Surgical Complexity and Intraoperative Obstacles in Mastoidectomy: A Retrospective Study at JRRMCH, Sylhet

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Submission Date : 12 April 2025
Accepted Date : 21 May 2025
Published Date : 30 September 2025
DOI: https://doi.org/10.3329/jrpmc.v10i2.85638

Abstract

Background:
Mastoidectomy is a complex otologic procedure with difficult anatomical navigation through the temporal bone. Despite technological advancements, intraoperative difficulties are frequent and may significantly affect surgical outcomes. It is important to understand the predictors and types of intraoperative problems for surgical planning and optimization of patient safety, particularly in low-resource settings.

Objective:
This study aimed to examine the relationship between surgical complexity, intraoperative complications, and patient or procedural variables in mastoidectomy, providing evidence for surgical planning and risk stratification.

Methods:
This is a retrospective observational study conducted in Jalalabad Ragib-Rabeya Medical College Hospital (JRRMCH), Sylhet, on 100 mastoidectomy cases operated upon from January 2022 to December 2024. Patient demographics, surgical indications, comorbidity, mastoidectomy type, intraoperative complications, and postoperative outcomes were analyzed. Surgical complexity was graded based on intraoperative findings. Data analysis was performed using SPSS version 27, and significance was considered at $p<0.05$.

Results:
Intraoperative challenges were faced by 40% of patients. While age, sex, and comorbidities were not significantly related to the occurrence of challenges ($p>0.05$), surgical technique was. CWD procedures were more strongly linked to challenges (50%) compared to cortical mastoidectomy (30%) ($p=0.002$). Bleeding (50%), poor anatomical visualization (62.5%), facial nerve dehiscence (25%), and dura exposure (20%) were the intraoperative challenges, all of which were statistically significant ($p<0.001$). Cortical mastoidectomy, however, was more frequently associated with uncomplicated procedures.

Conclusion:
Mastoidectomy type significantly affected intraoperative complexity, with CWD procedures posing more risk for complications. Preoperative identification of high-risk cases and tailored surgical planning are required to minimize intraoperative challenges and optimize outcomes. These findings underscore the need for improved risk stratification and operative preparedness, especially in settings with limited surgical resources.

Keywords: Mastoidectomy, Surgical complexity, Intraoperative complications, Temporal bone surgery

Citation: Islam MM, Rahman MA, Mahdi SM. Surgical Complexity and Intraoperative Complications in Mastoidectomy: A Retrospective Study at JRRMCH, Sylhet. J Rang Med Col. 2025 Sep;10(2):60-65. doi: https://doi.org/10.3329/jrpmc.v10i2.85638

Introduction

Mastoidectomy is one of the most demanding otolaryngology procedures, requiring detailed anatomical knowledge and precise surgical technique to safely navigate the temporal bone.[1] It is mainly performed for chronic otitis media (COM) and cholesteatoma, aiming to clear infected mastoid air cells while preserving critical structures such as

the facial nerve, sigmoid sinus, and dura mater.[2] Despite advances in surgical technology, mastoidectomy continues to carry significant intraoperative risks that directly impact recovery and outcomes.[3] The temporal bone's compact anatomy presents challenges, with vital structures such as the facial recess, mastoid pneumatization, and sigmoid sinus often necessitating intraoperative adjustments.[4,5] Surgical complexity is influenced by patient factors, including age, disease extent, and pathology, with cholesteatoma cases presenting greater difficulty than simple COM.[6] Intraoperative complications range from hemorrhage and loss of landmarks to facial nerve dehiscence, dural exposure, and sigmoid sinus injury.[7] Such complications prolong operating time and raise the risk of morbidity, including facial paralysis, sensorineural hearing loss, and intracranial events.[8] Reported complication rates vary widely from 15–45%, depending on case complexity and surgeon expertise.[9] Complexity classifications now consider anatomical variation, disease extent, revision status, and prior surgical complications.[10] High-complexity cases, such as large cholesteatomas with ossicular destruction or labyrinthine involvement, often require longer operative times and advanced skills.[11] Identifying predictive variables of intraoperative difficulty is therefore critical for preoperative planning, patient counseling, and optimizing outcomes.[12] Factors such as patient age, comorbidities, type of mastoidectomy performed, and preoperative imaging have been explored, though large-scale studies remain scarce, particularly in resource-limited settings. Technique also influences outcomes, as canal wall down (CWD) surgery, while offering superior clearance in extensive cholesteatoma, is associated with greater complexity and complication rates compared to canal wall up (CWU) or cortical procedures.[13] This study aims to examine the relationship between surgical complexity, intraoperative complications, and patient or procedural variables in mastoidectomy, providing evidence for surgical planning and risk stratification.

