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Patterns of middle-ear cholesteatoma and implications for surgical approach

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Abstract

Objectives. Understanding the pattern of middle-ear cholesteatoma becomes pertinent with the rise of endoscopic surgery as surgeons decide on the optimal approach to visualise and extirpate disease. With modifications to the Telmesani attic–tympanum–mastoid staging system, this study aimed to evaluate the commonest patterns of middle-ear cholesteatoma and their implications for surgical approach.

Methods. A retrospective study was conducted in a single tertiary institution in Singapore. All patients undergoing cholesteatoma surgery between January 2012 and June 2015 were included. Staging of cholesteatoma was based on clinical assessment corroborated by radiological findings.

Results. Out of the 55 ears included, 98.2 per cent had cholesteatoma involving the attic. The disease extended into the mastoid antrum and beyond in 43 cases (78.2 per cent). The facial recess and/or sinus tympanum was affected in 26 cases (47.3 per cent).

Conclusion. The majority of cholesteatoma cases present with extensive attic disease and significant mastoid involvement. In these cases, endoscopes may be best suited to adjunctive rather than exclusive use in surgery.

Introduction

Understanding the pattern of involvement of middle-ear cholesteatoma is important for achieving the primary goal of cholesteatoma surgery; namely, the complete eradication of disease, and creation of a safe and dry ear. Jackler[1] was the first to describe the typical routes of cholesteatoma growth based on anatomical boundaries and middle-ear space compartments. Tos and Lau[2] demonstrated considerable differences in the extent of cholesteatoma depending on its site of origin.

In recent years, with the rise of endoscopic ear surgery, this subject has become even more pertinent. Surgeons have to decide between the use of a microscopic, endoscopic or combined approach to visualise and extirpate middle-ear cholesteatoma. The current literature suggests that the conventional microscopic approach is well suited to areas such as the mastoid,[3–5] whereas endoscopy allows for better visualisation of areas such as the sinus tympani and facial recess,[3] reducing the rate of residual disease.[6–8] A combined approach may achieve the best of both worlds, but may not always be necessary when there is limited disease. The choice of surgical approach should be individualised depending on the involvement and extent of middle-ear cholesteatoma in different patients.

Previous studies, such as those by Jackler,[1] Tos and Lau,[2] Maresh *et al.*[9] and Rosito *et al.*,[10] have investigated the pattern of cholesteatoma involvement and/or have classified growth patterns. However, these studies did not separately grade the extent of attic, tympanum, mastoid, or sinus tympani or facial recess involvement. This information is critical in selecting between microscopic, endoscopic and combined approaches for surgical extirpation.

With modifications to the attic–tympanum–mastoid ('ATM') classification system proposed by Telmesani *et al.*,[11] this study aimed to evaluate the commonest patterns of middle-ear cholesteatoma involvement. This knowledge will aid in the selection of the optimal surgical approach for surgical extirpation of cholesteatomas.

Materials and methods

All patients undergoing surgery for cholesteatoma at a single tertiary institution between January 2012 and June 2015 were included in this study, after obtaining approval from the SingHealth Institutional Review Board. Medical records were reviewed retrospectively, and data including patient demographics, clinical history, examination findings, surgical records and computed tomography (CT) temporal bone scan findings were collected.

All patients scheduled to undergo cholesteatoma surgery routinely have a CT temporal bone scan performed pre-operatively. This is a high-resolution, multi-detector CT temporal bone scan, at 0.625 mm collimation with 50 per cent overlap, reconstructed at 0.3 mm increments in the axial plane. Images were read and reported by a radiologist with a subspecialty in head and neck imaging. Intra-operative microscopic evaluation of the extent of cholesteatoma and presence of complications was conducted by the senior author, who was the primary surgeon performing the operation in all cases.

