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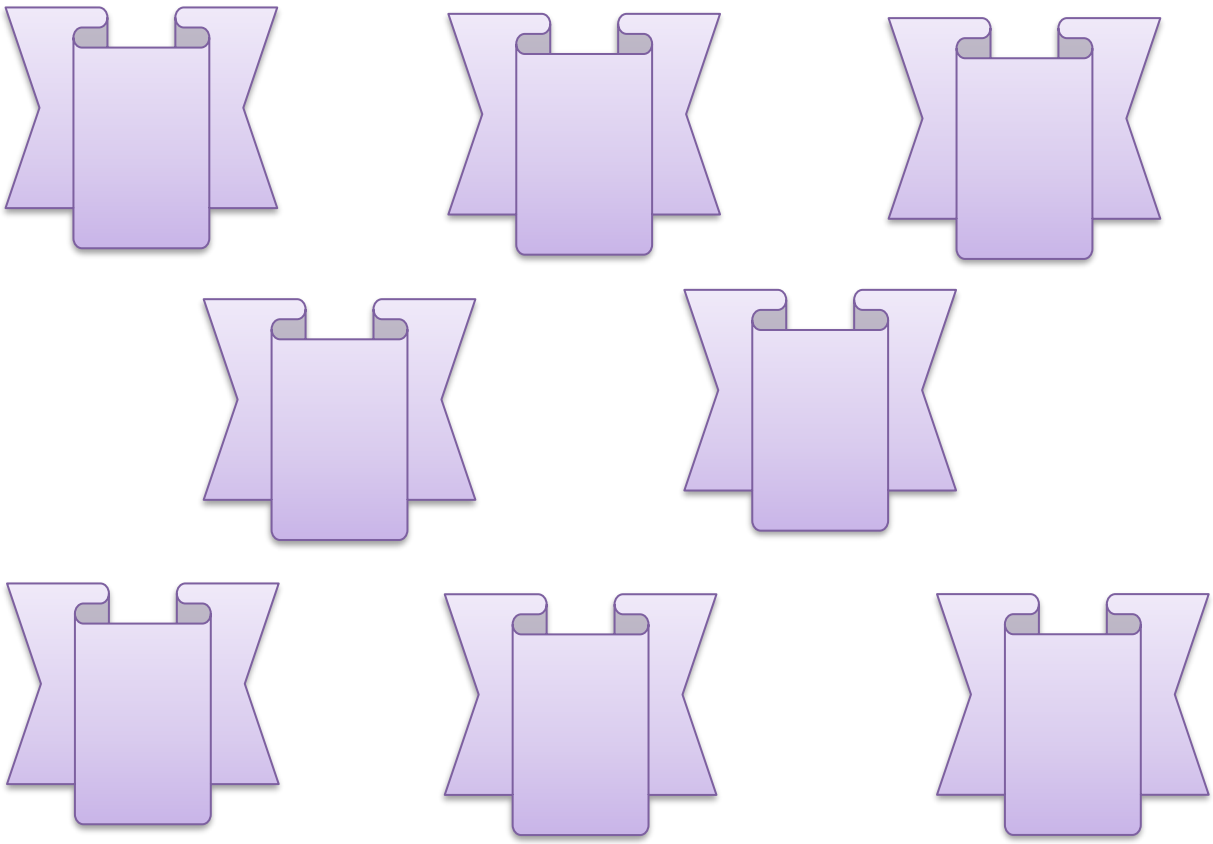

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Original Article

The Outcome of Canal Wall Up versus Canal Wall Down Mastoidectomy in Cholesteatoma

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ABSTRACT

Background: The subject of cholesteatoma in the middle ear is a highly intricate area of study in the field of otology, which has sparked numerous research studies and discussions across the globe. However, despite all the research and debates, there remains a significant lack of agreement among experts regarding many aspects of cholesteatoma.

Aim of the work: This study aims to compare between the hearing outcome and recidivism [recurrence or residual] of canal wall up [CWU] and canal wall down [CWD] mastoidectomy in cholesteatoma.

Patients and Methods: This randomized comparative prospective study involved eighty-six adult patients with acquired cholesteatoma divided into two equal groups; Group A: included patients who undergo CWU mastoidectomy, and Group B: include patients who undergo CWD mastoidectomy. Follow up for at least 12 months using otoendoscop, PTA, as well as DWI-MRI.

Results: Air-bone [AB] gap and AC threshold improved significantly in both groups after surgery. However, the improvement was significantly better in the CWU group compared to the CWD group [P=0.025 for AB gap and 0.039 for AC threshold]. Regarding recidivism, the CWD group had less recurrence rate than CWU group [4 vs. 9], but with no significant difference [P=0.11].

