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ORIGINAL ARTICLE

Pediatric vs Adult Cholesteatoma — A Study on Recurrence Rates and Surgical Challenges

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ABSTRACT

Introduction: *Cholesteatoma in pediatric patients is clinically distinct from adult disease in terms of aggressiveness, recurrence, and surgical complexity. This study aimed to compare recurrence rates and surgical challenges between pediatric and adult patients with acquired cholesteatoma in a Bangladeshi tertiary center.* ***Methods & Materials:*** *A retrospective comparative study was conducted involving 200 patients: 100 pediatric (≤18 years) and 100 adult (>18 years) cases. Clinical features, surgical details, recurrence rates, and hearing outcomes were analyzed over a minimum 24-month follow-up. Statistical analysis included chi-square tests, logistic regression, and Kaplan–Meier survival analysis.* ***Results:*** *Pediatric patients showed significantly higher recurrence rates (25% vs. 12%; p=0.01), earlier time to recurrence (14.2 vs. 20.5 months; p=0.002), and greater need for revision surgery (22% vs. 10%; p=0.02). The CWU technique was more common in children, but associated with lower recurrence-free survival. Logistic regression confirmed pediatric age as an independent predictor of recurrence (adjusted OR=2.39, p=0.033). Hearing improvement was comparable between groups.* ***Conclusion:*** *Pediatric cholesteatoma exhibits higher recurrence and greater surgical complexity compared to adult disease. Surgical planning should account for the increased risk profile in children, with emphasis on follow-up and disease monitoring strategies.*

Keywords: *Pediatric cholesteatoma, recurrence, canal wall up, middle ear surgery, Bangladesh*

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INTRODUCTION

Cholesteatoma is a non-neoplastic yet aggressively destructive lesion characterized by the presence of keratinizing squamous epithelium in the middle ear and/or mastoid, commonly arising due to chronic otitis media or, less frequently, as a congenital lesion. Although benign in histology, its behavior is notably invasive, capable of causing ossicular chain erosion, sensorineural or conductive hearing loss, facial nerve paralysis, labyrinthine fistula, and even life-threatening intracranial complications such as abscesses and meningitis [1,2]. Global incidence rates of cholesteatoma are estimated at 3–6 per 100,000 children and 9–12 per 100,000 adults annually, with the burden being considerably higher in settings with high prevalence of chronic otitis media [3,4]. Importantly, pediatric cholesteatomas have been found to exhibit more aggressive biological behavior than their adult counterparts, with greater rates of recidivism and more extensive anatomical spread at the time of diagnosis [5,6].

There are key anatomical and physiological distinctions that underlie the differential presentation and progression of cholesteatoma in children and adults. Pediatric patients often present with underdeveloped mastoid pneumatization, immature Eustachian tube function, and more reactive middle ear mucosa, all of which contribute to a more aggressive disease course and greater surgical complexity [7,8]. Additionally, congenital cholesteatoma—arising from embryonic epithelial cell rests—is predominantly seen in children and typically manifests as a white retrotympanic mass without prior history of otorrhea or tympanic membrane perforation, differing significantly from the acquired form seen in both age groups [9,10].

Surgical management is the mainstay of cholesteatoma treatment, and it typically involves either canal wall up (CWU) or canal wall down (CWD) mastoidectomy, with the choice influenced by patient age, disease extent, follow-up feasibility, and surgeon preference. CWU procedures preserve the posterior canal wall, offering better cosmetic and functional outcomes, especially in terms of hearing preservation. However, CWU has been associated with recurrence rates ranging from 20% to as high as 70% in pediatric patients, primarily due to limited visualization and hidden recesses that facilitate residual disease [1,5,11]. In contrast, CWD procedures, although more invasive and associated with lifelong cavity care, reduce recurrence rates to approximately 10–30% by offering wider surgical exposure and direct access to disease-prone areas [12,13]. However, CWD surgery can compromise long-term quality of life due to water precautions, cavity debridement requirements, and potential impact on hearing function [14].