Main Article

Dr H W Yuen takes responsibility for the integrity of the content of the paper

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Table 1. Staging of cholesteatoma

Grade	Site of disease*		
	Attic (A)	Tympanum (T)†	Mastoid (M)
0	No attic involvement with cholesteatoma	No mesotympanum involvement	No mastoid involvement
1	Cholesteatoma restricted to posterior attic (posterior to malleus head)	Only posterior mesotympanum is affected	Cholesteatoma only reaches antrum
2	Cholesteatoma only in anterior attic	Only anterior mesotympanum (anterior to malleus handle) is affected	Cholesteatoma extends beyond antrum
3	Cholesteatoma affecting anterior or posterior attic, & extending in opposite direction beyond malleus head	Cholesteatoma is anterior & posterior to malleus handle	Cholesteatoma affects whole mastoid cavity

Complications to be considered in grading include: ossicular erosion ('OE'), defined as the erosion of one or more ossicles (malleus, incus or stapes) in the middle ear, with ossicular discontinuity; dehiscence of tegmen tympani ('DTT'), defined as complete bony erosion that allows communication between the middle ear and the cranial fossa; lateral semicircular canal fistula ('LSCF'), defined as complete erosion of the bony labyrinth, exposing the inner membrane of the lateral semicircular canal; round or oval window involvement ('WI'), defined as disease involvement immediately adjacent to the windows; and automastoidectomy ('AM'). *According to the Telmesani attic–tympanum–mastoid staging system. †The abbreviation 'S' in grading denotes facial recess and/or sinus tympani involvement.

Where the disease, especially in the sinus tympani, was assessed to be beyond the field of view with the microscope despite maximal safe surgical exposure, the endoscope was used to inspect the middle-ear cavity, and, when necessary, disease was removed endoscopically.

Staging of cholesteatoma was determined clinically and corroborated with the radiological findings based primarily on the grading system proposed by Telmesani *et al.*[11] Specifically, cholesteatoma sites were divided into attic (A), tympanic cavity (T) and mastoid (M), with specific identification of the facial recess and/or sinus tympani extension (S). Each site was given a grade of 0–3 reflecting progressive involvement (Table 1).

Telmesani and colleagues' classification system,[11] proposed in 2009, was meant to be used on the pre-operative CT temporal bone scans of patients scheduled for cholesteatoma surgery. Hence, variables such as the presence of ossicular erosion and inner-ear involvement were not included in the classification system, as the CT temporal bone scans at that time did not afford a high enough resolution (2 mm cuts) to determine this with sufficient accuracy. As such, for the purpose of the current study, we added more variables to Telmesani's classification system, so as to more thoroughly define the extent of cholesteatoma. In addition to the variables in Telmesani's classification system, the presence of an automastoidectomy cavity, ossicular erosion, tegmen tympani dehiscence, a lateral semicircular canal fistula, and round or oval window involvement were also noted. This is summarised in Table 1.

Cholesteatoma surgery aims to produce a safe cavity for easy surveillance. Two main types of surgery were performed during this period: modified radical mastoidectomy with meatoplasty, and atticotomy or atticoantrostomy with meatoplasty.

The patients were followed up regularly for a period of at least one year. Any suspicion of residual disease was recorded. Residual cholesteatoma is defined as a collection of squamous epithelium found in the middle ear or mastoid cavity likely due to incomplete local resection of pathological squamous epithelium at the time of surgery.[12] Recurrent cholesteatoma is defined as development of a new cholesteatoma in a newly formed retraction pocket.[12]

Results

A total of 53 patients (55 ears) underwent surgery for cholesteatoma. The diagnosis of cholesteatoma was made clinically, supported by radiological findings on CT temporal bone scans, and further confirmed by intra-operative findings and histology.

Out of the 53 patients studied, 10 had bilateral middle-ear cholesteatoma; however, only 2 patients with bilateral disease had both ears included in the study, as both ears were operated on at the study institution within the 3.5-year study duration. There were 31 left ears and 24 right ears.

Of the ears included, 31 belonged to males (56.4 per cent) and 24 to females (43.6 per cent). Patient ages ranged from 15 to 90 years, with a mean (standard deviation) of 45.8 (18.4) years. The patients presented with otorrhoea (67.9 per cent), hearing loss (41.5 per cent), otalgia (26.4 per cent), vertigo (7.5 per cent) and tinnitus (3.8 per cent).

