

Stapedotomy and Stapedectomy Outcomes as Surgical Approaches in Juvenile Otosclerosis: A Systematic Review

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Abstract

Background: Pediatric otosclerosis is characterized by progressive conductive hearing loss with a relatively low incidence, compared to adults. The treatment approaches range from conservative options, such as hearing aids, to surgical managements including stapedectomy and stapedotomy.

Aim: To compare hearing outcomes (air-bone gap < 10 dB) after stapedectomy vs. stapedotomy in patients with juvenile otosclerosis.

Methods: We conducted a systematic search in Google scholar, PubMed, and Scopus. Studies reporting the outcomes of stapedectomy and/or stapedotomy and those specifically defining the mixed data from data of each procedure for the patients under the age of 18 years old with juvenile sclerosis were included. On the other hand, post-operative air-bone gap was extracted. There was no time limitation for search of studies.

Results: After evaluating all studies, post-operative air-bone gap below 10dB ranged from 66% to 91% of cases in stapedectomy group and from 66% to 92% in stapedotomy group.

Conclusion: Based on the reviewed studies, we found similar success rates in hearing outcome of the patients with juvenile otosclerosis following stapedotomy and stapedectomy.

Conflicts of Interest: The authors declared no conflicts of interest.

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Introduction

Otosclerosis is a disorder of the bone growth and remodeling predominantly in the middle ear around the otic capsule, which is characterized by progressive conductive hearing loss(1). Stapes surgery as a safe and effective option in adult otosclerosis has been a risky approach in children(2). The incidence of pediatric or juvenile otosclerosis is relatively low, compared to adults with conductive hearing loss, which has been reported in less than 1% of children aged under 5 years (one case out of 161 temporal bones) and about 4% of children aged between 5 and 18 years(3). Conservative managements

such as observation and hearing aids have been treatment options along with surgical approaches including stapedectomy and stapedotomy.

Stapedotomy is a procedure of fenestration on a fixed footplate which may be performed via a perforator, microdrill, pick or piezoelectric device(4). Safety and feasibility of stapedotomy in children has been discussed previously(5). As another stapes surgery, stapedectomy in children was published first by House in 1980(2). In the searching for stapes surgery and its outcome in juvenile sclerosis, there are limited number of studies outlining stapedotomy versus stapedectomy

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distinctively. Herein, we tried to conduct a review from the available data about hearing outcome of stapedectomy and stapedotomy in the cases of juvenile otosclerosis.

Review of Literature

Literature search

A literature search was performed in databases of PubMed and Scopus as well as google scholar. The search terms used were stapedotomy [All Fields] OR "stapes surgery" [MeSH Terms] OR "stapes" [All Fields] AND "surgery" [All Fields] OR "stapes surgery" [All Fields] OR "stapedectomy" [All Fields] AND "juvenile otosclerosis" [All Fields] OR "pediatrics" [MeSH Terms] OR "pediatrics" [All Fields] OR "pediatric" [All Fields] AND "otosclerosis" [MeSH Terms] OR "otosclerosis" [All Fields].

Inclusion criteria

Type of studies: Studies published in English language, international journals addressing randomized controlled trials, case reports, and clinical retrospective trials specifying juvenile otosclerosis, stapedectomy and stapedotomy were included. Outcomes for patients < 18 years of age with juvenile otosclerosis were included who underwent stapedotomy or stapedectomy.

Type of participants: Patients under the age of 18 with juvenile otosclerosis with profound sensorineural hearing loss were included.

Type of intervention: Stapedectomy or stapedotomy.

Types of outcome measures: Post-operative air-bone gap less than or equal 10 dB as success rate of operations was extracted from studies.

Exclusion criteria

The studies with the following criteria was excluded: the patient's being 18 or older,

languages other than English, no description of pre and post-hearing levels, mixed data from both stapedectomy and stapedotomy procedures and allocated data not being specified, operations other than stapedotomy or stapedectomy, genetic, radiologic, histopathologic studies, or animal experiments. Then, duplicate as well as studies with inadequate data were excluded. To reduce the bias, the searching of the studies was independently conducted by two researchers, and in case of any disagreement, it was evaluated by the third author.

Main outcome measurements

The total number of juvenile otosclerosis cases was extracted from studies and success rates of operations (stapedectomy and stapedotomy) were detected. The main outcome variable assessment was a postoperative air-bone gap (ABG) of 0 to 10 dB hearing level (HL) (described as success of surgery).

