



Endoscopic ear surgery in Australia

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Background: Endoscopic ear surgery (EES) is increasingly used in otology, with a growing body of evidence to support its efficacy and safety. The purpose of this survey is to understand the prevalence of EES usage in Australia, attitudes towards EES, and barriers preventing its adoption amongst Australian otolaryngologists.

Methods: Members of the Australian Society of Otolaryngology – Head & Neck Surgery (ASOHNS) were contacted to complete a survey on EES. The content of the questionnaire focused on indications for usage, case volumes, attitudes, perceptions, and barriers of EES uptake. Descriptive statistics were used to analyze the responses.

Results: Sixty-five responses were received (representing 14.4% of ASOHNS members). Twenty-eight (43%) respondents reported performing EES in their practice (EES surgeon), whereas 37 (56.9%) do not perform endoscopic dissection intraoperatively (non-EES surgeon). Of the 28 EES surgeons, only 5 (17.8%) have performed over 50 EES cases. Most common indications for EES were tympanoplasty, cholesteatoma, and ossiculoplasty. Of the 37 non-EES surgeons, 17 (45.9%) use the endoscope intraoperatively to inspect without dissection. The mean duration in practice between EES and non-EES surgeons was 13.0 *vs.* 21.4 years ($P < 0.01$). Twenty-two (78.6%) in the EES group have attended an EES workshop, compared to 9 (24.3%) in the non-EES group. Both groups felt positively that EES would be relevant in the future of otology (EES group: 4.8, non-EES group 4.0, on a 5-point Likert scale).

Conclusions: Although the study response rate was limited, preliminary attitudes towards the adoption and use of EES are positive. Further efforts, including research and workshop development, could help improve penetrance of EES in Australia.

Keywords: Surgical technique; endoscopic ear surgery (EES); otology; survey; Australia

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Introduction

The use of the endoscopic ear surgery (EES) in otology was first described in the late 1990s (1,2). However, it was not until the early 2010s that interest in the technique began

to grow globally, with corresponding increases in EES-related publications (3). The efficacy and safety of EES has been demonstrated by multiple authors (4-6). EES is particularly effective in addressing certain pathologies, such as tympanoplasty and cholesteatoma, primarily due to the

greater degree of visualization afforded by the endoscope. Furthermore, the ability to avoid an external incision (endural or postauricular) offers patients superior cosmetic results.

Despite its advantages, the endoscope does present some shortcomings. The surgeon is typically reduced to one-handed operating as the non-dominant hand actively positions the endoscope. This can render certain situations more challenging, such as hemorrhage, or dissection of significantly scarred tissue. Secondly, there is a loss of three-dimensional depth perception with the endoscope. Thirdly, EES requires a considerable learning curve, which may make its adoption by adept microscopic surgeons difficult for logistical reasons.

Given the potential role of EES in the future of otology, we felt it is relevant to conduct a cross-sectional evaluation of EES usage patterns. The purpose of this study is to obtain an understanding of the attitudes towards EES in Australia, its pattern of usage in clinical practice, and any barriers that prevent its adoption. We present the following article in accordance with the STROBE reporting checklist (available at <http://dx.doi.org/10.21037/ajo-19-78>).

Methods

Questionnaire

An electronic questionnaire (Google Forms) generated and vetted by the authors was distributed electronically to members of the Australian Society of Otolaryngology – Head & Neck Surgery (ASOHNS) (Appendix 1). Trainees were excluded from participating in the survey. Data was analyzed after a four-week collection phase. Reminders were sent to ASOHNS members at the second and fourth week. Participant consent was obtained to use the anonymized data for analysis. Depending on how participants answered with respect to EES use in their practice, different follow up questions were presented to the “EES surgeon” group *vs.* the “non-EES surgeon” group (see Appendix 1). An EES surgeon was defined as a surgeon who has performed at least one EES case in their practice. The survey explored further details in EES use in the “EES surgeon” group. In the “non-EES surgeon” group, questions explored possible barriers to adoption of EES. The survey included twelve questions and was designed to be completed in 10 minutes or less. Questions relating to attitudes towards EES were evaluated on a Likert scale (5-point scale with 1 representing “strongly disagree” and 5 representing “strongly agree”).

Statistics

Descriptive statistics were used to analyze the results. Student’s *t*-test was used to compare numerical data between subgroups, Mann-Whitney test was used to compare Likert scale responses between subgroups. Statistical analysis was performed using R software (RStudio, Boston, MA). The significance level was set at 0.05.

Ethical statement

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the North Sydney Local Health District (NSLHD) Human Research Ethics Committee (HREC) (RESP/18/21) and informed consent was taken from all individual participants.

