



Endoscopic Malleostapedotomy in primary stapes surgery: Preliminary Results



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Abstract

Objective To describe the surgical steps in endoscopic malleostapedotomy as a primary intervention and to evaluate the audiological and surgical outcomes.

Methods 14 patients (10 males and 4 females) who underwent endoscopic malleostapedotomy as a primary intervention between April 2017 to July 2023 were enrolled in this study. Demographic data, surgical information, preoperative and postoperative pure tone averages and air bone gaps, intraoperative and postoperative complications and follow-up data were summarized and gathered in a database for further consideration and analysis.

Results During endoscopic ear surgery, congenital ossicular chain malformation was present in thirteen cases, and tympanosclerosis in one case. The postoperative air-bone gap improved significantly compared to the preoperative gap (18.4 vs 47.4 dB HL, respectively), and the mean air-bone gap closure was 29 dB HL. In 14 % of cases, the observed postoperative air-bone gap was less than 10 dB HL and in 64 % it was between 11 dB HL and 20 dB HL. An ABG closure lower than 20 dB HL was achieved in a total of 78 % of patients. There was no sensorineural hearing loss or persistent vertigo in the study sample. Two cases of prosthesis too short or prosthesis extrusion occurred after a mean follow-up of 16.9 months.

Conclusions Endoscopic malleostapedotomy as a primary intervention is a safe and reliable procedure and is a technique of choice in selected cases of stapes fixation with incus anomaly.