Conclusion: The CWU group has demonstrated superior results in terms of hearing improvement compared to the CWD group. However, the CWD technique showed better outcomes in terms of preventing the recidivism of cholesteatoma.

Keywords: Cholesteatoma; Mastoidectomy; Canal Wall; Hearing loss; Recidivism.

INTRODUCTION

Cholesteatoma is a condition in which there is a long-term inflammation of the middle ear cleft, and it is characterized by an unusual growth of a squamous epithelium that produces keratin [1].

The subject of cholesteatoma in the middle ear is a highly intricate area of study in the field of otology, which has sparked numerous research studies and discussions across the globe. However, despite all the research and debates, there remains a significant lack of agreement among experts regarding many aspects of cholesteatoma [2].

Canal wall down [CWD] and canal wall up [CWU] are two surgical techniques that are used in the treatment of cholesteatoma. These techniques differ primarily in the preservation of the external ear canal. CWD is considered to be more effective in eliminating the cholesteatoma because it provides a wider view of the mastoid and middle ear structures. However, it may not result in a self-cleaning cavity and the patient must avoid water contact, which can limit their social activities [3].

On the other hand, the CWU technique preserves the anatomy and avoids these problems, but it may have a higher chance of recurrence compared to CWD. In addition, the CWU technique is generally believed to produce better hearing outcomes than the CWD technique [3].

In the past ten years, non-EPI-DW MRI has become a popular option for postoperative cholesteatoma screening after CWU surgeries. This method is less invasive, takes less time, and is more affordable than second-look operations [4].

The main goal of surgery for cholesteatoma is to completely remove the squamous epithelium from the middle ear and mastoid cavity. However, it is also crucial to ensure that the patient maintains satisfactory hearing after the surgery, and to prevent any future recurrences of the condition [5].

This study aimed to compare the results of hearing improvement and the recurrence rate of cholesteatoma between two surgical techniques: canal wall up [CWU] and canal wall down [CWD] mastoidectomy.

PATIENTS AND METHODS

From December 2019 to August 2022, a prospective randomized comparative study was conducted at Al-Azhar University Hospitals.

The study included 86 adult patients with acquired cholesteatoma, who were divided into two groups based on a lottery system. Group A included 43 patients who underwent canal wall up [CWU] mastoidectomy, while group B included 43 patients who underwent canal wall down [CWD] mastoidectomy.

Exclusion criteria

Patients who had undergone previous mastoidectomy, had cholesteatoma in the only functional ear, had erosion of the posterior bony canal wall, or were deemed unfit for surgery were excluded from the study.

Ethical considerations

Patients were fully informed of the details of the surgical procedure, and written consent was obtained from each patient or their legal guardian after receiving this information.

Sample size

To determine the appropriate sample size for the study, we used version 3 of the power and sample size program. Based on the results of a previous study [6], which found that the mean air-bone gap [ABG] in patients managed by CWD and CWU was 52 and 41, respectively, with a standard deviation of 18, we calculated that a sample size of at least 40 patients per group was necessary to achieve a 95% confidence level and study power of 80%.

Data collection

Preoperative clinical, HRCT petrous bone and pure tone audiometry examination were performed in all the patients.

Surgical procedures

All patients were subjected to operations under general anesthesia. All cases were operated by one senior surgeon [third author] in Al-Azhar University hospitals.

Group A [CWU]

All surgical procedures were performed using general anesthesia with a hypotensive technique. Adrenaline was injected into the retro-auricular region at a concentration of 1/200000. A retro-auricular incision was then made using a No. 21 blade. The incision extended just above and behind the root of the helix down to the mastoid tip, and was placed 1 cm behind the postauricular sulcus.

Temporalis facia Harvesting: The incision was extended down to the level of the loose areolar tissue that overlies the temporalis fascia. The temporalis fascia was then harvested.

Mastoid exposure: Elevation of the Musculo-periosteal [palva] flap using a periosteal elevator.

EAC incisions: The posterior limb of canal incision is carried out with a No. 15 blade 2 mm deeper than the entrance of the bony EAC. The tympanomeatal flap was then elevated till the annulus [figure 1].

To keep the surgical field clear of blood during flap elevation, pledgets soaked with adrenaline were used for hemostasis. The annulus was identified and carefully elevated out of the tympanic sulcus. The middle ear was entered. The chorda tympani nerve was identified. Any adhesions with incus, stapes, or incudostapedial joint were meticulously divided. Dissection of tympanmeatal flap from the malleus with a sharp cut of the umbo when needed. Insertion of epinephrine soaked pledged into the middle ear for hemostasis.

Cortical mastoidectomy was performed after identification of the spine of Henle and MacEwen triangle: 3 lines were drilled: first-line parallel to the temporal line, second line posterior to the external auditory canal, and the third line connecting the first and second line. The mastoid cortex was drilled until the mastoid antrum was opened.

