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# Canal Wall Down Mastoidectomy for Cholesteatoma: Indications, Technique, Outcomes, and Long-Term Care

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## ABSTRACT

***Background*:** Canal wall down mastoidectomy remains a cornerstone surgical technique in the management of middle ear cholesteatoma, particularly in cases of extensive disease, unfavorable anatomy, or high risk of recurrence. By removing the posterior external auditory canal wall, this approach provides wide exposure of the middle ear and mastoid cavity, facilitating complete eradication of cholesteatoma and reducing the likelihood of residual disease. Despite its long-standing role and proven reliability, canal wall down surgery is often associated with postoperative cavity-related morbidity, including chronic otorrhea, debris accumulation, and the need for lifelong aural care, which continue to fuel debate regarding its optimal indications in the modern era.

The primary aim of this review is to comprehensively evaluate the contemporary role of canal wall down mastoidectomy in cholesteatoma surgery, with emphasis on patient selection, surgical technique, clinical outcomes, and long-term postoperative management. Particular attention is given to the anatomical and pathological factors that favor a canal wall down approach, including extensive epitympanic and mastoid disease, poor Eustachian tube function, recurrent or residual cholesteatoma, and complications such as labyrinthine fistula or facial nerve exposure.

The review synthesizes current evidence regarding disease control, hearing outcomes, complication rates, and quality-of-life considerations following canal wall down mastoidectomy. Advances in surgical modifications, cavity design, and postoperative care strategies are discussed, highlighting efforts to reduce cavity-related morbidity while maintaining the oncologic reliability of the technique. The impact of adjunctive procedures, such as ossiculoplasty and cavity reconstruction measures, on functional outcomes is also examined.

In addition, long-term care considerations are addressed, including outpatient cavity surveillance, management of chronic cavity problems, water precautions, and patient education. The evolving role of imaging in postoperative follow-up and the place of canal wall down surgery within contemporary cholesteatoma treatment algorithms are explored.

In conclusion, canal wall down mastoidectomy continues to play a vital role in the management of cholesteatoma, particularly in advanced and high-risk cases. When appropriately indicated and meticulously performed, it offers durable disease control. Ongoing refinements in surgical technique and postoperative management are essential to optimize functional outcomes and minimize long-term morbidity.

**Keywords:** Canal Wall Down Mastoidectomy, Cholesteatoma

## INTRODUCTION

Acquired middle ear cholesteatoma is a chronic otologic disease characterized by keratinizing squamous epithelium within the middle ear and mastoid, capable of progressive bone erosion and serious intratemporal and intracranial complications. Despite advances in diagnostic imaging, surgical instrumentation, and endoscopic visualization, complete surgical eradication remains the only definitive treatment. The choice of surgical technique continues to represent a balance between achieving durable disease control and preserving ear anatomy and function, a balance that has shaped the long-standing debate between canal wall preservation and canal wall removal strategies [1].

Canal wall down mastoidectomy was developed to address the limitations of early canal wall up approaches, particularly incomplete exposure of the epitympanum, mastoid air cell system, and retrofacial recesses. By removing the posterior external auditory canal wall, canal wall down surgery provides wide, continuous visualization of the middle ear and mastoid, allowing thorough removal of cholesteatoma and reducing the risk of residual disease. Historically, this technique has been regarded as the most reliable method for managing extensive or aggressive cholesteatoma, especially in anatomically complex or poorly ventilated temporal bones [2].

The strength of canal wall down mastoidectomy lies in its oncologic reliability. Numerous long-term studies have demonstrated lower rates of residual and recurrent cholesteatoma compared with canal wall up procedures, particularly in advanced disease. This reliability has made canal wall down surgery the preferred approach in cases of extensive mastoid involvement, recurrent cholesteatoma, poor follow-up compliance, and the presence of complications such as labyrinthine fistula or facial nerve exposure. As a result, canal wall down mastoidectomy remains an essential technique in the armamentarium of the otologic surgeon [3].

However, the benefits of disease eradication achieved through canal wall down surgery are counterbalanced by well-recognized postoperative challenges. Creation of an open mastoid cavity alters the natural anatomy of the external auditory canal and middle ear, often resulting in chronic cavity problems such as persistent otorrhea, debris accumulation, dizziness with temperature changes, and lifelong dependence on regular otologic care. These functional and quality-of-life issues have driven continued efforts to refine surgical technique and postoperative management, as well as to explore alternatives that preserve canal wall anatomy where feasible [4].

