

## Audit Article

# The future of stapedectomy – the Singapore problem

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### Abstract

Concern has been expressed in the recent literature regarding the problem of a dwindling number of stapedectomy cases and an increasing number of surgeons trained to do this operation. In Singapore, the problem is made worse by the very low incidence of this disease in its main ethnic groups of Chinese and Malays who together make up more than 90 per cent of the population.

We report here an audit of 47 ears that underwent stapedectomy in a teaching hospital over a six-year period. The hearing results for consultants and surgical trainees were compared. Closure of the air–bone gap to within 10 dB was obtained in 64 per cent of Consultants' cases and 68 per cent of trainees' cases. These results fall short of the 90 to 95 per cent figure reported by experts in this procedure and only comparable to the less satisfactory results of several series recorded by residents in North America.

We conclude that the unsatisfactory results arise from the small number of surgical cases available for each surgeon to improve and maintain his skills in a technically demanding procedure. It is proposed that such cases be directed to those pursuing otology as a subspecialty rather than all otolaryngologists in general.

**Key words:** Otosclerosis; Stapedectomy; Physicians practice patterns; Education, medical, graduate

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### Introduction

Singapore is a city state on a small island located at the southern tip of the southeast Asian peninsula. It has a population of about three million on a land area of 225 square kilometres. Its ethnic composition comprises: Chinese 77.7 per cent, Malays 14.1 per cent, Indians 7.1 per cent and a number of minority groups including Eurasians and Caucasian. Otosclerosis is known to be uncommon in the Chinese race. According to Huang and Lee (1988), it makes up only 1.13 per cent of those treated for impaired hearing loss in Taiwan. This incidence is 50 times less than that reported for Caucasians by Nager (1969). Although there are no established figures available on its incidence in Malays, it is our impression from this report that it is very rare. Nizar (1960) reported that otosclerosis is also a rare disease in Indonesia, a country in which the bulk of its population is of Malay stock. Indians, of which the majority are descendants of migrants from South India make up a disproportionately high percentage of our otosclerosis patients. The condition is common in Indian races.

According to Schuknecht (1976) 'stapedectomy is a technically difficult operative procedure, the success of which is directly related to the skill of the surgeon'. In this case, effective training and constant practice assume great importance in promoting a successful outcome in a high proportion of patients. There has been growing concern in

the past decade regarding the dwindling number of operations, even in countries where the incidence of otosclerosis is high with its indigenous Caucasian population (e.g. USA, Britain and the European continent). This diminishing trend is also evident in Singapore and the effects are even greater because of the lower incidence of the disease.

The training of otolaryngologists in Singapore is concentrated in three government-owned hospitals and training in stapes surgery usually commences at senior registrar level. Following traditional methods, operations are performed either by consultants themselves or by the trainees under close supervision by the consultant in charge of the case. The trainees are expected to have adequate practice on temporal bones first.

A review of all the stapes surgery performed over a six-year period in the Otolaryngology Department at the National University Hospital, (one of three main teaching ENT Departments in Singapore) is discussed and the results audited in order to determine how cases performed by senior registrars fare in comparison to those performed by consultant surgeons. A comparison with reported series in other countries is discussed.

### Patients and methods

The study included all patients who underwent primary surgery for otosclerosis from January 1988 to December

1993. Revision stapedectomy procedures were excluded from the study as they introduced a number of undesirable variables such as a much greater risk of cochlear hearing loss and complications. The case records were then reviewed. The data analysed included age, sex, race, side of operation, grade of surgeon, operative technique, operative findings, hearing results and complications. The pre-operative audiogram was defined as the final assessment prior to surgery. The post-operative audiogram selected was the one showing the best hearing within six months of surgery; these criteria were adopted as the best means of comparing like with like in determining the technical expertise of the surgeon. However the initial hearing gain may deteriorate in the long term. Averages of the pre-operative and post-operative air-bone pure tone thresholds at 500 Hz, 1 and 2 kHz were calculated and the results were evaluated using three different criteria (Table I). The first method involved application of the Chandler and Rodriguez-Torro (1983) formula in which the percentage of hearing gain/loss is calculated as follows:

$$\frac{\text{Pre-op AC} - \text{Post-op AC}}{\text{Pre-op AC} - \text{Pre-op BC}} \times 100$$

The second method uses closure of the air-bone (AB) gap measured in decibels as the criterion of success/failure. The third method measures the change in bone conduction resulting from surgery. The results are shown in Table II. Perioperative and post-operative complications were also recorded. These were retrieved from the operative records and the case notes.