Cholesteatoma was then meticulously dissected and removed from the mastoid antrum and air cells. Irrigation of the middle ear and mastoidectomy cavities was performed [figure 2] and patent communication between both cavities was ensured. Posterior tympanotomy was done in 11 out of 43 selected cases with retrotympanum cholesteatoma according to intraoperative extension of cholesteatoma. When ossicular discontinuity was found, primary ossicular reconstruction was performed. If the incus was eroded and the stapes superstructure was present, incus interposition or PORP was done. If the incus and stapes superstructure were absent, TORP was done.

If ossicular re-construction was done by TORP or PORP, cartilage graft was inserted lateral to them to prevent extrusion. TM reconstruction using underlay temporalis fascia graft and attic reconstruction and reinforcement by concheal or tragal cartilage. Insertion of gel foam under and over the graft. Closure of periosteal flap then skin in two layers.

Group B [CWD]

The initial steps of the surgical procedure were the same for both groups. This included making an incision in the skin of the external auditory canal, elevating the tympanomeatal flap, and entering the middle ear. The integrity and continuity of the ossicular chain were checked, and the malleus and/or incus were removed if eroded. Epinephrine-soaked pledgets were inserted into the middle ear for hemostasis. Cortical mastoidectomy was performed in the same manner as in the CWU mastoidectomy. Adequate saucerization was performed, and cholesteatoma was dissected and removed from the mastoid cavity and antrum. The posterior canal wall was taken down, the bridge was removed, and the facial ridge was lowered [figure 3], allowing full exposure of the attic region and dissection and removal of cholesteatoma from the anterior and posterior epitympanic spaces.

Primary Ossicular reconstruction by incus interposition\ PORP or TORP. If ossicular reconstruction was done by TORP or PORP, cartilage graft was inserted lateral to them to prevent extrusion. Tympanic membrane reconstruction using temporalis fascia or perichondrium and cartilage graft [figure 4].

Adequate conchomeatoplasty was done. Gel foam insertion above and below the graft and in the mastoid cavity. Packing the resultant cavity with ear wick soaked with antibiotic. Skin closure in layers same as CWU mastoidectomy.

