

# Utility and Cost Analysis of Cholesteatoma Histopathologic Evaluation

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**Objectives/Hypothesis:** To evaluate the correlation between the surgeon's intraoperative findings and histopathologic diagnosis of cholesteatoma specimens and the associated health care cost in requesting pathologic evaluation.

**Study Design:** Retrospective chart analysis.

**Methods:** Chart data were collected at a tertiary neurotology referral center from patients undergoing tympanomastoidectomy for chronic otitis media, with specimens submitted for pathologic review between 2010 and 2011. Correlation between the surgeon's intraoperative findings and the pathologic diagnosis was evaluated using a kappa statistic. Cost analysis for pathologic consultation was also reviewed.

**Results:** A Cohen's kappa value of 0.93 ( $P < .01$ ) was found between the surgeon's intraoperative findings and pathologic diagnosis. Using accepted kappa magnitude guidelines, there is perfect agreement between the surgeon's intraoperative findings and pathologic diagnosis of cholesteatoma after tympanomastoidectomy. The average cost for microscopic evaluation of cholesteatoma (current procedural terminology code 88304) as estimated per 2012 Medicare reimbursement rates is \$61.95.

**Conclusions:** In the absence of concern for other pathology, intraoperative findings of cholesteatoma are adequate to confirm diagnosis in patients undergoing tympanomastoidectomy for chronic otitis media without the use of histopathology. The increased cost of routine cholesteatoma histopathologic evaluation should be considered in future health care cost-containing measures, as clinical utility appears to be low.

**Key Words:** Cholesteatoma, histopathology, health care cost, kappa statistic.

**Level of Evidence:** 4.

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## INTRODUCTION

The annual incidence of cholesteatoma in the United States is estimated to be between 3 and 6/100,000.<sup>1,2</sup> A study of 500 patients in Finland reported a mean annual incidence of 9.5/100,000 for cholesteatoma.<sup>3</sup> Tympanomastoidectomy in the treatment of chronic otitis media with or without cholesteatoma is commonly performed, generating surgical specimens that must be judged as to whether or not to undergo pathologic evaluation. Given the relative frequency and unique nature of cholesteatoma disease, we sought to explore the clinical utility of routine cholesteatoma histopathologic evaluation, much in the same way that routine tonsillectomy histopathologic evaluation has been questioned.<sup>4-8</sup>

Many otologic surgeons routinely submit all tympanomastoidectomy surgical specimens for histopa-

thologic evaluation including obvious cholesteatoma specimens, whereas other surgeons selectively submit specimens when pathology other than cholesteatoma is considered. For those otologists who routinely utilize pathologic evaluation, the idea to submit all surgical tissue for the sake of consistency and to avoid misdiagnosis prevails. However, many experienced surgeons feel that cholesteatoma evident on intraoperative examination is sufficiently diagnostic without histopathologic confirmation, and little benefit is obtained from pathologic submission.

We also inquired about the associated health care cost incurred with the use of cholesteatoma histopathologic evaluation. It is well known that current US federal and state health care budgets are under increasing pressure to contain costs. Simple measures of avoiding unnecessary medical tests and procedures are feasible cost-saving options that most agree should be evaluated and implemented, with the input of treating physicians who understand the clinical impact of such decisions. Given the greater awareness of our limited medical care resources, we sought to document the incurred cost associated with routine cholesteatoma histopathologic evaluation.

This study evaluated the agreement between the surgeon's intraoperative findings and histopathologic diagnosis in cholesteatoma specimens submitted after tympanomastoidectomy for chronic otitis media and the health care costs associated with histopathologic evaluation.

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TABLE I.  
Kappa Magnitude Guidelines.

Kappa	
<0	No agreement
0–0.2	Slight agreement
0.21–0.4	Fair agreement
0.41–0.6	Moderate agreement
0.61–0.8	Substantial agreement
0.81–1	Perfect agreement

## MATERIALS AND METHODS

Approval from the institutional review board of Providence Hospital and Medical Centers was obtained to review the records of all patients at a tertiary neurotology referral center undergoing tympanomastoidectomy for chronic otitis media, with surgical specimens submitted for histopathologic evaluation from January 1, 2010 through October 26, 2011. Correlation between the surgeon's intraoperative findings as documented per the operative report and pathologic tissue diagnosis was evaluated. The operating surgeon had to explicitly state that cholesteatoma was present in his/her operative report to be included in the cholesteatoma disease group. The reviewed cases include patients from seven different otologists, of which four surgeons routinely submit specimens and three surgeons selectively submit specimens for histopathology after tympanomastoidectomy.

The cost for microscopic evaluation of cholesteatoma specimens was estimated using 2012 Medicare reimbursement rates (US Department of Health and Human Services, Center for Medicare and Medicaid Services, 2012 Reimbursement Schedule). Medicare reimbursement rates were considered to more accurately reflect true economic costs. Hospital charges were not used due to charge/cost differences present between regions in the medical marketplace. Current procedural terminology (CPT) code 88304 was used for microscopic pathologic examination. The Medicare reimbursement rate in 2012 was \$61.95 for CPT code 88304.

### Statistical Analysis

The Cohen's kappa inter-rater reliability test was used, as it measures the agreement between two raters (the surgeon's intraoperative findings and pathologic diagnosis). Kappa values give the proportion of agreement between two or more observers above the expected agreement due to chance alone. The kappa statistic is defined as the fraction of the observed agreement not due to chance in relation to the maximum nonchance agreement. Kappa can range from  $-1$  to  $+1$ , but it usually falls between 0 (agreement expected due to chance alone) and 1 (perfect agreement). The variance was calculated and using a z-statistic, and the *P* value was determined. When using a kappa test, a *P* < .05 indicates that the rater's agreement level was unlikely due to chance alone.