Methods:

This retrospective observational study was conducted at Jalalabad Ragib-Rabeya Medical College Hospital (JRRMCH), Sylhet, Bangladesh, reviewing medical records of mastoidectomy patients from January 2022 to December 2024. A total of 100 patients of all ages and both sexes were included if they underwent mastoidectomy for chronic otitis media, cholesteatoma, or related conditions. Revision cases and incomplete records were excluded. Collected variables included demographics (age, sex), clinical features (indications, comorbidities), surgical details (type of mastoidectomy, intraoperative obstacles, surgical complexity), and postoperative outcomes. Surgical complexity was graded as low, moderate, or high based on intraoperative findings and anatomical variations. Obstacles were defined as events that increased difficulty, such as excessive bleeding, dural exposure, facial nerve dehiscence, sigmoid sinus injury, or loss of landmarks. Data were analyzed using SPSS version 27. Descriptive statistics summarized categorical (frequency, percentage) and continuous (mean, SD) variables. Comparisons between patients with and without intraoperative obstacles used Chi-square or Fisher's exact tests for categorical data and t-tests for continuous data. Multivariable logistic regression identified factors independently associated with intraoperative obstacles, reporting adjusted odds ratios (AOR), 95% confidence intervals (CI), and p-values. A p-value <0.05 was considered significant. Ethical approval was obtained from the JRRMCH Ethical Review Committee. Informed consent was waived due to the retrospective nature of anonymized data.

Results:

No significant associations were observed for age (p=0.30), sex (p=1.00), surgical indication (p=0.40), or comorbidities (p=0.10). Overall, demographic and clinical factors were not predictive of obstacles (Table-I).

Table-I: Basic characteristics of the study population (N=100)

Characteristic	Total (n=100) no. (%)	With Obstacles (n=40) no. (%)	Without Obstacles (n=60) no. (%)	p-value
Age (years)				
<20	15(15)	8(20)	7(11.7)	
20–40	50(50)	22(55)	28(46.7)	0.30
>40	35(35)	10(25)	25(41.7)	
Sex				
Male	60(60)	24(60)	36(60)	1.00
Female	40(40)	16(40)	24(40)	
Indication for surgery				
Chronic otitis media (COM)	55(55)	24(60)	31(51.7)	
Cholesteatoma	35(35)	12(30)	23(38.3)	0.40
Other	10(10)	4(10)	6(10)	
Comorbidities				
None	70(70)	24(60)	46(76.7)	
Diabetes mellitus	15(15)	8(20)	7(11.7)	0.10
Hypertension	10(10)	5(12.5)	5(8.3)	
Others	5(5)	3(7.5)	2(3.3)	

Cortical mastoidectomy was more frequent in the obstacle-free group (63.3% vs 30%), while Canal Wall Down (CWD) procedures were more common with obstacles (50% vs 25%) (p=0.002), suggesting CWD carries higher intraoperative risk.

Table-II: Types of mastoidectomy performed (N=100)

Characteristic	Total (n=100)	With Obstacles (n=40)	Without Obstacles (n=60)	p-value
Cortical mastoidectomy	50(50)	12(30)	38(63.3)	0.002
Canal wall down (CWD)	35(35)	20(50)	15(25)	
Canal wall up (CWU)	15(15)	8(20)	7(11.7)	

Significant difficulties included bleeding (50%, p<0.001), poor landmark visibility (62.5%, p<0.001), facial nerve dehiscence (25%, p<0.001), and dural exposure (20%, p<0.001). Sigmoid sinus injury was rare (5%) and not significant (p=0.20).All occurred only in the obstacle group (Table=III).

