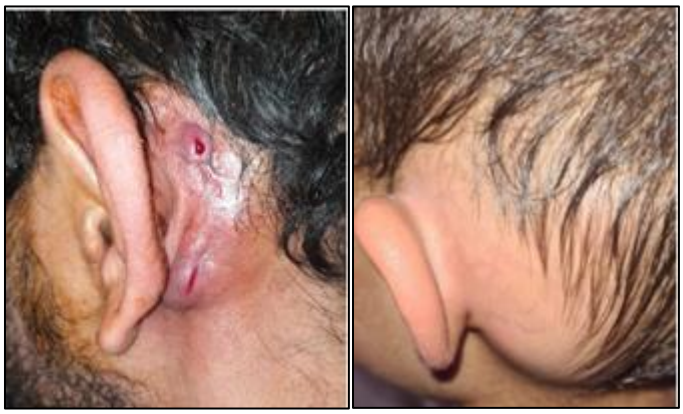

Figure 2 Otomastoiditis of the left ear with two fistulaes (left) with intact skin (right)

Figure 3 Stage V left facial palsy in a cholesteatoma patient

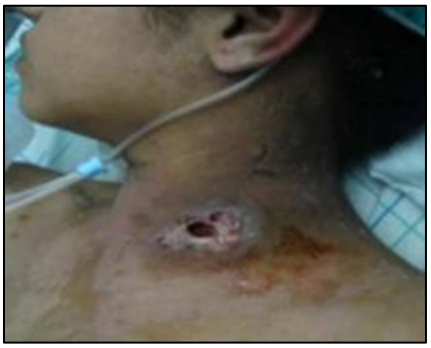

Figure 4 Left Bezold Abscess

3.4. Otoscopic Findings

Microscopic examination revealed marginal perforation in 56.8% of cases (most commonly posterosuperior at 27%), attic perforation in 29%, grade 3 Chara chon retraction pocket in 22%, and inflammatory polyp in 22%. Epidermis was visible in 90% of patients. Examination of the contralateral ear was normal in 23 patients, while abnormalities included inflammatory polyp (52 cases), grade I retraction pocket (12 cases), non-marginal perforation (8 cases), retracted tympanic membrane (18 cases), grade II retraction pocket (5 cases), and grade III retraction pocket (15 cases).

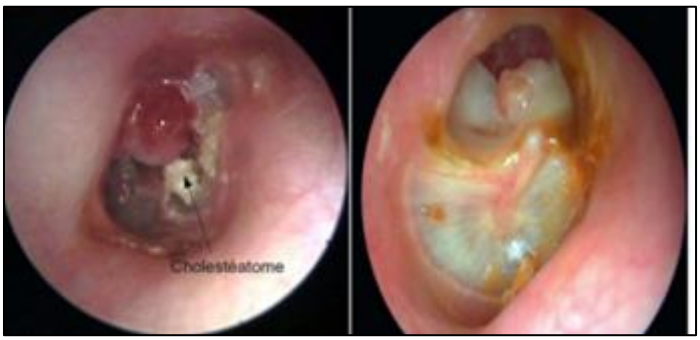

Figure 5 Superior polyp with epidermis (left) – Superior marginal perforation with epidermis (right)

3.5. Audiometric Results

Pure-tone audiometry demonstrated conductive hearing loss in 57.4%, mixed hearing loss in 32%, sensorineural hearing loss in 6.3%, and anacusis (cophosis) in 4.3% of patients.

3.6. CT Scan Findings

All patients underwent temporal bone CT scanning. The key findings are summarized in Table 1.

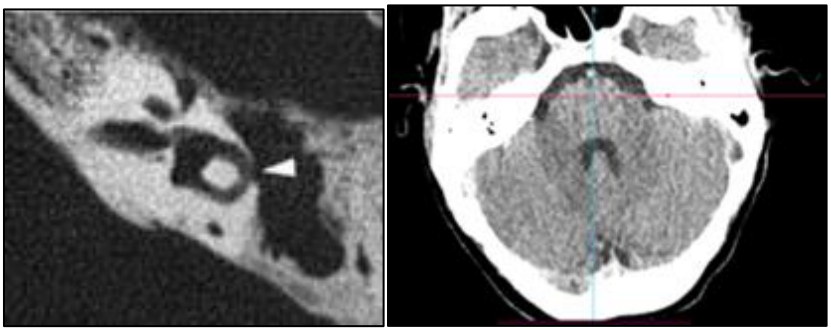

Figure 6 CT axial images of Lateral SCC erosion (left) – Thrombosis of the left sigmoid sinus (right)