Results

Participants

The survey was emailed to 452 members of the ASOHNS. Responses were obtained from 65 otolaryngologists, representing 14.4% of ASOHNS members. Most respondents were from New South Wales (20), followed by Queensland (13) and Victoria (11) (Figure 1). Duration of independent clinical practice varied widely, from as few as 2 years up to 50 years (mean 17.8 years). Most respondents (84.8%) pursued fellowship training. Eighteen (27.7%) respondents were fellowship-trained in otology/neurotology. The majority (75.4%) were involved in education of trainees. Forty-one (63.1%) reported otology as being a “significant part” of their practice.

EES usage

Participants were asked regarding use of EES in their clinical practice. The questions roughly mirror the Massachusetts EES grading scale (Tables 1,2). Based on their response, participants were grouped either as an “EES surgeon” or a “non-EES surgeon” (Table 3).

EES surgeon subgroup

There were 28 respondents in this subgroup. Thirteen (46.4%) were otology fellowship-trained. Mean duration of clinical practice was 13.0 years. Extent of intraoperative endoscope usage is seen in Table 2. Twenty (71.4%) surgeons



Figure 1 Geographic distribution of survey respondents.

Table 1 System

Class	Endoscope usage
0	Microscope only
1	Microscope dissection, endoscope inspection
2A	Microscope and <50% endoscope usage
2B	Microscope and >50% endoscope usage
3	Total endoscopic ear surgery

have performed between 1–25 EES cases, 3 (10.7%) have performed between 26–50 cases, and 5 (17.9%) have performed over 50 cases.

The most common indication for endoscopic surgery was cholesteatoma, as indicated by 23 of 28 (82.1%) EES surgeons, followed by tympanoplasty (20–71.4%), and ossiculoplasty (11–39.3%). Surgical indications are shown in *Figure 2*. Nine surgeons began performing EES between 2010 to 2014. Between 2015 to 2018, nineteen surgeons began performing EES (*Figure 3*).

Non-EES surgeon subgroup

There were 37 respondents in this subgroup. Five (18.5%) respondents were otology-fellowship trained. Mean duration of clinical practice was 21.4 years. Although the endoscope

was not used actively in intraoperative dissection, 17 (45.9%) use the endoscope intraoperatively for inspection as an adjunct to the microscope. In the outpatient setting, 15 (40.5%) use endoscopes for consultation (*Table 2*).

The most commonly cited reasons for not performing EES were “insufficient time to explore/learn EES” (14–37.8%), “the microscope is a sufficient instrument in otology” (13–35.1%), and “I don’t have the necessary equipment” (9–24.3%). Less common reasons included discouragement by the required learning curve, low-volume otology practice, and practice nearing retirement.

Attitudes

Respondents were asked to respond on a 5-point Likert scale (1, strongly disagree; 5, strongly agree) to questions regarding the utility and future of EES. EES surgeons were more likely than their non-EES counterparts to agree that the endoscope will be relevant in the future of otology (4.8 vs. 4.0 on Likert scale, P<0.001) (*Figure 4*). Both EES and non-EES surgeons tended to agree with the statement that the use of endoscopes provides a superior view of the middle ear compared to the microscope (4.3 vs. 3.9 on Likert scale, P=0.07) (*Figure 5*). EES surgeons also endorsed the statement that “the endoscope is an excellent tool to teach middle ear anatomy” with 21 of 28 (75%) strongly

Table 2 Respondents were asked to choose the option which “best describes your use of the endoscope in ear surgery”. Responses were classified as either “non-EES surgeon” or “EES surgeon”

Question	N (%)	Category
I do not perform otologic surgery	8 (12.3)	Non-EES surgeon (n=37)
I don't use the endoscope in otologic surgery	12 (18.5)	
I occasionally use the endoscope intraoperatively to inspect difficult areas	17 (26.2)	
I am beginning to use the endoscope to dissect in combination with the microscope	15 (23.1)	EES surgeon (n=28)
I regularly use the endoscope in ear surgery (>50% of the time)	6 (9.2)	
I regularly perform total endoscopic ear surgery	7 (10.8)	

EES, endoscopic ear surgery.

Table 3 Comparison of characteristics between EES and non-EES subgroups

Parameter	EES subgroup	Non-EES subgroup
n	23	37
Years in practice (mean)	13.0	21.4
Fellowship trained	78.6%	73.0%
Otology fellowship trained	46.4%	13.5%
Involved in trainee education	89.3%	64.9%
Attended EES course	78.6%	24.3%
“Significant” otology practice	85.7%	45.9%

EES, endoscopic ear surgery.

agreeing (mean 4.7).