In the modern era, advances in reconstructive surgery, mastoid cavity management, and imaging surveillance have reshaped the context in which canal wall down mastoidectomy is performed. Modifications in cavity design, improved ossicular reconstruction techniques, and structured long-term follow-up protocols have aimed to mitigate traditional cavity-related morbidity while preserving the fundamental advantage of complete disease exposure. Nevertheless, variability in surgical technique, outcome reporting, and long-term care strategies persists across the literature [5].

The aim of this review is to provide a comprehensive and contemporary synthesis of canal wall down mastoidectomy for cholesteatoma, focusing on indications, surgical technique, clinical outcomes, and long-term postoperative care. By critically examining current evidence and clinical practice patterns, this review seeks to clarify the ongoing role of canal wall down surgery within modern cholesteatoma management and to identify areas where further research and standardization are required [6].

**Figure 1:** Cholesteatoma. A large mass of white keratin debris is visible in the upper left quadrant of the left tympanic membrane, indicating a cholesteatoma. The majority of the tympanic membrane is missing due to perforation. In the lower right quadrant, the round window niche on the medial wall of the middle ear is visible [6].

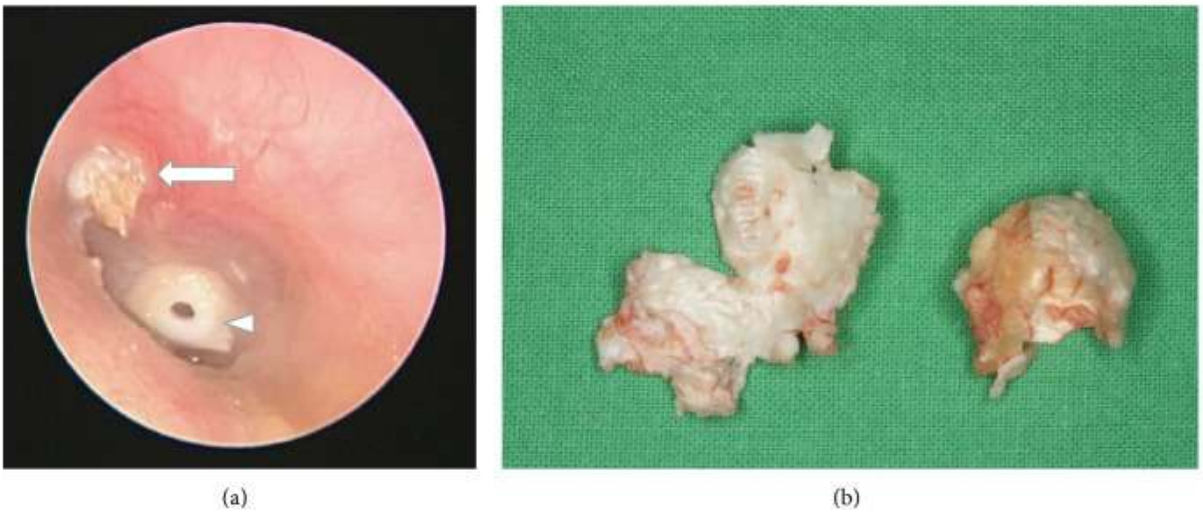


**Figure 2.** (a) Acquired cholesteatoma of attic in the left ear (arrow). Accumulation of debris within an attic retraction pocket led to gradual expansion of cholesteatoma. Grommet insertion revealed poor ventilation function in the middle ear (arrow head). (b) Dissected friable cholesteatoma with a thin pearly-white greasy-looking wall containing pultaceous substance [6].

**Indications and Patient Selection for Canal Wall Down Mastoidectomy**

Selection of the canal wall down approach in cholesteatoma surgery is primarily guided by the extent of disease and the need for reliable exposure to ensure complete eradication. Canal wall down mastoidectomy is most commonly indicated in patients with extensive cholesteatoma involving the mastoid air cell system, epitympanum, and retrofacial spaces, where preservation of the posterior canal wall may compromise visualization and increase the risk of residual disease. In such cases, removal of the canal wall provides a single, open surgical field that facilitates thorough clearance of epithelial pathology [7].

Recurrent and residual cholesteatoma represent strong indications for canal wall down surgery. Revision cases often involve distorted anatomy, scarring, and compromised ventilation, all of which limit the effectiveness of canal wall up approaches. Canal wall down mastoidectomy allows direct inspection of previously inaccessible areas and reduces reliance on staged procedures or imaging-based surveillance alone. For patients with a history of failed prior surgery, this approach offers a definitive solution aimed at minimizing further recurrence [8].