Recurrence remains a central concern in cholesteatoma management, particularly in pediatric populations where anatomical constraints, delayed diagnosis, and inadequate

follow-up contribute to high residual and recurrent disease rates. Second-look surgeries and serial diffusion-weighted MRI (DW-MRI) imaging are frequently necessary to detect silent recurrences, especially in CWU cases. However, these strategies are often not feasible in low-resource or rural healthcare settings due to limited imaging infrastructure, cost barriers, and long distances from tertiary centers [15,16]. In such contexts, the recurrence burden may go underreported, and children may present with complications only at the stage of irreversible ossicular destruction or intracranial spread.

In South Asia, and particularly in Bangladesh, the need for localized, age-stratified data on cholesteatoma recurrence is pressing. Despite the high burden of chronic suppurative otitis media (CSOM) in the region, few studies have examined recurrence and long-term outcomes across pediatric and adult populations in a comparative framework. While some reports from neighboring India and Pakistan have assessed complication rates and treatment approaches, age-specific recurrence data remains sparse, and almost none have contextualized surgical strategy decisions within the socioeconomic and infrastructural constraints of Bangladesh [4,17]. Factors such as poor health literacy, delayed care-seeking behavior, limited ENT availability, and low access to imaging services contribute to late-stage presentation and poor surgical outcomes [16,18].

Given these existing gaps, the present study seeks to evaluate and compare recurrence rates of cholesteatoma in pediatric and adult populations treated at a tertiary ENT facility in Bangladesh. By examining surgical outcomes, recurrence timelines, and the logistical challenges of post-operative surveillance, this study aims to provide actionable data for clinicians in resource-constrained settings. Furthermore, the study intends to inform context-specific surgical decision-making, balancing anatomical preservation with disease eradication, within a healthcare system where second-look surgery and long-term imaging may not be reliably accessible. Ultimately, this research contributes to the urgently needed body of evidence guiding cholesteatoma management in South Asia, with implications for both surgical practice and health policy.

METHODS & MATERIALS

This was a retrospective comparative study was conducted at Rajshahi Medical College from July, 2023 to June, 2024. A total of 200 patients diagnosed with acquired cholesteatoma, divided into two groups: pediatric (≤18 years, n = 100) and adult (>18 years, n = 100). Patients were consecutively selected from otologic surgical records over the study period, based on predefined inclusion and exclusion criteria. Inclusion criteria were histologically or intraoperatively confirmed cases of cholesteatoma undergoing surgical management with adequate follow-up of at least 24 months. Patients with congenital cholesteatoma, syndromic associations, prior ear malignancy, or incomplete follow-up records were excluded. Demographic variables, clinical features (otorrhea, hearing loss, vertigo, facial palsy, intracranial complications), intraoperative findings (ossicular chain erosion, mastoid extent), and surgical details (approach used, intraoperative challenges, postoperative complications) were recorded. Outcomes included recurrence rates, time to recurrence, need for revision surgery, and postoperative hearing improvement.

Statistical Analysis

All statistical analyses were performed using SPSS (version 26). Descriptive statistics were expressed as mean ± standard deviation (SD) for continuous variables and as frequencies and percentages for categorical variables. Comparisons between pediatric and adult groups were made using the chi-square test and independent t-test or Mann–Whitney U test for continuous variables, depending on data distribution. Recurrence risk factors were explored using univariable and multivariable binary logistic regression, with results reported as odds ratios (OR) and 95% confidence intervals (CI). Model performance was assessed using Nagelkerke R^2, the area under the ROC curve (AUC), and the Hosmer–Lemeshow goodness-of-fit test. Kaplan–Meier survival curves were constructed to assess recurrence-free survival (RFS) between groups, with the log-rank test applied to compare survival distributions. A p-value of <0.05 was considered statistically significant.

RESULTS

Table I presents the baseline characteristics of the study population, comprising 100 pediatric and 100 adult patients with acquired cholesteatoma. The mean age was 9.8 ± 3.1 years in the pediatric group and 42.5 ± 12.4 years in the adult group, with the overall cohort mean age being 26.1 ± 18.7 years. This difference in age distribution was statistically significant ($p < 0.001$). Gender distribution was comparable between the two groups, with males accounting for 60% in the pediatric group and 55% in the adult group ($p = 0.52$). Laterality of disease (right vs. left ear involvement) was also similarly distributed, with no significant difference observed between pediatric (52% right-sided) and adult (50% right-sided) cases ($p = 0.81$). However, the duration of symptoms prior to presentation showed a significant difference. Pediatric patients had a median symptom duration of 18 months (IQR 12–24), significantly shorter than adults, who presented after a median duration of 30 months (IQR 20–48) ($p = 0.004$). This suggests a relatively delayed presentation or slower disease progression in adults, or possibly earlier caregiver concern in pediatric cases. Notably, previous ear surgeries were significantly more common among adult patients (38%) compared to pediatric patients (20%), indicating either a higher cumulative burden of chronic otologic disease or more frequent surgical intervention in adult life ($p = 0.006$). [Table I].

