The Journal of International Advanced Otology

J Int Adv Otol 2025; 21: 1–6 • DOI: 10.5152/iao.2025.241839

Original Article

Proceedings of the Round Table Discussion on the Fifth International Symposium on Otosclerosis and Stapes Surgery

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Cite this article as: Sönmez S, Serkan Orhan K, Baumgartner W, et al. Proceedings of the round table discussion on the Fifth International Symposium on Otosclerosis and Stapes Surgery. *J Int Adv Otol.* 2025, 21(2), 1839, doi: 10.5152/iao.2025.241839.

BACKGROUND: Debates and research about otosclerosis and stapes surgery have continued since the time it was described, and there is still no consensus on many issues. The aim of this article is to report the controversies in the etiology, pathophysiology, diagnosis, imaging, treatment, and management of otosclerosis and address the points of consensus of experts.

METHODS: In the last session of the Fifth International Otosclerosis and Stapes Surgery Symposium held in Brussels, a round table meeting was held where controversial issues in otosclerosis and stapes surgery were discussed, and a survey was administered to all participants. Nine experienced panelists were interviewed by the moderator on stage, and 166 participants provided their answers interactively through the online voting system.

RESULTS: All of the panelists were experts in their field who had performed more than 1000 cases, and if we take into account the more experienced participants, the results are based on at least 16 968 stapes surgery experiences. While full consensus was reached by the expert panelists on 14 questions, agreement was reached by participants on only 2. The most striking difference between the panelists and attendees was regarding reparative granuloma.

CONCLUSION: Even if a consensus was reached on some issues, controversies, especially the surgical technique, medical equipment and prostheses used are subjects to both discussion and development. Even the experts who come to present and share knowledge do not always agree. It is strongly recommended that clinicians follow all developments, compare their results with those of others, and use the techniques and materials with which they feel most comfortable for their patients.

KEYWORDS: Consensus, controversies, management, otosclerosis, stapes surgery

INTRODUCTION

Controversies in the etiology, pathophysiology, and treatment methods of otosclerosis have been ongoing since the late 18th century.[1] Since the disease was defined as otosclerosis by Politzer, many reasons for the exact etiology have been suggested and are

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Received: December 17, 2024 • **Accepted:** December 30, 2024 • **Publication Date:** March 24, 2025
Available online at www.advancedotology.org

still being investigated.[2] Due to advancements in genetic research, it is now accepted as a hereditary disease. Gene studies on this subject have accelerated in the last 2 decades and are shaping the future.[3,4]

Environmental factors such as fluoride deficiency and the measles virus have also been indicated as causative factors but have not been efficiently substantiated. Due to the detection of measles-like structures and antigens in otosclerotic foci, it has been thought that they may be involved in the formation of otosclerotic foci.[5,6] With the current quality standardization of tap water (containing enough fluoride) and vaccination programs for measles in most European countries, the incidence of otosclerosis is yet another controversy, but it did not become an extinct disease. In general, progressive, often asymmetrical conductive hearing loss in women around 35 years old is still is clinically most suspect for otosclerosis, especially when the stapes reflexes are absent on the ipsilateral side. Apart from the most classic adult presentation, juvenile otosclerosis has also been reported already by House et al.[7] This paper advocated stapes surgery with some restrictions, such as a minimum of 5 years of age and a hearing loss of more than 35 dB. Others advocate deferring surgery to an advanced age. A meta-analysis reported that the risk of sensorineural hearing loss in children is higher than in adults in stapes surgery.[8] Therefore, surgery for otosclerosis in childhood is controversial but not impossible when counseled correctly.[9] Even the earliest techniques for stapes surgery as described by Kessel provoked much debate.[1,10] After being abandoned for many years due to complications such as labyrinthitis, meningitis and hearing loss seen. A revival of stapes surgery was initiated by Shea[11] in the 1950s and gained popularization but again debate.

Some older references report that inner ear anomalies are rare, and they would not discourage surgery even if they were multifocal. Therefore, computed tomography (CT) scanning is not needed, and X-ray exposure is unnecessary.[12] Today, the exposure for X-rays in cone beam CT is reasonably low, meaning significantly less than conventional scans. Minor diseases, such as superior canal dehiscence, are more often diagnosed, which is a condition that may clinically mimic otosclerosis but cannot benefit from stapes surgery. Therefore, in the preoperative management of otosclerosis, imaging with CT, most preferably a cone beam CT, seems to have become imperative.

