It's All About the Money, Honey! - A retrospective cost comparison between total endoscopic ear surgery and microscopic surgery for attic cholesteatoma

Eishaan Bhargava[1], Oliver Wakelam[1], Laura Leach[1], Ajmal Masood[1], and Asad Qayyum[1]

[1]North West Anglia NHS Foundation Trust

April 28, 2020

Abstract

Introduction and Objectives: Endoscopic ear surgery (EES) is rapidly emerging as a mainstream surgical modality, with recent literature highlighting its advantages over traditional approaches. This study tests the null hypothesis that there is no difference in direct costs of total endoscopic ear surgery and microscopic ear surgery for attic cholesteatoma in a British National Health Service District General Hospital setting. Study Design: Retrospective cost comparison Setting: district general hospital Participants: patients undergoing surgery for cholesteatoma limited to the attic, either via endoscopic or microscopic approach Cost comparison: Direct cost comparison of anaesthetic set up, surgical set up, and surgical time between total endoscopic ear surgery and microscopic ear surgery for attic cholesteatoma. Main outcome measures: Direct costs of anaesthetic set up, surgical set up, and surgical time Results: Total endoscopic ear surgery had a significant cost saving of £1419.01 per operation. Conclusion: Total endoscopic ear surgery is more cost-effective than microscopic surgery for attic cholesteatoma in a British National Health Service District General Hospital setting.

Introduction:

Endoscopic ear surgery has come a long way since it was first described in 1990 (1) and is emerging as a mainstream surgical modality for the management of ear pathologies. One of the primary indications for endoscopic ear surgery is in the management of epitympanic and mesotympanic cholesteatoma (1,2). The endoscopic approach to management of cholesteatoma has been shown to be comparable to the more traditional microscopic approach in both safety and efficacy (3).

In a healthcare setting limited by resources, there is a need for justification for new approaches beyond safety and efficacy, with rationalisation of the expenditure involved. The ideal scenario would be achieving a health gain with a novel improvement in technology with minimal additional costs or, even better, with a cost saving. From an institutional perspective, the initial capital involved in setting up new technology often delays its implementation. An analysis of the initial and on-going direct costs, such as surgical, anaesthetic, hospital and equipment costs, would be helpful to justify implementation.

There is currently a dearth of literature on costs involved in endoscopic ear surgery (4,5), with no study in reviewed literature exploring the costs involved in a National Health Service (NHS) setting in the UK. Keeping the above in mind, this study aims to compare the direct costs of total endoscopic ear surgery with that of microscopic surgery, testing the null hypothesis that there is no difference in direct costs of total endoscopic ear surgery and microscopic ear surgery for attic cholesteatoma in a British National Health Service District General Hospital setting.

Materials and Methods:

A retrospective cost analysis study was conducted, in an NHS district general hospital setting. The direct costs involved in a patient journey for a total endoscopic approach to management of an attic cholesteatoma were compared to those for a microscopic combined approach tympanoplasty. Indirect and future costs were excluded.

A retrospective chart analysis was carried out for 10 consecutive cases of attic cholesteatoma who were managed with a total endoscopic approach and 10 consecutive cases managed with a combined approach tympanoplasty between 2017 and 2019, at the same institution and under the care of the same consultant surgeon. Only cases where the cholesteatoma did not extend beyond the posterior limits of the lateral semicircular canal or below the inferior limits of the stapes supra-structure were included.

The patients' health journey was mapped (figure 1) to identify resources for comparison, similar to a previously described study (4). There was an initial overlap of required resources in the diagnostic work up of patients, which were not included in our final analysis. A comparison of the direct costs involved in the surgical set up, anaesthetic set up and operation theatre running costs was made.

Total endoscopic ear surgery was defined as transcanal surgery performed completely using an endoscopic with no use of an operating microscope. Hypotensive anaesthesia was given using remifentanil and desflurane. Endoscopic atticotomy was performed in all ten cases using 0 and 45 degree 4mm rigid endoscopes and a curette. A composite tragal cartilage-perichondrium graft was used for reconstruction of the tympanic membrane and the attic defect in all endoscopic cases. Post-operatively, the canal was packed with chloramphenicol ointment. No head dressing was applied, and the surgery was done as a day case.

Microscopic ear surgery was defined as a postaural approach combined approach tympanoplasty involving a cortical mastoidectomy and a posterior tympanotomy in all ten cases. Hypotensive anaesthesia was given using remifentanil and desflurane. The postaural incision was made using a handheld diathermy, and the mastoidectomy and tympanotomy were done using a drill and an average of 4.5 different size burrs (Medtronic). Temporalis fascia and conchal cartilage were used for reconstruction. Post-operatively, the skin was closed using skin clips, and the canal was packed with bismuth subnitrate and iodoform paraffin paste impregnated gauze (BIPP dressing). A head dressing was applied for 24 hours, and the patient was admitted overnight.