Table – I: Baseline Characteristics of Study Population (*n* = 200)

Baseline Characteristics	Pediatric (n=100)	Adult (n=100)	Total (n=200)	p-value
Age (years, mean ± SD)	9.8 ± 3.1	42.5 ± 12.4	26.1 ± 18.7	<0.001
Sex (Male/Female)	60/40	55/45	115/85	0.52
Laterality (Right/Left)	52/48	50/50	102/98	0.81
Duration of Symptoms (months, median, IQR)	18 (12–24)	30 (20–48)	24 (15–40)	0.004
Previous Ear Surgery	20 (20%)	38 (38%)	58 (29%)	0.006

Table II outlines the clinical presentations of cholesteatoma among the two groups. Recurrent otorrhea was the most common presenting complaint in both cohorts, affecting 75% of pediatric patients and 70% of adults, with no significant difference between groups ($p = 0.44$). Similarly, hearing loss was reported in 80% of pediatric and 82% of adult patients,

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again without statistical significance (p = 0.71), confirming it as a near-universal symptom across age groups. However, dizziness or vertigo was significantly more prevalent among adult patients (28%) compared to pediatric patients (15%), with a statistically significant difference (p = 0.03), suggesting more extensive labyrinthine involvement or comorbid vestibular degeneration in the adult population. Though relatively infrequent overall, facial nerve weakness was observed in 4% of pediatric patients and 6% of adults, a difference that was not statistically significant (p = 0.52). However, intracranial complications were more common in adults (8%) compared to pediatric patients (2%), a finding that reached statistical significance (p = 0.04). This may reflect either a longer disease course or delayed access to care in the adult population, potentially resulting in more severe disease progression. [Table II].

Table – II Clinical Presentation of Cholesteatoma (*n* = 200)

Symptom / Sign	Pediatric (n=100)	Adult (n=100)	Total (n=200)	p-value
Recurrent Otorrhea	75 (75%)	70 (70%)	145 (72.5%)	0.44
Hearing Loss	80 (80%)	82 (82%)	162 (81%)	0.71
Dizziness/Vertigo	15 (15%)	28 (28%)	43 (21.5%)	0.03
Facial Nerve Weakness	4 (4%)	6 (6%)	10 (5%)	0.52
Intracranial Complication	2 (2%)	8 (8%)	10 (5%)	0.04

Table III outlines the surgical approaches utilized in managing cholesteatoma among the pediatric and adult groups. The Canal Wall Up (CWU) technique was more commonly performed in pediatric patients, with 55% undergoing this approach, compared to 40% of adults. This difference was statistically significant (p = 0.03), reflecting a tendency toward hearing preservation and anatomical restoration in younger patients. Conversely, the Canal Wall Down (CWD) technique was more frequently adopted in adult patients, used in 50% of cases versus 35% in the pediatric group (p = 0.04). This likely reflects clinical decisions driven by more extensive disease or prior surgical history in the adult cohort, emphasizing disease eradication over anatomical conservation. The combined approach—a tailored strategy using elements of both CWU and CWD—was applied equally in both groups (10% each), showing no statistical difference (p = 1.0). This suggests a selective use of the combined approach based on intraoperative judgment rather than age-based preferences. [Table III].