## Results

A total of 50 patients underwent 52 stapes operations for otosclerosis (two had both sides operated on). Five ears were excluded owing to lack of adequate audiometric records. The cases were divided into two groups, those operated on by consultants and those by trainees (all of whom were at senior registrar level). Of the 47 ears available for analysis, 28 were operated on by consultants and 19 by senior registrars.

The racial distribution was as follows: Chinese 33 (70.2 per cent), Indians 11 (23.4 per cent), Caucasians three (6.4 per cent) and Malays none. Seventeen cases (36.1 per cent) were males and 30 (63.8 per cent) were females. Thirty-one patients (65.9 per cent) had bilateral disease while in the unilateral cases seven (14.9 per cent) had right-sided disease and nine (19.1 per cent) left-sided. Of the 31 patients with bilateral disease 23 (74.2 per cent) were females and eight (25.8 per cent) males. These statistics reflect the experience of others in relation to sex and bilateral involvement.

Perioperative antibiotic cover was used in 30 (63.8 per cent) according to the individual choice of the surgeon. All the operations except two were carried out under general anaesthesia. The transcanal approach was used in all operations and no particular difficulties were recorded. The surgical procedure, type of prosthesis and material used for oval window seal varied among the different surgeons depending on their training background and the oval window anatomy and disease. The data are tabulated on Table II. Large fenestra stapedectomy implies removal of the whole or greater part of the footplate and limited fenestra stapedectomy implies removal of enough footplate to fit a piston or at most the posterior third of the footplate.

In the consultant group, closure of the air-bone gap to within 10 dB of the pre-operative bone conduction was found in 64 per cent of ears and to within 20 dB in 82 per cent. The corresponding figures in the trainee group showed closure of the air-bone gap to within 10 dB occurred in 68 per cent and to within 20 dB in 89 per cent (see Figure 2). No dead ears occurred in either group. No statistical significant difference was found in the results between the two groups. Using criterion 1, the results showed a similar pattern (superior and good) being recorded in 70 per cent (69 per cent for consultants and 74 per cent for senior registrars) (see Figure 1). Again there was no statistically significant difference. There were also no significant differences in hearing results between the groups using different prostheses and different types of oval window seal. However as only five patients underwent a large fenestra stapedectomy, the numbers were too small for meaningful comparison with those who underwent small fenestra surgery.

In two cases in the consultant series floating footplate occurred in the process of fracturing the stapes crura but no serious problem was encountered perforation of the footplate having already been performed. Furthermore, there were no significant deterioration of the bone conduction post-operatively in either instance. The post-operative bone conduction thresholds according to criterion 3 are summarized in Figure 3. Two cases with overhanging facial nerve presented no problem, in both instances the operation being completed using the small fenestra technique and a 0.4 mm piston. There were no serious perioperative problems such as perilymph gusher or persistent stapedia artery. Post-operative vertigo lasting less than a week was noted in five (18 per cent) of the consultant series and four (21 per cent) of the senior registrar's cases. However in none of these did vertigo or unsteadiness persist for more than a month. No cases of post-operative facial palsy or persistent perilymph fistula

TABLE I  
CRITERIA FOR EVALUATION OF RESULTS

Result	Criterion 1 (% improvement)	Criterion 2	Criterion 3
Superior	100 (overclosure)	AC > Pre-operative bone conduction	>11 dB gain
Good	80-99	AC within 1-10 dB	No change or 1-10 dB gain
Fair	60-79	AC 11-20 dB	1-10 dB drop
Poor	0-59	AC within 21-30 dB	11-20 dB drop
Failure	Hearing loss	AC > 31 dB	>20 dB drop

Criterion 1: Improvement in air-conduction (AC) level, according to Chandler and Rodriguez-Torro (1983).

Criterion 2: Closure of post-operative air-conduction (AC) and pre-operative bone-conduction gap.

