Improving the success in surgery of chronic middle ear diseases

Ph.D. Thesis

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1. Introduction

1.1. What is the topic?

Our focus is on integrating our current knowledge about middle ear surgery and increasing the success of surgical outcomes after cholesteatoma surgery and tympanic membrane grafting.

1.2. What is the problem to solve?

There is a debate in the field of middle ear surgery about which surgical method should be used. Since there are no guidelines, the surgical method is chosen based on the surgeon's experience and the extent of the middle ear disease. Our aim was to integrate the knowledge by creating a meta-analysis and retrospective analysis of our database to find out how to develop everyday practice.

1.3. What is the importance of the topic?

Cholesteatoma is one of the most dangerous middle ear diseases; it could lead to severe complications without treatment. Due to hearing loss and recurrent discharge, the tympanic membrane perforation could also negatively affect the patient's quality of life. Both problems can only be solved by surgery. The major aim of the operation is to eradicate the disease; however, there is a risk of recidivism; thus, applying the right surgical method is essential.

1.4. What would be the impact of our research results?

Increasing the success rate in the field of middle ear surgery by applying the scientifically proven best care could reduce the number of reoperations, and knowing the predictors of the success could lead to more precise patient education and tailored surgical techniques.

2. Objectives

2.1. Study I.- Mastoid Obliteration Decrease the Recurrent and Residual Disease: Systematic Review and Meta-analysis

The aim of cholesteatoma surgery is the complete eradication of the disease. However, the residual rates can be 5-35 % depending on the surgical technique, patient age and cholesteatoma extension . The mastoid obliteration technique was invented to reduce the size of the drilled mastoid bowl and prevent disadvantages such as recurrent discharge and infection of the ear after canal wall down (CWD) mastoidectomy. It has been hypothesised that this could also reduce the recurrent and residual disease rate. Our systematic review and meta-analysis aimed to evaluate the effectiveness of mastoid obliteration and to summarize the knowledge from the published comparative studies to assess the effectiveness of mastoid obliteration compared to the canal wall up (CWU) technique.

2.2. Study II.- Factors influencing successful reconstruction of tympanic membrane perforations: a systematic review and meta-analysis

The perforation of the eardrum is one of the most common chronic middle ear diseases. The treatment is surgical, and its success rate depends on many personal and external factors besides the surgical technique. To provide adequate and precise patient information, it is necessary to know what these factors are and how they affect the success rate of the surgical procedure. Uncovering the most important factors also helps to choose the appropriate surgical technique.

The reason behind focusing on the patient-related factors is that the surgical approach is the choice of the surgeon, while patient-related factors are given. Furthermore, the predictive factors are, by definition, the characteristics of the patient that affect a particular treatment. Evaluating and comparing surgical techniques requires different scientific questions and approaches.

Our study aimed to provide comprehensive and more accurate information about the prediction of tympanic

membrane reconstruction without evaluating the approaches, including all the new studies, and focus on patient-related factors based on a systematic review and meta-analysis.

3. Methods

The Cochrane Handbook recommendations and PRISMA 2020 updated guideline for reporting systematic review were followed during the first and second study process. The PICO framework was applied to create the study protocols registered on Prospero (registration number study I: CRD42021282485, study II: registration number: CRD42021289240).

In the statistical analyses, a random effect model was used in both studies.

3.1. Study I.-Mastoid Obliteration Decrease the Recurrent and Residual Disease: Systematic Review and Meta-analysis

The systematic search was performed in four major databases (MEDLINE, Web of Science, Embase, and CENTRAL) on October 14, 2021. Studies comparing the CWU technique with mastoid obliteration were included, while exclusion criteria were the following: congenital cholesteatoma, follow-up period of less than 12 months,

unclear descriptions of surgical methods, and animal studies. ROBINS-I tool was used for evaluating the risk of bias. Primary outcomes were analysed such as residual and recurrent disease proportions, while secondary outcomes were evaluated quality of life, ear discharge, infection rates, hearing outcomes, and operation time.

3.2. Study II. -Factors influencing successful reconstruction of tympanic membrane perforations: a systematic review and meta-analysis

The systematic search was performed on November 24, 2021, using the CENTRAL, Embase, and MEDLINE databases. Observational studies with a minimum of 12 months of follow-up on type I tympanoplasty or myringoplasty were included, while non-English articles, patients with cholesteatoma or specific inflammatory diseases, and ossiculoplasty cases were excluded. QUIPS tool was used for risk of bias assessment. The primary outcome was the rate of closed tympanic cavities.

4. Results

4.1. Study I.-Mastoid Obliteration Decrease the Recurrent and Residual Disease: Systematic Review and Meta-analysis

A total of 11 articles, incorporating data from 2,077 operations, were deemed eligible for inclusion. All the identified studies were retrospective cohorts. The pooled odds of residual and recurrent disease proportions were significantly lower in the obliteration group compared to the CWU group (OR: 0.45, CI:0.28;0.80, p-value: 0.014). However, when analysed separately, the odds of recurrent disease (OR: 0.41, CI:0.11;1.57, p-value: 0.140) and residual disease (OR: 0.59, CI:0.23, 1.50, p-value: 0.207) showed no significant differences, despite being similar in trend. The qualitative synthesis revealed no significant differences in secondary outcomes, though obliteration was associated with longer operation times.

4.2. Study II-Factors influencing successful reconstruction of tympanic membrane perforations: a systematic review and meta-analysis

After removing duplicates, 9,454 articles were identified, of which 39 cohort studies were included. Results of four analyses revealed significant effects: age (OR: 0.62, CI 0.50; 0.78, p-value: 0.0002), size of the perforation (OR: 0.52, CI 0.29; 0.94, p-value: 0.033), opposite ear condition (OR: 0.32, CI 0.12; 0.85, p-value: 0.028), and the surgeon's experience (OR: 0.42, CI 0.26; 0.67, p-value: 0.005). Conversely, prior adenoid surgery, smoking, perforation site, and ear discharge showed no significant effects. Four additional factors: etiology, Eustachian tube function, concomitant allergic rhinitis, and duration of ear discharge were analysed qualitatively.

5. Conclusions

Our findings indicate that four factors significantly influence the success rate of tympanic membrane reconstruction: patient age, perforation size, the condition of the opposite ear, and the surgeon's experience. Factors such as a discharging operated ear, perforation site, history of adenectomy or adenotonsillectomy, and patient smoking status were not found to have a significant impact. Mastoid cavity obliteration could effectively decrease recidivism without leading to severe complications or a decline in quality of life. However, due to the low quality of available data, we are unable to make definitive recommendations.

6. Bibliography

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