Patients that have multiple pathologies in addition to otosclerosis, pose an even a bigger challenge in their management. Stapes surgery in patients who also have endolymphatic hydrops is a controversial issue. Many surgeons are reluctant to perform stapedotomy, as they believe the risk of sensorineural hearing loss is high due to the enlarged endolymphatic sac. On the contrary, there is a lot of evidence that stapes surgery has very good results in concomitant Meniere's patients.[13,14]

Another debate is the best type of anesthesia for stapes surgery. Stapedoplasty under local or general anesthesia is both possible, and the choice seems to depend on the personal preference of the surgeon or patient. Although local anesthesia has the advantage of immediate evaluation of improved hearing, general anesthesia has a much greater advantage in terms of patient and surgeon comfort. There are studies reporting that local anesthesia is superior to general anesthesia in revision surgery, probably because of the immediate auditory feedback.[15] While there are options such as transcanal, endaural, and endoscopic approaches in surgery, the advantages and disadvantages of each technique are presented by its advocates. Although small fenestra stapedotomy is currently the most preferred approach, there are still surgeons who prefer stapedectomy. However, hand perforators, various lasers (CO_2, KTP, Er-YAG, diode, argon), and microdrills are available instruments for stapedotomy. Not surprisingly, this may provoke debate on which is the best. Discussions continue about which instrument and tools provide better results or safer surgery.[16,17] If we introduce yet another variable in this debate, such as characteristics of the prostheses, more specifically the type (material) and length of the prosthesis, we have enough content for the round table discussion at the 5th International Symposium on Otosclerosis and Stapes Surgery in the Palace of Academia in Brussels, Belgium in April 2023.[18]

The aim of this article is to report the controversies in the etiology, diagnosis, imaging, treatment and management of otosclerosis and address the points of consensus of experts.

METHODS

The last session of the Fifth International Symposium on Otosclerosis and Stapes Surgery, held in Brussels between 9 and 21 April 2023, consisted of a round table that included all attendees with a voting system. Previously in this meeting, current developments and controversial issues were discussed, as well as the sessions in which the most competent surgeons and researchers in the field of stapes surgery and otosclerosis and experiences were shared even outside sessions during breaks and social programs. At the end of the symposium, during the very last session, a survey was applied to the symposium participants. The moderator interviewed 9 experienced panelists on stage, and 166 attendees of the last session interactively indicated their answers via an online voting system. The first author wrote this paper and is an attendee, the last author moderated the round table, and the 9 other authors were part of the expert panel. Table 1 showed all the 20 questions that were assessed during this session. The first question tried to quantify the experience in stapes surgery present during this session. The answers of the expert panelists and attendees were compared in an attempt to find consensus on the matter.

RESULTS

It was reported by 60% of all participants that they had performed less than 45 stapes surgeries. For practical reasons, we can state that this can be researchers or audiologist or radiologist dealing with otosclerosis, although the younger otologists can also be included in this group. Nevertheless, if we focus on other attendees, 28% reported having operated more than 100 cases, 4% more than 500 cases, and 8% more than 1000 stapes surgeries. All of the panelists were experts who had performed more than 1000 surgeries, representing approximately 9000 cases. We can add $(28 \times 1.66 \times 100) + (4 \times 1.66 \times 500) = 4648 + 3320 = 7968$ cases and state that the present audience's responses in Table 1 were based on at least 16.968 stapedoplasty procedures (Table 1).

It is convinced by all the expert panelists that otosclerosis has a genetic origin with environmental triggers, whereas agreement with this statement was reached by only 50% of the attendees. However, nobody in the session thought that it is not a genetic trait (question 2

