

# Office-Based Stapes Surgery

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Otolaryngology—  
 Head and Neck Surgery  
 2019, Vol. 161(6) 1018–1026  
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 Surgery Foundation 2019  
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 DOI: 10.1177/0194599819877652  
<http://otojournal.org>



No sponsorships or competing interests have been disclosed for this article.

## Abstract

**Objective.** The objective of this study was to provide a proof of concept and to assess the success and safety of stapes surgery for otosclerosis under local anesthesia in an office-based setting (OBS) as compared with a hospital operating room setting (ORS).

**Study Design.** Retrospective cohort study.

**Setting.** We reviewed all patients who underwent stapes surgery by the same surgeon from October 2014 to January 2017 at our tertiary care center (ORS, n = 36, 52%) and in an OBS (n = 33, 48%).

**Subjects and Methods.** The surgical technique was identical in both groups. All patients had a temporal bone computed tomography scan and audiogram within the 6 months prior to surgery. Air-bone gaps (ABGs), bone conduction, and air conduction pure tone average values were calculated. Preoperative results for pure tone average, bone conduction, ABG, and word recognition scores were compared with early (4 months) and late (12 months) follow-up audiograms. Intra- and postoperative complications were compared.

**Results.** Both groups were comparable in terms of demographic characteristics and severity of disease. The mean 1-year postoperative ABG was 5.66 dB (95% CI = 4.42-6.90) in the ORS group and 6.30 dB (95% CI = 4.50-8.10) in the OBS group ( $P = .55$ ). ABG improved by 24.27 dB (95% CI = 21.40-27.13) in the ORS group and 23.15 dB (95% CI = 18.45-27.85) in the OBS group ( $P = .68$ ). Complication rates did not differ, although this study remains underpowered.

**Conclusions.** In this small group of patients, the success of stapes surgery performed in an OBS and its complications were comparable to those of an ORS, thus providing an alternative to patients on long operating room waiting lists.

## Keywords

otosclerosis, stapes surgery, stapedectomy, stapedotomy, office-based surgery, day surgery

Received February 11, 2019; accepted September 2, 2019.

Otosclerosis is an abnormal osteoclastic activity causing bone resorption in the otic capsule with new sclerotic bone formation that results in stapes fixation and conductive hearing loss. Surgical management of otosclerosis has proved its efficiency in functional hearing rehabilitation and in the improvement of a patient's quality of life.<sup>1</sup>

Surgical technique consists of stapedotomy, during which a fenestra is drilled into the posterior part of the footplate. This allows for the insertion of a prosthesis extending from the long process of the incus through the fenestra, transmitting vibrations freely. Over time, stapes surgery has become a minimally invasive procedure, being safely performed as day surgery<sup>1</sup> and under local rather than general anesthesia.<sup>2</sup> Although general anesthesia is still performed, local anesthesia offers the advantage of testing for hearing shortly after the placement of the prosthesis and screening for vertigo.<sup>3</sup> A systematic review performed by Wegner et al in 2013 showed no difference in postoperative air-bone gap (ABG), sensorineural hearing loss (SNHL), and postoperative vertigo for stapedectomy or stapedotomy performed under local versus general anesthesia.<sup>2</sup> To our knowledge, no studies have evaluated or compared stapes surgery for otosclerosis in an office-based setting (OBS) versus an operating room setting (ORS).

The desire to develop more minimally invasive and cost-effective approaches is omnipresent in today's medical and surgical specialties. Otolaryngologists are in a great position to take advantage of such procedures and subsequently pass the benefits along to their patients. These benefits include decreased health care costs, operative time, exposure to general anesthesia, and postoperative morbidities. Various otologic procedures are now performed safely and effectively with office-based techniques without compromising results.

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This article was presented as a poster at the AAO-HNSF 2018 Annual Meeting & OTO Experience; October 7-10, 2018; Atlanta, Georgia.

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Since operating room waiting lists may limit the otologist, performing stapes surgery for otosclerosis in an OBS would offer a potential alternative.

The purpose of this retrospective cohort study is to assess the outcome of stapes surgery under local anesthesia in an OBS as compared with an ORS in a hospital and to compare the complications rate between settings.

## Materials and Methods

### Patient Selection

All patients diagnosed with otosclerosis who underwent stapes surgery by a single neurotology surgeon (senior author) between October 2014 and January 2017, in either our tertiary care center or an OBS, were included. Patients had to be  $\geq 18$  years old and undergoing stapedotomy, stapedectomy, or revision surgery including a prosthesis replacement for a diagnosed otosclerosis. Patients undergoing revision surgery where only prosthesis tightening was done were excluded. Patients with preoperative severe to profound SNHL were also excluded. Patients with major comorbidities, such as congestive heart failure, severe chronic obstructive pulmonary disease, anxiety, or claustrophobia, were not candidates for the OBS. The presence of cochlear otosclerosis on high-resolution computed tomography (HRCT) was not an exclusion criterion. The study was approved by our institutional review board: the ethical committee of the research center of the Montreal University Hospital Center.