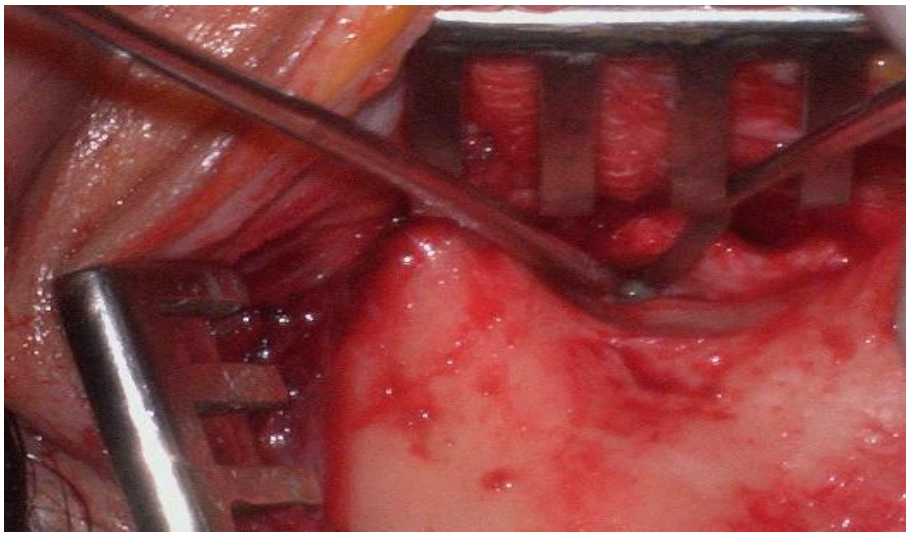

Figure [1]: The posterior limb of EAC incision with elevation tympanometal flap

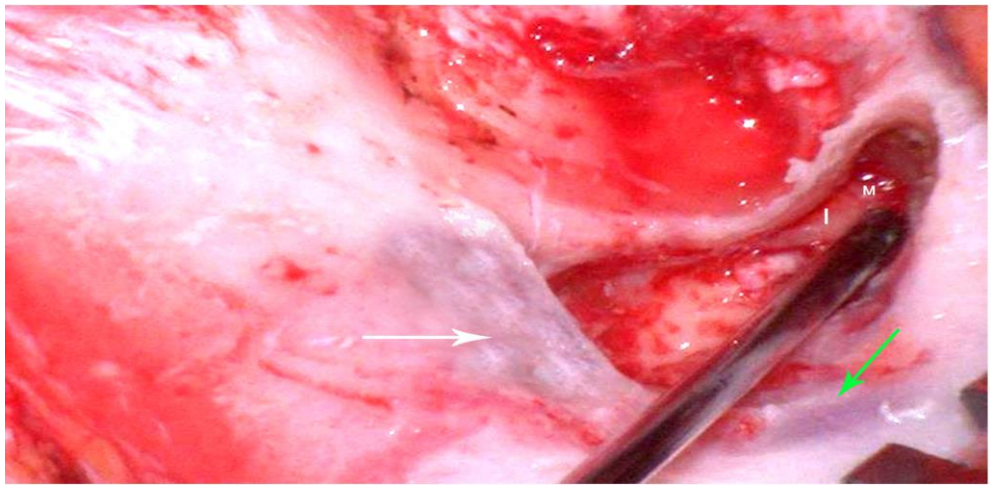

Figure [2]: CWU Mastoidectomy with exposure short process and body of incus [I] and head of malleus [M], white arrow: blue discoloration of sigmid sinus & Green arrow: show pink discoloration of dura

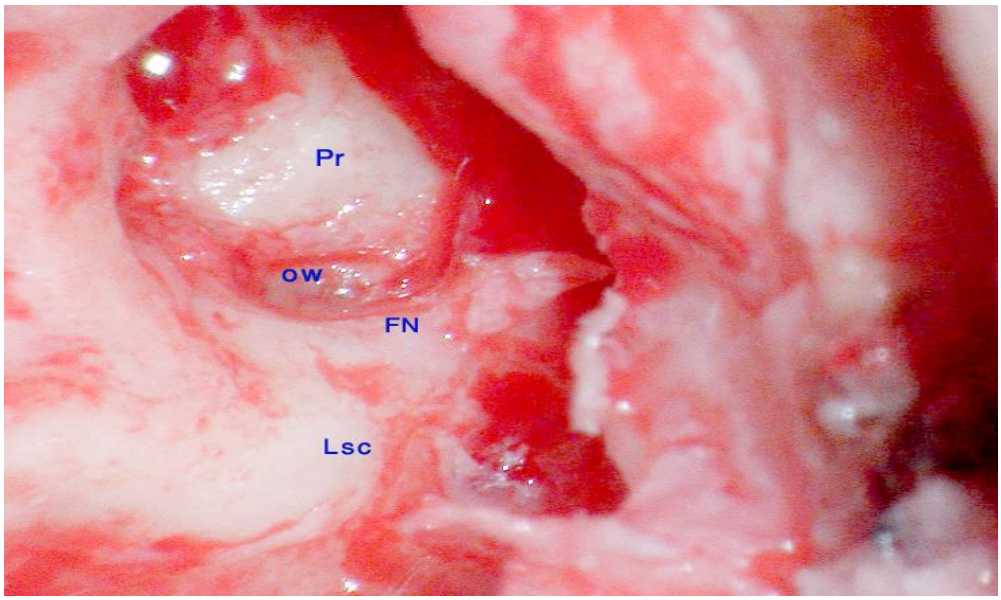

Figure [3]: After the bridge was removed, the facial ridge was lowered, and the cholesteatoma was completely eradicated, the mastoidectomy cavity was evaluated. The facial nerve canal [FN], lateral semicircular canal [LSC], oval window membrane, and round window niche were all visible

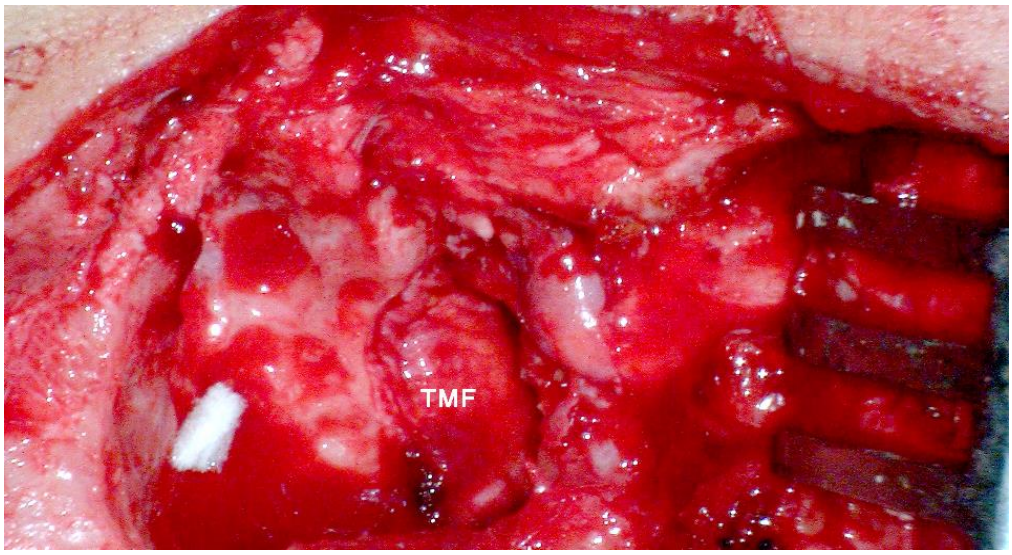

Figure [4]: CWD with hearing reconstruction by TORP, Concheal cartilage and temporalis fascia