Poor Eustachian tube function is another important factor influencing patient selection. Chronic negative middle ear pressure contributes to retraction pocket formation and recurrent epithelial migration, undermining the long-term stability of canal wall preserving techniques. Canal wall down surgery reduces dependence on middle ear ventilation by eliminating retraction-prone spaces and allowing gravity-assisted drainage of the mastoid cavity. As a result, it is often favored in patients with persistent Eustachian tube dysfunction or severely atelectatic middle ear spaces [9].

The presence of cholesteatoma-related complications further strengthens the indication for canal wall down mastoidectomy. Labyrinthine fistula, facial nerve dehiscence, tegmen erosion, and intracranial extension require maximal exposure to ensure safe and complete disease removal while protecting critical neurovascular structures. In such high-risk scenarios, the priority shifts toward disease eradication and complication prevention rather than anatomic preservation, making canal wall down surgery the preferred approach [10].

Patient-related factors also play a role in surgical decision-making. Limited access to long-term follow-up, poor compliance with postoperative care, and socioeconomic barriers may favor canal wall down mastoidectomy due to its reduced reliance on second-look procedures and advanced imaging for disease surveillance. Additionally, elderly patients or those with significant comorbidities may benefit from a single definitive operation that prioritizes long-term disease control over anatomical reconstruction [11].

In summary, canal wall down mastoidectomy remains indicated in a well-defined subset of cholesteatoma patients characterized by extensive disease, high risk of recurrence, compromised middle ear physiology, or limited follow-up capacity. Careful patient selection ensures that the strengths of this approach are applied where they provide the greatest clinical benefit, reinforcing its continued relevance in contemporary otologic practice [12].

**Surgical Technique of Canal Wall Down Mastoidectomy**

Canal wall down mastoidectomy is designed to create a single, open cavity encompassing the mastoid, epitympanum, and middle ear, allowing complete visualization and eradication of cholesteatoma. The procedure begins with a postauricular approach and elevation of the tympanomeatal flap, followed by systematic cortical mastoidectomy. Key anatomical landmarks, including the tegmen tympani, sigmoid sinus, lateral semicircular canal, and facial nerve, are carefully identified to guide safe drilling and prevent iatrogenic injury during disease removal [13].

Removal of the posterior external auditory canal wall is a defining step of the procedure. The canal wall is lowered in a controlled manner to establish continuity between the mastoid cavity and the external auditory canal. This maneuver exposes the epitympanum, aditus ad antrum, and mastoid air cell system, enabling direct access to common sites of residual disease. Complete exteriorization of cholesteatoma is prioritized, with meticulous removal of epithelial matrix from the facial recess, sinus tympani, and hypotympanum [14].

Management of the middle ear structures is tailored according to disease extent and ossicular status. Ossicles encased by cholesteatoma are removed to ensure complete clearance, while preservation of intact and disease-free ossicular remnants is attempted when feasible. Ossiculoplasty may be performed during the same stage or deferred depending on mucosal health, infection control, and surgeon preference. In cases of extensive disease, the primary objective remains safe eradication rather than immediate hearing reconstruction [15].

Cavity design is a critical determinant of long-term outcomes following canal wall down surgery. The mastoid cavity is contoured to promote self-cleaning and adequate aeration, with saucerization of the cavity walls and smoothing of sharp bony edges. The facial ridge is lowered to enhance visualization and facilitate postoperative cleaning, while maintaining sufficient bone coverage to protect the facial nerve. Adequate exteriorization of the cavity reduces debris accumulation and minimizes chronic otorrhea [16].

Reconstruction of the tympanic membrane and canal skin is performed to establish a stable epithelial lining of the cavity. Temporalis fascia or perichondrium is commonly used for tympanic membrane grafting, while careful redraping of canal skin ensures complete epithelial coverage. Meatoplasty is routinely performed to widen the external auditory canal opening, allowing ventilation, drainage, and ease of postoperative surveillance. An adequately sized meatoplasty is essential for long-term cavity health and patient comfort [17].

Intraoperative judgment plays a pivotal role throughout canal wall down mastoidectomy. Surgeons must continuously balance

aggressive disease clearance with preservation of critical structures, adapting technique based on anatomical variation and intraoperative findings. When meticulously executed, canal wall down mastoidectomy provides a reliable and definitive approach for cholesteatoma eradication, forming the foundation for long-term disease control in appropriately selected patients [18].