### Hearing Evaluation

All patients had a preoperative audiogram within 6 months of their surgery as well as a preoperative temporal bone HRCT scan with fine 0.6-mm cuts to rule out cochlear otosclerosis or other temporal bone pathologies. All HRCT images were reviewed by the senior author twice, in addition to the subspecialized neuroradiologist's interpretation to increase the sensibility of the imaging study.

Pure tone audiometry was conducted to determine individual frequency thresholds for air conduction and bone conduction (BC) at 0.5, 1, 2, 3, and 4 kHz on the decibel hearing level scale. The 4-frequency pure tone average (PTA) was calculated with 0.5, 1, 2, and 3 kHz, as recommended by the American Medical Association and American Academy of Otolaryngology—Head and Neck Surgery.<sup>4</sup> When the 3-kHz value was missing on the audiogram, an average of the 2- and 4-kHz measures was calculated. The use of an interpolated threshold at 3 kHz introduces a small degree of error but has been shown to provide accurate approximation of the measured value in a majority of cases, especially when incorporated into the PTA.<sup>5</sup> Furthermore, the use of an interpolated value rarely occurred ( $n = 3$  cases in each group).

The ABG is the difference between air conduction and BC thresholds. The mean ABG was calculated with 0.5-, 1-, 2-, and 4-kHz frequencies. ABG improvement was calculated by subtracting the postoperative ABG from the

preoperative ABG. On speech audiometry, the word recognition score (WRS) was obtained at a comfortable instead of a standardized hearing level.

### Procedure

The operative setting was almost identical in the OBS and ORS. The patient was supine, with the head placed at 45° of extension and 45° of lateral tilt away from the surgeon, which allowed direct perpendicular visualization of the footplate. To limit involuntary patient movements during the procedure, the patient's head was secured to the operating table, with a headrest and adhesive tape. No intervention was compromised by patient movement.

The surgeon's assistant was standing across the table, facing the surgeon. One difference between the settings was that the air ventilation system in the OBS was a regular ventilation system, not comparable to that of the ORS. Given that patients were not sedated in the OBS, according to Canadian law, no supplementary inspection or licensing was necessary. Only 1 nurse was present in the OBS, whereas 2 were present in the ORS.

Draping was identical in both groups, as was local anesthesia (xylocaine 1% with epinephrine 1:100,000). In the ORS group, patients were not under general anesthesia. The anesthesiologist administered midazolam to achieve mild sedation. No sedation was given in the OBS group, and no anesthesiologist was present. Patient saturation and cardiac rhythm monitoring in the OBS were done by the nurse and surgeon together, as for any minimally invasive surgical or dental office-based procedure.

The same surgical technique (standard permeatal stapedotomy) was used in each group, starting with a Rosen incision in the posterior external auditory canal skin, followed by the elevation of the tympanomeatal flap. The annulus was exposed along the entire width of the flap and freed from its sulcus. Enough bone was curetted from the sulcus to provide adequate exposure of the pyramidal eminence, stapes tendon, footplate, and facial nerve. Mobility of the ossicular chain and fixation of the stapes were assessed by palpating the ossicles. The incudostapedial joint was divided. The tendon and the anterior and posterior crura of the stapes were sectioned. The stapes's superstructure was removed before creation of the fenestra. A 0.7-mm cutting Skeeter microdrill (Medtronic, Watford, United Kingdom) was used to create the fenestra in the posterior part of the footplate. After the stapedotomy, measurement of the prosthesis's length was taken from the midthickness of the incus's long process to the footplate, with a House strut caliper.<sup>6</sup> A Schukhnet wire prosthesis (0.6-mm diameter) was inserted in place and crimped on the long process of the incus. Small pieces of Gelfoam were used to create a seal around the prosthesis to minimize the risk of perilymph fistula. The tympanomeatal flap was put back in its anatomic position. Hearing was subsequently assessed by whispering approximately 50 cm from the operated ear and asking the patient to repeat words and numbers. Conscious

**Table 1.** Demographic Characteristics.<sup>a</sup>

	Operating Room Setting (n = 36)	Office-Based Setting (n = 33)	P Value
Sex			.08
Male	16 (44.44)	8 (24.24)	
Female	20 (55.56)	25 (75.76)	
Mean age (95% CI), y	49.17 (45.61-52.73)	51.61 (46.28-54.93)	.44
Surgical history			.05
None	34 (94.44)	25 (75.76)	
Tympanoplasty	1 (2.78)	0	
Stapes surgery	1 (2.78)	6 (18.18)	
Transtympanic tubes	0	2 (6.06)	
Side			.74
Right ear	20 (55.56)	17 (51.52)	
Left ear	16 (44.44)	16 (48.48)	

<sup>a</sup>Values are presented as n (%) unless noted otherwise.

sedation did not prevent patients from answering. This provided some feedback regarding the coupling between the incus and the inner ear. The ear was then packed with a strip of Gelfoam and covered by ciprofloxacin ointment. A small dressing covered the external auditory canal for 1 week after surgery.

