# Needs Analysis Survey Paper

## Journals:

* [Journal of Otolaryngology - Head & Neck Surgery](https://journalotohns.biomedcentral.com/)
* Otolaryngologic Clinics

## Abstract:

## Background:

Endoscopes provide direct access and a wide angle view into the middle ear, reducing the time required to gain access, drill bone for exposure and close during middle ear surgery and are able to visualize hidden recesses within the middle ear including: the sinus tympani, anterior and posterior epitympanum and hypotympanum [1][2][3][4]. As well, the endoscope allows visualization past the shaft of the instrument, such as the drill, which is a problem during microscopic surgery[5].

Despite the enthusiasm of some otologists, endoscopic ear surgery has a low acceptance rate[6][7].  The principal challenge with TEES is that a one-handed surgical technique is required as the endoscope is held in the other hand[6][8]. During traditional surgery, the non-dominant hand usually maintains suction and removes blood from the operative field while the dominant hand performs the delicate maneuvers [8]. Otologic instruments were developed for two-handed microscope-guided surgery so they are not optimized for the TEES environment. As otologists have been trained and gained experience in microscope-guided ear surgery, they have developed techniques with the according instruments and have become accustomed to a two-handed surgical approach. By learning different surgical techniques and gaining experience with the endoscope, most surgeons find that they can complete more cases totally endoscopically [9][6][1][8].

Technological advances in the design of the endoscope, camera and suction dissection instruments have lead to incremental stepwise jumps in this learning curve [10]. In order to further develop technology and instruments to facilitate TEES, it is important to understand the specific difficulties experienced during TEES. It is proposed that in order to facilitate TEES, the needs of surgeons and current limitations of tools must be determined.

*We hypothesize that otologists need better instrumentation to facilitate specific challenges posed by TEES. Further, we hypothesize that otologists performing greater proportions of surgeries using TEES will experience different challenges than those who use TEES less frequently. Similarly, we hypothesize that those surgeons who use specialized TEES instrument sets may experience different challenges that those who do not. To this end, we conducted a mixed-methods study to explore these hypotheses.*

## Methods:

### Study Design:

This cross-sectional study employed a mixed-methods self-administered online questionnaire consisting of nine questions. The responses were scored using multiple choice, yes/no, an analog scale and an open-ended free-text response. The analog scale was anchored with verbal descriptions to ensure comparability between participants, while facilitating parametric statistical analysis. The contents of the questionnaire consist of: the percentage of surgeries performed by the participant using TEES, whether the participant uses a specialized TEES instrument set and the degree to which an instrument that addresses the following difficulties would be of use to the participant:

Table 1: List of difficulties experienced during TEES for which new instruments may be required.

|  |
| --- |
| Bleeding control |
| Keeping the endoscope lens clean |
| Cutting and/or removing bone |
| Reaching structures visualized by the endoscope |
| Dissection and removal of cholesteatoma |
| Moving and positioning a graft into the intended place |
|  |

In addition, participants were asked to identify any other types of instruments that they would find useful while performing TEES. The questionnaire content was developed through a literature search of existing literature on challenges experienced during TEES and the clinical experience of the principal author and his colleagues. Local otologists with varying TEES experience were consulted about their thoughts regarding TEES, namely its advantages and disadvantages. Using this data, a preliminary questionnaire was developed and piloted amongst local otologists. The results of the pilot questionnaire were used to create the final concise and non-redundant questionnaire that was distributed internationally.

### Participants and Data Collection:

We identified otologists who attended the 2nd World Congress of Endoscopic Ear Surgery, members of the International Working Group of Endoscopic Ear Surgery and attendees of a TEES course in Japan. After obtaining approval of the protocol from the Research Ethics Board at the Hospital for Sick Children, Toronto, surgeons were invited to participate in the survey. The top of the online survey includes a letter of information and informed consent was assumed upon anonymous completion of the questionnaire. All information was stored confidentially.

### Data Analysis:

Data were analyzed using a descriptive format. The quantitative data were analyzed by the means, with a confidence interval of 95% using JMP statistical analysis software (JMP Version 13.0, SAS Institute Inc.) ANOVA was used to determine if surgeon experience and the use of a specialized TEES instrument set affected the degree of need for each difficulty. The difficulties were ranked in order of greatest to least degree of need. Qualitative data was analyzed by grouping the responses into themes/categories which would describe additional difficulties those tools would address.

## Results:

### Study Participants and Demographics

The questionnaire was sent to <???> number of people. (attendees of 2nd world congress + Japan course participants + members of IWGEES). Sixteen attendees at the 2nd World Congress on Endoscopic Ear Surgery, six attendees of the Japanese course, responded

* 6/number of people at the Japan course
* 26/IWGEES

49 people responses were received, with a response rate of <???>. To organize the respondents, the questionnaire asked surgeons to indicate the percentage of surgeries they perform by TEES and whether they use a specialized TEES instrument set. This is summarized in Tables 2 and 3.