Follow up: After the surgery, the patients were advised to avoid getting their operated ears wet and to attend regular follow-up appointments. All patients were prescribed post-operative antibiotics. They were examined for any bleeding, discharge, facial asymmetry, infection, and improvement in their hearing abilities during their postoperative appointments.

Postoperative follow-up appointments were scheduled for all patients at 1 week, 1 month, 3 months, 6 months, 9 months, and 12 months after the surgery.

1. Otoendoscopy at 3, 6, 9 and 12 months postoperatively checking the graft, retraction pockets and/or the presence of a cholesteatoma.

2. Hearing results at 500, 1000, 2000, and 4000 Hz at the postoperative 6 months by:

- Comparing the postoperative improvement [closure] of the air-bone gap among the two groups
- Comparing between the preoperative and postoperative periods in both groups according to the air-bone gap thresholds in dB.
- Comparing the postoperative worsening of the BC thresholds among the two groups.
- Comparing between the preoperative and postoperative periods in both groups according to the bone conduction thresholds in dB

3. Evaluation cholesteatoma recidivism in both groups:

- After the surgery, canal wall up [CWU] cases were evaluated for the recurrence of cholesteatoma using non-EPI-DW MRI, at least 12 months after the surgery.
- For canal wall down [CWD] cases, the recurrence of cholesteatoma was evaluated using otoendoscope and otomicroscope at 3, 6, 9, and 12 months after the surgery.

Statistical analysis: The data collected for the study were verified, coded, and analyzed using IBM-SPSS 21.0 software. Descriptive statistics such as mean, standard deviation, median, range, and percentage were calculated. The chi-square test was used to compare the distribution of frequencies among different groups, while the independent t-test was used to compare means for dichotomous data. The Man-Whitney U test was used to compare the median difference between groups that did not follow a normal distribution. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The age of patients who participated in the study ranged from 17 to 54 years, with a mean age of 32.48 ± 9.6 years. Group A had a mean age of 32.19 ± 9.75 years, with a range of 17-54 years, while Group B had a mean age of 32.77 ± 9.56 years, with a range of 18-49 years. There were 39 [45.3%] male patients and 47 [54.7%] female patients. The majority of the patients, 73 [84.88%], lived in rural areas, while only 13

[15.12%] lived in urban areas. Most patients in both groups had attic perforation [table 1].

The preoperative clinical assessment of hearing function showed that there were no significant differences [p >0.05] in the air-bone gap, bone conduction threshold, and air conduction threshold between the two surgical groups. However, postoperative assessment of hearing function revealed statistically significant differences [p = 0.025, 0.04, and 0.039, respectively] between the two groups, with the canal wall up [CWU] group showing better results. The air-bone gap, bone conduction threshold, and air conduction threshold were all significantly better in the CWU group [table 2].

Clinical assessment of hearing function of group [A] showed that air-bone gap and air conduction threshold were decreased post-operatively showed statistically significant difference [p= 0.000& 0.001 respectively], but bone conduction threshold increase post-operatively showed statistically insignificant difference [p= 0.35] in comparison between preoperative and postoperative pure tone audiometry [PTA]. Clinical assessment of hearing function of group [B] showed that air-bone gap and air conduction threshold were decreased postoperatively showed statistically significant difference [p= 0.002 and 0.003 respectively], but bone conduction threshold increase postoperatively showed statistically significant difference [p=0.04] in comparison between preoperative and postoperative PTA [table 3].

During the surgery, there were no significant differences between the two groups in terms of any abnormal findings [table 4].

Regarding hearing reconstruction, six cases [6.98%] had an intact ossicular chain and did not require reconstruction; four cases [9.3%] were in group A, and two patients [4.65%] were in group B [p = 0.68]. Forty-seven cases [54.7%] underwent partial ossicular replacement prosthesis [PORP]; 19 [44.2%] were in group A, and 28 [65.1%] were in group B, with a significant difference [p = 0.026]. Twenty-nine patients [33.7%] underwent total ossicular replacement prosthesis [TORP]; 16 [37.2%] were in group A, and 13 [30.2%] were in group B, with no significant difference [p = 0.48]. Four cases [4.65%] required incus interposition, all of which were in group A [9.3%], with no significant difference [p = 0.058]. There were no significant differences between the two groups regarding postoperative complications. [table 5].