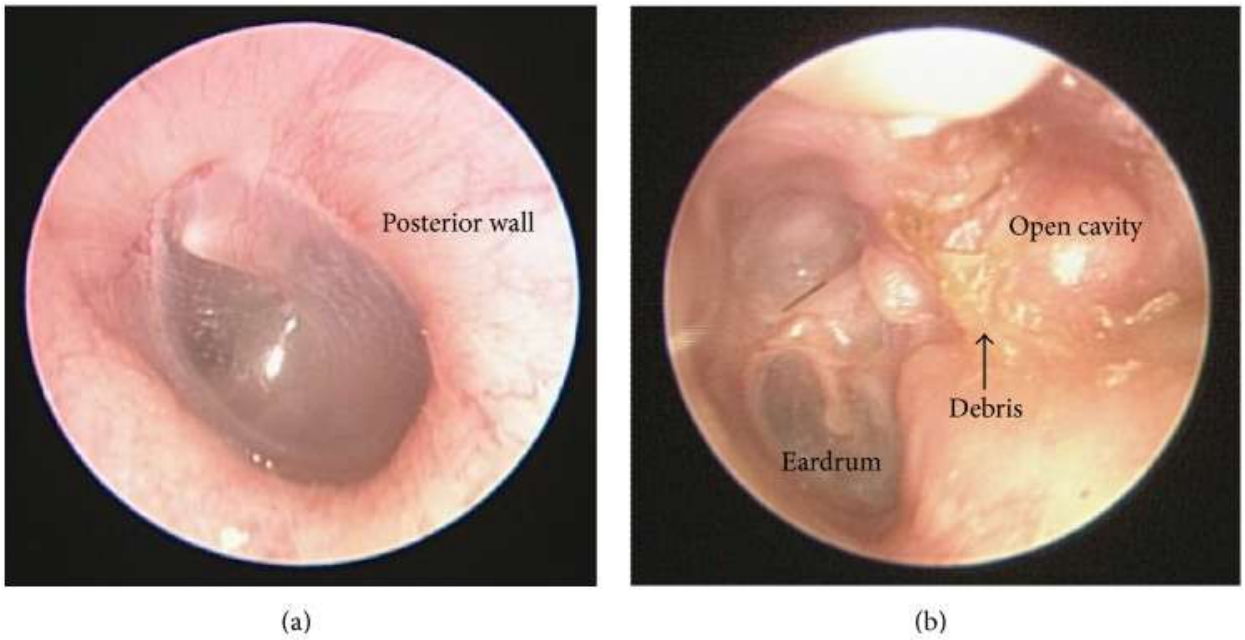


**Figure 3.** (a) Normal contour of the external ear canal in the left ear. (b) Traditional canal wall down mastoidectomy involves removing the posterior canal wall, which results in the formation of an open cavity. Regular ear cleaning is required to remove accumulated debris and control infection [18].

**Clinical Outcomes of Canal Wall Down Mastoidectomy**

Clinical outcomes following canal wall down mastoidectomy are primarily evaluated in terms of disease control, hearing results, complication rates, and long-term cavity stability. The principal advantage of this approach lies in its ability to achieve reliable eradication of cholesteatoma through wide surgical exposure. Numerous long-term series have consistently demonstrated lower rates of residual disease compared with canal wall up techniques, particularly in patients with advanced or recurrent cholesteatoma, reinforcing the role of canal wall down surgery as a definitive oncologic procedure [19].

Residual cholesteatoma following canal wall down mastoidectomy is uncommon when meticulous surgical technique is employed. The open cavity allows direct inspection of the middle ear and mastoid during both the primary operation and subsequent follow-up visits, facilitating early identification of suspicious epithelial remnants. This continuous visual access reduces dependence on routine second-look surgery and contributes to the long-term reliability of disease control reported in many retrospective and longitudinal studies [20].

Recurrent cholesteatoma may still occur after canal wall down surgery, typically arising from inadequate exteriorization, epithelial migration at the margins of the cavity, or persistent retraction in the residual middle ear space. However, recurrence rates are generally lower than those reported for canal wall up procedures, particularly in high-risk ears. When recurrence does occur, the open cavity configuration often allows earlier detection and simpler surgical management compared with closed techniques [21].

Hearing outcomes following canal wall down mastoidectomy are variable and depend on preoperative ossicular status, extent of disease, and reconstruction strategy. While canal wall down surgery has traditionally been associated with poorer hearing outcomes compared with canal wall up approaches, contemporary series suggest that satisfactory hearing can be achieved in selected patients through careful ossiculoplasty and stable cavity design. Nonetheless, the primary objective of canal wall down surgery remains disease control, and hearing rehabilitation is often considered secondary, particularly in advanced cases [22].