Immediate postoperative care differed between groups. In the ORS group, the patient was observed for 45 minutes in the recovery room. The patient was then transferred to the day surgery department on a stretcher and observed for approximately 3 hours. In the OBS group, the patient stayed on the table with the head elevated at 30° for 10 minutes following the procedure before being seated for 5 minutes. Afterward, most patients were able to walk to an adjacent room (few needed a wheelchair), where they remained for a 30-minute observation period. All patients in the OBS group received a 1-week course of oral first-generation cephalosporin, while no antibiotics were given in the ORS group. Patients were advised to keep the ear dry and restrain from any physical effort for 8 weeks.

### Follow-up

Patients were followed up at 1 week to remove the dressing and evaluate the presence of potential complications, at 4 months with an audiogram, and at 1 year for a repeat audiogram and to report any late-onset complication. To minimize the loss to follow-up, every patient who did not come to his or her 4- or 12-month follow-up appointment were phoned to enquire about complications.

### Statistical Analysis

Preoperative results for PTA, BC, ABG, and WRS were compared with the early (4 months) and late (12 months) follow-up results. Complication rates were compared between groups. The statistical analyses used were the chi-square test ( $\chi^2$ ) and Student's *t* test. *P* values <.05 were considered statistically significant. Power calculation was performed with *P* < .05 and power set at 0.8.

## Results

Sixty-five patients were included, 4 of which underwent bilateral stapes surgery, for a total of 69 operated ears. Stapes surgery was performed in an OBS in 33 cases (48%) and in an ORS in 36 cases (52%). Given that the number of patients included in this study was small, the power reached 0.54 for the 12-month postoperative air conduction PTA and 0.38 for the 12-month postoperative ABG. Because >300 patients should have been included to reach a power of 0.8, the following results can be considered only a preliminary proof of concept.

### Demographics

**Table 1** compares the demographic characteristics of the groups, which were comparable in terms of sex, age, and side of operation. Although more patients in the OBS group had revision surgery ( $n_{\text{OBS}} = 6$ ,  $n_{\text{ORS}} = 1$ ), we excluded all patients who did not undergo prosthesis replacement.

### HRCT Findings

Temporal bone HRCT scan showed otosclerotic foci around the footplate in 72.22% and 84.84% of patients in the ORS and OBS groups, respectively (*P* = .35). HRCT was not conclusive in 1 ORS case and 2 OBS cases. Although facial nerve overhangs were seen on 3 HRCT scans in the ORS group, there were no cases of complete oval window obliteration. All of these findings were confirmed intraoperatively.

### Audiograms

**Table 2** shows no statistically significant difference between groups in disease severity, as estimated by the mean PTA and ABG, with a *P* value >.05 for all variables.

**Table 3** compares postoperative PTA, BC, ABG, and WRS at different times.

### PTA and WRSs

Our results are presented according to the American Association of Otolaryngology—Head and Neck Surgery's

**Table 2.** Preoperative Workup Results.<sup>a</sup>

	Operating Room Setting (n = 36)	Office-Based Setting (n = 33)	P Value
Otosclerosis on temporal bone HRCT			.12
No signs of otosclerosis	9 (25)	3 (9.09)	
Otosclerosis	25 (69.44)	24 (72.72)	
Equivocal	1 (2.78)	2 (6.06)	
Prosthesis displacement and otosclerosis	1 (2.78)	4 (12.12)	
Cochlear otosclerosis on temporal bone HRCT			.35
None	34 (94.44)	28 (84.85)	
Present	2 (5.56)	4 (12.12)	
Equivocal	0	1 (3.03)	
Preoperative audiograms			
Tone, dB			
PTA	57.93 (52.40-63.46)	58.56 (53.59-63.54)	.86
BC	28.29 (23.85-32.74)	29.21 (25.32-33.09)	.75
ABG	31.11 (27.98-34.25)	29.62 (25.89-33.36)	.54
Speech: WRS, %	90.33 (86.12-94.54)	91.50 (87.06-95.94)	.70

Abbreviations: ABG, air-bone gap; BC, bone conduction; HRCT, high-resolution computed tomography; PTA, pure tone average; WRS, word recognition score.