Methods and Materials

Endoscopic MS procedures

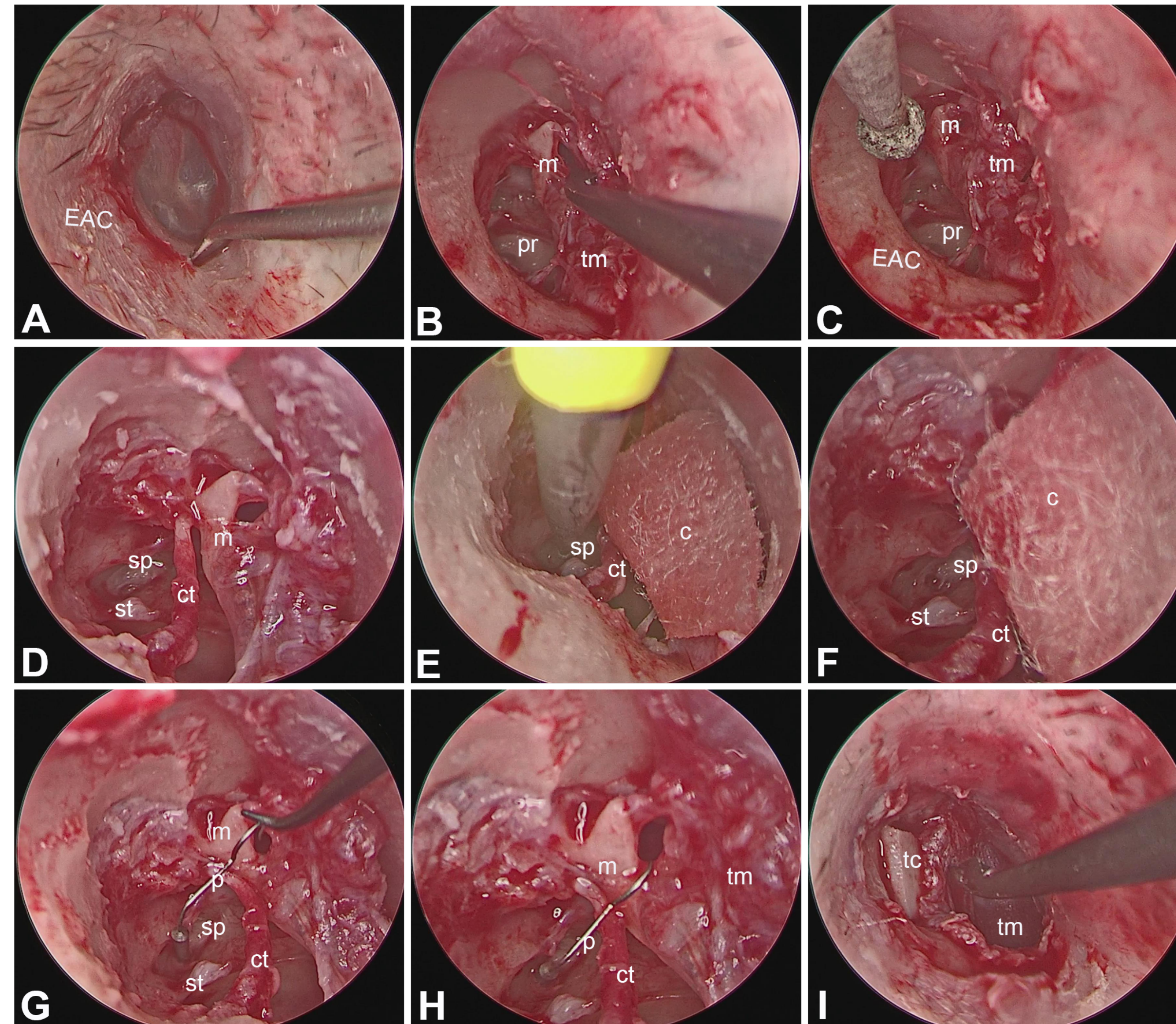


Fig. 1. Endoscopic Malleostapedotomy procedures. A, a circumferential incision in the external ear canal; B, elevation of the tympanomeatal flap and separation of the tympanic membrane from the malleus handle; C, drilling of the scutum; D, exposure of the stapes, oval window, footplate, and facial nerve; E, F, footplate perforation by a microdrill; G, H, Positioning the prosthesis and its fixation at the handle of the malleus; I, reconstruction of the scutum with a piece of cartilage and reposition of the tympanomeatal flap. EAC, external auditory canal; m, malleus; pr, promontory; tm, tympanic membrane; sp, stapes plate; st, stapes tendon; c, cotton; ct, chorda tympani; p, prosthesis; tc, tragus cartilage

Table II. Preoperative and Postoperative audiological results

Variables	Preoperatively	Postoperatively	p-value
ABG ≤10dB, %		14% (2/14)	
ABG 11-20dB, %		64% (9/14)	
ABG 21-30dB, %		7% (1/14)	
ABG > 30dB, %		14% (2/14)	
Mean ABG, dB	47.4 (SD 7.2)	18.4 (SD 8.5)	< 0.001
Mean BC, dB	22.1(SD 6.9)	18.1(SD 11.9)	0.44
Mean AC, dB	69.9 (SD 3.3)	35.6(SD 14.7)	< 0.01

ABG, air-bone gap; BC, bone conduction; AC, air conduction; SD, standard deviation.

