

Comparison of Middle Ear Cholesteatoma Recurrences after Canal Wall Down and Canal Wall Up Mastoidectomy Based on Diffusion-Weighted MRI

Dewi Gemala Wahab¹, Masyita Gaffar^{1,2,3}, Abdul Qadar Punagi^{1,2,3}, Andi Alfian Zainuddin⁴

1. Department of Otorhinolaryngology - Head and Neck Surgery, Faculty of Medicine Hasanuddin University, Makassar, Indonesia

2. Hospital of Hasanuddin University Makassar

3. Hospital Dr.Wahidin Sudirohusodo Makassar

4. Department of Public Health and Community Medicine, Faculty of Medicine Hasanuddin University, Makassar, Indonesia

Masyita Gaffar Orcid ID <https://orcid.org/0000-0002-0636-3334>

Qadar Punagi Orcid ID <https://orcid.org/0000-0002-8273-5849>

Andi Alfian Zainuddin Orcid ID <https://orcid.org/0000-0003-4436-3906>

Address for correspondence

Masyita Gaffar

Department of Otorhinolaryngology - Head and Neck Surgery, Hasanuddin University Teaching Hospital, Jl. Perintis Kemerdekaan Km 11 Makassar, South Sulawesi, Indonesia

(e-mail: sitagaffar@gmail.com).

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ABSTRACT

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Background: Middle ear cholesteatoma is a disease that is often recurs. However, the suspicion of recurrent cholesteatoma is still difficult to confirm based on the clinical picture in cases with granulation tissue; therefore magnetic resonance imaging diffusion-weighted imaging (MRI-DWI) examination is required. MRI-DWI have been used to identify such lesions.

Objective: To detect early recurrences of cholesteatoma in patients after canal wall down (CWD) and canal wall up (CWU) mastoidectomy based on MRI-DWI. **Methods:** This was a prospective cohort study of an observational analytical nature. Held at the ENT-HNS at two tertiary teaching hospitals, Hasanuddin University Hospital and Dr. Wahidin Sudirohusodo Hospital, from April 2023 to October 2023. The sample for this study was patients with chronic suppurative otitis media (CSOM) cholesteatoma who had undergone CWD or CWU mastoidectomy with symptoms of otorrhea, granulation, and extended healing wounds. Patients with contraindications to MRI-DWI examinations were excluded from this study. Each patient underwent otoendoscopy. Tuning fork tests and pure-tone audiometry were also performed. Then, an MRI-DWI examination was carried out on all study samples at least 6 months after the first mastoidectomy.

Results: Twenty patients were included in this study. The majority (12/20) of the patients were men. Ten patients underwent CWD, and 10 patients had undergone CWU. Recurrence occurred in 11 patients (55.0%). In post-CWD mastoidectomy patients, Only 40.0% experienced recurrence. Meanwhile, 70% of post-CWU patients, experienced recurrence, although this difference was not significant ($p=0.370$).

Conclusion: CWU mastoidectomy was associated with a higher risk of cholesteatoma recurrence. MRI DWI is an ideal methods to identify early recurrent middle ear cholesteatoma.

INTRODUCTION

Chronic suppurative otitis media (CSOM) is one of the most common ear diseases in developing countries, including Indonesia.¹ Cholesteatoma is a condition that must be treated with cessation. Epidemiological data shows that the incidence of cholesteatoma in the general population is 3.7-13.9 per 100,000 population.² It has been predicted that around more of the 20 million people worldwide suffer from otitis media, and one in four (about 5 million) have cholesteatoma.³

Recurrent cholesteatoma is the result of or re-formation after complete cessation, which must be differentiated from residual cholesteatoma which activates an unclean cholesteatoma in the previous surgery.⁴ Cholesteatoma has specific intensity characteristics on Magnetic Resonance Imaging (MRI) with very high intensity on Diffusion Weighted imaging (DWI).⁴

Currently, it is difficult to ascertain the presence of recurrence/residual disease in patients with post-operative cholesteatoma based on the clinical picture, particularly in cases that have minimal clinical symptoms or have not yet shown symptoms. A clinical picture in the form of recurrent or persistent otorrhea that does not heal after surgery and the appearance of granulation are the most frequently used indications for the presence of residual or recurrent cholesteatoma. Therefore, the aim of this study was to detect early recurrence of cholesteatoma in patients with unsafe sCSOM after canal wall down (CWD) and canal wall up (CWU) mastoidectomy based on DWI-MRI examination.

MATERIALS AND METHODS

The study was a prospective cohort study with an observational analytic nature. This research was conducted at a tertiary referral hospitals at Hasanuddin University Hospital and Dr. Wahidin Sudirohusodo Hospital between April 2023 and October 2023.

Recurrence of middle ear cholesteatoma was defined as cholesteatoma in a subsequent surgery in the same ear.