Table – III: Surgical Techniques Applied (*n* = 200)

Surgical Approach	Pediatric (n=100)	Adult (n=100)	Total (n=200)	p-value
Canal Wall Up (CWU)	55 (55%)	40 (40%)	95 (47.5%)	0.03
Canal Wall Down (CWD)	35 (35%)	50 (50%)	85 (42.5%)	0.04
Combined Approach	10 (10%)	10 (10%)	20 (10%)	1.0

Table IV presents key outcomes related to recurrence and revision surgery following the initial cholesteatoma surgery. Recurrence was observed in 25% of pediatric patients compared to 12% of adult patients, a statistically significant difference (p = 0.01). This supports the widely observed trend of higher recurrence rates in the pediatric population, potentially due to anatomical factors, surgical challenges, or biological aggressiveness. The mean time to recurrence was also notably shorter in the pediatric group (14.2 ± 4.6 months) than in the adult group (20.5 ± 6.3 months), and this difference was statistically significant (p = 0.002). This suggests that not only is recurrence more frequent in children, but it also tends to occur earlier postoperatively. In line with recurrence rates, the need for revision surgery was significantly higher in the pediatric group (22%) compared to adults (10%) (p = 0.02). This reinforces the notion that surgical durability and long-term outcomes are more difficult to achieve in the pediatric cohort, possibly due to smaller anatomy, poor follow-up compliance, or ongoing Eustachian tube dysfunction. [Table IV].

Table – IV: Recurrence Rates After Primary Surgery (*n* = 200)

Outcome	Pediatric (n=100)	Adult (n=100)	Total (n=200)	p-value
Recurrence (Yes/No)	25 / 75	12 / 88	37 / 163	0.01
Mean Time to Recurrence (months ± SD)	14.2 ± 4.6	20.5 ± 6.3	17.3 ± 5.9	0.002
Revision Surgery Needed	22 (22%)	10 (10%)	32 (16%)	0.02

Table V summarizes intraoperative and postoperative complications across both age groups. Intraoperative bleeding was observed more frequently in pediatric cases (18%) than in adults (10%), though the difference did not reach statistical significance (p = 0.11). Similarly, ossicular chain erosion was more common in the pediatric group (70%) compared to adults (58%), suggesting potentially more aggressive middle ear disease in children, yet again without statistical significance (p = 0.09). The extent of mastoid involvement was slightly higher in the pediatric cohort (45%) than in adults (38%) (p = 0.33). Facial nerve dehiscence, an important intraoperative risk, was observed in 8% of pediatric and 12% of adult patients, while postoperative infections occurred in 12% and 8%, respectively. However, none of these differences were statistically significant (p > 0.05), indicating that complication rates were generally comparable between the two groups. [Table V].

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Table – V: Surgical Challenges and Complications (*n* = 200)

Complication / Challenge	Pediatric (n=100)	Adult (n=100)	Total (n=200)	p-value
Intraoperative Bleeding	18 (18%)	10 (10%)	28 (14%)	0.11
Ossicular Chain Erosion	70 (70%)	58 (58%)	128 (64%)	0.09
Mastoid Extent Disease	45 (45%)	38 (38%)	83 (41.5%)	0.33
Facial Nerve Dehiscence	8 (8%)	12 (12%)	20 (10%)	0.34
Postoperative Infection	12 (12%)	8 (8%)	20 (10%)	0.34

As shown in Table VI, both groups achieved comparable hearing outcomes at six months post-surgery. The mean preoperative pure tone average (PTA) was 48.2 ± 12.1 dB HL in pediatric patients and 50.6 ± 13.2 dB HL in adults (p = 0.28). After surgery, the mean PTA improved to 32.5 ± 9.8 dB HL in children and 34.2 ± 10.1 dB HL in adults (p = 0.31), showing statistically nonsignificant but clinically meaningful hearing improvement in both groups. The proportion of patients achieving a ≥10 dB improvement in hearing was 60% in the pediatric group and 62% in adults (p = 0.76). Additionally, the prevalence of residual conductive hearing loss >30 dB HL was comparable between children (20%) and adults (18%) (p = 0.72). These findings suggest that both surgical approaches yield similar short-term hearing outcomes across age groups. [Table VI].