As shown in Table 2, the majority of cases had cholesteatoma involving the attic (98.2 per cent). The cholesteatoma extended to the facial recess and/or sinus tympanum in 26 cases (47.3 per cent). The disease extended into the mastoid antrum and beyond in 43 cases (78.9 per cent).

Ten cases (18.2 per cent) had an automastoidectomy cavity. In 46 cases (83.6 per cent), the ossicular chain demonstrated signs of erosion. Dehiscence of the tegmen tympani was observed in 11 cases (20 per cent). There were eight cases (14.5 per cent) with lateral semicircular canal fistula. Three cases (5.5 per cent) had disease involvement of the round and/or oval windows. Only in one case was surgery conducted with the aid of an endoscope for visualisation of the cholesteatoma sac, which was extending into the sinus tympani.

One case (1.8 per cent) had a significant complication, with bleeding from the meatoplasty wound. Out of the 55 cases, 43 (78.2 per cent) were on regular follow up for more than one year. The mean duration of follow up was 42.2 months (range, 0–82 months). Three patients were only followed up for less than one month, as they did not reside in Singapore. Only one patient had recurrent disease, which was detected 22 months after initial surgery; this required revision surgery for squames medial to a mastoid cavity scar band that was obliterating the antrum and sinodural angle. None of the other patients had residual or recurrent disease at the last follow-up visit.

Discussion

Grading the extent of cholesteatoma serves to provide a common criterion for the comparison of surgical outcomes and prognosis among surgeons. It is also an important decision-making tool for determining the best surgical approach for

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Table 2. Summary of results

Parameter	Cases (*n* (%))*
Gender	
– Female	24 (43.6)
– Male	31 (56.4)
Age (years)	
– 10–20	4 (7.3)
– 21–30	9 (16.4)
– 31–40	9 (16.4)
– 41–50	15 (27.3)
– 51–60	6 (10.9)
– 61–70	4 (7.3)
– 71–80	6 (10.9)
– 81–90	2 (3.6)
Disease site – attic (A)	
– Grade 0	1 (1.8)
– Grade 1	7 (12.7)
– Grade 2	2 (3.6)
– Grade 3	45 (81.8)
Disease site – tympanum (T)	
– Grade 0	19 (34.5)
– Grade 1	12 (21.8)
– Grade 2	2 (3.6)
– Grade 3	22 (40)
Disease site – facial recess &/or sinus tympani involvement (S)?	
– Yes	26 (47.3)
– No	29 (52.7)
Disease site – mastoid (M)	
– Grade 0	12 (21.8)
– Grade 1	11 (20)
– Grade 2	21 (38.2)
– Grade 3	11 (20)
Disease complications	
– Ossicular chain erosion	46 (83.6)
– Dehiscence of tegmen tympani	11 (20)
– Lateral semicircular canal fistula	8 (14.5)
– Round &/or oval window involvement	3 (5.5)
– Automastoidectomy	10 (18.2)

*Total of 55 ears (53 patients)

extirpation of disease, especially given the rise of endoscopic ear surgery.

Although various studies have classified middle-ear cholesteatomas, none has individually graded the extent of involvement in the attic, tympanum and mastoid. Rosito *et al.*[10] studied growth patterns of cholesteatoma, and found that the majority of cholesteatomas originated in the posterior epitympanum (34.3 per cent) or posterior mesotympanum (33.8 per cent). A smaller number involved: both the epitympanum and mesotympanum (13.8 per cent), the attic only (1.9 per cent), or were undetermined (16.2 per cent) because of extensive disease involvement. Another study, by Black and Gutteridge,[13] yielded similar results to those of Rosito *et al.*[10] However, neither study graded the extent of middle ear involvement, and only classified cholesteatomas according to region of origin.

Similar to our study, Saleh and Mills[14] classified cholesteatomas based on extent of involvement. The study staged cholesteatomas based on the region of origin (attic or pars tensa) as well as number of contiguous areas involved. However, the study did not individually grade the extent of involvement of each area, nor did it quantify the number of cases in which the sinus tympani was involved. This information is relevant as more extensive mastoid involvement may render the endoscopic approach inadequate,[7,15,16] and presence of disease in the sinus tympani may make the use of endoscopes helpful.