Patients

A total of 20 patients consisted of 10 post-CWD mastoidectomy and 10 post-CWU with symptoms/findings of otorrhea, granulation, and extended wound healing (April 2023 to October 2023) for clinical re-examination at least six months postoperatively. The inclusion criteria were CSOM with congenital or acquired cholesteatoma who had undergone CWD or CWU mastoidectomy with or without tympanoplasty within a period of ≥ 6 months. Patients with canal cholesteatoma and those with contraindications to MRI-DWI were excluded from the study.

Statistical Analysis

Fisher's exact test was performed. Patients post-CWD and CWU mastoidectomy with symptoms/findings of otorrhea, granulation, and unresolved wound healing were examined using DWI-MRI. All statistical analyses were performed using Fisher's test.

Test results are considered significant if the p value < 0.05 .

The present study was approved by the Ethics Commission for Biomedical Research on Humans, Faculty of Medicine, Hasanuddin University, with a letter of recommendation for ethical approval from the Health Research Ethics Commission (KEPK). RSPTN UH – RSWS, Number: 186/UN4.6.4.5.31/PP362023.

RESULTS

The 20 patients consisted of 10 post-CWD mastoidectomy samples and 10 post-CWU samples.

Table 1. Subject Characteristics

Variable	n	%
Gender		
Men	12	60.0%
Women	8	40.0%
Age		
	30.75" ±15.28	
Children (Ç,β18 years)	5	25.0%
Adult (>18 years)	15	75.0%
Mastoidectomy Type		
CWD	10	50.0%
CWU	10	50.0%
Recurrence Events		
Recurrence	11	55.0%
No Recurrence	9	45.0%
Symptoms		
Otorrhoea	20	100.0%
Hearing disorders	20	100.0%
Dizziness	0	0.0%
Clinical Manifestation		
Secret	20	100.0%
Secret+blood	7	35.0%
Granulation	13	65.0%
Keratin	12	60.0%
Total	20	100

Primary Data. 2023

As shown in Table 1, the subjects of this study were more men (12(60.0%)) than women (8(40.0%)). The adult age group (>18 years) was more numerous than that of the children (18 years). Ten subjects (50.0%) underwent CWD mastoidectomy and 10 (50.0%) underwent CWU mastoidectomy. Of the research participants who underwent mastoidectomy, 11 (55.0%) experienced recurrence, and 9 (45.0%) did not experience recurrence. All research participants had symptoms of otorrhoea (100.0%) and hearing disorders (100.0%). None of the subjects had dizziness (0.0%). Based on the clinical picture, all research subjects had a clinical picture of secretions (100.0%), 7 subjects (35.0%) had secretions and blood, 13 subjects (65.0%) had granulations, and 12 subjects (60.0%) had keratin.

Table 2. Comparison of cholesteatoma recurrence post-CWD mastoidectomy with CWU based on MRI diffusion weighted imaging (DWI) examination

Recurrence Rate	Mastoidectomy Type		p-value	OR
	CWD	CWU		
Recurrence	4 (40.0%)	7 (70.0%)	0.370*	0.286 (0.045-1.821)
No Recurrence	6 (60.0%)	3 (30.0%)		
Total	10 (100.0%)	10 (100.0%)		

Primary Data. 2023

*Fisher

As shown in Table 2, in patients who underwent post-CWD mastoidectomy, recurrence occurred in 4 subjects (40.0%) and non-recurrence in 6 subjects (60.0%). In patients who underwent post-mastoidectomy CWU, recurrence occurred in 7 subjects (70.0%) and non-recurrence in 3 subjects (30.0%). There was no significant difference between recurrence rates in post-mastoidectomy CWD and CWU patients (p=0.370).

Table 3. Recurrence Rates Based on Symptoms

Variable	Otorrhoea (+)	Hearing Disorder (+)	Dizziness (-)
Recurrence	11 (55.0%)	11 (55.0%)	11 (55.0%)
No Recurrence	9 (45.0%)	9 (45.0%)	9 (45.0%)

Primary Data. 2023

The recurrence rates based on the symptoms are presented in Table 3. Table 4 describes the recurrence rates based on the clinical features. Patients who experience recurrence, most often have a clinical picture of keratin. Patients who do not experience recurrence often have a clinical picture of discharge. This difference was statistically significant ($p=0.001$).