<sup>a</sup>Values are presented as n (%) or mean (95% CI).

**Table 3.** Postoperative Audiometric Results.<sup>a</sup>

	Operating Room Setting (n = 36)	Office-Based Setting (n = 33)	P Value
Early (4 mo) postoperative (n = 66)	n = 33	n = 33	
Pure tone audiometry, dB			
PTA	27.92 (23.14-32.70)	31.45 (27.32-35.59)	.26
BC	20.57 (15.81-25.34)	25.67 (21.41-29.92)	.11
ABG	7.84 (5.95-9.73)	5.81 (4.18-7.44)	.10
ABG improvement	23.48 (20.09-26.89)	23.81 (20.36-27.26)	.89
Speech audiometry: WRS, %	94.34 (91.53-97.16)	94.55 (91.97-97.12)	.91
Late (12 mo) postoperative (n = 57)	n = 33	n = 24	
Pure tone audiometry, dB			
PTA	25.80 (21.68-29.91)	32.24 (26.22-38.26)	.08
BC	21.06 (16.95-25.17)	25.98 (20.07-31.89)	.16
ABG	5.66 (4.42-6.90)	6.30 (4.50-8.10)	.55
ABG improvement	24.27 (21.40-27.13)	23.15 (18.45-27.85)	.68
Speech audiometry: WRS, %	92.25 (89.34-95.16)	91 (85.79-96.21)	.67

Abbreviations: ABG, air-bone gap; BC, bone conduction; PTA, pure tone average; WRS, word recognition score.

<sup>a</sup>Values are presented as mean (95% CI).

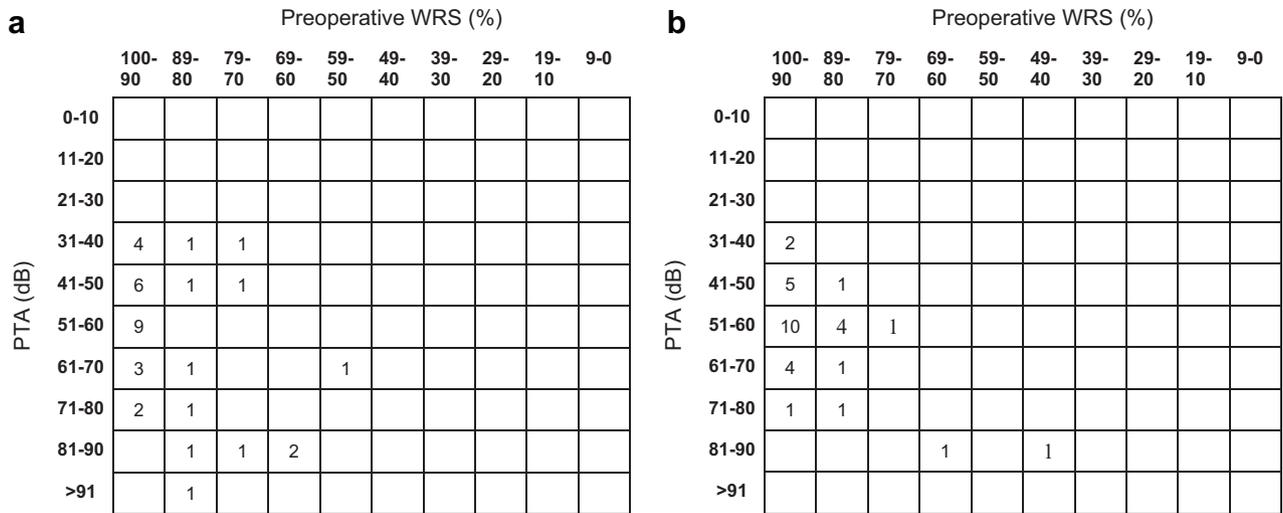
standardized method for reporting the level of hearing function.<sup>4</sup> **Figure 1** plots each patient according to his or her preoperative PTA and WRS. The WRSs were high, with a majority >90% in both groups. **Figures 2** and **3** are postoperative scattergrams showing the evolution of WRS and PTA in each group. WRS variations are clustered around the “No change” column, a result that is partially attributable to the good preoperative values that limit potential improvement.

Of note, at 12-month follow-up, the 2 patients who showed worsened PTA and WRS values did not report any complications or symptoms.