Criterion 3: Changes in bone conduction post-operatively.

TABLE II  
SURGICAL TECHNIQUES

Surgical procedure	Consultants		Senior registrars	
	no.	(%)	no.	(%)
Large fenestra stapedectomy	3	(6)	2	(4)
Limited fenestra stapedectomy	25	(53)	17	(36)
Prosthesis type				
Full Teflon	11	(23)	2	(4)
Teflon/wire	16	(34)	16	(34)
Not recorded	1	(2)	1	(2)
Oval window seal				
Gelfoam	8	(17)	2	(4)
Fat	14	(30)	11	(23)
Connective tissue	4	(9)	5	(11)
Not recorded	2	(4)	1	(2)

encountered. Three patients had a persistent conductive hearing defect of more than 30 dB post-operatively (two consultant and one senior registrar cases). Two of these underwent re-exploration and both were found to have slipped prostheses (both Teflon/wire prosthesis).

**Discussion**

Concern has been expressed in the recent literature regarding the problem of a dwindling number of stapedectomy cases and an increasing number of surgeons trained to do this operation. According to Chandler and Rodriguez-Torro (1983) this has been the pattern since the late 70s in the USA and has resulted in a significant drop in the successful hearing results compared with those reported by the 'pioneer' surgeons of the 60s and early 70s. The latter benefited from operating on a backlog of patients suffering from the disease prior to the development of successful surgical treatment. In Singapore a corresponding patient pool did not exist because of the low incidence of otosclerosis in Chinese and Malays who together make up more than 90 per cent of our population. Thus even in the pioneer group of otolaryngologists who acquired their

technical expertise in stapedectomy from training stints in Australia and the UK in the mid-70s enjoyed the benefit of operating on more than 10 cases a year (with the majority probably less). These comprise the group of consultants reflected in this report. In view of the paucity of cases, it is perhaps time to ask ourselves if this operation should be taught to all otolaryngologists or only to those intending to subspecialize in otology.

The hearing results, comparing those of consultants with senior registrars, showed no statistical significant difference in all the three criteria of measurement used. It is therefore perhaps pertinent to consider whether this is a reflection of good training and supervision of the senior registrars or rather a failure of the consultant group to elevate their standards to a higher level because of inadequate constant surgical practice. It is interesting to compare our results with those reported in the literature. According to Engel and Schlinder (1984), Shapira *et al.* (1985) and Levenson *et al.* (1987) reported on the hearing results of residents in the USA, 75 to 89 per cent of the patients had closure of the air-bone gap to within 10 dB. They advocated continued resident training in this operation in view of the satisfactory results provided adequate previous otological experience has been obtained and faculty supervision is available. Chandler and Rodriguez-Torro (1983) and Coker *et al.* (1988) recorded less satisfactory results of 62 to 64 per cent closure of air-bone gap to within 10 dB and a significantly higher incidence of complications in these residents' cases when compared with the faculty. They question the wisdom of training all otolaryngologists to do this operation. Leighton *et al.* (1991) reporting on stapedectomy results in a teaching hospital in the UK found air-bone gap closure to within 10 dB in 73 per cent of consultant cases and 79 per cent of surgical trainees' cases. He recommended it as a safe operation to teach otolaryngologists in training. Huang and Lee (1988) reporting on a personal series of 163 stapedectomies in the Chinese population in Taiwan obtained air-bone gap closure of 10 dB in 74 per cent of his patients. He com-