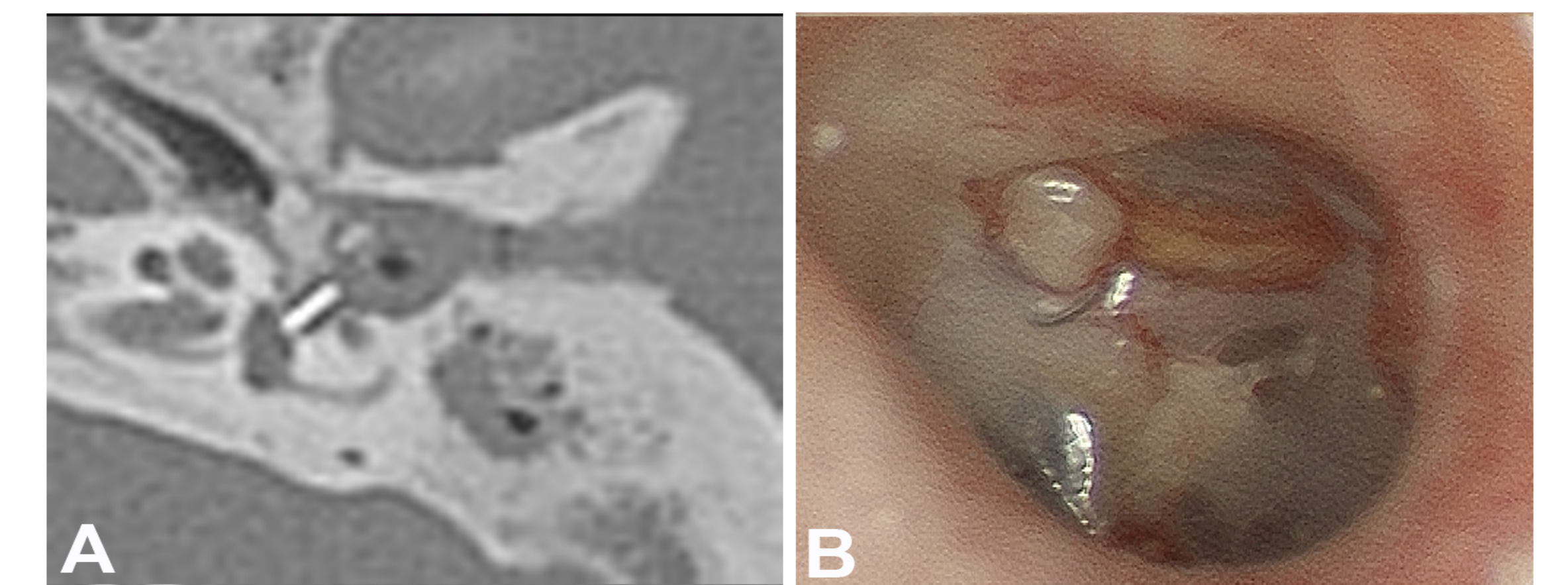


Fig. 2. No significant hearing improvement in two patients. A, Prosthesis too short; B, Prosthesis displacement out of the oval window and free in the tympanic cavity.

Introduction

Malleostapedotomy, also known as malleovestibulopexy, is a stapes surgery technique, which objective is to fasten a piston directly on the malleus handle instead of the incus. This technique was originally regarded as a technically challenging otologic procedure which can create the potential to affect the vestibular sense organs, and mainly used in stapes revision surgery for otosclerosis [1-3], and primary surgery for congenital footplate fixation with incus deformity or tympanosclerosis with functional blocking of the footplate [4, 5, 6]. Traditionally, those surgical procedures have been achieved with the practice of an operating microscope.

The endoscope improves visualization and illumination of middle ear structures while enabling a better field of view of the stapes and footplate [7], and transcanal endoscopic incus-stapedotomy shows similar audiological and safety outcomes when compared to the traditional microscopic approach [8-10]. However, endoscopic malleostapedotomy was only sporadically described in stapes revision surgery after prior stapedotomy [11, 12], and no studies have reported this endoscopic technique in primary stapes surgery in the current literature. The aim of this study is to assess audiological and surgical outcomes in a cases of fourteen patients who underwent MS as primary surgery.

Results

Table I. Individual patients' characteristics.

Patient No	Age (yr)	Sex	Side	Pre-Operative ABG	Intraoperative findings	Follow-up (mo)
1	43	m	L	51	Superstructure and ILP absent, FP fixation	58
2	41	m	R	53	Extensive tympanosclerosis plaques, FP fixation	12
3	8	f	R	54	Oval window atresia, stapes and incus dysplasia, FN deformity	23
4	10	m	L	44	Stapes and incus dysplasia, FP fixation,	26
5	12	m	R	55	Stapes and incus dysplasia, FP fixation	12
6	17	m	R	42	Superstructure and ILP absent, small FP, FP fixation, CC	13
7	13	f	R	52	Stapes and ILP absent	12
8	19	m	R	51	Narrow EEC, Superstructure and ILP absent, FP fixation, CC	16
9	17	m	L	52	Superstructure and ILP absent, FP fixation, ossification of AML	15
10	15	m	R	55	ILP absent, stapes fixation, small FP, Malleus fixation	12
11	14	m	L	44	Oval window atresia, stapes and incus dysplasia, FN bifurcation	14
12	53	f	R	37	Superstructure and ILP absent, FP fixation	8
13	55	f	R	30	Superstructure and ILP absent, FP fixation, Malleus fixation	8
14	38	m	R	44	Superstructure and ILP absent, FP fixation	7

Discussion

To our knowledge, this is the first study to exclusively report the endoscopic MS for primary surgery. Prior to this, endoscopic MS was only reported in revision stapes surgery and only mentioned in several studies about endoscopic stapes surgery without differentiating incus-stapedotomy and malleus-stapedotomy [4], and the latter is technically more challenging.

One hand work is regarded as the most prominent limitation of endoscopic stapes surgery. However, in our study, none of the surgical steps involved in the MS procedures were judged not feasible by endoscopic ear surgery. The most difficult step is positioning and crimping of the prosthesis through the malleus handle and oval window. With the technical improvement, the use of an endoscope holder and new pistons such as self-fixing articulated titanium piston, or heat-crimping piston could make this procedure more precise and feasible [6].

In addition to surgical technique, accurate measuring the distance between the malleus handle and stapes footplate and selecting the correct prosthesis length in MS is sometimes difficult, due to the angulated relationships among the ossicular landmarks, the anterior location of the malleus in relation to the stapes.

Conclusions

Endoscopic MS as a primary intervention is a safe and reliable procedure with good audiological outcomes and low complication rates.

Contact

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