Table 4. Recurrence Rates Based on Clinical Features

Variable	Secret	Blood stained otorrhea	Granulation	Keratin	p-value
Recurrence	11 (55.0%)	6 (85.7%)	11 (84.6%)	11 (91.7%)	0.001*
No Recurrence	9 (45.0%)	1 (14.3%)	2 (15.4%)	1 (8.3%)	

Primary Data. 2023

*Kolmogorov-Smirnov

DISCUSSION

More men with cholesteatoma were include in this study. These results are in line with those of Alhazmi et al. (2023), who reported that more cholesteatoma sufferers were men (51.7%) than women (48.3%). The annual incidence of cholesteatoma is reported to be 3 per 100,000 in children and 9.2 per 100,000 in adults with a male predominance of 1.4:1.⁵ Based on the age of occurrence, cholesteatoma is estimated to occur more frequently in adults, but they tend to behave more aggressively and have the prognosis is worse in children.⁶ Cholesteatoma is a collection of keratinized squamous epithelium in the middle ear. There are two main types of middle ear cholesteatoma; congenital, which is found in children, and acquired, which is more often found in adults. Acquired cholesteatoma is the result of pathological changes that cause uncontrolled growth of squamous keratinized epithelium in the middle ear which is often associated with chronic otitis media causing the incidence to correlate with adult age. In addition, cholesteatoma causes hearing loss, which interferes with daily activities; therefore more adult patients seek treatment.⁷

Based on the results of this study, the recurrence rate was higher in post-CWU mastoidectomy patients than in post-CWD mastoidectomy patients. Although based on statistical calculations, there was no significant difference between the recurrence rates in post-mastoidectomy CWD and CWU sufferers with a value of $p=0.370$, which is supported by the latest literature analysis by Piras et al. (2021), who found that CWU had a mean residual disease or recurrence rate of about 15% (range 3.8%-21%), whereas CWD had a mean residual disease and recurring cholesteatoma rate of 6.5% (range 0%-11.4%) and 5.1% (range 0%-18.4%), respectively. These findings indicate that a phased approach for treating cholesteatoma is not always more effective in lowering recurrence rates.⁹⁽⁸⁾ CWD remains the most effective technique for cholesteatoma therapy, with residual and recurrence rates of 5%.⁹

The distribution of clinical symptoms based on sex and age in our study showed constant values, where all research subjects, both children and adults, men and women, had complaints of otorrhea (100.0%) and hearing loss (100.0%). This shows that the main complaints of research subjects who checked themselves at health facilities were the same for both those with recurrent and non-recurrent cholesteatoma. A study by Yehudai et al. (2015) of 124 subjects found a significant relationship between the presence of cholesteatoma and the degree of sensorineural hearing loss, in which large cholesteatoma interferes with sound transmission by filling the middle ear space with desquamated epithelium, with or without mucopurulent secretions. Bone damage also often occurs and can cause or increase conductive hearing loss.¹⁰ In addition, research conducted by Dongol et al (2021) showed that 66.67% of their research subjects complained of otorrhea, either with or without other complaints such as otalgia, hearing loss and paralysis. face.¹¹

In a recent study, the distribution of clinical symptoms in all ages and sex was 100% for otorrhea, 35% for bloody discharge, 65% for granulation, and 60% for keratin. These results did not show significant differences in clinical features based on either age or sex. However, in this study, the clinical picture in the form of granulation was the second most common clinical picture after otorrhea, both in patients with and without recurrent cholesteatoma. This is in line with research by Ghanie et al. (2017), where there were 103 (40.87%) cholesteatoma patients with granulation tissue and 42 (16.67%) with granulation tissue without cholesteatoma.¹²

Meanwhile, the recurrence rate based on the clinical picture showed a significant number ($p=0.001$), where subjects who had a clinical picture of keratin experienced more recurrence than those with other clinical pictures. These results are supported by epidemiological data which has been associated with microtrauma and smoking, especially in male subjects, which causes microangiopathy in the ear canal and causes keratin deposition due to poor blood supply.¹¹ Other clinical features are also supported by several other studies such as Yehudai et al. (2015) who on physical examination found that the most common signs of cholesteatoma formation were the ear canal containing mucoid drainage and granulation tissue in the ear canal and middle ear space.¹⁰ Meanwhile, in the research of Guo et al. (2023), as many as 53 patients (62%) experienced at least one outpatient irrigation treatment with ear secretions after previous cholesteatoma treatment which may be related to the accumulation of secretions on the surface of keratinocytes in some patients with cholesteatoma.¹³ As for the study of Linghui Luo et al (2002) who observed 15 cases of cholesteatoma, all 15 cases had a long-term history of otitis media such as otorrhea and eardrum perforation where bleeding otorrhea was found in 8 cases (53.3%).¹⁴

Limitations of the study

The major limitation of the study was a size of population was small.

CONCLUSION

There were differences in the recurrence rate of middle ear cholesteatoma between patients who underwent CWD and CWU mastoidectomy. CWU mastoidectomy was associated with a higher risk of cholesteatoma recurrence. One of the standard methods for the identification of early recurrent middle ear cholesteatoma is MRI-DWI. Therefore, in cases of suspected recurrent cholesteatoma, MRI-DWI should be performed before a second or revision surgery.

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