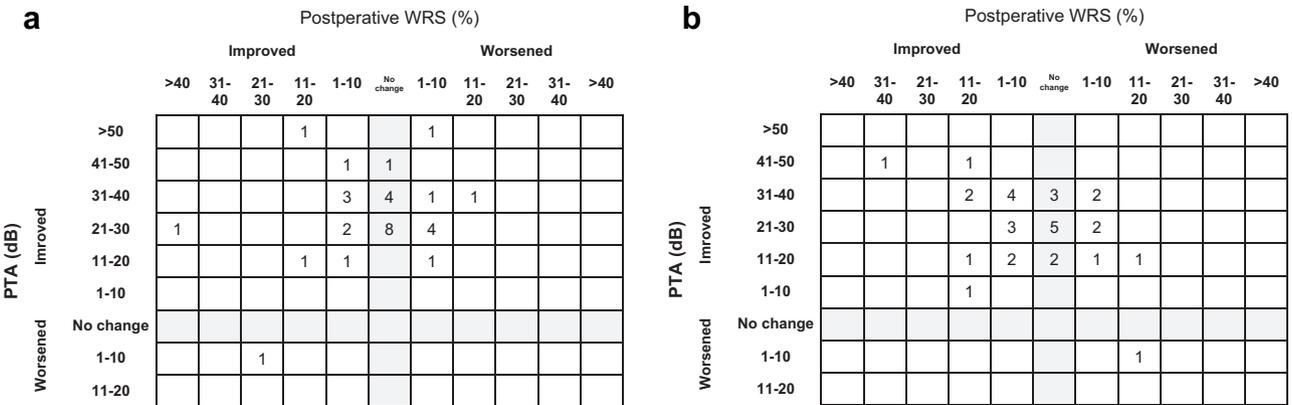
### Bone Conduction

Postoperative BC at 4 and 12 months did not differ between the groups ( $P = .11$  and  $P = .16$ , respectively).

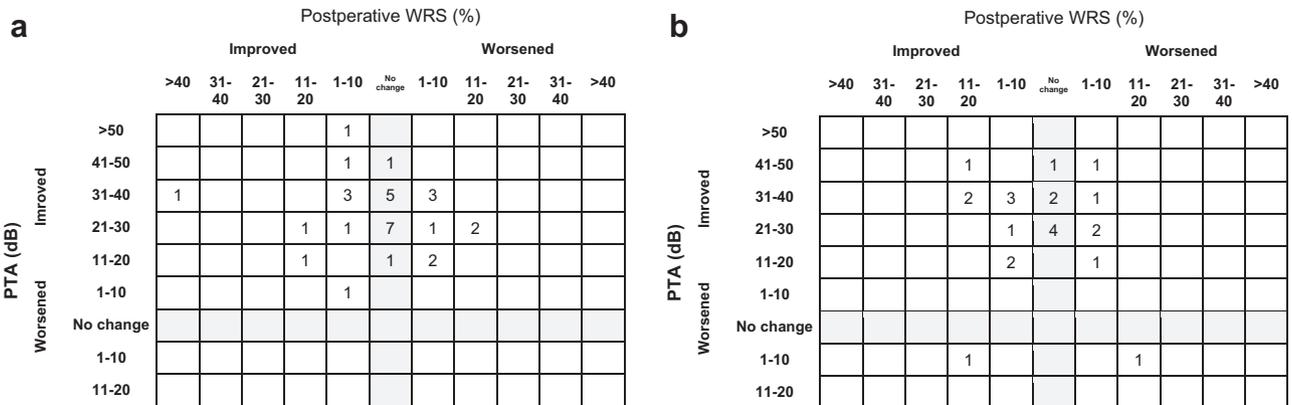
Within the ORS group, even though postoperative BC at 4 and 12 months was significantly improved as compared with preoperative values ( $P = .019$  and  $P = .018$ , respectively), it was not clinically significant (7.72 dB and 7.23 dB). No statistically significant difference was noted between 4 and 12 months postoperatively ( $P = .874$ ), showing that results were stable over time.



**Figure 1.** Preoperative scattergrams for (a) the ORS group and (b) the OBS group. OBS, office-based setting; ORS, operating room setting; PTA, pure tone average; WRS, word recognition score.



