# 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 challenges 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:

Ethics approval was obtained for this study from the institution’s Research Ethics Board (REB numbers: )

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. Participant demographics included the percentage of cholesteatoma surgeries performed using TEES as well as whether the surgeon uses a specialized TEES instrument set. Participants were asked the degree to which an instrument that addresses the following challenges would be of use to the participant:

Table 1: List of challenges 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 on challenges experienced during TEES and the clinical experience of the principal author and his colleagues. Using this data, a preliminary questionnaire was developed and piloted amongst local otologists with varying degrees of TEES experience. 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 REB approval, these otologists were invited to participate in the survey. The beginning of the online survey includes a letter of information and informed consent was assumed upon anonymous completion of the questionnaire. All information was storedanonymously .

### Data Analysis:

Visual analog scales were quantified and the means as well as the 95% confidence intervals were established. ANOVA was used to determine which challenge presented the greatest degree of need. The Kruskall-Wallis H-test was used to determine if percentage of cases done with TEES influenced the degree of need for each challenge. The t-test was used to determine if use of a specialized TEES instrument set affected the degree of need for each challenge. Qualitative data was analyzed by grouping the responses into themes/categories which would describe additional difficulties those tools would address. Statistical analysis was performed using JPM statistical analysis software (JMP version 13.0; SAS Institute; Cary, NC)

## Results:

### Study Participants and Demographics

The questionnaire was distributed to a total of \_\_\_\_\_ surgeons and fourty nine surgeons completed the questionnaire corresponding to an overall response rate of <???>. The questionnaire was sent to <???> number of people. (attendees of 2nd world congress + Japan course participants + members of IWGEES). 16 attendees at the 2nd World Congress on Endoscopic Ear Surgery, six attendees of the Japanese course, and 26 members of the International Working Group on Endoscopic Ear Surgery (IWGEES) responded. 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. Of the respondents, 4 (8.1%) do not perform any surgeries using TEES, 15 (30.6%) perform up to 50% of surgeries using TEES, 20 (40.8%) perform 50-90% of surgeries using TEES, and 10 (20.4%) perform greater than 90% of surgeries using TEES. Thirty eight (77.6%) of respondents use specialized TEES instrument sets.

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 |

Figure XXX. Bar graph to present the percent degree of need for each TEES challenge. The error bars show the standard error, n = 51.

The Kruskal-Wallis Test is used to determine if there are statistically significant differences between six groups of an independent variable (six challenges) on a continuous dependent variable (degree of need). The distribution of the data from each challenge are not the same shape and so the Kruskal-Wallis test to compare mean ranks with a 95% CI was used to determine the statistically significant differences in degree of need for the challenges. The p-value comes from a chi-squared distribution.

### Challenges during TEES that exhibit the greatest degree of need by surgeons:

The average degree of need for each challenge exceeded 50% for all challenges, suggesting that all challenges presented are experienced significantly by the respondents. A Reaching structures visualized by the endoscope resulted in the highest degree of need (mean 83%, 95%CI \_\_-\_\_%, p=)83%±3% (mean Conversely, positioning the graft resulted in the lowest degree of need (mean; 95% CI, p= )

The p value for the Kruskal-Wallis test was <0.0001. Reaching structures (mean 83% ± 3%) is not statistically significantly greater than dissection and removal of cholesteatoma (mean 77% ± 3%). Reaching structures is significantly greater than cutting bone, p = 0.0016. Positioning a graft (mean 58% ± 3%) is significantly lower than dissection and removal of cholesteatoma, p = 0.0002.