One of the main strengths of endoscopic ear surgery is the improved visualisation of, and ability to remove disease from, hidden areas in the middle ear, especially the sinus tympani, facial recess and anterior epitympanum.[3] The use of an endoscope and its round-the-corner vision reduces the incidence of residual cholesteatoma by improving visualisation of remnant disease, especially in the sinus tympani, which could otherwise be overlooked when using the microscope alone.[6,15,17–19] Our study found that cholesteatoma was present in the facial recess and/or sinus tympani in 47.3 per cent of cases. This is similar to the findings of Yung,[15] who found that 41.1 per cent of patients had cholesteatoma in the sinus tympani. Hence, the use of endoscopes as an adjunct to the operating microscope in cholesteatoma removal could potentially benefit a substantial number of patients.

Further to that, some authors have advocated the exclusive use of endoscopes in cholesteatoma surgery, even in some cases with disease involving the mastoid.[20] However, most authors suggest careful selection of patients for the endoscopic-only approach. Tarabichi[16] first described endoscopic accessibility for disease that does not extend beyond the level of the lateral semicircular canal posteriorly. Other authors generally exclude cases with mastoid extension of disease from an exclusively endoscopic approach.[7,21]

Marchioni *et al.*[22] used the Telmesani classification for cholesteatoma staging in a paediatric population. They found a significant correlation between the A2 and A3 stages (more extensive attic disease) and recurrence, with the A3 stage resulting in a statistically significant higher risk than A1 and A2 stages for antral and mastoid recurrence. However, Marchioni and colleagues' paper did not show a statistically significant difference between the exclusively transcanal endoscopic approach and the microscopic canal wall up approach.

Migirov *et al.*[23] and Glikson *et al.*[7] performed an exclusively transcanal endoscopic approach on patients with cholesteatoma not extending beyond the lateral semicircular canal. Migirov and colleagues' study showed no residual disease in all 18 patients who were followed up for more than one year. Glikson and colleagues' study showed overall residual and recurrence rates of 10 per cent and 8.3 per cent, respectively, for a patient cohort of 60 patients with a mean follow-up duration of 35 months. Magliulo and Iannella[21] compared primary exclusive endoscopic surgery and a conventional approach in a group of patients with cholesteatoma limited to the attic, and found no difference in surgical outcomes. The good outcomes could be possibly attributed to the exclusion of all patients with mesotympanic or mastoid extension of disease. This highlights the importance of careful selection of patients with limited disease for the success of an endoscopic-only approach.

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The patients in our study presented with middle-ear cholesteatoma that was extensive: 85.4 per cent of cases had disease that extended beyond the posterior attic (A1/A3), 43.6 per cent had disease that extended beyond the posterior mesotympanum (T1/T3), and 58.2 per cent had disease that extended beyond the mastoid antrum (M2/M3). As discussed above, particularly when cholesteatoma extends beyond the antrum into the mastoid cavity, there is poor visualisation with a transcanal endoscopic approach, and a microscopic or combined approach is usually more ideal.[7] Moreover, there is limited evidence on the exclusive use of an endoscopic approach in cholesteatoma cases with complications, other than ossicular reconstruction cases. Preliminary results for ossicular reconstruction with an exclusively transcanal endoscopic approach are promising,[16,23] but more studies comparing the microscopic and endoscopic approaches are needed. Fifteen cases with disease that did not extend beyond the antrum also did not have complications of tegmen dehiscence and/or lateral semicircular canal fistula; thus, only 27.3 per cent of cases could have potentially benefitted from a transcanal endoscopic approach.

Our population has relatively good access to healthcare, with a doctor-to-population ratio of 1:420,[24] and our centre provides both secondary and tertiary healthcare. Nonetheless, most patients in our study have advanced cholesteatomas, and therefore may not be suitable candidates for surgery utilising an endoscopic-only approach. We did not use an endoscopic-only approach for any patient, and only in one case was an endoscope needed for better visualisation of the disease. For more limited cholesteatomas, we perform atticotomy, and may reconstruct the canal wall afterwards. Intact canal wall mastoidectomy was not performed because of the advanced disease presentation. In addition, our patient population tends to be resistant to second-look procedures, opting for definitive procedures instead. It is important to understand common cholesteatoma disease patterns in our patients as certain surgical approaches may increase cholesteatoma recurrence rates.