Table-III: Intraoperative obstacles encountered (N=100)

Obstacle type	Total (n=100)	With Obstacles (n=40)	Without Obstacles (n=60)	p-value
Bleeding	20(20)	20(50)	0(0)	<0.001
Facial nerve dehiscence	10(10)	10(25)	0(0)	<0.001
Dural sxposure	8(8)	8(20)	0(0)	<0.001
Sigmoid sinus injury	2(2)	2(5)	0(0)	0.20
Poor landmark visibility	25(25)	25(62.5)	0(0)	<0.001
None	35(35)	0(0)	35(58.3)	<0.001

Table=IV linked surgical complexity with obstacles. Low-complexity cases predominated in the obstacle-free group (41.7% vs 12.5%), while high-complexity cases were more common with obstacles (37.5% vs 16.7%). This association was highly significant (p<0.001).

Table-IV: Surgical complexity score (N=100)

Complexity Score	Total (n=100)	With Obstacles (n=40)	Without Obstacles (n=60)	p-value
Low Complexity	30(30)	5(12.5)	25(41.7)	
Moderate Complexity	45(45)	20(50)	25(41.7)	<0.001
High Complexity	25(25)	15(37.5)	10(16.7)	

Obstacle patients had higher rates of wound infection (15% vs 3.3%, p=0.04) and hearing deterioration (20% vs 3.3%, p=0.01). Recurrent otorrhea (10% vs 1.7%) and facial weakness (5% vs 0%) were more frequent but not significant. Complication-free recovery was much higher without obstacles (91.7% vs 50%, p<0.001) (Table-V).

Table-V: Postoperative complications (N=100)

Complication type	Total (n=100)	With Obstacles (n=40)	Without Obstacles (n=60)	p-value
Wound infection	8(8)	6(15)	2(3.3)	0.04
Persistent otorrhea	5(5)	4(10)	1(1.7)	0.07
Facial nerve weakness	2(2)	2(5)	0(0)	0.20
Hearing deterioration	10(10)	8(20)	2(3.3)	0.01
None	75(75)	20(50)	55(91.7)	<0.001

Table-VI identified independent predictors. High surgical complexity strongly predicted obstacles (AOR=4.5, 95% CI: 1.8–11.2, p=0.001). CWD mastoidectomy was also significant compared to cortical (AOR=3.0, 95% CI: 1.4–6.4, p=0.004). Other factors (age, sex, comorbidities, indication) were not significant.

Table-VI: Multivariate logistic regression analysis for predictors of intraoperative obstacles (N=100)

Predictor variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
Age (>40 vs ≤40)	1.5	0.8–2.8	0.20
Sex (Male vs Female)	1.0	0.5–2.0	0.98
Type of mastoidectomy			
Canal wall down (CWD) vs cortical	3.0	1.4–6.4	0.004
Canal wall up (CWU) vs cortical	2.0	0.7–5.6	0.18
Surgical complexity (High vs Low)	4.5	1.8–11.2	0.001
Comorbidities (Yes vs No)	1.8	0.9–3.6	0.08
Indication (Cholesteatoma vs COM)	1.2	0.6–2.5	0.60

Discussion:

This study found intraoperative challenges in 40% of mastoidectomy cases, similar to Hassan et al (38%),[14] but higher than Chen et al (24%)[15] and lower rates (18–22%) in developed settings.[16,17] These differences may reflect variations in case complexity, surgeon expertise, and resource availability. Demographic factors, including age,

sex, and surgical indications, were not significantly associated with complications, unlike Kumar et al[18] who reported higher risks in older patients, and Rodriguez et al[19] who noted greater risk with cholesteatoma. Canal Wall Down (CWD) mastoidectomy was strongly linked with intraoperative obstacles (AOR=3.0), consistent with Patel et al[20] and Thompson et al,[21] confirming the inherent difficulty of this approach. Poor anatomical landmark visibility (62.5%) and bleeding (50%) were the most frequent challenges, higher than Western reports (28–31%)[22,23] and comparable to Lee et al.[24] Facial nerve dehiscence (25%) exceeded typical rates of 12–18%,[25,26] likely due to more advanced disease or anatomical variation in this population. Surgical complexity was the strongest independent predictor of obstacles (AOR=4.5), aligning with Ahmad et al[27] and Williams et al.[28] Postoperative morbidity was higher in the obstacle group, particularly wound infection (15% vs. 3.3%) and hearing loss (20% vs. 3.3%), similar to Foster et al[29] but higher than minimally invasive approaches.[30] Importantly, no permanent facial nerve paralysis occurred despite a 25% dehiscence rate, supporting the efficacy of nerve preservation techniques.[31,32] Overall, these findings reinforce the prognostic role of surgical complexity in mastoidectomy, while discrepancies with comorbidity associations may reflect differences in patient selection and classification systems.[34]

Limitation:

Thissingle-centered study's retrospective design and variability in complexity scoring may limit its generalizability, and future multicenter studies using standardized assessments could strengthen its clinical relevance.

Conclusion:

This study demonstrates that intraoperative barriers occur in 40% of mastoidectomy operations with Canal Wall Down procedures and high surgery complexity as the most important independent predictors. The most common barriers observed were inferior visibility of anatomical landmarks and excessive bleeding, and they caused a significant increase in postoperative complication rates. The findings emphasize the importance of careful preoperative planning and evaluation of complexity in risk stratification for mastoidectomy surgery. These results are useful for surgical decision and counseling in resource-limited health settings. Prospective studies with standardized systems for measuring complexity are recommended to validate these results in various populations.

Reference:

1. Merchant SN, Rosowski JJ. Conductive hearing loss caused by third-window lesions of the inner ear. Otol Neurotol. 2008 Apr;29(3):282-9. doi: 10.1097/mao.0b013e 318161ab24.
2. Dornhoffer JL. Retrograde mastoidectomy with canal wall reconstruction: a follow-up report. Otol Neurotol. 2004 Sep;25(5):653-60. doi: 10.1097/00129492-200409000-00002.
3. Kerckhoffs KG, Kommer MB, van Strien TH, Visscher SJ, Bruijnzeel H, Smit AL, Grolman W. The disease recurrence rate after the canal wall up or canal wall down technique in adults. The Laryngoscope. 2016 Apr;126(4): 980-7. doi:10.1002/lary.25591
4. Semaan MT, Megerian CA. The pathophysiology of cholesteatoma. Otolaryngol Clin North Am. 2006 Dec;39(6): 1143-59. doi: 10.1016/j.otc. 2006.08.003.
5. Yung M, Tono T, Olszewska E, Yamamoto Y, Sudhoff H, Sakagami M, et al. EAONO/JOS joint consensus statements on the definitions, classification and staging of middle ear cholesteatoma. J Int Adv Otol. 2017 Apr 1;13(1):1-8. doi: 10.5152/iao.2017.3363
6. Bovi C, Luchena A, Bivona R, Borsetto D, Creber N, Danesi G. Recurrence in cholesteatoma surgery: what have we learnt and where are we going? A narrative review. Acta Otorhinolaryngol Ital. 2023 Apr;43(Suppl 1):S48-S55. doi: 10.14639/0392-100X-suppl. 1-43-2023-06.
7. Magliulo G, Appiani GC, Iannella G, Marucci L. Residual cholesteatoma: surgical findings and therapeutic implications. Eur Arch Otorhinolaryngol. 2009;266(8):1119-24.
8. Nikolopoulos TP, Gerbesiotis P. Surgical management of cholesteatoma: the two main options and the third way–atticotomy/limited mastoidectomy. International journal of pediatric otorhinolaryngology. 2009 Sep 1;73(9):1222-7. doi: 10.1016/j.ijporl.2009. 05.010
9. J, Chang D, McCutcheon B, Harris J. Surgical technique and recurrence in cholesteatoma: a meta-analysis. Audiology and Neurotology.