Table 1. Questions

	Questions	9 Panelist's (%)	166 Attendees (%)
1	How many stapes surgeries have you performed?		
	a) 0-45	–	60
	b) >100	–	28
	c) >500	–	4
	d) >1000	100	8
	e) >2500	–	–
2	Is otosclerosis a genetic disease?		
	a) Autosomal dominant, with variable penetrance.	–	36.4
	b) Genetics origin but only occurs after triggers.	100	50
	c) Combination of gene defects.	–	13.6
	d) Not genetic trait at all: its due to Physionomy.	–	–
3	Is the onset at age changing?		
	a) No: 30-35+: have not seen a change in my career.	66.7	58.8
	b) Yes, patients are becoming younger.	33.3	23.5
	c) Yes, patients are older.	–	17.7
4	Is there such thing as juvenile otosclerosis?		
	a) Yes, absolutely.	100	68.75
	b) No, clinically it is similar but probably is different pathology (ankyloses).	–	18.75
	c) Do not know, but you should never do stapedotomy in children.	–	12.5
5	Incidence/prevalence has interracial differences (otosclerosis is more in Caucasians > Chinese > Africans)	100	100
	a) Yes	–	–
	b) No		
6	Incidence/prevalence correlates with Measles virus?		
	a) Yes	–	13.3
	b) No	100	86.7
7	Incidence/prevalence correlates with hormones/sex?		
	a) Yes	100	94.4
	b) No	–	5.6
8	Incidence decreased due to Fluor in tap water/tooth paste?		
	a) Yes	–	29.4
	b) No	100	70.6
9	The otoscopic Schwartze sign:		
	a) Is too subjective/ difficult to recognize.	66.7	50
	b) Is not clinically relevant.	–	–
	c) Is useful to estimate how active the disease is.	33.3	50
10	What is the most important question to ask before counseling a patient with otosclerosis?		
	a) How do you want to restore your hearing loss: hearing aid versus hearing improving surgery?	100	55
	b) Written consent for failing stapedoplasty and complications.	–	25
	c) What is your profession?	–	20
	d) Do you have diabetes (or other co-pathologies)?	–	–
11	Can vertigo be a presenting symptom? (cavitating otosclerosis/dehiscence due to otospongiotic phase)	–	41.2
	a) Yes	100	58.8
	b) b. No		
12	Vertigo due to otospongiosis can be treated with:		
	a) Medicine (fluor, bisphosphonates, vestibulo-suppression).	–	–
	b) Just wait, second phase will heal it.	100	73.3
	c) Surgery.	–	6.7
	d) Vertigo is not a presenting symptom.	–	20
13	Middle ear inspection is the definite diagnosis, I do not need a CT to decide if I am going to perform stapedotomy because,	–	–
	a) We do not have access to cone beam CT.	–	–
	b) CT is a static finding, you need to feel the ossicular chain during surgery.	–	–
	c) My patients refuse or cannot pay for CT.	100	100
	d) Disagree: No imaging means No surgery.		

(*Continued*)

Table 1. Questions (*Continued*)

	Questions	9 Panelist's (%)	166 Attendees (%)
14	Absolute contra-indication for stapedotomy is		
	a) Only hearing ear.	66.7	66.7
	b) Facial nerve is overhanging.	–	–
	c) Round window is obliterated.	–	6.6
	d) There is no absolute contra-indication.	33.3	26.7
15	The best prosthesis is		
	a) Made from Teflon.	–	21.4
	b) Made from Titanium.	–	14.3
	c) Placed robotically.	–	–
	d) Does not matter, the one you are best trained in.	100	64.2
16	Measuring prosthesis length		
	a) Is not necessary; I use a standard length.	11.1	7.7
	b) Is very important.	88.9	69.2
	c) I always measure but fall back to my routine sizes.	–	23.1
17	Stapes surgery induced granuloma tissue by a titanium piston: reparative granuloma.		
	a) Is an emergency operation to save the ear.	100	27.4
	b) First of all treated with cortisone and then operated on, depending on the symptoms?c)	–	54.6
	Planned extraction of piston after 6 weeks.	–	9
	d) No opinion.	–	9
18	Active middle ear implants for otosclerosis:		
	a) Are not indicated after successful stapedotomy, patients become gradually CI candidates.	–	–
	b) Provide better quality of hearing (Piston + vibrant sound bridge is superior to only piston).	44.4	50
	c) No opinion.	55.6	50
19	Stapes reflex will not recover after surgery; so		
	a) I actively counsel the patients for post-operative hyperacusis.	44.4	40
	b) It is a non-issue, I do not mention it.	55.6	60
20	Far advanced otosclerosis		
	a) Intracochlear ossification can prohibit placement of CI array.	100	44.5
	b) Coming from the otic capsule is only external deformation of cochlea.	–	22.2
	c) No opinion.	–	33.3

Table 1). Question 3 in Table 1 indicated that almost one-third of the present people thought that patients are becoming younger. Juvenile otosclerosis is a clinical entity according to the expert panelists, but 12.5% of the attendees would rather like to prescribe hearing aids for them.