Table 2: Percent of surgeries performed totally endoscopically

|  |  |
| --- | --- |
| Percent of Surgeries Performed Totally Endoscopically | Number of Respondents |
| 0% | 4 |
| Up to 50% | 15 |
| 50%-90% | 20 |
| More than 90% | 10 |

Table 3: Use of specialized TEES Instrument set

|  |  |
| --- | --- |
| Use of TEES Instrument Set | Number of Respondents |
| Yes | 38 |
| No | 11 |

### Difficulty during TEES that exhibits the greatest need by surgeons:

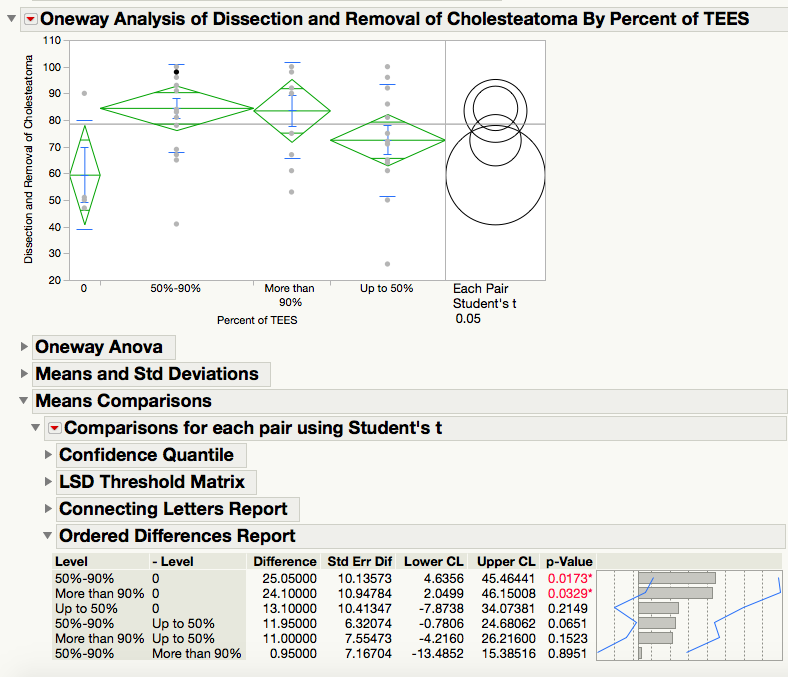
The average degree of need for each difficulty exceeded 50%, suggesting that all challenges presented are experienced significantly by the respondents. Reaching structures visualized by the endoscope and dissection and removal of cholesteatoma resulted in the highest degree of need at 83%±4% and 78%±4% , respectively.

### Effect of percent of surgeries performed totally endoscopically on difficulties experienced:

ANOVA with an alpha of 0.05 showed that the percent of surgeries performed totally endoscopically had a significant effect on the degree of need for the following difficulties.

* F statistic for ANOVA, Oneway analysis of percent of TEES vs.
  + Reaching structures P-value = 0.0336
  + Positioning a graft P-value = 0.0064
  + Dissection and removal of cholesteatoma P-value = 0.0463

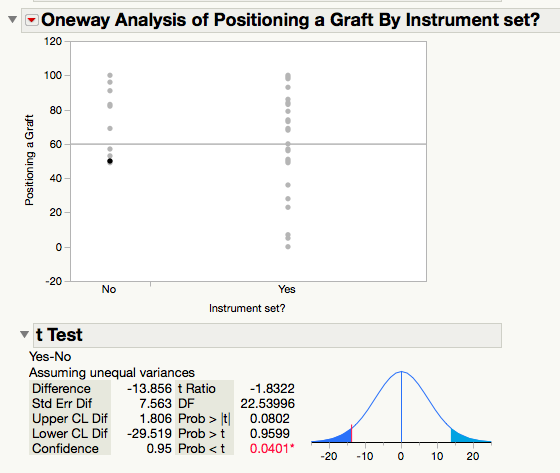
Question: which percent level of TEES experience is the one that is different?



According to a one-tailed t-test with α = 0.05, respondents who perform 50%-90% and more than 90% of TEES reported significantly greater need of dissection and removal of cholesteatoma than those who perform 0% of TEES, p=0.0173 and 0.0329, respectively.

### Effect of using a specialized TEES instrument set on difficulties experienced:

The effect of using a specialized TEES instrument set on reported need was tested using a one tailed t-test with α = 0.05, and respondents who did not have an instrument set presented greater need for an instrument to position a graft (p=0.0401).