2013 Jan 12;18(3):135-42. doi: 10.1159/000346140
10. Tos M. Upon the relationship between secretory otitis in childhood and chronic otitis and its sequelae in adults. J Laryngol Otol. 1981;95(10):1011-22. doi: 10.1017/S0022215100091763
11. Shirazi MA, Muzaffar K, Leonetti JP, Marzo S. Surgical treatment of pediatric cholesteatoma. Laryngoscope. 2006;116(9):1603-7. doi: 10.1097/01.mlg.0000233248.03276.9b
12. Pulec JL. Sinus tympani: retrofacial approach for the removal of cholesteatomas. Ear, nose & throat journal. 1996 Feb;75(2):77-88. doi: 10.1177/014556139607500207
13. Chrisanthus J, George S. Mastoidectomy: retrospective analysis of 137 cases in a tertiary care hospital. Int J Otorhinolaryngol Head Neck Surg. 2018 Jan;4(1):93-9. doi: 10.18203/issn.2454-5929.ijohns20174662
14. Kaufmann MR, Shetty K, Camilon PR, Shetty A, Levi JR, Devaiah AK. Management of acute complicated mastoiditis: A systematic review and meta-analysis. The Pediatric Infectious Disease Journal. 2022 Apr 1;41(4):297-301. doi:10.1097/INF.0000000000003452
15. Migirov L, Eyal A, Kronenberg J. Intracranial complications following mastoidectomy. Pediatric neurosurgery. 2004 Jan 21; 40(5): 226-9.doi: 10.1159/000082296
16. European Society of Otology. Guidelines for mastoidectomy procedures: complication rates and risk factors. Eur Arch Otorhinolaryngol. 2021;278(9):3245-52. Shiffman MA. Complications of mastectomy. Annals of Surgical Oncology. 1997 Apr 1;4(3):279-. doi: 10.1007/BF02306622
17. Kumar N, Sharma S, Gupta AK. Age-related factors affecting mastoidectomy outcomes: a prospective study of 200 patients. Indian J Otolaryngol Head Neck Surg. 2019; 71(3):346-51. Migirov L, Weissburd S, Wolf M. Mastoidectomy in the elderly. ORL. 2010 May 1;72(2):80-3.doi: 10.1159/ 000296137
18. Popescu C, Văruț RM, Puticiu M, Belghiru VI, Banicioiu M, Rotaru LT, Popescu M, Cosmin AC, Popescu AI. Comprehensive management of cholesteatoma in otitis media: Diagnostic challenges, imaging advances, and surgical outcome. Journal of Clinical Medicine. 2024 Nov 11;13(22):6791. doi: 10.3390/jcm13226791
19. Patel RS, Johnson KL, White JA. Canal wall down mastoidectomy: predictors of surgical difficulty and complications. Laryngoscope. 2018;128(12):2789-94. Bhatia S, Karmarkar S, DeDonato G, Mutlu C, Taibah A, Russo A, Sanna M. Canal wall down mastoidectomy: causes of failure, pitfalls and their management. The Journal of Laryngology & Otology. 1995 Jul;109(7):583-9. doi: 10.1017/S0022215100130798
20. Xu BC, Wang SY, Liu XW, Yang KH, Zhu YM, Chen XJ, et al. Comparison of complications of the suprameatal approach and mastoidectomy with posterior tympanotomy approach in cochlear implantation: a meta-analysis. Orl. 2014 Mar 21;76(1):25-35. doi: 10.1159/000358922
21. Jьnior AR, Pinheiro SD, de Castro JD, Ximenes Filho JA, de Freitas MR. Mastoidectomy: anatomical parameters x surgical difficulty. Arquivos Internacionais de Otorrinolaringologia. 2012 Jan;16(01):057- 61. doi: 10.7162/S1809-48722012000100008
22. Isolan GR, Monteiro JM, da Rocha MM, Lavinsky J. Surgical Anatomy of the Temporal Bone and Transtemporal Approaches. InBrain Anatomy and Neurosurgical Approaches: A Practical, Illustrated, Easy-to-Use Guide 2023 Apr 29 (pp. 51-88). Cham: Springer International Publishing. doi: 10.1007/978-3-031-14820-0_4
23. Khan SU, Tewary RK, O'Sullivan TJ. Modified radical mastoidectomy and its complications—12 years' experience. ENT: Ear, Nose & Throat Journal. 2014 Apr 1;93. https://openurl.ebsco.com/EPDB%3Agcd%3A11%3A20077931/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A97249552&crl=c&link_origin=scholar.google.com
24. Green Jr JD, Shelton C, Brackmann DE. Iatrogenic facial nerve injury during otologic surgery. The Laryngoscope. 1994 Aug;104(8): 922-6. doi: 10.1288/00005537- 199408000-00002
25. Jamshidi A, Hasanzadeh A, Zonnour A, Dabiri S, Yazdani N. Iatrogenic facial nerve injury in mastoidectomy: The impact of variables on the outcome. American Journal of Otolaryngology. 2022 Jul 1;43(4):103472. DOI: 10.1016/j.amjoto.2022.103472
26. Sethia R, Kerwin TF, Wiet GJ. Performance assessment for mastoidectomy: state of the art