Recidivism was less in group B [9.3%] than group A [20.9%], but with no statistically significant difference [p =0.11] [table 6].

Table [1]: Studied groups' Demographic and clinical data

Variables		Group [A] CWU [n=43]	Group [B] CWD [n=43]	Significance	
				Test	P
Age [years]	Range Mean ±SD	17 – 54 32.19 ± 9.75	18 – 49 32.77 ± 9.56	0.014	0.718
Gender	Males Females	22 [56.4%] 21 [44.7%]	17 [43.6%] 26 [55.3%]	0.137	0.181
Residence	Urban Rural	6 [13.95%] 37 [86.05%]	7 [16.28%] 36 [83.72%]	0.027	0.742
Clinical presentation	Otorrhea	43 [100%]	43 [100%]	0.000	1.000
	Hearing loss	43 [100%]	43 [100%]		1.000
	Tinnitus	7 [16.3%]	5 [11.6%]		0.534
	Otalgia	10 [23.3%]	11 [25.6%]		0.346
	Attic perforation Perforation only With granulation With polyp	31 [72.1%] 15 [43.3%] 9 [29.0%] 7 [22.6%]	28 [65.12%] 12 [27.9%] 10 [23.7%] 6 [21.4%]	0.486	0.486
	Posterior MP Perforation only With granulation With polyp	12 [27.9%] 5 [13%] 5 [13%] 2 [5%]	15 [34.9%] 8 [20%] 4 [10%] 3 [7%]	0.364	0.55

Table [2]: Preoperative and postoperative PTA of the two studied groups

Variables		Group [A] CWU [n=43]	Group [B] CWD [n=43]	Significance	
				Test	P
Preoperative PTA					
Air-bone gap	Range Mean ±SD	25 – 60 41.0 ± 9.37	20 – 60 43.0 ± 7.74	0.045	0.482
BC threshold	Range Mean ±SD	5 – 20 12.8 ± 3.5	5 – 20 12.2 ± 3.14	0.011	0.845
AC threshold	Range Mean ±SD	30 – 80 53.8 ± 11.8	25 – 80 55.2 ± 10.9	0.023	0.615
Postoperative PTA					
Air-bone gap	Range Mean ±SD	15 – 30 19.0 ± 2.92	20 – 40 27.0 ± 3.67	0.494	**0.025***
BC threshold	Range Mean ±SD	5 – 20 13.4 ± 2.34	5 – 40 14.4 ± 2.27	2.01	**0.04***
AC threshold	Range Mean ±SD	20 – 50 32.4 ± 5.26	25 – 65 41.4 ± 5.94	0.386	**0.039***

Table [3]: Comparison between pre- and post-operative PTA of studied groups

	Group A		Significance		Group B		Significance	
	Preoperative PTA	Postoperative PTA	Test	P	Preoperative PTA	Postoperative PTA	Test	P
Air-bone gap	41.0 ± 9.37	19.0 ± 2.92	4.67	**0.000***	43.0 ± 7.74	27.0 ± 3.67	2.925	**0.002***
BC threshold	12.8 ± 3.5	13.4 ± 2.34	0.93	0.35	12.2 ± 3.14	14.4 ± 2.27	2.01	**0.04***
AC threshold	53.8 ± 11.8	32.4 ± 5.26	1.25	**0.001***	55.2 ± 10.9	41.4 ± 5.94	2.832	**0.003***

Table [4]: Intraoperative findings of the two studied techniques

Outcome		Group [A] CWU [n=43]		Group [B] CWD [n=43]		Test of significance	
		No.	%	No.	%	χ^2/FET	P
Malleus	Normal Eroded	40 3	93.0 7.0	38 5	88.4 11.6	-	0.71
Incus	Normal Eroded	9 34	20.9 79.1	6 37	13.9 86.1	0.39	0.72
Stapes supra-structure	Normal Eroded	27 16	72.8 37.2	30 13	69.8 30.2	0.47	0.49
Facial nerve canal	Normal Dehiscent	28 15	65.1 34.9	32 11	74.4 25.6	0.88	0.34
Internal carotid artery	Normal Abnormal	43 0	100 0	43 0	100 0	-	-
Mastoid bone	Contracted Non-contracted	17 26	39.5 60.5	14 29	32.6 67.4	0.45	0.5
Jugular bulb	Normal High Dehiscent	39 3 1	90.7 6.98 2.33	42 1 0	97.7 2.33 0	0.82	0.36

Table [5]: Hearing reconstruction and Postoperative complications in the two studied groups