- The pattern of middle-ear cholesteatoma affects the choice of surgical approach since the advent of endoscopic ear surgery
- Using a modified Telmesani staging system, 55 ears with cholesteatoma were assessed; 98.2 per cent involved the attic
- Cholesteatoma extended to the facial recess and/or sinus tympanum in 26 cases, and into the mastoid antrum and beyond in 43
- Ten cases had an automastoidectomy cavity, 46 had ossicular chain erosion signs, 11 had tegmen tympani dehiscence
- Eight cases had lateral semicircular canal fistula, and three had disease involvement of the round and/or oval windows
- Most cholesteatomas present with extensive attic disease and mastoid involvement; endoscopes may be best suited to adjunctive rather than exclusive use in surgery

Although there have been a few proposed classifications of cholesteatoma, there is a lack of literature comparing surgical outcomes, likely because of fundamental disagreements within the international otology community regarding a common classification system.[25] The Tos and Lau[2] classification (1989) helped us understand the site of origin of cholesteatoma and its common paths of spread, but it is limited in clinical use as it is often difficult to determine the origin of disease in advanced disease cases.[10] Saleh and Mills[14] devised a staging system with the Tos classification as the basis, by categorising the extent of disease, ossicular damage and complications based on intra-operative findings. However, correlation with pre-operative CT findings was not performed. The attic–tympanum–mastoid system proposed by Telmesani *et al.*[11] and the tympanum–mastoid–complications ('TMC') system put forward by Belal *et al.*[26] both classified cholesteatoma based on disease extent, and demonstrated a high correlation between clinico-radiological findings and intra-operative findings. Our study mainly adopted the Telmesani classification system, with modifications, as it is simple and practical, involving separate evaluation of the different middle-ear parts.

To the best of our knowledge, this is the first study to evaluate the patterns of middle-ear cholesteatoma in an adult population using the existing Telmesani classification. Although retrospective in nature, a single surgeon evaluated all the patients' disease, with findings corroborated by CT reports from a specialised head and neck radiologist. This study did not aim to compare the surgical outcomes of the endoscopic and microscopic approaches, and correlate the findings with different disease extent. Instead, our study highlights the importance of implementing a classification system for the evaluation of disease extent for future meaningful comparison of surgical outcomes.

Conclusion

Our study indicates that the majority of cholesteatoma patients present with extensive attic disease and disease significantly involving the mastoid cavity. In these cases, endoscopes may be best suited to adjunctive rather than exclusive use in cholesteatoma surgery. It is crucial to review the extent and pattern of cholesteatoma involvement in order to select the best approach for surgical extirpation, as using the endoscopic-only approach in extensive disease has been shown to increase recurrence rates. While the endoscopic wider field of view does afford better visualisation of the various recesses in the middle-ear cavity, it is important to be flexible, in order to capitalise and fully optimise the advantages both of endoscopic and microscopic approaches in cholesteatoma surgery.