The non-EES surgeons reported mixed results when asked whether they planned to incorporate EES into their future practice, with 40.5% agreeing, 40.5% disagreeing, and 19.0% undecided.

Discussion

Although early reports of endoscope-guided otologic surgery have been described since the turn of the millennium, the uptake of EES into mainstream otology has only rapidly progressed within the last decade (3). The adoption of the endoscope in otologic surgery has been likened to the introduction of the endoscope to sinus surgery in its potential to revolutionize the field. Naturally, the emergence of this new technology has also led some to caution against its rapid utilization before further study has been undertaken to validate its efficacy and safety (7,8). However, growing evidence of the EES literature has resulted in its use by otologists around the world. To date,

there is no study looking at the use of EES in Australia.

The benefits of EES have been well described in literature. While the most obvious advantages include improved intraoperative visualization and avoidance of external scars, EES has also been shown to potentially further reduce residual disease in cholesteatoma when compared to microscopic surgery (9). The application of EES in cholesteatoma and tympanoplasty surgery has been well studied, and demonstrated to be safe and effective (5,10-13). This is echoed within the EES surgeon subgroup with both tympanoplasty and cholesteatoma being the most common surgical indications. EES was not routinely used in stapedotomy or lateral skull base surgery in this study. These indications represent more technically demanding surgery and would likely not be performed by lower-volume EES surgeons. In particular, the loss of depth perception can be challenging when performing footplate and/or prosthesis work, which requires considerable endoscopic experience to overcome (14). EES-assisted lateral skull base surgery has been described by subspecialty otology-referral

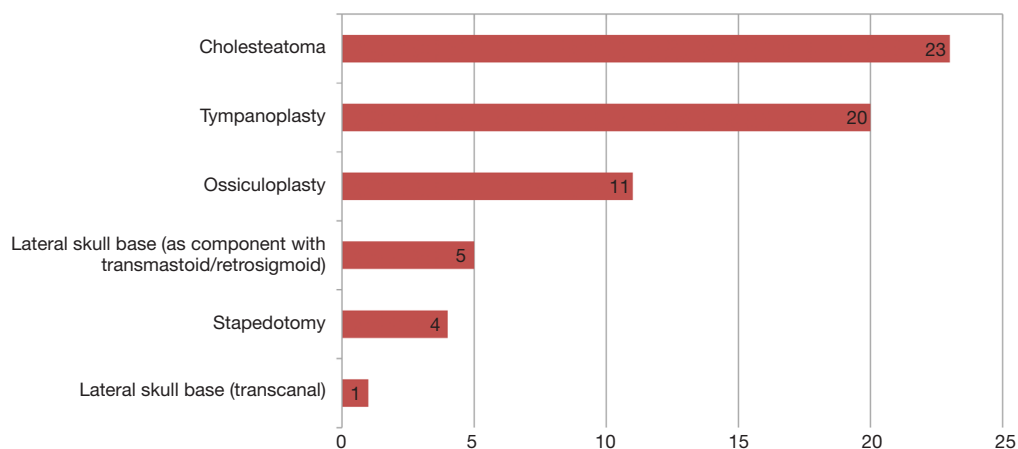


Figure 2 EES subgroup—most common indications for EES. EES, endoscopic ear surgery.

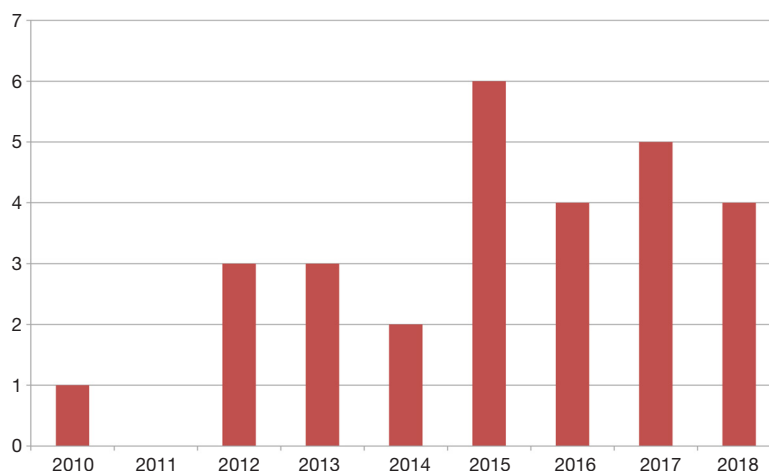


Figure 3 EES subgroup—“What year did you perform your first EES case?”. EES, endoscopic ear surgery.

centers (15,16) and falls out of the scope of the average EES surgeon.