Only 2 questions were unanimously answered with 100% agreement between attendees and panelists. Everybody present agrees that otosclerosis has different prevalence among races (question 5) and that if surgery is needed, every patient should undergo preoperative imaging with a CT scan (question 13). Additionally, questions 6, 7, and 8 showed rather high agreement between the panel and attendees on other factors concerning the incidence but never reached a 100% consensus in the attendees. In general, the expert panelists were more consistent in their responses: 14 out of 20 questions had unanimous 100% answers. Only questions 5 and 7 had an unanimous answers from the attendees.

The attendees were equally divided in their opinion about the clinical usefulness of the otoscopic Schwartze sign, although 1/3 of the experts find it correlating to the otosclerosis activity. During the round table discussion, it seemed that the most important determining factor for indicating stapes surgery lies within the patient's choice (Question 10), and about 1/3 of all thought that there is no absolute contraindication for surgery from a medical point of view (Question 14). On vertigo, all panelists agreed that vertigo is never a primary symptom but can be a secondary symptom. Of all attendees, 58.8% thought that this is not a primary symptom (Question 11). In the treatment of vertigo, the consensus of the panelists was to wait for it to improve in the second phase. The participants agreed with the panelists with a high rate of 73%.

As for the best prosthesis option, all the panelists agreed to use the one that they feel the best and most trained in. While 64.2% of the attendees agreed with the panelists, 21.4% the Teflon piston, and 14.3% the titanium piston as the best. Noteworthy, nobody present thought robotic placement of the prosthesis was the best. There was no consensus in the attendees in measuring the length of the piston in contrast to experts in panel who always measure.

The most striking difference between the panelists' and the attendee's responses was on the issue of reparative granuloma. All the panelists agreed that when repetitive granuloma is diagnosed, especially if there is a decrease in bone thresholds, an operation should be planned immediately to preserve hearing. On the other hand, 54.55% of the participants in the audience approved the "First of all treated with cortisone and then operated on, depending on the symptoms?" option.

About the use of active middle ear implants in otosclerosis treatment, half of the attendees and 5/9 of the panelists reported that they had no experience or idea about this issue. Four of the panelists and the

other half of the audience stated that the use of active middle ear implants gives better hearing results.

Regarding stapes reflexes, 4/9 of the panelists stated that they actively provided counseling due to hyperacusis in the postoperative period, while 5/9 of them stated that it did not pose a problem in their daily practice. On the other hand, 60% of the attendees reported that it is a non-issue. The audience seems to be indecisive when it comes to counseling patients for post-operative hyperacusis in question 19. In the last question, the experts were again unanimous in reporting that otosclerosis can cause intracochlear ossification that can hinder cochlear implantation.

DISCUSSION

Otosclerosis is and remains a challenging but utmost interesting disease in otology.

Since the 1980s, it has been taken out of the training program for Ear, Nose, and Throat (ENT) specialists in the Netherlands and, therefore, is considered as a procedure that requires much experience and dedicated training in Europe. In experienced hands, even without any intraoperative complication, inner ear damage can occur, which makes this procedure legendary and most surgeons superstitious. Because of this mythical status of this intervention, many aspects lack consensus and are the topic of studies aiming to standardize the therapy for otosclerosis.

Here we report the results of a round table during an international symposium on otosclerosis with expert panelists, but also researchers, audiologists, lobbyists, radiologists, and other health care workers in the room referred to as "attendees" who contributed their opinions by a voting system.

In the introduction of all panelists for the closing roundtable session at the Fifth Otosclerosis and Stapes International Symposium, most expert panelists mentioned that they had acquired their experience after being recognized as ENT surgeons. Except for Türkiye, where panelists indicated that stapedoplasty is still part of their training program. So immediately at the very start of the session, there was more dissensus than consensus. However, it seemed logical that the surgeon indicating the stapedoplasty should be the one to perform it, and in doing so, the most important factor is what the patient would want (as stated in the results of Question 10). Although some of the attendees found it important to collect written informed consent (25%), most of the audience agreed upon a very special doctor–patient relationship. It seems that experts admit that stapedoplasty can have adverse results even in the most experienced hands, and this doctor–patient relationship should be well established in terms of trust before the surgery to be able to deal with all possible complications. Another striking result of this study is that all expert panelists would immediately revise a case that encounters a reparative granuloma, in contrast to 27% of the attendees. Of course, this finding could be biased because all experts were surgeons versus a more heterogeneous population of healthcare workers in the audience. Perhaps for the same reason, expert answers seem to have more unanimous responses (14 out of 20 questions in Table 1) and in the attendees a much more scientific discussion often arises between experts in the fields of otosclerosis. Somehow, it is reassuring that 14 out of 20 questions enjoy some consensus in expert surgical opinions.