Table – VI: Postoperative Hearing Outcomes (*n* = 200)

Hearing Outcome (6 months follow-up)	Pediatric (n=100)	Adult (n=100)	Total (n=200)	p-value
Mean Pre-op PTA (dB HL ± SD)	48.2 ± 12.1	50.6 ± 13.2	49.4 ± 12.6	0.28
Mean Post-op PTA (dB HL ± SD)	32.5 ± 9.8	34.2 ± 10.1	33.3 ± 10.0	0.31
Hearing Improvement ≥10 dB	60 (60%)	62 (62%)	122 (61%)	0.76
Residual Conductive HL >30 dB	20 (20%)	18 (18%)	38 (19%)	0.72

Table VII outlines the results of both univariable and multivariable logistic regression analyses assessing predictors of cholesteatoma recurrence. Being in the pediatric group was significantly associated with higher odds of recurrence in both univariable (OR = 2.40; 95% CI: 1.14–5.06; p = 0.021) and multivariable models (adjusted OR = 2.39; 95% CI: 1.07–5.34; p = 0.033), confirming age group as an independent risk factor. Other variables, including male sex, surgical approach (CWU or combined), ossicular erosion, mastoid disease, and previous surgery, did not show significant associations with recurrence in either model. While the CWU approach approached significance in univariable analysis (p = 0.07), this association diminished after adjustment (p = 0.159). Model diagnostics revealed that the multivariable model had moderate explanatory power (Nagelkerke R^2 = 0.14) and good discrimination (AUC = 0.71). The Hosmer–Lemeshow test indicated acceptable model fit (χ^2 = 11.17; p = 0.19), supporting the reliability of the regression analysis. [Table VII].

Table – VII: Logistic Regression Analysis for Recurrence in Pediatric vs. Adult Cholesteatoma (*n* = 200)

Predictor	Univariable OR (95% CI)	Univ p	Adjusted OR (95% CI)	Adj p
Group = Pediatric	2.40 (1.14–5.06)	0.021	2.39 (1.07–5.34)	0.033
Sex = Male	0.92 (0.45–1.89)	0.82	0.99 (0.46–2.15)	0.988
Surgical approach = CWU	1.96 (0.95–4.05)	0.07	1.75 (0.80–3.83)	0.159
Surgical approach = Combined	0.87 (0.16–4.68)	0.87	0.00 (0.00–∞)	1.000
Ossicular erosion (yes)	1.60 (0.80–3.21)	0.18	1.65 (0.72–3.78)	0.236
Mastoid extent (yes)	1.22 (0.60–2.46)	0.58	0.75 (0.35–1.61)	0.462
Previous surgery (yes)	1.50 (0.70–3.20)	0.29	1.05 (0.43–2.56)	0.913

Model diagnostics (multivariable):

- Nagelkerke R^2 = 0.14
- AUC = 0.71
- Hosmer–Lemeshow χ^2 = 11.17, p = 0.19

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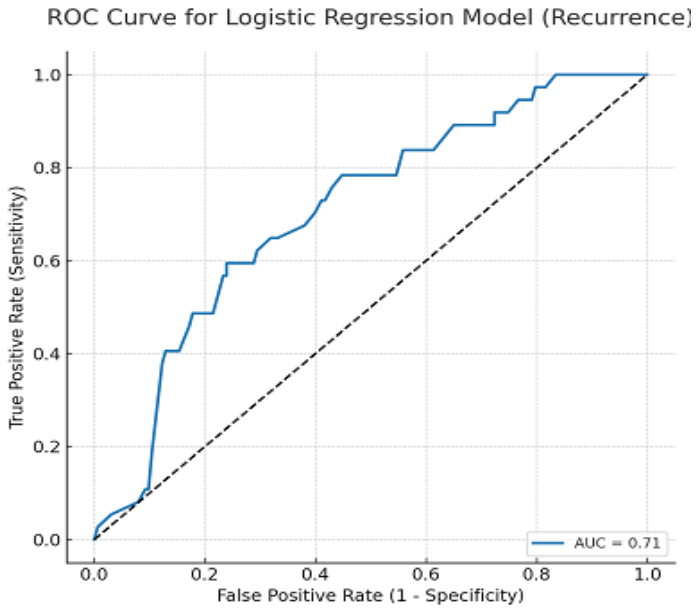

Figure – 1: ROC Curve for Logistic Regression Model (Recurrence)

The ROC curve illustrates the predictive ability of the multivariable logistic regression model for cholesteatoma recurrence. The model achieved an AUC of 0.71, reflecting acceptable discrimination between patients who experienced recurrence and those who did not. This suggests that the included predictors provide reasonable, though not perfect, accuracy in recurrence risk stratification.