There are several challenges to implementing EES into clinical practice. A significant difference was noted between EES *vs.* non-EES surgeons with respect to duration of practice. Non-EES surgeons were more likely to be further into their career compared to EES surgeons, who tended to be younger (13.0 *vs.* 21.4 years, $P < 0.01$). This could be related to the younger consultants’ earlier and more frequent exposure to endoscopic techniques during training, such as endoscopic sinus surgery, thereby reducing the learning curve time required to become adept at EES. Prior studies have examined the impact of case volumes on EES proficiency, with reports of approximately 50 cases required

to cross the transition from learning to proficient (17). For a lower-volume surgeon, it may be logistically challenging to commit 50 cases to learning a new technique. In addition to time commitment, one must also accept a possibility of reduced operative efficiency and potentially worse outcomes early on. Indeed, almost 40% of non-EES respondents identified a lack of time to learn as a major barrier to adoption of EES. To combat this, numerous EES courses have been offered around the world and are becoming increasingly popular. Interest to attend an EES course was frequently expressed within the non-EES group. Comparatively, 78.6% of the EES surgeon group reported attending at least one EES course.

Another barrier to implementation cited was lack of

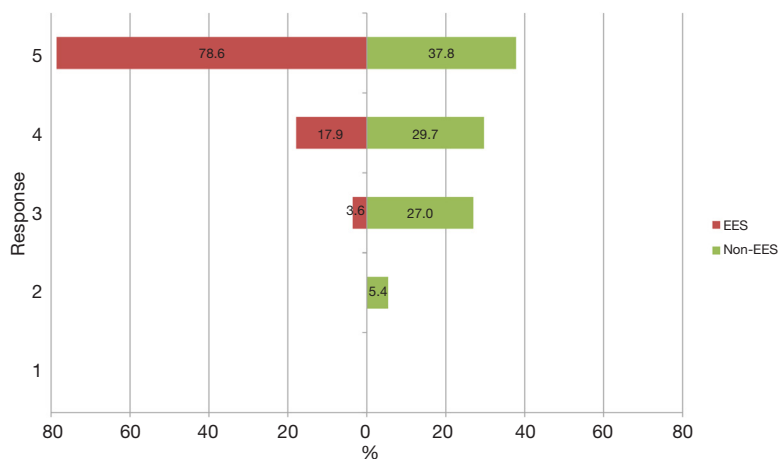


Figure 4 Comparison (%) between EES and non-EES surgeons for the statement: “Endoscopic ear surgery will have an important role in the future of otology”. P<0.01. EES, endoscopic ear surgery.

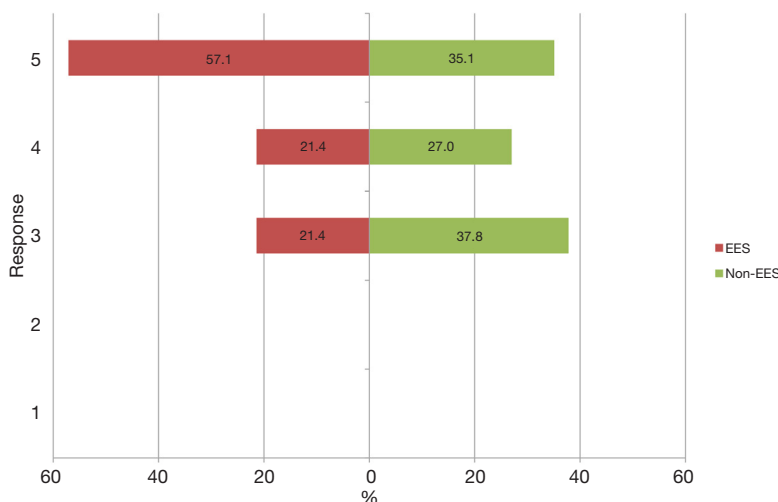


Figure 5 Comparison (%) between EES and non-EES surgeons for the statement: “The view of the middle ear is superior with the endoscope compared to the microscope”. P=0.07. EES, endoscopic ear surgery.

appropriate instrumentation. However, the instruments found in a standard middle ear tray are often sufficient for relatively simpler EES cases, such as grommet insertion or underlay tympanoplasty (18). As experience is gained, advanced instruments that maximize the ability to dissect around corners become necessary. While 3 mm endoscopes are preferred, 4 mm sinus endoscopes can often fit into most external auditory canals. Surgeons wishing to start with EES often have sufficient instrumentation in their centers to tackle simple, appropriately selected cases. The interested reader is referred to other works detailing

implementation of EES into practice (18,19).