### Effect of percent of surgeries performed totally endoscopically on TEES challenges:

The percentage of surgeries performed with TEES had a significant effect

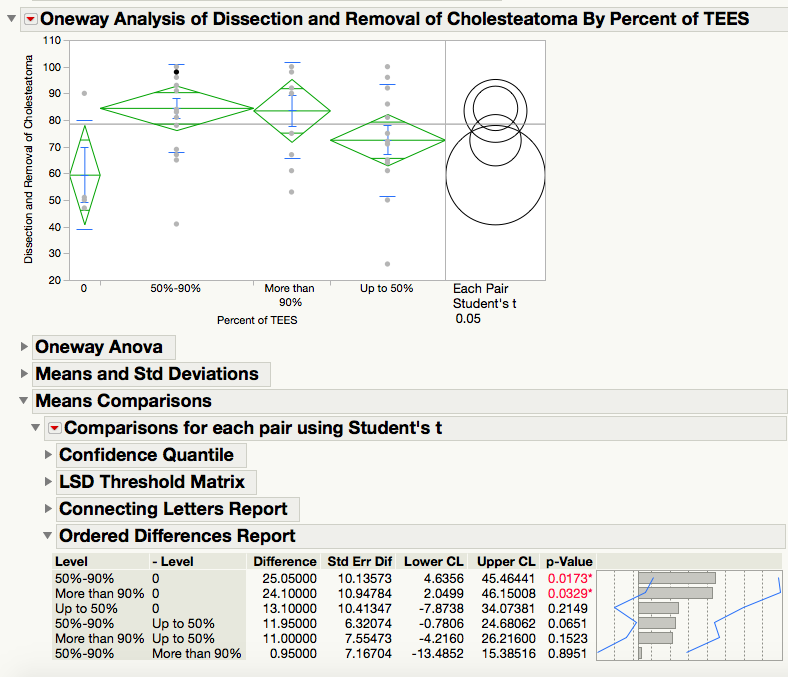
ANOVA with an alpha of 0.05 showed that the percent of surgeries performed totally endoscopically had a significant effect on the degree of need for the following challenges.

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

Table XXX. This table reports the significant effect of TEES experience on the degree of need to facilitate TEES challenges.

|  |  |  |
| --- | --- | --- |
| TEES Difficulty | Significant Kruskal-Wallis rank sum p-value | Comparison of Means\* |
| Reaching structures | 0.0300 | Degree of need:  More than 90% > Up to 50%, p-value = 0.0079  50%-90% > Up to 50%, p-value = 0.0092 |
| Positioning a graft | 0.0050 | More than 90% > Up to 50%, p-value = 0.0007  More than 90% > 0, p-value = 0.0381  More than 90%> 50%-90%, p-value = 0.0359 |
|  |  |  |

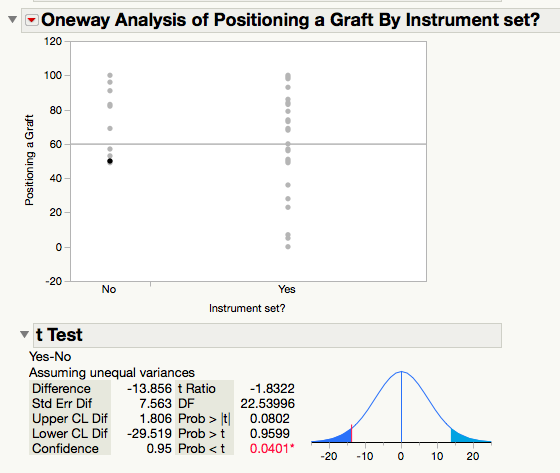
\*oneway ANOVA or the Kruskal Wallis test rank sums was performed and the p-value was calculated using the chi-squared distribution. And comparison of the means was calculated by comparing each pair using a one tailed Student’s t test, α = 0.05.



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 TEESchallenges 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 | Mechanical scalpel and/or curette |  |
| 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) |  |  |  |  |
|  | Suction specifically designed for sinus tympani |  |  |  |  |

\*yellow = both reaching and suction

From the comments regarding instrumentation to facilitate TEES, 10 out of 21 responses described an instrument that combines suction with another functionality, such as dissection, cautery and reach via shaft shape. 10 comments described an instrument that could reach areas better and four comments mentioned a tool that combined reach and suction. Four 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.

