Non-Sac Contained Matrix is the Strongest Predictive Factor for Residual Disease in Acquired Cholesteatoma

HealthPartners

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ABSTRACT

Introduction: The objective of this study was to investigate predictive factors for residual disease in acquired cholesteatoma and determine whether the quality of the matrix, sac versus non-sac contained, impacts the outcomes.

Methods: A retrospective cohort study of pediatric and adult EAONO-JOS-staged acquired cholesteatoma operated with endoscopic and combined approaches by the senior author at an academic teaching hospital from January 2015 to November 2023. Presence of residual disease was determined through second look surgery, MRI with DWI, or a minimum of one year follow-up after canal wall down mastoidectomy. Initial occurrence of residual disease was examined relative to age, sac versus non-sac contained matrix, ossicular status and surgical approaches using Cox proportional hazard models. Kaplan-Meier curves were used to visualize time to disease stratified by predictive factors.

Results: Out of 105 ears included, 42% had residual disease. In isolation, non-sac contained cholesteatoma (HR 3.89, 95%CI 1.53-9.89), pediatric patients (HR 1.97, 95%CI 1.01-3.85), incus erosion (HR 2.43, 95%CI 1.17-5.05), and stapes erosion (HR 2.01, 95%CI 1.02-4.00) were significantly more likely to develop residual disease. EAONO/JOS stage and surgical approach were not significantly related. In multivariable modeling, only matrix quality retained significance, with non-sac contained matrix associated with a threefold higher hazard of residual disease (HR 3.05, 95%CI 1.17-7.93).

Conclusion: When accounting for several factors inherent to the disease process as well as surgical approach, a non-sac contained cholesteatoma matrix was three times more likely to lead to residual disease in acquired cholesteatoma among all ages.

INTRODUCTION

- Eradication of cholesteatoma remains a major surgical challenge
- It is essential to differentiate residual vs. recurrent rates when reporting surgical outcomes
- Anatomical subsites, type of cholesteatoma, surgical technique, and ossicular chain status are primary factors affecting the rate of residual disease[1-4]
- Infiltrative matrix quality may complicate a complete removal of cholesteatoma
- Primary objective: identify whether cholesteatoma matrix quality is a major predictive value in determining the likelihood of residual disease
- Secondary objective: determine whether stapes erosion is a secondary predictive variable for residual disease

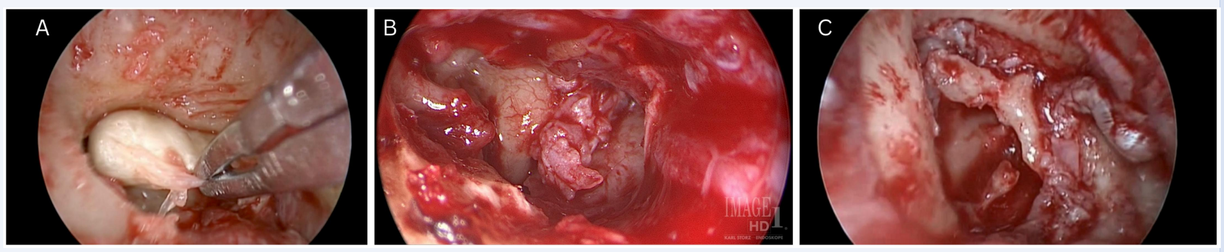

Figure 1. Examples of cholesteatoma matrix quality. (A) Sac contained cholesteatoma. (B) Non-sac contained cholesteatomas possessing non-adherent loose sheets. (C) Infiltrative epithelium adherent onto epitympanic wall.