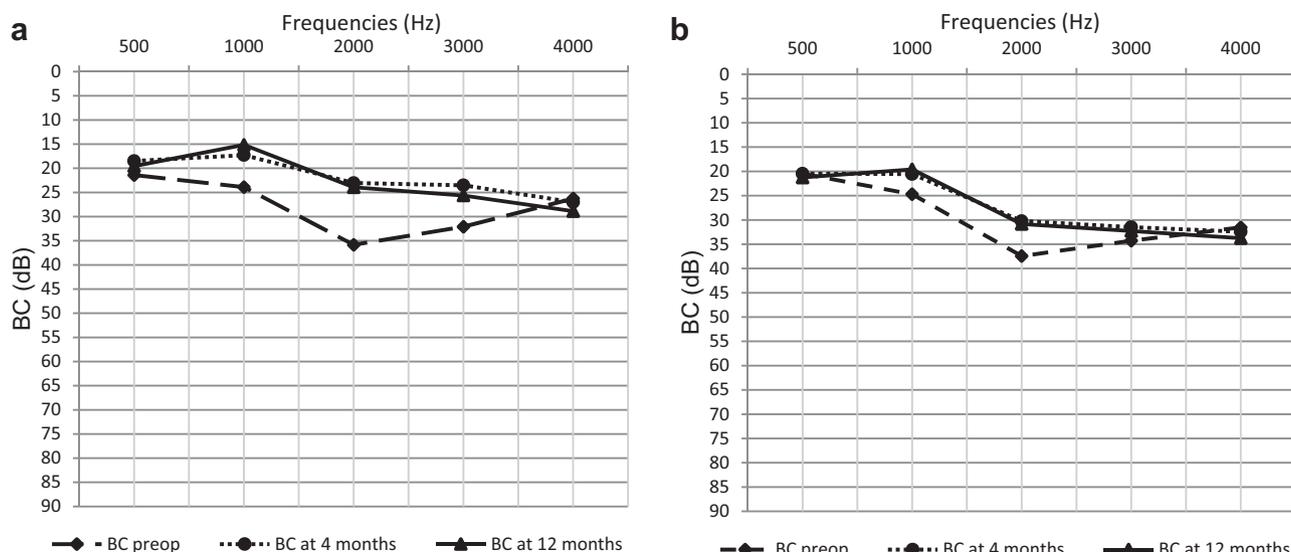
**Figure 2.** Early (4 months) postoperative scattergrams for (a) the ORS group and (b) the OBS group. OBS, office-based setting; ORS, operating room setting; PTA, pure tone average; WRS, word recognition score.



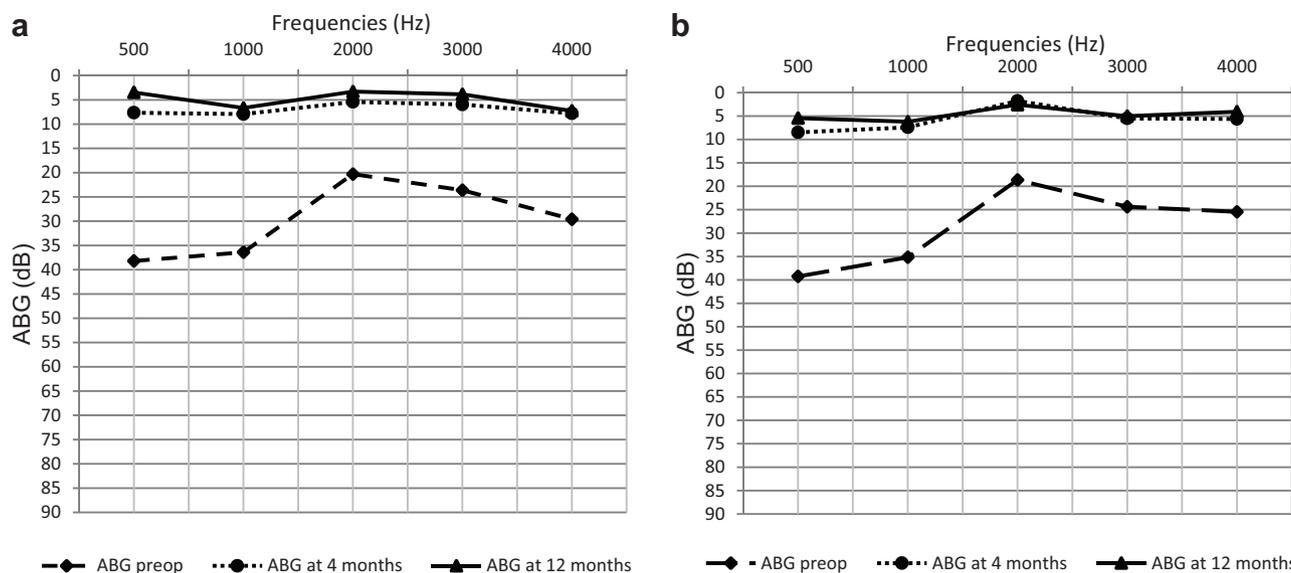
**Figure 3.** Late (12 months) postoperative scattergrams for (a) the ORS group and (b) the OBS group. OBS, office-based setting; ORS, operating room setting; PTA, pure tone average; WRS, word recognition score.

Within the OBS group, there was no clinically or statistically significant difference between postoperative BC at 4 and 12 months as compared with the preoperative values

(3.54 dB,  $P = .215$ , and 3.23 dB,  $P = .353$ , respectively). Although the mean BC did not decline, 2 patients in the OBS group showed a worsened PTA (<10-dB decline;



**Figure 4.** BC by frequency preoperatively and at 4 and 12 months postoperatively for (a) the ORS group and (b) the OBS group. BC, bone conduction; OBS, office-based setting; ORS, operating room setting.