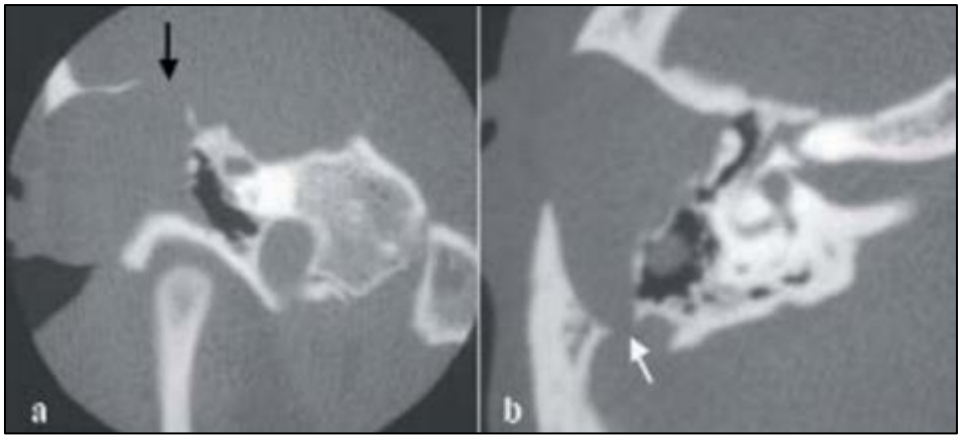

Figure 7 CT axial (b) and coronal (a) images of tegmen tympani and sigmoid sinus erosion

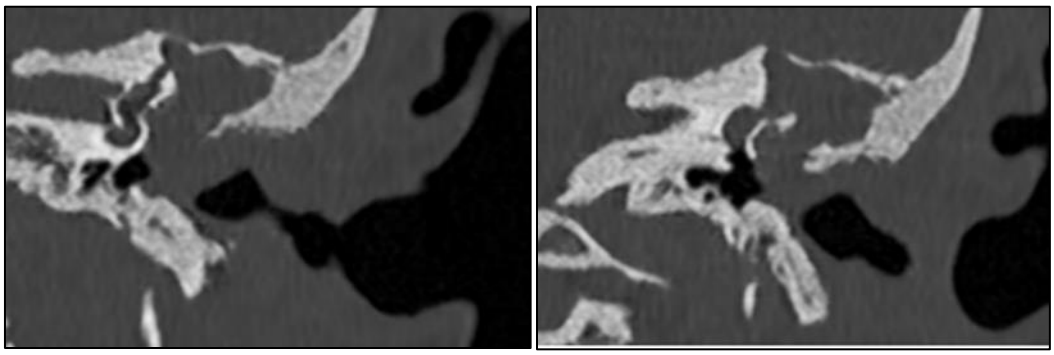

Figure 8 CT coronal images of (left) scutum and superior SCC erosion, (right) tegmen tympani erosion

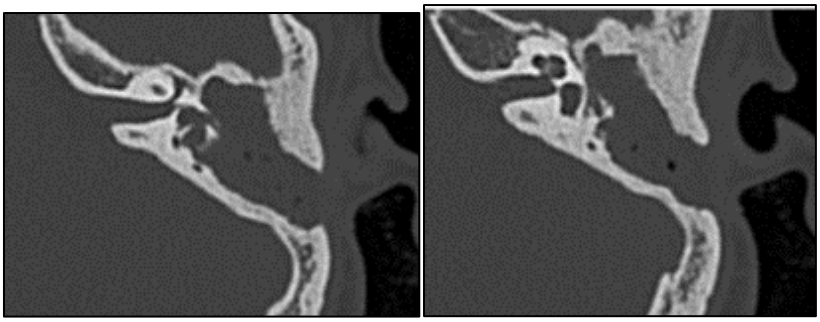

Figure 9 CT axial images of Vestibule and Posterior SCC erosion (left) and facial nerve erosion (right)