Some argue that statistical significance is not as useful a guide when dealing with kappa statistics and have proposed magnitude guidelines. Landis and Koch characterized kappa values <0 as indicating no agreement, 0 to 0.20 as slight, 0.21 to 0.40 as fair, 0.41 to 0.60 as moderate, 0.61 to 0.80 as substantial, and 0.81 to 1 as perfect agreement (Table I).<sup>9</sup>

## RESULTS

One hundred seventy-eight consecutive cases of tympanomastoidectomy for chronic otitis media with surgical

specimens submitted for histopathologic review were used for this study. Each histopathologic diagnosis was compared to the surgeon's intraoperative gross findings per operative report. Of the 178 cases sampled, 162 of the surgeon's operative and pathology reports agreed that cholesteatoma was present. In 14 cases, the surgeon's operative and pathology reports agreed that pathology other than cholesteatoma was present (i.e., granulation tissue, glomus tumor). In two cases, the surgeon suspected cholesteatoma per the operative report, but the pathologist disagreed stating that submitted tissue was mucosa or inflammatory tissue. No malignancies were found in the sampled cases, and no instances occurred where the surgeon stated cholesteatoma was present but the pathology report disagreed (Table II).

The resulting Cohen's kappa value was 0.93. The calculated variance in kappa was calculated as 0.0097, with a resulting z score of 7.10. This z score is statistically significant at a level of an  $\alpha$  of .01. The confidence interval about kappa is  $\pm 0.193$ . When the magnitude guidelines are applied to our kappa value, it falls into the category of perfect agreement, which indicates a very high correlation between the surgeon's intraoperative findings and pathologic diagnosis of cholesteatoma.

## DISCUSSION

The 2011 National Quality Strategy Report to Congress from the Department of Health and Human Services laid out the federal administrations plans to improve health care efficiency by seeking input from clinicians, patients, and provider organizations as to the best way to contain cost while maintaining quality measures.<sup>10</sup> The report seeks to incorporate evidence-based results of research and scientific advances in establishing new federal health care coverage guidelines. It is in the best interest of health care practitioners to play an active role in this process by providing the best evidence to support or refute current practices. In this way, the interests of our patients and respective medical specialty will be well represented.

This is not the first time that the routine use of pathologic evaluation of surgical specimens has been called into question. Multiple studies have shown low clinical utility in routinely submitting tonsillectomy specimens for histopathologic review.<sup>4–8</sup> Some of these authors have noted that surgical specimens from this common procedure require pathologic evaluation only in specific circumstances, thereby avoiding unnecessary

TABLE II.  
Agreement Between Surgeon and Pathologist Regarding Presence of Cholesteatoma or Noncholesteatoma Disease in Submitted Surgical Specimens.

Surgeon	Pathologist		
	Yes	No	Total
Yes	162	2	164
No	0	14	14
Total	162	16	N = 178

pathologic consultation costs. This current study demonstrates a similar trend. In fact, given the unique nature of cholesteatoma disease, the concern for occult malignancy is exceedingly low when compared to tonsillectomy specimens.

The kappa value demonstrates perfect agreement between surgeon and pathologist. Two cases occurred where the surgeon described gross cholesteatoma evident intraoperatively; however, the submitted specimen was read as chronic inflammation and mucosa. This discrepancy may be explained by the piecemeal resection of cholesteatoma disease and submission of only part of the whole specimen. It is likely that cholesteatoma was present, but surrounding inflammatory and granulation tissue was instead submitted for histopathologic review.

It should be mentioned that no cases of malignancy were identified in our series. Clinical history and physical findings should readily differentiate temporal bone cancer from cholesteatoma in most cases, with a high index of suspicion maintained in patients with pain out of proportion to physical examination and/or a consideration for metastatic disease. In addition, the lack of confirmatory pathologic diagnosis may be seen as a disadvantage in a patient who suffers complications after tympanomastoidectomy. These situations, although rare, should be managed on a case-by-case basis with selective use of histopathologic review.

If using an approximate annual incidence of 6/100,000 for cholesteatoma in the US population of 300 million, then 18,000 cases of cholesteatoma may be evaluated and treated on a yearly basis. The total annual cost for histopathologic review of cholesteatoma would be \$1,115,100. Although this number is small when considering the larger context of health care spending, we believe that this cost analysis represents a simple health care cost-containment opportunity.

Given that health care today is provided within ever-increasingly strained federal and state budgets. Evidence-based medicine combined with economic analyses will continue to play an increasing role in optimizing delivery of care and protecting those patients in need of certain treatment. This case series demonstrates evidence to limit or avoid routine histopathologic evaluation of cholesteatoma and instead selectively utilize histopathology in cases where pathology other than cholesteatoma is suspected. Certainly, surgeons should reserve the right to submit specimens for pathologic review

based upon clinical suspicion. No significant unexpected pathology was identified in this series of patients undergoing tympanomastoidectomy for chronic otitis media with or without cholesteatoma. Admittedly, the small number of cases included in this study limits our analysis, and larger studies may help to confirm our findings.

## CONCLUSION

In the absence of concern for other pathology, intraoperative findings of cholesteatoma are adequate to confirm diagnosis in patients undergoing tympanomastoidectomy for chronic otitis media without the use of histopathology. The increased cost of routine cholesteatoma histopathologic evaluation should be considered in future health care cost-containing measures, as clinical utility appears to be low.

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