Competing interests. None declared

References

1 Jackler RK. The surgical anatomy of cholesteatoma. *Otolaryngol Clin North Am* 1989;**22**:883–96
2 Tos M, Lau T. Late results of surgery in different cholesteatoma types. *ORL J Otorhinolaryngol Relat Spec* 1989;**51**:33–49
3 Bennett ML, Zhang D, Labadie RF, Noble JH. Comparison of middle ear visualization with endoscopy and microscopy. *Otol Neurotol* 2016;**37**:362–6
4 Preyer S. Endoscopic ear surgery – a complement to microscopic ear surgery. *HNO* 2017;**65**(suppl 1):29–34
5 Nogueira JF, Cohen MS. Combined endoscopic and microscopic approaches to cholesteatoma. *Oper Tech Otolaryngol Head Neck Surg* 2017;**28**:36–8
6 Ayache S, Tramier B, Strunski V. Otoendoscopy in cholesteatoma surgery of the middle ear: what benefits can be expected? *Otol Neurotol* 2008;**29**:1085–90
7 Glikson E, Yousovich R, Mansour J, Wolf M, Migirov L, Shapira Y. Transcanal endoscopic ear surgery for middle ear cholesteatoma. *Otol Neurotol* 2017;**38**:e41–5
8 Presutti L, Gioacchini FM, Alicandri-Ciufelli M, Villari D, Marchioni D. Results of endoscopic middle ear surgery for cholesteatoma treatment: a systematic review. *Acta Otorhinolaryngol Ital* 2014;**34**:153–7
9 Maresh A, Martins OF, Victor JD, Selesnick SH. Using surgical observations of ossicular erosion patterns to characterize cholesteatoma growth. *Otol Neurotol* 2011;**32**:1239–42

https://doi.org/10.1017/S0022215120000109 Published online by Cambridge University Press

10 Rosito LS, Netto LFS, Teixeira AR, da Costa SS. Classification of cholesteatoma according to growth patterns. *JAMA Otolaryngol Head Neck Surg* 2016;**142**:168–72
11 Telmesani L, Sayed H, Bahrani N. Proposed clinical classification of cholesteatoma. *Egypt J Ear Nose Throat Allied Sci* 2009;**10**:50–3
12 Rutkowska J, Ozgirgin N, Olszewska E. Cholesteatoma definition and classification: a literature review. *J Int Adv Otol* 2017;**13**:266–71
13 Black B, Gutteridge I. Acquired cholesteatoma: classification and outcomes. *Otol Neurotol* 2011;**32**:992–5
14 Saleh HA, Mills RP. Classification and staging of cholesteatoma. *Clin Otolaryngol Allied Sci* 1999;**24**:355–9
15 Yung MW. The use of middle ear endoscopy: has residual cholesteatoma been eliminated? *J Laryngol Otol* 2001;**115**:958–61
16 Tarabichi M. Endoscopic management of limited attic cholesteatoma. *Laryngoscope* 2004;**114**:1157–62
17 Badr-el-Dine M. Value of ear endoscopy in cholesteatoma surgery. *Otol Neurotol* 2002;**23**:631–5
18 Sajjadi H. Endoscopic middle ear and mastoid surgery for cholesteatoma. *Iran J Otorhinolaryngol* 2013;**25**:63–70
19 EL-Meselaty K, Badr-El-Dine M, Mandour M, Mourad M, Darweesh R. Endoscope affects decision making in cholesteatoma surgery. *Otolaryngol Head Neck Surg* 2003;**129**:490–6
20 Marchioni D, Villari D, Alicandri-Ciufelli M, Piccinini A, Presutti L. Endoscopic open technique in patients with middle ear cholesteatoma. *Eur Arch Otorhinolaryngol* 2011;**268**:1557–63
21 Magliulo G, Iannella G. Endoscopic versus microscopic approach in attic cholesteatoma surgery. *Am J Otolaryngol Head Neck Med Surg* 2018;**39**:25–30
22 Marchioni D, Soloperto D, Rubini A, Villari D, Genovese E, Artioli F *et al.* Endoscopic exclusive transcanal approach to the tympanic cavity cholesteatoma in pediatric patients: our experience. *Int J Pediatr Otorhinolaryngol* 2015;**79**:316–22
23 Migirov L, Shapira Y, Horowitz Z, Wolf M. Exclusive endoscopic ear surgery for acquired cholesteatoma: preliminary results. *Otol Neurotol* 2011;**32**:433–6
24 Ministry of Health, Singapore. Health Manpower. In: https://www.moh.gov.sg/resources-statistics/singapore-health-facts/health-manpower [16 March 2019]
25 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;**13**:1–8
26 Belal A, Reda M, Mehana A, Belal Y. A new staging system for tympanomastoid cholesteatoma. *J Int Adv Otol* 2012;**8**:63–8

https://doi.org/10.1017/S0022215120000109 Published online by Cambridge University Press