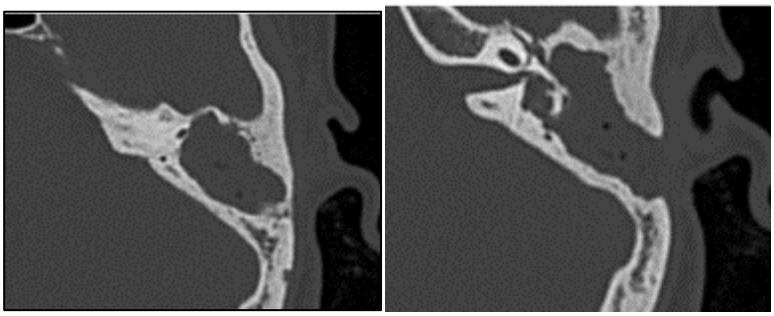

Figure 10 CT axial images of Superior SCC erosion (left) and: Lateral and posterior SCC erosion (right)

Table 1 CT Scan Findings

CT Findings	**Percentage**
Aggressive soft tissue opacification	100%
Attic only	1.8%
Attico-atrial	16.6%
Attico-antro-mastoid	81.6%
Ossicular chain lysis (overall)	72.4%
Long process of incus	62.3%
Malleus head	40%
Stapes superstructure	9.1%
Total lysis	3.6%
Scutum erosion	59%
Facial canal erosion	40.3%
Semicircular canal lysis (overall)	24.7%
Lateral	11%
Posterior	5.5%
Tegmen tympani erosion	23.8%
Tegmen antri erosion	18.3%
Lateral sinus thrombosis	8.3%

Labyrinthine fistula	22%
Labyrinthitis	2%

MRI was performed in all patients with suspected intracranial complications (19.3%). Findings included meningitis (7.3%), intraparenchymal abscess (1.8%), and meningoencephalitis (1.8%).

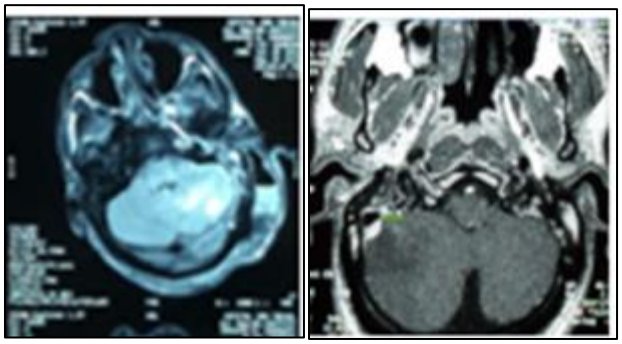

Figure 11 MRI images of posterior cerebellar fossa collection and subdural collection (left) – Thrombosis of the left sigmoid sinus (right)

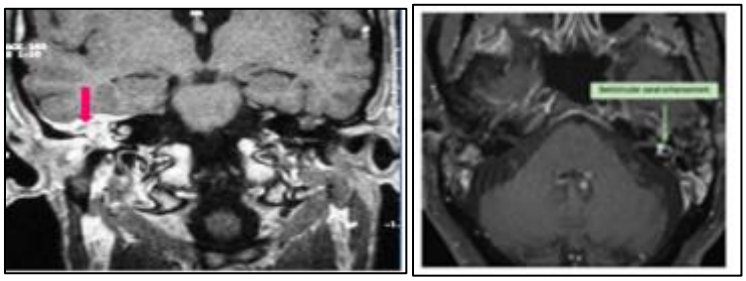

Figure 12 MRI coronal image of tegmen tympani erosion and meningeal contrast enhancement (left) – Axial image of left labyrinthitis (right)

3.7. Complications

The distribution of extracranial and intracranial complications is presented in Table 2.

Table 2 Distribution of Complications

Complication	Number	Percentage
Extracranial complications	88	—
Otomastoiditis	45	41.3%
Peripheral facial paralysis	25	23%
Labyrinthine fistula	10	9.2%
Labyrinthitis	2	1.8%
Bezold abscess	6	5.5%
Intracranial complications	21	—
Meningitis	8	7.3%
Brain abscess	2	1.8%
Meningoencephalitis	2	1.8%
Lateral sinus thrombophlebitis	9	8.3%

3.8. Management

3.8.1. All patients received combined medical and surgical treatment.

Intracranial complications: Intracranial complications: Infectious intracranial complications were treated with meningeal-dose third-generation cephalosporins combined with metronidazole. Neurosurgical drainage was performed in one case of brain abscess exceeding 2.5 cm. Lateral sinus thrombosis was managed with anticoagulation using low-molecular-weight heparin (0.6 U twice daily) in 36% of cases and with surveillance combined with cholesteatoma excision in 64%.