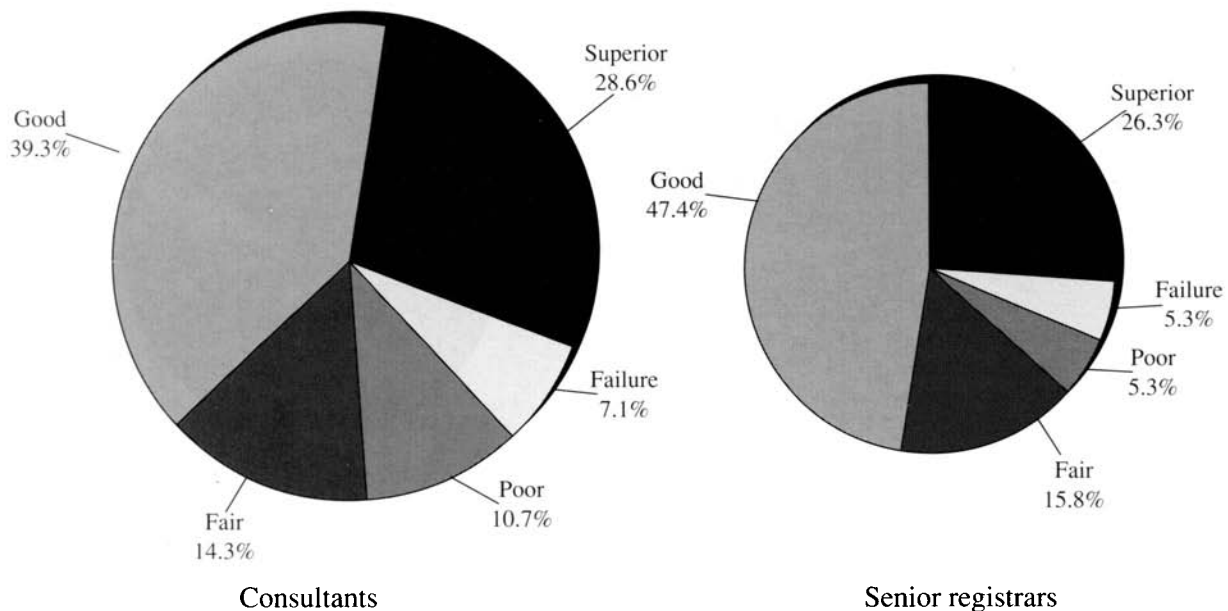


FIG. 1  
Hearing results using criterion 1.

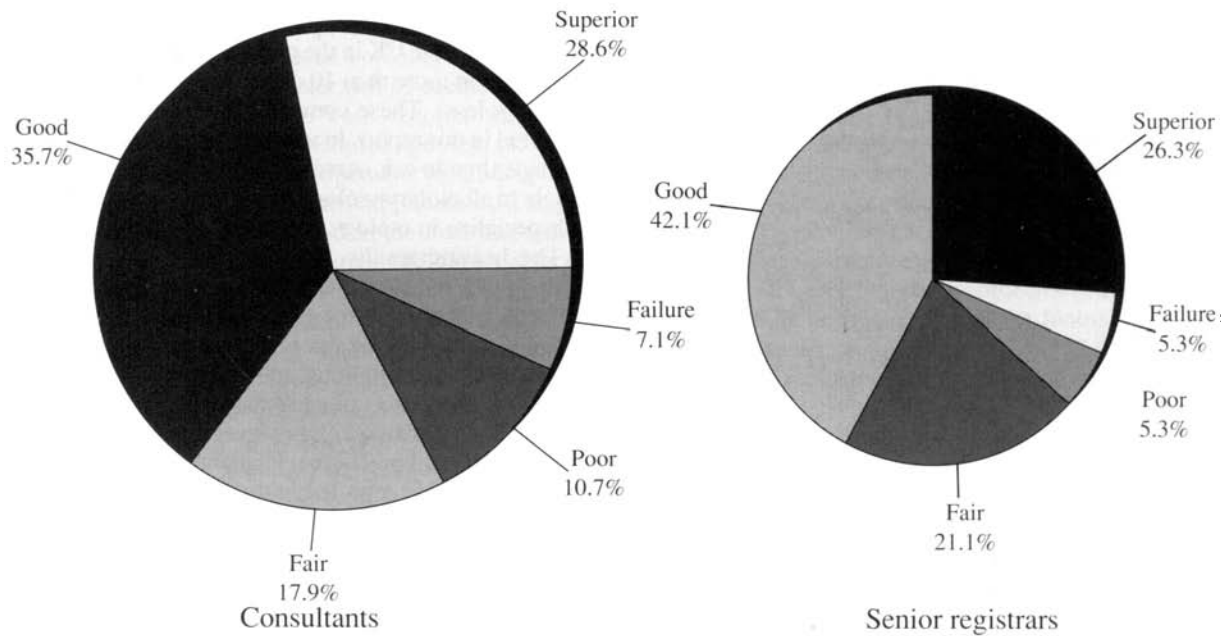


FIG. 2  
Hearing results using criterion 2.

mented that although his results are clearly poorer than the 90 to 95 per cent reported by Hough (1976), Shea (1971), Smyth and Hassard (1978), Austin (1980); McGee (1981) and Robinson (1981); they are comparable to those reported by Chandler and Rodriguez-Torro (1983). He also raised the issue of the problems in training new surgeons in a procedure in which operative experience has proven extremely important in obtaining proficiency and good results when the disease is so scarce in the population.