### Qualitative Results:

Participants were asked to comment on any other instrumentation they would like to see modified or developed for TEES.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Endoscope** | **Instrument** | | | | |
|  | Suction | Cutting Bone | Reaching areas |  | cutting |
| flexible | suction elevators to control amount of suction | single handed drilling - irrigation and suction at the same time | Reach disease in the mastoid through the canal (retractible) | angled shaft to keep hands from bumping into each other | Curved round knife for better incision of the skin in first step of any middle ear surgery |
| Endoscope holder to facilitate 2-handed surgery | bipolar with suction | Bone cutting – piezoelectric | Bent and longer instruments to reach supratubal recess or deep sinus tympani | Remove vascular lesions without causing bleeding |  |
| Continuously cleaning lens | disposable curved and angled suckers | Piezoelectric drill is quite useful | Instruments with working angles that can be adjusted | Specialized for coagulations |  |
| Feasible endoscope holder | Suction + blunt dissector | Drill that can remove bone without obscuring vision | Tool that can reach structures and disease that are visible by the endoscope |  |  |
| Flexible joint by storz to fix endoscope to allow bimanual work is useful but too thick | Curved suction |  | Modify the whirly bird instrument (from Bausch and Lomb) as they are too short to dissect cholesteatoma in deep sinus tympani. |  |  |
| Endoscope holder to help the two-handed technique | Suction with different angles to suction cholesteatomatous matrix at different sites |  |  |  |  |
|  | Dissection + suction simultaneously |  |  |  |  |
|  | Improved curved suctions able to reach and aspirate cholesteatoma matrix from attic and sinus tympani (difficult to reach areas) current Storz curved suctions are too flimsy, thin and long |  |  |  |  |
|  | Suction smoke during laser surgery (separate or or mounted on the laser tip) |  |  |  |  |

\*yellow = both reaching and suction

## Discussion:

We have conducted a cross-sectional mixed-methods survey to identify, *quantify* and describe the difficulties otologists face with TEES. A survey on TEES for Canadian otologists has reported that 11% of otologists in Canada use TEES for cholesteatoma, tympanoplasty, and ossicular reconstruction surgeries and they find the following factors difficult about TEES: single-handed surgery, efficiency/operative time, technical difficulty, cost, managing bleeding [6]. This questionnaire was intended to build upon this research by measuring the degree to which surgeons experience specific difficulties during surgery and whether these difficulties could be addressed by a specialized surgical tool. Whileprevious studies have sought to identify challenges experienced during specific TEES surgeries, fewer studies have attempted to identify these challenges as well as instruments that could address these challenges. This survey included respondents internationally to get a world-wide response on what challenges during TEES require instrumentation.

***<main findings>***

From the comments regarding instrumentation to facilitate TEES, nine out of seventeen responses described an instrument that combines suction with another functionality, such as dissection, cautery and reach via shaft shape. Nine out of seventeen comments described an instrument that could reach areas better and four out of seventeen comments mentioned a tool that combined reach and suction. Four out of seventeen comments described an instrument to hold the endoscope and four comments described an instrument that could drill bone while combining irrigation and suction or with better visualization.

Analog visual scales were chosen over likert scales as they are continuous and thus respondents can select any values between the boundary points and visually appreciate where their answers lie on continuous scales [11][12]. It is suggested that a continuous rating scale is *superior* to a likert scale because respondents are not *arbitrarily bound to a set number of discrete ratings and do not need to subjectively discriminate between those ratings*. Further, the analog visual scale *is more sensitive in detecting* differences between measured variables as compared with a likert scale. Finally, analog visual scales are more likely to yield normally distributed data and this facilitates parametric statistical analysis with smaller sample sizes[11][13].

The following discusses the different difficulties outlined in the questionnaire.

### Bleeding control

-discuss the nature of the challenge

-identified this as a challenge (can also cite an excellent paper by le Nobel et al.!!)

-compare this to existing literature on the topic (i.e. did we identify this as being a greater concern? Subgroup analyses?)

-discuss existing methods managing bleeding

-discuss potential future ways of managing

Managing bleeding has been reported many times as a challenge during TEES in various papers regarding teaching TEES, instrumentation and a survey of Canadian otologists where 24% of respondents reported bleeding as a challenge during TEES [5][6][3][4][14]. As well, a study by le Nobel et al. reported that impaired surgical field clarity due to intraoperative bleeding is associated with increased risk of residual cholesteatoma for meso/epitympanic cholesteatoma [15]. Specialized instruments are being developed to mitigate the problem of bleeding control. Instruments that incorporate a functional tip with a suction shaft allow for cutting, dissecting or elevating tissues while suctioning [3]. As well, there are techniques to maintain hemostastis during TEES to facilitate one-handed surgery such as: injecting local anesthetic and epinephrine, packing the ear canal with topical epinephrine soaked neuro-patties before surgery, maintaining hypotensive anesthesia and gentle head elevation, careful instrument manipulation in external canal and applying epinephrine soaked cotton balls while raising the tympanomeatal flap [8][14]. From this questionnaire, bleeding control exhibited a need of 67% ± 5% and nine of the seventeen comments from respondents described that an instrument combining suction with another functionality, such as dissecting, cauterizing or reaching, would be beneficial for TEES.

