The Relationship Between Individual Ossicular Status and Conductive Hearing Loss in Cholesteatoma

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Introduction

Patients with cholesteatoma often report hearing loss as one of their first symptoms. Hearing loss in these patients is thought to occur mainly as a result of destruction of the ossicles by cholesteatoma, and the subsequent interruption of the ossicular chain’s continuity. Numerous theories exist that include enzymatic resorption due to products of cholesteatoma growth and direct pressure necrosis of ossicles by an impinging mass of cholesteatoma (1). It would seem that progressive erosion of the ossicles by cholesteatoma, and the discontinuity of the ossicular chain would cause a concordant increasing and progressive conductive hearing loss. Studies, however, have found that in cholesteatoma, ossicular destruction is not uniform, and destruction is not always found in the same three ossicles (2,3). The osseous destruction is categorized as primary acquired, secondary acquired, or congenital, with a significant number of cases when the ossicular destruction was gradual and ABG was unchanged. For each ossicle, the relationship between degree of cholesteatoma involvement and ossicular erosion and the ABG was analyzed using a more detailed grading scale (1).

Materials and Methods

Clinical data for patients undergoing surgery for cholesteatoma by the senior author (at Weill Cornell Medical College from 1992 to 2009) were entered into a database. A retrospective review of these patients was performed by the senior author between 1992 and 2009 that met our inclusion criteria. The status of each ossicle was determined at the time of primary or revision surgery, previous radiation treatment to the head and neck, trauma to their ear, incomplete ossicular or hearing loss, or completion of cholesteatoma surgery (2). Thus, ABG and the ABG across all the tested frequencies. In order to isolate the independent effects of each ossicle, a multivariate analysis was carried out. The malleus, the incus and the stapes were all significantly associated with ABG. The incus had by far the most significant association with ABG (p= <0.0001), followed by the stapes (p=0.008), and the malleus (p=0.037). Analysis of the secondary variables showed that the incus also had the most significant and consistent association with ABG across all the different frequencies (from 0.5 kHz to 6 kHz). The malleus had a significant association with ABG at 1 kHz and a rating of 3.

Discussion

No significant change in ABG when cholesteatoma does not intact ossicle.

The effect of cholesteatoma on ossicular coupling does not seem to occur from the direct contact of cholesteatoma with an intact ossicle. The amount of change in ABG that occurred with erosion of an ossicle was the same across all the frequencies (within SE).

Results showed that cholesteatoma abutting any intact ossicle (rating 2) did not significantly alter average ABG compared to a normal ossicle (rating 1). For the incus, the greatest difference in average ABG occurred between a rating of 2 and a rating of 3, and between a rating of 3 and a rating of 4. No significant difference was found in effect on average ABG between a rating of 2 and a rating of 3 (p=0.01 for malleus, p=0.03 for stapes).

Adjacency ratings that showed no significant difference were then combined. The analysis was then continued using the newly combined ossicle rating (rating 2) for this tissue and (1), 3, and 4 for the malleus and the stapes. The overall status of each ossicle was the most significant factor across all the tested frequencies. To determine the influence of each ossicle, a multivariate analysis was carried out. The malleus, the incus and the stapes were all significantly associated with average ABG. The incus had by far the most significant association with ABG (p= <0.0001), followed by the stapes (p=0.008) and the malleus (p=0.037). Analysis of the secondary variables showed that the incus also had the most significant and consistent association with ABG across all the different frequencies (from 0.5 kHz to 6 kHz), while the malleus and the stapes varied in the significance across different frequencies. All three ossicles were significantly associated with ABG in 1 kHz.

Conclusions

Five clinical studies have carefully examined the relationship between ossicular erosion by cholesteatoma and conductive hearing loss. Studies by Jung and Corti (4) determined that a four-step scale for each ossicle is proposed. The data shows that this refinement demonstrates a close relationship between hearing loss and ossicular status, in which destruction of each ossicle contributes, in a graded fashion, to clinical hearing loss. It would seem that progressive erosion of the ossicles by cholesteatoma, and the discontinuity of the ossicular chain would cause a concordant increasing and progressive conductive hearing loss. Studies, however, have found that in cholesteatoma, ossicular destruction is not uniform, and destruction is not always found in the same three ossicles (2,3). The osseous destruction is categorized as primary acquired, secondary acquired, or congenital, with a significant number of cases when the ossicular destruction was gradual and ABG was unchanged. For each ossicle, the relationship between degree of cholesteatoma involvement and ossicular erosion and the ABG was analyzed using a more detailed grading scale (1).

Results: 158 primary cholesteatoma surgeries were performed by the senior author between 1992 and 2009 that met our inclusion criteria. The status of each ossicle was significantly associated with the ABG in a graded and independent manner this association was most significant for the incus. Cholesteatoma abutting on intact ossicles did not significantly affect the ABG. Clinical categorization of cholesteatoma was not significantly associated with the ABG. Significant difference was found in effect on average ABG between a rating of 2 and a rating of 3 (p=0.01 for malleus, p=0.03 for stapes).

References