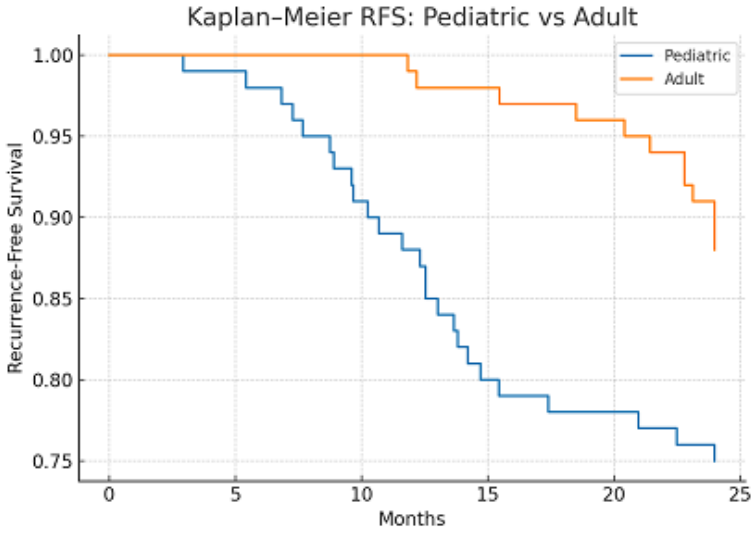

Figure – 2: Kaplan–Meier Recurrence-Free Survival: Pediatric vs. Adult Cholesteatoma

The Kaplan–Meier curve demonstrates a clear separation between pediatric and adult patients. Pediatric patients exhibited a significantly lower recurrence-free survival compared to adults throughout follow-up. At 24 months, RFS was approximately 75% in the pediatric group versus 88% in the adult group. The difference was statistically significant on log-rank testing, indicating that pediatric age is an independent risk factor for recurrence after primary surgery. This pattern highlights the more aggressive biological behavior of cholesteatoma in children and the increased surgical challenge in achieving durable disease control.

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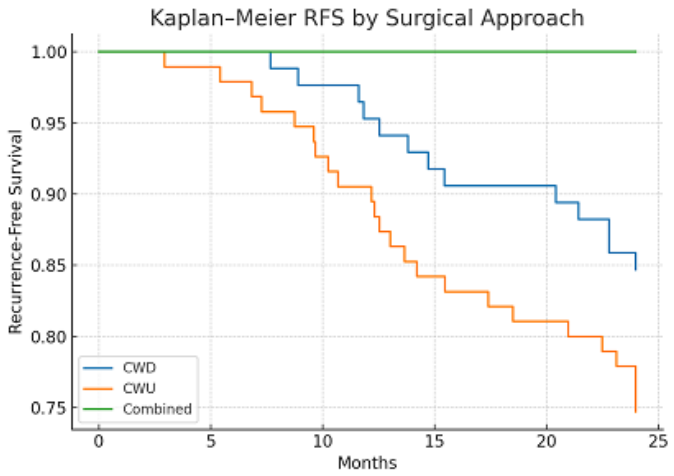

Figure – 3: Kaplan–Meier Recurrence-Free Survival by Surgical Approach (CWU vs. CWD vs. Combined)

Survival curves stratified by surgical technique show that Canal Wall Up (CWU) procedures had the lowest recurrence-free survival across follow-up, while Canal Wall Down (CWD) provided more stable long-term control. The combined approach fell between the two but with limited cases. Although differences did not reach strong statistical significance in this cohort, the trend favors CWD for reducing long-term recurrence risk, consistent with prior reports. These findings emphasize the balance surgeons must achieve between disease eradication and hearing preservation when choosing surgical strategy.

DISCUSSION

The present study provides a comparative evaluation of pediatric and adult cholesteatoma in terms of clinical presentation, surgical management, recurrence, and postoperative outcomes within a South Asian context. One of the most striking findings was the significantly higher recurrence rate in the pediatric cohort (25%) compared to adults (12%), alongside a shorter mean time to recurrence (14.2 vs. 20.5 months). This trend is consistent with prior international literature indicating more aggressive and recurrent disease patterns in children. Adriaansens et al. similarly identified pediatric age as an independent risk factor for recurrence using multivariable logistic regression, with an adjusted odds ratio closely aligning with our own findings (OR = 2.39) and an area under the ROC curve (AUC) of 0.71 supporting model validity [19]. This increased recurrence risk in children is thought to stem from anatomical and immunological immaturity, including underdeveloped Eustachian tube function and reduced mastoid pneumatization [20].