Data regarding the operative set up costs and intraoperative consumables used were obtained from theatre staff. The operating theatre running costs (£1200 per hour) were obtained from hospital management, and included an hourly cost based on staffing, quality control, utilities, land rent and building depreciation. The average surgical time for both procedures was calculated using data available from operating theatre records for the consultant surgeon, and was used to calculate the cost of anaesthetic agents used and operation theatre running costs.

Statistical analysis was done using a two sample t- test to compare the endoscopic and microscopic surgical groups.

Results:

Itemised and total costs for surgical setup for the two groups were calculated (Table 1 and 2) and the surgical set up costs were compared. The total cost for operative setups for microscopic and endoscopic surgery were £416.58 and £199.88 respectively, with a cost saving of £216.70 in the endoscopic surgery group. These cost analyses included costs of sterilisable and disposable units used in both setups. They did not include purchase of any new equipment.

Operating theatre records for the consultant surgeon were used to calculate the average operative time for both procedures; it was 186.3 minutes for the microscopic group and 127.3 mins for the endoscopic group. This equalled a mean timesaving of 59 minutes when performing the endoscopic approach.

Anaesthetic maintenance costs were calculated based on the surgical duration (Table 3), with a mean cost saving of £66.52 for the endoscopic surgery group. Similarly, operative theatre running costs were £1180

cheaper for endoscopic surgery.

An overview of the overall cost comparison between the two surgical groups (Table 4) indicated a cost saving of £1463.22 when performing total endoscopic surgery. A two sample t -test which did not assume equal variances was performed, indicating that this cost saving was significant ($p<0.001$).

Discussion:

Otology as a surgical sub-specialty has seen several technological advances recently, especially the emergence of minimally invasive endoscopic techniques that have been applied to a wide variety of otologic surgical procedures. Looking at similar trends in other surgical subspecialties that have, to a large extent, adopted minimally invasive techniques as the standard of surgical care, it is conceivable that endoscopic techniques may well be the preferred surgical approach in otology in the near future.

The trend in published evidence suggests that endoscopic management of cholesteatoma is both safe and efficacious (1,2), with a recent metanalysis reporting a significantly lower risk of recurrent cholesteatoma with endoscopic removal of cholesteatoma compared to microscopic surgery (6).

In addition to safety and efficacy, economics play a major role in health technology assessments. Initial capital costs along with the ongoing direct costs are major considerations when introducing a new technology. This study demonstrates, in a British National Health Service setting, a direct cost saving of £1463.22 per case of cholesteatoma managed endoscopically. Similar cost savings have been demonstrated elsewhere as well, with Patel et al. demonstrating a cost saving of almost three thousand dollars in an Australian private healthcare set up (4).The cost savings in our study may be attributed to two main factors: surgical set up costs and operating theatre running costs.

Surgical set up costs for microscopic surgery were higher primarily due to the use of disposable surgical burrs, which comprised 39.8% of the total. All our endoscopic procedures were carried out with removal of bone using a curette, leading to a lower surgical set up cost. In addition, operating theatre running costs for endoscopic ear surgery were 31.7% lower, due to a shorter mean operating time. This may be attributed to the reduced need for skin incision, soft-tissue dissection and temporal bone drilling in the endoscopic approach. Similar trends in cost comparisons were reported in the Australian healthcare set-up as well (4).

Our study has a number of limitations. Ours was a retrospective study with a relatively small sample size. Despite careful attempts at case-matching in the endoscopic and microscopic groups, differences in patient co-morbidities and extent of cholesteatoma may have influenced the duration of surgery. The use of an atticoantrostomy microscopic approach, as opposed to the combined approach tympanoplasty approach that we follow in our institution, may influence duration of surgery as well as number of surgical burrs used. Prospective data collection, with larger numbers involving multiple surgeons in different institution would help address these weaknesses in future studies.

Despite the limitations, the direct cost savings reported in this study may under-represent actual total cost savings, due to exclusion of indirect costs to both the healthcare system as well as the patient. Although there is a paucity of published literature in this field, the lack of need for extensive soft-tissue dissection, mastoid drilling or a post-aural incision are likely to have an impact on the duration of in-patient stay, the recovery time, as well as the subjective quality of life, as was reported by Taneja et al in their review of 152 cases (7). The economic impact of an early recovery and return to work along with an improvement in quality of life were beyond the scope of the present study, and form avenues for future prospective collaborative research.

Conclusions:

This study demonstrates a direct cost saving of £1463.22 per case of cholesteatoma managed endoscopically. This figure may under-represent the total cost savings for the patient and the healthcare system as a whole. This work adds to the building armamentarium of evidence on the economic advantage of endoscopic ear surgery over a microscopic approach, and may be helpful to key policy stakeholders and hospitals in performing a Health Technology Assessment of the endoscopic approach to ear surgery.

Conflict of Interest:

The authors have no conflict of interest to declare.

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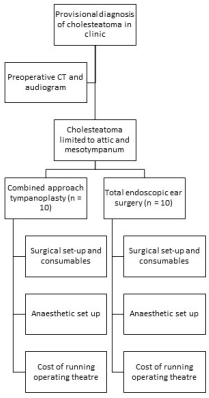

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