## Discussion:

We have conducted a cross-sectional mixed-methods survey to identify, *quantify* and describe the challenges 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 challenges during surgery and whether theycould 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

Reaching structures visualized by the endoscope and dissection and removal of cholesteatoma were the TEES challenges that exhibited the greatest need by respondents. More than 50% of the comments by respondents mentioned the need of instruments with suction and to reach structures. Experience with TEES resulted in a greater need for instruments to facilitate reaching structures, positioning a graft and dissection and removal of cholesteatoma.

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 challenges 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

Management of intraoperative bleeding represents a significant challenge when performing TEES. Intraoperative bleeding may impair surgical field clarity and obscure target tissues and this may lead to increased rates of residual cholesteatoma [15]. To manage this, techniques such as hypotensive anesthesia, patient positioning, local vasoconstrictors, and atraumatic surgical techniques have been employed[8][14][15]. In addition, specialized instrument sets have been developed to improve bleeding management in TEES [3]. These instruments incorporate a functional tip with a suction shaft to allow for cutting, dissecting or elevating tissues while suctioning[3]. Previous studies have identified management of intraoperative bleeding as a significant challenge faced by otologists when performing TEES (by 24% of Canadian Otologist respondents in Lea et al.’s survey)[5][6][3][4][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.

By contrast, our study identified bleeding management to be an issue in \_\_\_\_\_\_. ----- subgroup analysis and comments on this -------. ----- potentially novel instruments to facilitate management of intraoperative bleeding identified in this study -----

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

*While straight and angled endoscopes allow for excellent visualization of the recesses of the middle ear and mastoid, reaching these areas with current instruments remains a challenge.* Difficult to reach anatomical recesses include the sinus tympani, facial recess, and anterior epitympanic recess  [3]. As a result of inadequate access, patients may be at increased risk of residual disease if these areas are involved with cholesteatoma[15][16]. Further, surgeons may have to modify their approach to reach these areas, potentially necessitating a post-auricular approach or additional bone removal with a TEES approach thus resulting in more aggressive surgery. While specialized instruments with curved tips have been developed to address this, the curves in the shafts are fixed and there are areas where these instruments still cannot reach [3]. Reaching structures visualized by the endoscope for dissection and removal of cholesteatoma was identified in our study as the challenge with the highest degree of need. --- amongst surgeons with specialized sets ----? ---- novice vs. advanced surgeons? ----. ----- techniques to address this?----

### Cutting and removing bone

Cutting and removing bone allows visualization of and access to areas within the middle ear that cannot be seen by the endoscope or reached by existing instruments.

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 can be time consuming during surgery. 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.

The comments compliment the results of the degree of need for instruments to facilitate TEES challenges where more than 50% of the comments expressed the need for a tool to reach areas visualized by the endoscope, which also exhibited the greatest degree of need. As well, the need for a combined suction tool had the same number of responses which coincides with dissection and removal of cholesteatoma that requires suction(???).

### Implications of the Findings

The findings from this needs analysis study can be used for future development of tools to facilitate TEES or to develop training/teaching models. The team hopes that otologists will continue to study the needs of TEES to continually improve upon the technology available to facilitate its use (?????).

### Limitations

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). Furthermore, the questionnaire did not ask the types of surgeries that the respondents normally perform using TEES. Therefore, the results may be influenced by this bias of respondents. This would affect the results as surgeons who perform primarily cholesteatoma surgeries might face different challenges, such as dissection and removal of cholesteatoma, during surgery than surgeons who perform primarily tympanoplasties, where a major challenge could be positioning the graft. 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. This probably affected the statistical analysis of the results, where ideally 100 or more responses would be sufficient (?????). The surgeons who responded are probably biased towards using TEES and therefore, the responses did not 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. It would be interesting to see how/if the challenges between microscopic otologists and TEES otologists vary. The questions asked before the comments section may have prompted specific responses as many of the responses were related to the TEES challenges presented.

## Conclusion:

key findings

review main outcome measures

compare key findings with other literature

limitations of study

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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