**Figure 5.** ABG by frequency preoperatively and at 4 and 12 months postoperatively for (a) the ORS group and (b) the OBS group. ABG, air-bone gap; OBS, office-based setting; ORS, operating room setting.

**Figure 3).** No statistically significant difference was noted between 4 and 12 months postoperatively ( $P = .930$ ), showing that results were also stable over time in this group.

**Figure 4** compares mean BC by frequencies.

**Air-Bone Gap**

ABG improvement for each frequency is presented in **Figure 5**. ABG improvement at 4 and 12 months did not differ between groups ( $P = .89$  and  $P = .68$ , respectively). Within the ORS group, the ABG significantly improved from presurgery to postoperative 4 and 12 months ( $P < .001$  in both groups). Although the difference between 4 and 12 months was statistically significant ( $P = .021$ ), it was not

clinically significant (2.65 dB). Within the OBS group, the ABG significantly improved from presurgery to postoperative 4 and 12 months ( $P < .001$  in both groups). No statistically significant difference was noted between 4 and 12 months ( $P = .335$ ).

**Assessing Safety of the OBS**

The incidence of complications was low and comparable in both groups (**Table 4**).

At 12 months, 5 patients in the ORS group and 2 in the OBS group were evaluated over the phone. Three and 9 patients in the ORS and OBS groups did not attend their 12-month follow-up audiograms, respectively.

**Table 4.** Number of Complications in Each Group.

	Operating Room Setting (n = 36)	Office-Based Setting (n = 33)	P Value
Intraoperative	n = 36	n = 33	.057
None	26	30	
Section of chorda tympani	2	2	
Stretching of chorda tympani	0	1	
Tympanic membrane perforation	3	0	
Footplate fracture	5	0	
Immediate (1 wk) postoperative	n = 36	n = 33	.07
None	26	31	
SNHL	1	0	
Dizziness	8	1	
Ipsilateral dysgeusia	1	1	
Early (4 mo) postoperative	n = 34	n = 33	.56
None	31	31	
SNHL	1	0	
Persistent ipsilateral dysgeusia	0	1	
Sound distortion necessitating revision surgery	1	1	
Residual ABG necessitating revision	1	0	
Late (12 mo) postoperative	n = 33	n = 26	.366
None	31	23	
Prosthesis displacement necessitating revision	0	1	
Sound distortion necessitating revision surgery	0	1	
SNHL: perilymphatic fistula	1	0	
Dizziness	0	0	
Ipsilateral dysgeusia	0	0	

Abbreviation: SNHL, sensorineural hearing loss.

## Discussion

The main objectives of this study were to assess the outcome and safety of stapes surgery for otosclerosis in an OBS.

### Surgical Outcomes

Outcome was measured by ABG closure and nonworsening of BC. The mean 1-year postoperative ABG in the OBS group reached 6.3 dB and was not statistically or clinically significantly different from the ORS group (5.66 dB,  $P = .55$ ). The procedure efficiently decreased the ABG, with a mean absolute improvement  $>20$  dB in both groups ( $P = .68$ ). ABG closure following stapedotomy has been reported to be as high as 90%<sup>7</sup>; our results in the OBS and in the ORS are comparable. **Figure 5** emphasizes the stability of the results.

In the ORS group, BC scores showed a statistically significant improvement without a clinically significant improvement; therefore, results were reverified. This improvement was mainly attributable to 3 patients whose BC improved  $>10$  dB unexpectedly. For all other patients, the difference was not clinically significant, and there was no significant difference between the BC values of the ORS and OBS groups. Furthermore, no group showed a diminished BC at postoperative 4 or 12 months.

### Surgical Complications

The incidence of complications in both operative settings was shown to be comparable: intra- and postoperative complications did not differ clinically or statistically between the groups (intraoperative,  $P = .057$ ; postoperative<sub>1wk</sub>,  $P = .07$ ; postoperative<sub>4mo</sub>,  $P = .56$ ; postoperative<sub>12mo</sub>,  $P = .366$ ). It is important to note that no case was abandoned intraoperatively in the OBS group to be converted to an ORS and that no patient in either group presented any medical complication to the procedure.

### SNHL and Perilymphatic Fistula

A rare but severe complication of stapes surgery is SNHL. In the literature, postoperative SNHL can range from 1% to 2%.<sup>8</sup> In our study, the patient from the ORS group who presented with SNHL at 1 week was the one who was found to have a perilymphatic fistula. After perilymph fistula repair surgery, the patient's final ABG was 13.75 dB, with a 100% WRS and a PTA of 40 dB.