METHODS

- Approved by the IRB at HealthPartners in Bloomington, MN (#22-232)
- Retrospective chart review
- Operated ears of all ages that underwent primary resection for primary or secondary acquired cholesteatoma from 01/01/2015-11/30/2023
- Follow up with second look surgery, MRI with DWI, or a minimum of one-year clinical examination after canal wall down (CWD) mastoidectomy
- Exclusion: congenital cholesteatomas or insufficient follow-up
- Cholesteatoma was staged according to the EAONO/JOS classification and assessed for ossicular chain erosion and/or surgeon-mediated removal
- Matrix quality was classified as sac contained versus non-sac contained
- Statistical analyses were performed using R software
- Time to residual disease was analyzed relative to key variables using univariable and multivariable Cox proportional hazard models
- Model fit was compared between models with and without matrix quality as independent variable

RESULTS

- 105 operated ears included, 53% were male, and 81% were adults, median age of 42 years (IQR 23, 60)
- EAONO/JOS stages I (18%), II (65%), and III (17%)
- Subsites: attic (77%), tympanic cavity (74%), mastoid antrum and air cells (51%), supratubal recess (S1) (11%), sinus tympani (S2) (30%)
- Ossicular chain erosion 67% of ears; incus erosion being most frequent at 64%
- Non-sac contained 71%; of these: infiltrative 73%, loose sheets 27%
- 42% had residual disease

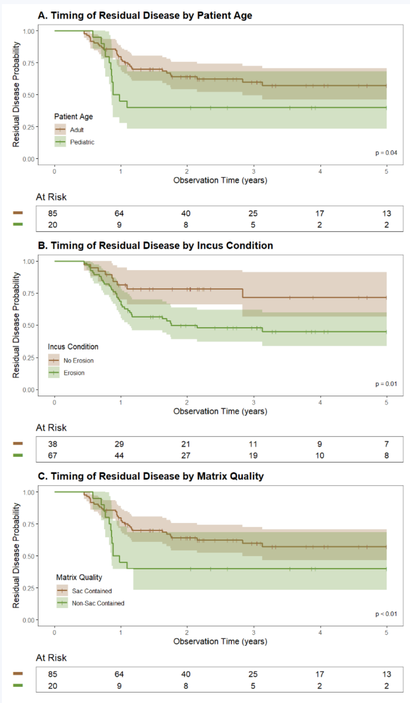

Figure 2. Kaplan-Meier curves for residual disease stratified by (A) patient age, (B) incus condition, and (C) matrix quality.

	(A) Unadjusted/Univariable Each Variable Alone			(B) Adjusted/Multivariable Only significant ones excluding Matrix Quality			(C) Adjusted/Multivariable Only significant ones with Matrix Quality		
	HR	95% CI	p-value	HR	95% CI	p-value	HR	95% CI	p-value
Patient Age									
Adult	—	—		—	—		—	—	
Pediatric	1.97	1.01, 3.85	0.046	1.96	0.98, 3.90	0.055	1.82	0.91, 3.64	0.09
EAONO Stage									
I	—	—		—	—		—	—	
II	2.76	0.98, 7.79	0.056	2.08	0.72, 5.99	0.18	1.61	0.55, 4.69	0.39
III	2.31	0.68, 7.91	0.18	2.6	0.75, 9.00	0.13	1.94	0.55, 6.82	0.3
Incus Erosion									
No	—	—		—	—		—	—	
Yes	2.43	1.17, 5.05	0.018	2.19	1.03, 4.64	0.041	1.91	0.90, 4.05	0.093
Stapes Erosion									
No	—	—		—	—		—	—	
Yes	2.01	1.02, 4.00	0.045	1.54	0.75, 3.14	0.24	1.62	0.79, 3.34	0.19
Matrix Quality									
Sac Contained	—	—					—		
Non-Sac Contained	3.89	1.53, 9.89	0.004				3.05	1.17, 7.93	0.022

Table 1. Univariable (A) and multivariable analyses without (B) and with (C) matrix quality assess the hazard ratio (HR) for residual disease. $p<0.05$ is considered significant.

CONCLUSION

- Non-sac contained cholesteatoma had a threefold greater hazard of developing residual disease
- In isolation, incus erosion was 2.4-times more likely to be associated with residual disease
- There was no association between EAONO/JOS stage and residual disease

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