The primary limitation of this study is the self-reported nature of the survey. Approximately 14% of ASOHNS members replied to the survey. Attempts were made to maximize response rate by keeping the questionnaire brief as well as sending multiple reminder notices to ASOHNS members. The response rate of this survey could relate to a response bias with those having an interest in otology being more likely to reply. We recognize the findings of this study would be difficult to generalize to the average otolaryngologist in Australia. Additionally, trainees were

not included in the study, and comments cannot be made regarding the status of EES exposure in specialist training programs.

Overall, preliminary attitudes towards EES are generally positive in Australia. Both groups tended to agree that EES has a relevant role in the future of otology. Even in the non-EES group, the endoscope is frequently used in consultations (40.5%) and for inspection intraoperatively (45.9%). Importantly, within the EES subgroup, many respondents addressed the complementary roles of the endoscope and the microscope with the recognition that both are valuable tools possessing their respective strengths and weaknesses. Furthermore, there is a considerable proportion (40.5%) of current non-EES surgeons expressing interest in incorporating EES into their practice in the future.

Conclusions

This study represents the first of its kind to survey usage and attitudes towards EES in Australia. EES is being performed by some surgeons in Australia, but only five report performing high volume EES (>50 cases). Amongst those not performing EES, the endoscope was used frequently in both outpatient consultation as well as intraoperative inspection after microscopic dissection. The limited response rate precludes statements regarding the overall uptake of EES in Australia, but amongst respondents, overall attitudes towards EES seem to be welcoming with many surgeons recognizing its role in appropriately selected otology cases.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <http://dx.doi.org/10.21037/ajo-19-78>.

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the North Sydney Local Health District (NSLHD) Human Research Ethics Committee (HREC) (RESP/18/21) and informed consent was taken from all individual participants.

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Appendix 1

General

1. How many years have you been in independent practice?
2. Have you undertaken sub-specialization fellowship training? Select all that apply.
3. Do you directly supervise trainees?
4. Do you consider otology to be a significant part of your practice?
5. Have you attended any endoscopic ear surgery workshops or courses?
6. Which of the following best describes your use of the endoscope in ear surgery?
 - a. I do not perform otologic surgery
 - b. I don't use the endoscope in ear surgery
 - c. I occasionally use the endoscope to inspect difficult areas after microscopic surgery
 - d. I am beginning to use the endoscope to dissect in combination with the microscope
 - e. I regularly use the endoscope in ear surgery (>50% of the time)
 - f. I regularly perform total endoscopic ear surgery

EES Subgroup Questions

7. In what year did you perform your first endoscopic dissection?
8. Which of the following procedures do you perform utilizing an endoscope? Check all that apply.
 - a. Tympanoplasty
 - b. Cholesteatoma
 - c. Ossiculoplasty
 - d. Stapedotomy
 - e. Lateral skull base (transcanal)
 - f. Lateral skull base (as component of translabyrinthine/retrosigmoid approaches)
9. How many endoscopic ear surgeries have you performed (partial or total use of endoscope)?
 - a. 1-25
 - b. 25-50
 - c. >50
10. Consider the statement: Endoscopic ear surgery will have an important role in the future of otology.
1 – Strongly disagree to 5 – Strongly agree
11. Consider the statement: The view of the middle ear is superior with the endoscope compared to the microscope.
1 – Strongly disagree to 5 – Strongly agree
12. Consider the statement: The endoscope is an excellent tool to teach middle ear anatomy.
1 – Strongly disagree to 5 – Strongly agree
13. Any other comments you would like to make regarding the use of endoscopes in otology/neurotology.

Non-EES Subgroup Questions

7. Do you use endoscopes to examine the ear for outpatient consultations?
8. For what reasons do you not perform endoscopic ear surgery? Select all that apply
 - a. I am discouraged by the learning curve
 - b. I have not had time to explore/learn this technique
 - c. I don't have the necessary equipment
 - d. The microscope is a sufficient instrument in otology
 - e. I do not perform any otologic procedures
 - f. Other – please explain

9. Consider the statement: Endoscopic ear surgery will have an important role in the future of otology.
1 – Strongly disagree to 5 – Strongly agree
10. Consider the statement: I plan to incorporate endoscopic ear surgery into my practice in the future
1 – Strongly disagree to 5 – Strongly agree
11. Consider the statement: The view of the middle ear is superior with the endoscope compared to the microscope.
1 – Strongly disagree to 5 – Strongly agree
12. Any other comments you would like to make regarding the use of endoscopes in otology/neurotology.