Results

Studies. Based on inclusion and exclusion criteria, 7 studies were eligible (5-11) and 23 studies were excluded (Figure. 1). All results specifically reported postoperative ABG of stapedectomy or stapedotomy in only juvenile otosclerotic patients. Data from stapedectomy or stapedotomy were specifically extracted and mixed data were excluded.

Operations and success rate. We identified that 158 ears with juvenile otosclerosis received surgical treatment including stapedotomy and stapedectomy.

In stapedectomy group, the mean age at the time of surgery ranged from 11.3 to 16.3 years. Furthermore, post-operative air-bone gap below 10 dB ranged from 66% to 91% of cases (Table 1).

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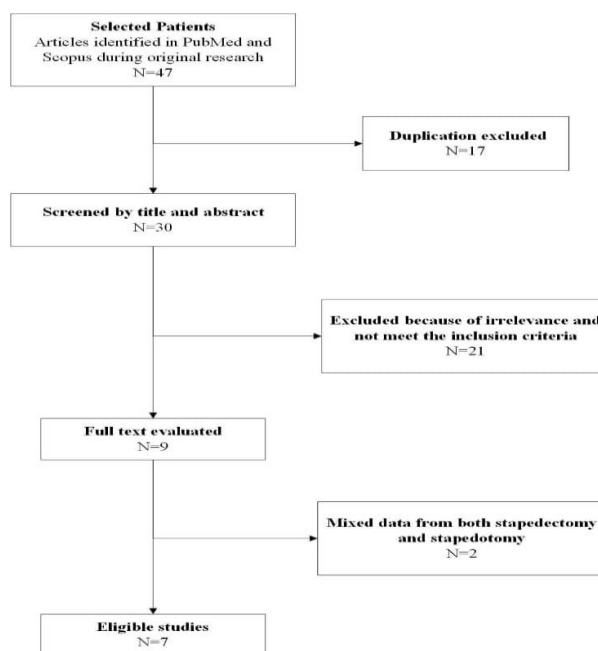


Figure 1. Flowchart of search based on searching different databases including PubMed and Scopus.

Table 1. The extracted data from included studies.

Author, publication year	Total number of cases	Type of surgery	Mean age at the surgery	Number of cases with Post-operative ABG <10 dB, percentage
Denoyelle et al. 2010 ⁶	5	Stapedectomy	13.4	4 (80%)
Cruz et al. 1999 ⁷	39	Stapedectomy	12.7	35 (89%)
Neilan et al. 2013 ⁸	6	Stapedectomy	11.3	4 (66%)
Carlson et al. 2013 ⁹	17	Stapedectomy	16.3	12 (70%)
Lippy et al. 1998 ¹⁰	47	Stapedectomy	13.1	43 (91%)
An et al. 2014 ¹¹	6	Stapedotomy	11.1	4 (66%)
Vincent et al. 2015 ⁵	38	Stapedotomy	14.4	35 (92%)

Discussion

Here, we specifically searched the studies on stapedectomy and stapedotomy in juvenile sclerosis as distinct approaches. Since there has been limited evidence in this field, we only found 7 eligible studies, which were completely consistent with our criteria. The number of patients within each study were significantly different, but our noted outcome, ABG, was almost in a similar range across all studies.

The success rate of 66 to 92 percent in achieving a postoperative ABG <10 dB, in both stapedectomy and stapedotomy

approached patients, was notable. Although we did not apply any meta-analysis, looking at the mean age of patients at the time of surgery indicating that outcome in midrange age, 13 to 14 years, is slightly better than two heads of age spectrum. There was no significant difference in the postoperative ABG between stapedectomy and stapedotomy in pediatrics with juvenile otosclerosis.

Previous studies in adult patients reported stable long-term hearing results for both stapedectomy and stapedotomy, although the overall stapedotomy provided better long-term audiometric results (2). In the search for

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potential complications of stapes surgery in adults, higher rates of sensorineural hearing loss were observed in stapedectomy compared with stapedotomy(2). This should be further studied in pediatric patients and comparison should be made between these two surgical approaches.

Overall, high success rate in both stapedotomy and stapedectomy for juvenile otosclerosis has been demonstrated in several studies, which is comparable with the results of stapes surgery in adults. The main limitation of our study was the lack of a meta-analysis on the results extracted from the mentioned studies, which could make it more conclusive. Further studies are required for evaluation of complications along with long-term outcomes to specify the superiority of one of the two procedures. Further studies can also examine the complications along with other perioperative and long-term outcomes to specify superiority for each of these two approaches.

Conclusion:

Considering the similar success rate between stapedectomy and stapedotomy, it is necessary to carry out more primary studies for determining the short and long-term outcomes of both procedures.

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Conflicts of Interest

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