Extracranial complications: Extracranial complications: Infectious extracranial complications were treated with amoxicillin-clavulanate alone in 41.3% of cases or combined with metronidazole in 5.5%. Surgical drainage was performed in 88.9% of otomastoiditis cases and in all but one Bezold abscess. Peripheral facial nerve paralysis was graded using the House-Brackmann scale and treated with corticosteroids (100%) and motor rehabilitation (64%). Vestibular complications were managed with antivertiginous medications, corticosteroids, and intraoperative fistula plugging (92%).

3.9. Facial Nerve Paralysis Grading

Table 3 Distribution of Peripheral Facial Paralysis by House-Brackmann Grade

House-Brackmann Grade	Number of Patients
Grade II	6
Grade III	12
Grade IV	2
Grade V	3
Grade VI	2
Total	25

3.10. Surgical Technique and Intraoperative Findings

A canal wall down (open) technique was employed in 82.5% of patients, while a canal wall up (closed) technique was used in 17.4%. The predominant macroscopic patterns were: sac-type cholesteatoma (58.7%), digitiform (22%), and invasive epidermises (13.7%). Intraoperative ossicular chain involvement was found in 79.8% of patients, with lysis of the long process of the incus being the most common finding (46%). Oculoplasty was performed in 42.2% of cases: type II in 34.8% and type III in 7.3%. Facial canal erosion was observed intraoperatively in 15.2% (second portion: 13.7%; third portion: 1.8%). Lateral semicircular canal lysis was noted in 5.5%, including labyrinthine fistula in 4.6%.

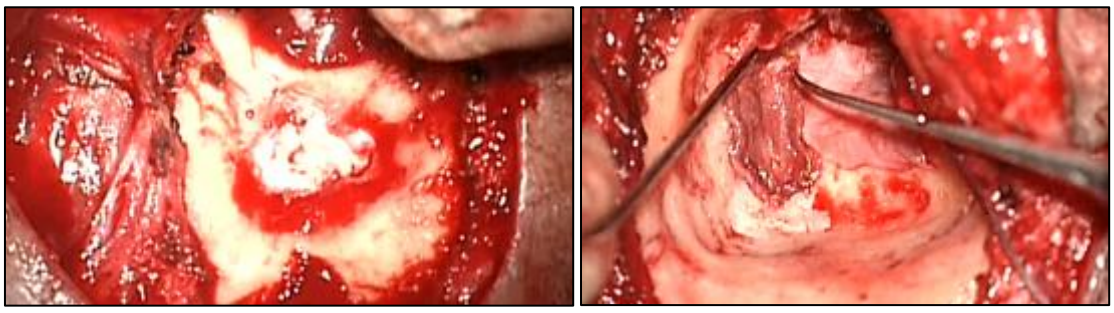

Figure 13 Surgical image of cholesteatoma in the mastoid (left) and tegmen tympani reconstruction with fascia (right)

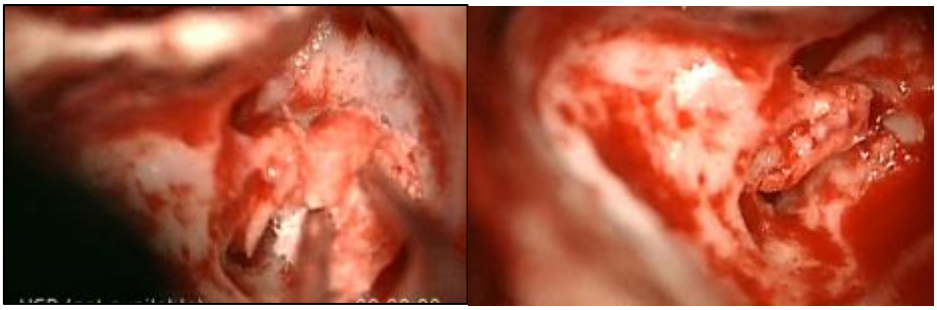

Figure 14 Surgical image of tegmen tympani erosion (left) and facial nerve erosion (right)