The crux of the matter seems to lie in the occasional surgeon performing this delicate surgical procedure on too few patients. In Singapore it is not likely that any surgeon will ever accumulate the wealth of experience in order to

achieve the results of 90 to 95 per cent 10 dB air-bone gap closure mentioned earlier. As the results in this study show, we are nowhere near this figure and even slightly behind those reported for residents in some of the training centres in the USA. What solution can be found? In Singapore we have already laid the foundations of subspecialization in that surgeons remaining in institutional practice after they have completed their three-year registrar postings are usually streamed into a subspeciality where it is otology/neuro-otology, head and neck oncology, rhinology, paediatric ENT etc. They are expected to take on advanced work in these various fields after an overseas training stint. Perhaps the best way to improve the hearing results in stapedectomy would be to direct all such work to

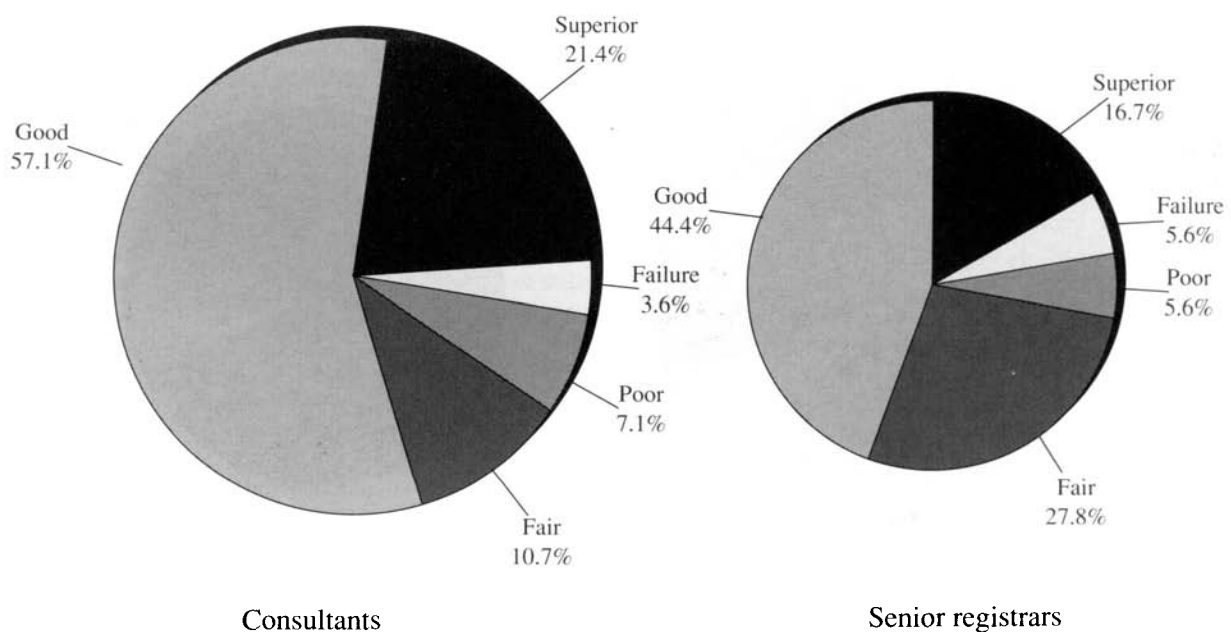


FIG. 3  
Hearing results using criterion 3.



surgeons in the otology field. This will maximize the exposure they will have and allow them to improve their results and maintain them once they have developed the proficiency. In the rest of Southeast Asia where the problem of low incidence exists, this is probably the best way to circumvent the problem once the socioeconomic cost of this practice can be overcome.

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