Postoperative complications associated with canal wall down mastoidectomy include chronic otorrhea, cavity infection,

granulation tissue formation, dizziness with thermal stimulation, and difficulty with water exposure. These complications are closely related to cavity size, contour, and epithelialization. Modern refinements in cavity construction and postoperative care have reduced the incidence and severity of these issues, although they remain a significant consideration in patient counseling and long-term management [23].

Overall, canal wall down mastoidectomy provides durable disease control and predictable outcomes in appropriately selected patients. While functional limitations and cavity-related morbidity persist, the technique remains a cornerstone of cholesteatoma surgery, particularly for extensive, recurrent, or complicated disease. Ongoing efforts to optimize surgical technique and postoperative management continue to improve both clinical and patient-reported outcomes following this established approach [24].

**Long-Term Care and Postoperative Management After Canal Wall Down Mastoidectomy**

Long-term care is an essential component of successful outcomes following canal wall down mastoidectomy, as the creation of an open mastoid cavity necessitates ongoing surveillance and maintenance. Unlike canal wall up procedures, where postoperative follow-up may rely heavily on imaging, canal wall down surgery requires regular clinical examination to ensure cavity cleanliness, epithelial stability, and early identification of recurrent disease. Structured follow-up protocols are therefore critical to maintaining cavity health and patient quality of life [25].

Routine outpatient cleaning of the mastoid cavity remains a cornerstone of postoperative management. Accumulation of keratin debris, cerumen, and desquamated epithelium can predispose to chronic otorrhea and infection if not regularly removed. The frequency of cleaning varies depending on cavity size, epithelialization, and patient-specific factors, ranging from several visits per year to more frequent early postoperative care. Patient education regarding the chronic nature of cavity maintenance is fundamental to long-term success [26].

Water precautions represent a common concern for patients following canal wall down mastoidectomy. Exposure to water may provoke vertigo, otorrhea, or infection due to direct stimulation of the exposed labyrinthine structures or contamination of the cavity. Patients are often advised to avoid unprotected water exposure and to use ear protection during bathing or swimming. While these restrictions can impact daily activities, careful counseling and individualized guidance can mitigate patient dissatisfaction and improve adherence to preventive measures [27].

Management of chronic cavity problems requires a tailored approach. Persistent otorrhea, granulation tissue formation, or recurrent infection may be addressed through topical therapy, debridement, and optimization of cavity contour. In selected cases, surgical revision or cavity modification may be necessary to improve aeration and drainage. Advances in cavity design and postoperative care have reduced the incidence of such complications, but they remain an important consideration in long-term follow-up [28].

Imaging plays a complementary role in long-term surveillance after canal wall down mastoidectomy. Although direct visualization of the cavity often suffices for routine assessment, imaging may be indicated in cases of suspected deep recurrence, atypical symptoms, or complications involving adjacent structures. High-resolution computed tomography and diffusion-weighted magnetic resonance imaging can provide valuable information when clinical findings are inconclusive [29].

In summary, effective long-term care following canal wall down mastoidectomy relies on a combination of regular clinical surveillance, patient education, and individualized management strategies. While the need for ongoing cavity care represents a trade-off inherent to the technique, adherence to structured follow-up protocols allows early detection of complications and contributes to sustained disease control and acceptable quality of life for most patients [30].

**Conclusion**

Canal wall down mastoidectomy remains a fundamental surgical technique in the management of cholesteatoma, particularly for patients with extensive disease, high risk of recurrence, or cholesteatoma-associated complications. Its principal strength lies in the wide exposure it provides, allowing reliable eradication of disease and facilitating direct postoperative surveillance of the middle ear and mastoid cavity.

Although the creation of an open mastoid cavity introduces long-term care requirements and potential functional limitations, refinements in surgical technique, cavity design, and postoperative management have substantially reduced cavity-related

morbidity. When patients are appropriately selected and thoroughly counseled, canal wall down mastoidectomy can achieve durable disease control with acceptable functional outcomes.

In the contemporary era, canal wall down surgery continues to occupy a critical role alongside reconstructive and minimally invasive approaches. Its value lies not in universal application, but in its judicious use for complex and high-risk cholesteatoma cases where complete exposure and definitive management are paramount. Continued efforts toward standardization of technique, outcome reporting, and long-term care strategies will further optimize results and reinforce the relevance of canal wall down mastoidectomy in modern otologic practice.

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