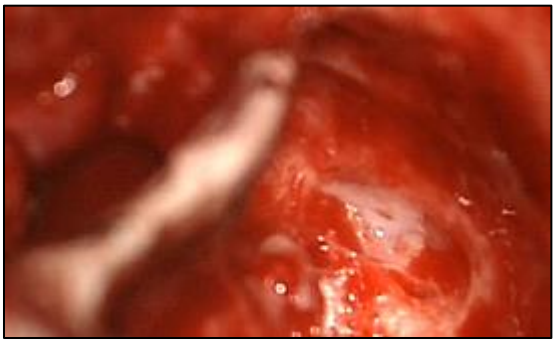

Figure 15 Surgical image of lateral SCC erosion

3.10.1. Postoperative Outcomes

Immediate postoperative course was uneventful in 94% of patients. Transient vertigo occurred in 12% and chondritis in 6.7%. At medium-term follow-up, otorrhea persisted in 16% of patients. Otoscopic control showed normal findings in 70%, bacterial infection in 16%, epidermal debris in 8%, and canal stenosis in 6%. Hearing was improved in 30%, preserved in 65%, and worsened in 5% of patients. Among patients with facial paralysis, 70% achieved complete recovery, while 30% showed partial improvement (grade III). Vertigo improved in 60% of patients, with residual instability in 40%. All patients with lateral sinus thrombophlebitis showed complete resolution of neurological symptoms.

4. Discussion

In this series of 109 complicated cholesteatomas managed over 18 years at a tertiary center in Morocco, we identified demographic, clinical, and therapeutic patterns largely consistent with the existing literature while reflecting specific features of management in a developing country. The mean age of 47.6 years and male predominance (sex ratio 1.37) are in agreement with published data [1,6]. The mean consultation delay of 2 years, characteristic of developing nations, is directly linked to the high intracranial complication rate of 19.3%, far exceeding the 0.04–2.3% reported in developed countries [7,13]. This underscores the need for public health measures aimed at improving early access to ontological care in underserved populations.

4.1. Otomastoiditis

Otomastoiditis was the most frequent complication (41.3%), a rate higher than in Western cohorts and attributable to delayed presentation [1,7,19]. Current guidelines recommend broad-spectrum intravenous antibiotic therapy (amoxicillin-clavulanate or a third-generation cephalosporin) combined with surgical management [19,20]. Mastoidectomy is indicated in cases of osteitis, abscess formation, intracranial extension, or failure to improve after 24–48 hours of intravenous antibiotics [20]. When cholesteatoma is present, definitive surgical excision is mandatory, with a canal wall down approach generally preferred [8,17]. Concurrent subperiosteal or Bezold abscesses should be drained simultaneously. Postoperative follow-up should include serial imaging, as radiologic features may persist long after clinical resolution [1].

4.2. Peripheral Facial Nerve Paralysis

Facial nerve paralysis occurred in 23% of our patients. Our recovery rate (70% complete, 30% partial to grade III) is comparable to the 78.5% satisfactory recovery reported by Lassaletta et al. (2023) [10]. Crucially, patients operated within one month of onset achieved 100% satisfactory recovery versus only 40% beyond one month ($p < 0.001$) [10]. The tympanic segment was the most commonly affected, correlating with cholesteatoma growth patterns [10,11].

Guidelines recommend urgent cholesteatoma excision with facial nerve decompression via canal wall down mastoidectomy [5,6,10]. The decompressed nerve is covered with temporalis fascia. The role of epineurial incision remains debated, with some authors reserving it for complete paralysis (HB V–VI) [10,11]. Systemic corticosteroid therapy is a standard adjunct. Motor rehabilitation is recommended to prevent synkinesis, particularly for Grade III or higher. Timing of surgery is the single most important prognostic factor: all evidence supports decompression within one month of onset [6,10].

4.3. Labyrinthine Fistula and Labyrinthitis

Labyrinthine fistula was present in 9.2% of our patients, consistent with the estimated prevalence of 7% (95% CI, 5–9%) reported in a systematic review [21]. Castro et al. (2023) achieved bone conduction preservation in 73% of patients after complete matrix removal [22]. In our series, fistula plugging with complete matrix removal was performed in 92% of cases.

Guidelines recommend single-stage complete matrix removal followed by immediate reconstruction using autogenous material (bone pate, cartilage, temporalis fascia) [21,22,24]. A non-suction technique is strongly advised to minimize perilymph loss. Intraoperative intravenous corticosteroids (500 mg) are recommended, with hearing preservation rates reaching 85% [25]. The underwater technique, involving drilling without suction to preserve labyrinthine fluids, has shown promising results [26]. Postoperative audiometric and vestibular follow-up is essential, as late hearing deterioration may occur [24]. For small fistulae without cochlear involvement, some authors advocate conservative matrix preservation with staged re-exploration [23].