	Group [A] CWU [n=43]		Group [B] CWD [n=43]		Significance	
	No.	%	No.	%	χ^2/FET	P
Hearing reconstruction						
Intact ossicular chain	4	9.30	2	4.65	-	0.68
PORP	19	44.2	28	65.1	0.384	**0.026***
TORP	16	37.2	13	30.2	0.208	0.48
Incus interposition	4	9.30	0	0.00	-	0.058
Post-operative complications						
Auricular pericindritis	0	0.00	1	2.33	1	0.5
Facial nerve paresis	2	4.65	1	2.33	-	0.5
Otorrhea	2	4.65	3	6.98	-	0.5
Granulation tissue	2	4.65	3	6.98	-	0.5
External canal stenosis	0	0.00	1	2.33	-	0.5
Wound dehiscence	0	0.00	0	0.00	N/A	N/A
Post-auricular fistula	0	0.00	0	0.00	N/A	N/A
Post-auricular hematoma	0	0.00	0	0.00	N/A	N/A
Residual perforation	5	11.6	4	9.30	-	0.5
SNHL	0	0.00	1	2.33	-	0.5
Total	11	25.6	14	32.6	0.413	0.31

Table [6]: Recidivism in the two studied groups

	Group [A] CWU [n=43]		Group [B] CWD [n=43]		Significance	
	No.	**%**	**No.**	**%**	**χ^2/FET**	**P**
Residual or recurrence	9	20.9	4	9.3	-	0.11
No recurrence	34	79.1	39	90.7		

DISCUSSION

The main goal of surgery for cholesteatoma is to remove the squamous epithelium from the middle ear and mastoid cavity. However, it is also important to maintain satisfactory hearing and prevent the recurrence of cholesteatoma [4]. The study showed that the canal wall up [CWU] technique resulted in better hearing outcomes but had a higher recurrence rate compared to the canal wall down [CWD] technique in cases of cholesteatoma where the bone in the external auditory canal was not eroded by the disease. The condition of the middle ear mucosa and external auditory canal was found to be the most important factor affecting the outcomes of cholesteatoma surgery [7].

Canal wall down [CWD] techniques are preferred over canal wall up [CWU] techniques because they provide better visualization of the middle ear, enabling complete eradication of the disease. The majority of studies in the literature report a lower recurrence rate in CWD surgeries compared to the CWU technique [8, 9].

The age of the patients in the study ranged from 17 to 54 years, with a mean age of 32.48 ± 9.6 years. There were no statistically significant differences between the two groups in terms of age and sex. While distinguishing between pediatric and adult studies may seem subtle, it is still an important issue [10].

In the current study, clinical assessment of hearing function of group [A] showed that air-bone gap and air conduction threshold were decreased postoperatively showed statistically significant difference. Our study results are similar to those of **Walker *et al.*** [11], who performed mastoidectomy with canal wall reconstruction. They reported a recurrence rate of cholesteatoma in 34 out of 253 ears [13%] during second-look ossiculoplasty. Additionally, the preoperative air-bone gap [ABG] improved from 27.8 dB before surgery to 23.4 dB after surgery. Also, **Mobashir *et al.*** [12] reported an improvement in symptoms. They found that 73.3% of cases achieved a normal hearing level [0-20 dB] after having 100% hearing impairment before surgery [p=0.008].

Also similar to our study, **Bhat *et al.*** [6] found the average hearing gain in CWU mastoidectomy was better 18.36 dB than CWD mastoidectomy 11.03 dB with statistically

significant difference [ANOVA F-test: -3.43, p=0.001]. **Osborn *et al.* [13]** provided information on hearing outcomes for 320 patients. Of these, 255 underwent the canal wall up [CWU] procedure, while 65 underwent canal wall down [CWD] or revision CWD procedures. The mean and median follow-up times were 355 and 214 days, respectively, with a range of 39-1656 days. The mean and median pure-tone average [PTA] for CWD procedures were 46 dB and 51 dB, respectively, compared to 30 dB for CWU procedures [P < 0.001, Mann-Whitney test]. Of the CWU patients, 53.7% achieved a final PTA of less than 30 dB, while only 18.5% of the CWD patients achieved the same result [P < 0.001]. This means that a number needed to treat of 5 was required, indicating that five cases must undergo CWU surgery to achieve one additional case of normal hearing.

During the surgery, 16 cases of eroded stapes were found in group A, and 13 cases were found in group B. The stapes superstructure is known to be crucial for restoring hearing, and some authors have reported better hearing outcomes with partial ossicular replacement prosthesis [PORP] compared to total ossicular replacement prosthesis [TORP] [14, 15]. However, other authors have not found a significant effect of the stapes superstructure on postoperative hearing outcomes [16].