### Reaching structures visualized by the endoscope and dissection and removal of cholesteatoma

Difficult to reach anatomical recesses include the sinus tympani, facial recess and anterior epitympanic recess [3]. As well, residual cholesteatoma occurs if cholesteatoma is found in inaccessible areas [16][17]. Reaching structures visualized by the endoscope and dissection and removal of cholesteatoma resulted in the highest degree of need. These two difficulties are related as dissecting and removal of cholesteatoma requires the surgeon’s tools to reach the cholesteatoma, which is often located in hard to access areas visualized by the endoscope. Specialized instruments that have a curved tip in order to reach structures visualized by the endoscope have also being developed, particularly instruments to reach the sinus tympani [3]. However, the curve in the shaft is fixed and there are areas where the tip cannot reach, which would require bone removal.

### Cutting and removing bone

need a source for this

### Keeping the endoscope lens clean

Fogging and smearing of the endoscope tip is a challenge of TEES and surgeons must pause surgery, remove the fogged lens and wipe it clean on a defog pad periodically[3][14]. This difficulty during surgery requires the surgeon to remove the tool and endoscope, and wipe it periodically when the lens is not clean. The lens can also become dirty during drilling when pieces of bone and irrigation fluid are flowing in the surgical field(???).

### Moving and positioning a graft into the intended place

In tympanoplasty surgery, the approach, graft material and graft placement technique vary depending on the training, case load, resources and experience available to the surgeon [18]. During TEES tympanoplasty the graft must be inserted into the ear canal and positioned single handedly in the desired orientation, e.g. underlay technique requires the graft to be supported under the annulus anteriorly and over the neck of the malleus for anterosuperior support [18]. Performing this technique single handedly can be challenging and so perhaps a tool that facilitates graft manipulation would be helpful for TEES surgeons. Lea and Mijovic show that cartilage or graft placement is easier when using two hands in a surgery video [8]

### Qualitative results:

Insert qualitative results – open ended responses with themes/categories.

***<implications of the findings>***

## Conclusion:

* key findings
* review main outcome measures
* compare key findings with other literature
* limitations of study
  + The questionnaire was sent to otologists who are interested in endoscopic ear surgery as the questionnaire asked participants to rate their experience on TEES. There is a low representation of surgeons who perform 0% of surgeries totally endoscopically (8% of respondents).
  + We do not know the major types of surgeries that the respondents do using TEES. This would affect the results as they would face different difficulties during surgery. For example, a surgeon who primarily performs TEES cholesteatoma would probably need more instrumentation for dissecting and reaching cholesteatoma.
  + Low response rate. The questionnaire, with 11 questions, was designed to be very short and easy to complete but it still received a low response rate.
  + The surgeons who responded probably are biased towards using TEES and therefore, the responses don’t include opinions from surgeons who are not interested in TEES. However, since this study aims to identify the needs of TEES surgeons, this limitation is not so significant as we want to know the opinions of surgeons who practice TEES and are therefore interested in TEES.

Notes:

* Why are we doing a needs analysis?

To identify, describe and rank the difficulties experienced during TEES and if developing new instruments to address these challenges would be beneficial to TEES.

* What do we want to learn from the needs analysis?

The difficulties that are most widely experienced by TEES surgeons and what difficulties do surgeons require new instruments for.

* What context does the reader need in order to understand this study?

TEES, endoscopes used

* Clinical implications, and say that this method is still contended because of…. The problems of TEES

Notes from “Endoscopic and keyhole endoscope-assisted neurosurgical approaches: A qualitative survey on technical challenges and technological solutions”[19]

Methods:

* asked: name, surgical unit, subspecialty interests
* survey:
  + whether surgeon presently uses endoscopic/endoscopic assisted approaches
  + what they consider to be major technical barriers to adopting such approaches
  + technological advances they foresee improving safety and efficacy in the field
  + three authors analysed the survey

Results:

* + 40 neurosurgeons (16% response rate within the first week)
  + reported the percent of surgeons that did xyz types of surgery
  + detailed opinions on technical challenges:
    - grouped responses into specific themes: surgical approach with better integration with image guidance, intra-op visualization and improvement in neuroendoscopy, surgical manipulation and improvements in instruments
    - subthemes outlined in a figure e.g. for approach: integrated IGS, flexible access subthemes
  + paragraphs outlining the results of the themes
    - how many respondents suggested that theme?
    - E.g. How many respondents said endoscope image quality was a problem in the visualization theme?
  + Table outlining the subspecialties of the neurosurgeon respondents

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