4.4. Otogenic Meningitis and Brain Abscess

Meningitis (7.3%) and brain abscess (1.8%) were the principal intracranial complications. Song et al. (2023) identified brain abscess as the intracranial complication with the highest fatality rate, emphasizing multidisciplinary management [6]. Our antibiotic regimen (meningeal-dose C3G + metronidazole) is concordant with both the ESCMID 2024 guidelines and the multicenter recommendations by Mazzoni et al. (2024) [27,28].

For otogenic meningitis, guidelines recommend immediate empiric therapy with ceftriaxone (2 g twice daily) or cefotaxime combined with metronidazole (500 mg every 8 hours) [27,28]. CSF analysis with antibiogram-guided adjustment is advised. Surgical intervention (mastoidectomy with source drainage) is indicated if no improvement within 48 hours, if imaging reveals an abscess, or if a tegmen defect requires repair [27]. For brain abscess, the ESCMID strongly recommends the same antibiotic regimen. Neurosurgical drainage is indicated for abscesses exceeding 2.5 cm or causing mass effect; smaller abscesses may be managed medically with serial imaging [28,29]. Otological surgery to eradicate the primary source should be performed once the patient is neurologically stable [6,29]. Long-term follow-up is essential given the risk of epilepsy (11–48%) and permanent neurological deficits [29].

4.5. Lateral Sinus Thrombophlebitis

Lateral sinus thrombophlebitis affected 8.3% of our patients. In our series, 36% received anticoagulation with LMWH, while 64% were managed with cholesteatoma excision and surveillance alone. All achieved complete resolution of neurological symptoms.

Guidelines recommend mastoidectomy with complete cholesteatoma excision, perisinus abscess drainage, and broad-spectrum intravenous antibiotics as the cornerstone of treatment [14,15,16]. Anticoagulation with LMWH should be strongly considered when thrombus propagation to the transverse or cavernous sinus is documented, when thrombophilia coexists, or when concurrent intracranial abscess is present [15,16]. For isolated OLST with adequate surgical source control, anticoagulation may be unnecessary, with serial imaging monitoring for spontaneous recanalization expected within 3–6 months [14,16]. Thrombectomy and jugular vein ligation are no longer routine [14].

4.6. Bezold Abscess

Bezold abscess (5.5%) results from mastoid infection extension through the mastoid tip into the sternocleidomastoid sheath [4,5]. Guidelines mandate prompt surgical drainage via a separate cervical incision combined with mastoidectomy and cholesteatoma excision, under broad-spectrum intravenous antibiotic coverage. CT of the temporal bone and neck is essential to rule out mediastinal or parapharyngeal extension. Delayed diagnosis can lead to mediastinitis and airway compromise [4,5].

4.7. Surgical Approach and Imaging

The CWD technique was used in 82.5% of our cases, reflecting the extent of disease and complications. Salem et al. (2023) demonstrated that CWD with mastoid obliteration achieved significantly lower recurrence rates than CWU (OR = 0.330; $p < 0.001$), while Solis-Pazmino et al. (2023) reported better hearing outcomes with CWU in their pediatric meta-analysis [8,9]. In our series, hearing was improved in 30% and preserved in 65%. Regarding imaging, HRCT remains the gold standard for preoperative assessment, while diffusion-weighted MRI is increasingly valuable for postoperative detection of residual or recurrent cholesteatoma [1,2]. MRI with contrast is mandatory for suspected intracranial complications [28]. The discrepancy between CT-detected facial canal erosion (40.3%) and intraoperative confirmation (15.2%) highlights the tendency of CT to overestimate bony erosion.

The limitations of this study include its single-center design, variable follow-up duration, and the absence of a standardized staging system such as the EAONO/JOS classification. Multicenter prospective studies would allow more robust comparisons [2,9].

5. Conclusion

Complicated cholesteatomas remain a significant concern in ontological practice, particularly in developing countries where delayed consultation contributes to higher complication rates. In this series of 109 patients, extracranial complications, led by otomastoiditis and facial nerve paralysis, were predominant, while intracranial complications, though less frequent, carried significant morbidity. Combined medical and surgical management, with a preference for the canal wall down technique in complicated cases, yielded favorable outcomes in the majority of patients. The management of each complication follows specific therapeutic algorithms that require timely execution and multidisciplinary coordination. Early diagnosis, prompt surgical intervention, and adherence to current evidence-based guidelines are paramount to optimize functional outcomes and prevent life-threatening complications.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no financial or non-financial conflicts of interest.

Statement of informed consent

Informed consent was obtained from all adult participants and from both parents for the children included in this study.

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