The study found that the best hearing outcomes were achieved with a canal wall up [CWU] procedure and an intact stapes, while a canal wall down [CWD] procedure with a missing stapes generally resulted in the least favorable hearing outcomes. Factors such as the condition of the middle ear mucosa or stapes superstructure had a greater impact on hearing outcomes than the presence of the canal wall. The absence of the stapes significantly worsened hearing outcomes in both the CWU and CWD cases. However, the study also found that the condition of the stapes alone did not fully account for the differences seen in hearing outcomes [13].

Hearing reconstruction was performed using various procedures in the current study. Partial ossicular replacement prosthesis [PORP] was found to be significantly more frequent in group B. In studies conducted by **Lasisi [17]** and **Bhat *et al.* [6]**, it was noted that the hearing benefits from canal wall down [CWD] procedures were minimal, and further hearing augmentation may be necessary with a second look surgery and ossiculoplasty, bone anchored hearing aid, or a hearing aid. These findings were consistent with the results of our study.

Ossiculoplasty is crucial for restoring hearing. In canal wall up [CWU] surgeries, posterior tympanotomy [PT] is often used to visualize the placement of the ossiculoplasty material, although this maneuver typically does not impact hearing outcomes [18]. In a study by **Karamert *et al.* [4]**, the hearing outcomes of CWU surgeries were better than those of canal wall down [CWD] surgeries. These findings suggest that hearing outcomes are related to the preservation of the external auditory canal.

There is some disagreement regarding the impact of different ossicular reconstruction materials on hearing outcomes, as similar hearing outcomes have been reported with different materials [19, 20]. However, some studies have reported better hearing outcomes with partial ossicular replacement prosthesis [PORP] compared to allograft reconstruction materials [21], or with titanium total ossicular replacement prosthesis [TORP] compared to autologous incus [22]. In the study by **Karamert *et al.* [4]**, no statistically significant difference was found between the various materials used for ossicular chain reconstruction and their impact on hearing outcomes.

In our study, two patients who underwent canal wall up [CWU] surgery and one patient who underwent canal wall down [CWD] surgery experienced iatrogenic facial nerve paresis, which was noticed the night after the surgery. The facial nerve was already exposed due to the pathology over it, and in some CWU patients, due to posterior tympanotomy. In the immediate post-operative period, the external auditory canal packs were removed, and intravenous steroids were administered. Patients were advised to perform facial exercises after 3 weeks of surgery. During follow-up, all patients fully recovered from facial nerve paresis.

In a study by **Alam and Chandra [23]**, three out of 56 patients who underwent canal wall down [CWD] tympanomastoidectomy experienced postoperative facial nerve paralysis. This was likely due to the facial canal being found to be dehiscent in some cases, as well as the presence of extensive pathology and granulations, which made it difficult to identify vital structures. The normal surgical landmarks were often distorted, increasing the risk of injuring the facial nerve,

especially during lowering of the facial ridge. In contrast, none of the patients who underwent canal wall up [CWU] tympanomastoidectomy experienced postoperative facial nerve paresis.

In our study, the recurrence rate of cholesteatoma was lower in group B [9.3%] than in group A [20.9%], although this difference was not statistically significant [p=0.11]. These results were consistent with the findings of **Azevedo *et al.*** [8], who reported that 57.9% of patients who underwent canal wall up [CWU] mastoidectomy required revision surgery, compared to only 15% of those who underwent canal wall down [CWD] mastoidectomy. They found higher recurrence rates in patients with cholesteatoma who underwent CWU mastoidectomy. Similar results were reported by **Wilkie *et al.*** [10], with disease recurrence rates of 7.3% and 16.3% in the CWD and CWU groups, respectively, and a statistically significant difference [p=0.02].

Meta-analyses of previous studies have reported a higher incidence of cholesteatoma recurrence in canal wall up [CWU] mastoidectomy compared to canal wall down [CWD] mastoidectomy [9, 24]. **Tomlin *et al.*** [24] reported that recurrence rates ranged from 9% to 70% [average 30%] in CWU mastoidectomy, while it ranged from 5% to 17% [average 8.5%] in CWD mastoidectomy.

Various factors can affect hearing outcomes after cholesteatoma surgery, including the condition of the middle ear mucosa [whether healthy or edematous], the depth of the middle ear, the ventilation of the middle ear, the presence of stapes superstructure, the surgical technique used, and the type of prosthesis used [25]. In the technique proposed by **Shewel and Abougabal** [26], they achieved good middle ear depth for proper ossiculoplasty in all patients during the primary surgery, which resulted in significant postoperative hearing improvement.

Conclusion: Both canal wall up [CWU] and canal wall down [CWD] mastoidectomy are alternative techniques for managing adult patients with acquired cholesteatoma. The CWU group tends to have better hearing improvement outcomes compared to the CWD group. However, the CWD group shows better outcomes in terms of cholesteatoma recidivism during early follow-up.

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