Abstract

Objectives: (1) Examine the correlation between tympanogram results and operative findings in children undergoing first-time ventilation tube placement. (2) Understand the importance of tympanometry in preoperative evaluation of patients who may benefit from ventilation tube placement.

Methods: The study population consisted of patients who had undergone first-time ventilation tube placement at the authors’ institution between January 1998 and May 2005. Patients under the age of 18 who had undergone surgery for recurrent otitis media with effusion, the patient’s age and gender, and the operative findings were considered for this study. A retrospective chart review was completed to ascertain the operative findings as well as the tympanometry results prior to the operation.

Results: 568 cases of first-time ventilation tube placement were identified. In each case, the right and left ears were considered separately. Tympanograms were found to have no fluid in the middle ear in 500 of 706 ears (78%) with a B (flat) tympanogram result had an operative finding positive for middle ear fluid in 50% of ears with a C (negative pressure) tympanogram had fluid while the other 50% did not. Chi square analysis showed this to be significant with a p-value of <0.0001. The time period between the tympanogram and the operation, gender, age, and diagnosis were controlled for, but no statistical differences were noted.

Conclusion: Tympanogram results were found to correlate well with operative findings in children undergoing ventilation tube placement. Therefore, tympanometry is a beneficial clinical tool in determining whether middle ear fluid is present and if further management is warranted.

Introduction

Otitis media is the most common reason for an illness-related medical visit in pre-school age children, and it is estimated that 84 billion dollars is spent each year in this country to treat otitis media. In 1994, new guidelines regarding the treatment and diagnosis of otitis media with effusion (OME) were published by the Agency for Healthcare Research and Quality. This document recommended that clinicians use pneumatic otoscopy as the primary tool in diagnosing OME while considering the results of tympanometry as a tool to confirm this diagnosis.

Tympanometry is a useful tool because it provides quantitative information about the possible presence of fluid in the middle ear, mobility of the middle ear system, and ear canal volume. Varying results have been found in the past in regards to the value of tympanometry. In 1997, Watters et al. conducted a study in which tympanometry was performed on 500 children within the two hours preceding ventilation tube placement. Their results showed a high sensitivity for type B tympanograms to predict the presence of middle ear fluid, and a high specificity of peaked (type A and C) tympanograms to diagnose a dry middle ear. In 2003, the Agency for Healthcare Research and Quality stated the positive predictive value for abnormal (type B) tympanogram is between 49 and 99% while a type C curve is an imprecise estimate of ME pressure, and the Canadian Task Force on Preventative Health Care reported in 2004 that tympanometry has a sensitivity and specificity greater than 80% in predicting fluid found in the middle ear at the time of surgery.

In this study, we reviewed the results of tympanometry performed on children in our office prior to surgery and the operative findings at the time of ventilation tube placement in order to determine the utility of tympanometry in clinical practice.

Methods

The study population consisted of patients who had undergone ventilation tube placement at the authors’ institution between 1998 and 2005. Patients under the age of 18 were considered for this study, and a retrospective chart review was conducted. Right and left ears were considered separately.

In each case, tympanometry was conducted in our clinic by a licensed audiologist. A type A or B tympanogram is defined as a waveform with a normal peak height and indicates a dry middle ear while type C and peaked (type A and C) tympanograms were noted with a negative peak pressure and also indicates a dry middle ear. The results of the tympanogram as well as the time period between the tympanogram and the operation, gender, age, and diagnosis were controlled for, but no statistical differences were noted.

Operative reports were also reviewed. Information obtained included indication for the procedure (recurrent acute otitis media vs. chronic otitis media with effusion), the patient’s age and gender, and the operative findings (presence or absence of fluid).

Results

568 patients undergoing first-time ventilation tube placement who had undergone preoperative evaluation and tympanometry were identified. In 500 of 706 ears, B (flat) tympanograms resulted had no fluid present in the middle ear intraoperatively while 50% of 706 (78%) ears with a B (flat) tympanogram result had an operative finding of middle ear effusion. 50% of ears with a C tympanogram had fluid while the rest did not. Chi square analysis demonstrated these findings to be significant with a p-value of <0.0001. These findings are summarized in Table 1.

The age range for this study was 6 months to 16 years of age (mean 3 years) while 65% of patients included were male. In 441/581 (76%) of cases, the indication for surgery was chronic otitis media, and 24% of patients underwent ventilation tube placement for recurrent otitis media. The mean time period between tympanometry and surgery was 26 days. Further analysis of the data was completed and the above characteristics were controlled for; however, no statistical differences were noted.

Sensitivity, specificity, positive predictive value, and negative predictive value were calculated for type A/As, type B, and peaked (type A and C) tympanogram findings. These values are summarized in Figures 1, 2, and 3.

Discussion

Overall, the results of this study show tympanometry to be an accurate tool in assessing patients for the presence of fluid in a pre-operative setting. Type A tympanograms were found to have a high sensitivity but little predictive value. Therefore, there is a high level of certainty that if a type A tympanogram is found, the ear is dry. In contrast, a type B tympanogram has a high sensitivity and average specificity for diagnosing middle ear effusion. Positive and negative predictive values were also quite high for type A and B curves. On the other hand, type C and peaked tympanograms had very little predictive value, and when results for Type A and C tympanograms were combined, the predictability of these peaked waveforms for diagnosing a dry middle ear was moderate. This study is useful as it does mimic clinical practice. Although completing tympanograms just prior to surgery will elicit more accurate results, it would be difficult to do as a busy clinical setting. Our study reviewed a last tympanometric and operative findings were completed at a clinic visit prior to surgery. As a result, the physician is able to consider the results when deciding if the patient is in need of surgical intervention.

Conclusion

Tympanometry results were found to correlate well with operative findings in children undergoing ventilation tube placement. Therefore, tympanometry is a beneficial clinical tool in determining whether middle ear fluid is present and if further management is warranted.

References