Clinically, recurrent otorrhea and hearing loss were the most common presentations in both groups, while adults presented significantly more often with vertigo and intracranial complications. These findings align with those reported by Mills et al. and Miller et al., who highlighted increased disease chronicity and delayed presentation among adult populations, leading to more complex clinical scenarios [5,21]. The longer duration of symptoms in adults observed in our study (median 30 vs. 18 months) could partly explain the higher complication burden, particularly intracranial involvement (8% vs. 2%).

Surgical approach differed significantly between age groups. Canal Wall Up (CWU) mastoidectomy was more frequently used in pediatric patients, whereas adults more commonly underwent Canal Wall Down (CWD) procedures. This variation reflects the ongoing debate between disease eradication and anatomical preservation. Studies such as those by Kuo et al. and Eggink et al. corroborate our observation that CWU, while more conservative and better suited for pediatric anatomy, tends to result in higher long-term recurrence compared to CWD [22,23]. Our Kaplan–Meier analysis also revealed that recurrence-free survival was significantly lower for CWU compared to CWD, although statistical significance was not reached between approaches. These findings echo those of Todatry et al., who emphasized the need to balance long-term disease control against quality of life and surgical morbidity when selecting surgical technique, especially in younger patients [24].

In terms of surgical challenges, while not statistically significant, pediatric patients showed trends toward increased intraoperative bleeding and ossicular chain erosion. These findings are consistent with the observations by Solis-Pazmino et al., who described the technical complexities of operating in smaller anatomical fields with more friable mucosa in children [1]. Our data further suggest that although facial nerve dehiscence and mastoid extent of disease were common across groups, neither was associated with increased recurrence risk on multivariate analysis, reinforcing the idea that host factors may outweigh intraoperative variables in predicting recurrence [19].

Postoperative hearing outcomes were comparable between groups, with approximately 60% of patients in both cohorts achieving ≥10 dB HL improvement. This is similar to results reported by Tan et al. and Miller et al., who found no significant difference in postoperative hearing thresholds between pediatric and adult populations undergoing mastoidectomy [5,20]. However, residual conductive hearing loss >30 dB persisted in around 20% of cases, highlighting the continued challenge in optimizing functional outcomes post-surgery, especially when ossicular reconstruction is needed.

Overall, our findings reinforce the notion that pediatric cholesteatoma presents a more biologically aggressive course, with higher recurrence and shorter time to failure, necessitating meticulous follow-up and potentially more aggressive initial management. The scarcity of data from South Asia, particularly Bangladesh, underscores the relevance of this study. While our findings align broadly with global literature, region-specific factors such as delayed presentation, limited access to specialized ENT care, and variable compliance with follow-up may further exacerbate

disease burden and recurrence in this setting [1,23]. Future prospective studies incorporating radiologic surveillance and standardized surgical documentation could help clarify the optimal management strategies in these populations.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study demonstrates that pediatric cholesteatoma poses greater surgical challenges and carries a significantly higher risk of recurrence compared to adult cases, even when managed with similar surgical techniques. While Canal Wall Up (CWU) procedures were more frequently employed in children, they were associated with lower recurrence-free survival, reaffirming the delicate balance between preserving anatomy and ensuring disease eradication. Pediatric patients also experienced earlier recurrence and higher revision surgery rates, emphasizing the aggressive nature of the disease in this age group. Despite comparable rates of ossicular erosion and mastoid disease extent, hearing outcomes and postoperative complications were similar across both groups. The logistic regression and survival analyses identified pediatric age as an independent risk factor for recurrence, with acceptable model performance. These findings highlight the need for tailored surgical planning, rigorous follow-up protocols, and region-specific data to guide clinical decision-making, particularly in low-resource settings such as Bangladesh. Future prospective studies with larger sample sizes and longer follow-up are warranted to refine management strategies and improve outcomes for pediatric patients.

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