Interestingly, there was no consensus in the attendees in measuring the length of the piston in contrast to experts in panel who always measure it. Perhaps having performed more than 1000 cases, including probably also revision cases, this is within their learning curve. Similarly, it is surprising that 67% of these same experts still see an absolute contraindication for stapes surgery in an only hearing ear. Especially in the era of cochlear implantation, one would expect the experts to be able to deal with the exceptional complication of a deafened only ear with cochlear implantation (CI). Alternatively, the experts who indicated that CI can also be challenging in far-advanced otosclerosis have the knowledge that sometimes difficult hearing aid rehabilitation is still better than cochlear implant rehabilitation. Nonetheless, it is likely that not all attendees perform cochlear implant surgery, which can explain their almost perfect division of answers in question 20. Another remarkable unanimous answer of the experts is that all of them think that otosclerosis is a genetic disease with some external triggers, whereas most scientific papers define the etiology as an autosomal dominant disease with variable penetrance. Moreover, recent genetic studies have even substantiated this etiology, and animal models are being developed.[4,19]

Although our study has many limitations, such as the setup to question a limited number of health care workers in a symposium session of 90 minutes, which cannot cover more than 20 questions. Matters such as benchmarking or otological databases improving learning curves and many more have not been addressed properly. However, 2 matters enjoyed full consensus of the present audience in this session.

- The patient should decide how the hearing loss should be treated (Q10).
- Stapes surgery requires a preoperative CT scan (Q13).

It would have been nice if we were able to question all participants before the Fifth International Symposium on Otosclerosis and Stapes Surgery in Brussels and then see if their opinions changed in this last session. We could have mentioned then that this symposium gave consensus on these 2 points. However, it is more likely that in current times with emerging imaging technologies and strong patient rights protection and patient organizations, it seems logical that these 2 items have become very straightforward issues. Nevertheless, 2 questions (Q18 and Q19) seem to result in a trend towards a "50-50" answer. Opinions are still divided still about the value of middle ear implants in otosclerosis patients. Strikingly, also half of the present health care workers do not mention hyperacusis as a possible burden after the operation. These and other possibly unaddressed controversies remain in the management of otosclerosis. Perhaps the Sixth International Symposium on Otosclerosis and Stapes Surgery in Rostock, Germany in 2025 can elaborate further.

CONCLUSION

In conclusion, controversies, especially regarding the surgical technique, medical equipment and prostheses used are subjects to both discussion and development. In this study, the proceedings of a round table on controversies at the Fifth International Symposium on Otosclerosis and Stapes Surgery in Brussels report the differences between experts and attendees. Even experts, who came to present and share knowledge, are not always unanimous. However,

the consensus we saw between attendees and experts may account for progression in new insights and clinical protocols.

We strongly advise clinicians to follow all the developments and compare them with their own results and use the technique and materials with which they feel most comfortable with for their patients.

Availability of Data and Materials: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: The last session of the 5th International Symposium on Otosclerosis and Stapes Surgery that was held in Brussels between 9-21 April 2023, consisted of a round tables that included all attendees with a voting system. At the end of the symposium, the very last sessions, a survey was applied to the symposium participants. The moderator interviewed 9 experienced panelists on stage and 166 attendees of the last session interactively also indicated their answers by a online voting system. In this study, no procedure was performed on any patient or subject and no application was made to the ethics committee since it was a survey conducted at an international meeting.

Informed Consent: Verbal and written informed consent was obtained from the participants who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – S.S., K.S.O., V.T.; Design – S.S., K.S.O., V.T.; Supervision – K.S.O., V.T.; Materials – S.S., K.S.O., W.D.B, A.Z., N.O.Ö., M.B., C.R., I.M., M.C., Y.N., V.T.; Data Collection and/or Processing – S.S., K.S.O., W.D.B, A.Z., N.O.Ö., M.B., C.R., I.M., M.C., Y.N., V.T.; Analysis and/or Interpretation – S.S.; Literature Search – S.S.; Writing – S.S., K.S.O., V.T.; Critical Review – K.S.O., V.T.

Declaration of Interests: Nuri Osman Özgirgin is the Editor of the Journal of International Advanced Otology, however, his involvement in the peer review process was solely as an author. Other authors have no conflicts of interest to declare.

Funding: The authors declared that this study received no financial support.

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