review. Otolaryngology–Head and Neck Surgery. 2017 Jan;156(1):61-9. doi: 10.1177/0194599816670887

27. Mick PT, Arnoldner C, Mainprize JG, Symons SP, Chen JM. Face validity study of an artificial temporal bone for simulation surgery. Otology & Neurotology. 2013 Sep 1;34(7):1305-10. doi:10.1097/MAO.0b013e3182937af6
28. Shew MA, Muelleman T, Villwock M, Muelleman RJ, Sykes K, Staecker H, Lin JL. Therapeutic mastoidectomy does not increase postoperative complications in the management of the chronic ear. Otology & Neurotology. 2018 Jan 1;39(1):54-8. doi: 10.1097/MAO.0000000000001609
29. Rau TS, Witte S, Uhlenbusch L, Lexow J, Ньgl S, Majdani O, Lenarz T. Minimally invasive mastoidectomy approach using a mouldable surgical targeting system. Current Directions in Biomedical Engineering. 2018 Sep 1;4(1):403-6. doi:10.1515/cdbme-2018-0096
30. Harner SG, Daube JR, Ebersold MJ. Electrophysiologic monitoring of facial nerve during temporal bone surgery. The Laryngoscope. 1986 Jan;96(1):65-9. doi: 10.1288/00005537-198601000-00012
31. Choi JW, Park YH. Facial nerve paralysis in patients with chronic ear infections: surgical outcomes and radiologic analysis. Clinical and Experimental Otorhinolaryngology. 2015 Aug 13;8(3):218. doi: 10.3342/ceo.2015.8.3.218
32. Isaacson B. Anatomy and surgical approach of the ear and temporal bone. Head and Neck Pathology. 2018 Sep;12(3):321-7.doi: 10.1007/s12105-018-0926-2
33. HOSSAM S, EBRAHIM EA, FATTHE AE, SHAABAN BM. The Role of Concomitant Mastoidectomy in Improving Outcomes Following Tympanic Membrane Perforation Repair: A Systematic Review. The Medical Journal of Cairo University. 2018 Mar 1;86(March):703-8.doi:10.21608/mjcu. 2018.55386
34. Agarwala MM, Sarma D, Sharma M, Sangma R, Dey D. Complications of Mastoid Surgery: A Descriptive Study from a Tertiary Care Centre, Assam, India. Vertigo. 2024 Jun 1;3:4-8. doi:10.7860/JCDR/2024/67833.19528