### Revision Surgery

In total, 5 patients had revision surgery. Indications for surgery are detailed in **Table 4**. A higher proportion of revision surgery occurred in the OBS, which represents a selection bias. Success rates in revision surgery range from 16% to 80%, and the literature reports that the potential

hearing gain decreases by  $\geq 10\%$  after each revision.<sup>9,10</sup> Furthermore, the risk of inner ear trauma and postrevision SNHL may increase up to 20%.<sup>11,12</sup> In the present study, the incidence of intraoperative complications did not statistically differ between groups. Therefore, this selection bias further supports the argument that an OBS is safe.

### Cutting or Stretching the Chorda Tympani Nerve

Stretching injury of the chorda tympani nerve occurred in 2 cases in each group. In 1 patient from the OBS group undergoing revision surgery, the chorda had to be cut because it was adherent to the tympanic membrane. This patient reported a deficit at 4-month follow-up. At 12 months, not one patient reported persistent ipsilateral dysgeusia. We believe that in the case of chorda tympani sectioning, contralateral compensation occurred over time, whereas in cases of stretching injury, the consequence was temporary praxis.

### Vertigo

Persistent postoperative vertigo could be due to a long intralabyrinthine prosthesis, which should be changed for a shorter one. There was no difference in dizziness between groups. Therefore, operating in the OBS without sedation did not increase dizziness.

### Tympanic Membrane Perforation

The tympanic membrane perforation healed spontaneously. No myringoplasty was performed.

### Facial Nerve Dehiscence and the Use of HRCT

In the present study, the use of HRCT allowed for preoperative identification of 3 cases (in the ORS group) of facial nerve overhangs covering half the oval window. All cases were confirmed intraoperatively. No patient experienced facial nerve injury.

### Advantages

Although not a primary objective of this study, an OBS in our opinion offers better time efficiency, reducing the postoperative observation period from approximately 3 hours 45 minutes to 45 minutes.

The presence of an anesthesiologist, the use of sedation, and the stay at the day surgery unit surely make the ORS less cost-effective. The use of local anesthesia presents many advantages. Clinical voice testing allows the surgeon to have immediate feedback of the hearing outcome; vertigo can be screened immediately after prosthesis insertion; and risks associated with general anesthesia are avoided.

In the present study, all patients in the OBS group tolerated the procedure well without sedation. We recommend that patients with major comorbidities, anxiety, or difficulty remaining immobile in a supine position throughout the procedure be preferentially operated in the ORS with light sedation.

### Limitations of the Study

First, the power calculation showed a power level  $< 0.8$  due to the small number of patients included in the study. Given

that this study is underpowered, no official recommendations can be drawn from these results, but we consider them an adequate proof of concept.

To preserve homogeneity in the surgical technique, cases from a single neurotologic surgeon were used. Therefore, the external validity of our findings may be challenged. We suggest that stapes surgery for otosclerosis in an OBS be performed only by experienced surgeons.

Another limitation is that the use of antibiotics differed in both settings. Patients in the OBS group received a 1-week antibiotic course of oral first-generation cephalosporin. No antibiotics were given in the ORS group. The effect of this discrepancy cannot be measured, as no patient in either group developed a postoperative infection. In the future, this may lead us to cease systematic postoperative antibiotic administration regardless of the operative setting.

Loss to follow-up represents a selection bias in this study. Nine patients were lost to follow-up at 12 months ( $n_{\text{ORS}} = 3$ ,  $n_{\text{OBS}} = 6$ ). Of those, 2 patients refused a follow-up visit and audiogram, and 3 other patients reported a satisfactory hearing level when contacted by phone and did not see the need for additional testing. The remaining 4 did not return calls.

### Conclusion

To our knowledge, this is the first proof of concept in the literature to evaluate the long-term outcome and complications of office-based stapes surgery while comparing it with a standard ORS. The long-term success of the procedure and its complications rate in the OBS and ORS have proven to be comparable in this study. When patients are carefully selected, we believe that the experienced neurotologic surgeon will be able to appropriately operate in this setting. Although this was not the prime objective of this study, we believe that the time and costs associated with the procedure are reduced in the OBS. A follow-up study on a larger sample of patients remains to be completed.

### Author Contributions

**Béatrice Voizard**, study design, data collection, data interpretation, manuscript redaction, figures and tables conception, manuscript revision; **Anastasios Maniakas**, study design, statistical analysis, data interpretation, manuscript revision; **Issam Saliba**, study design, data interpretation, manuscript redaction, manuscript revision.

### Disclosures

**Competing interests:** None.

**Sponsorships:** None.

**Funding source:** None.

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