Endoscopic Stapes Surgery

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KEYWORDS

• Otosclerosis • Endoscopic ear surgery • Stapedectomy • Stapedotomy
• Endoscope

KEY POINTS

- Transcanal endoscopic ear surgery provides a magnified, wide-field view of the entire middle ear even in the setting of a narrow external meatus or ear canal.
- Scutum removal during endoscopic stapes surgery is usually still required to access the oval window with instruments and for prosthesis placement.
- Stapes footplate work and prosthesis placement is often more challenging than microscopic stapes surgery given the lack of depth perception with the use of the endoscope.
- The efficacy of endoscopic stapes surgery seems to be equivalent to microscopic stapes surgery.
- No significant thermal or mechanical issues have been reported to date using the endoscope for stapes surgery.

Video content accompanies this article at http://www.oto.theclinics.com.

INTRODUCTION

Rosen[1] introduced the stapes mobilization procedure for the management of otosclerosis in 1953. Since then, other surgical techniques have been described, including lateral semicircular canal fenestration, the stapedectomy, and the stapedotomy.[2–4] Traditionally, these surgical techniques were and have been performed with the use of an operating microscope.

Mer and colleagues[5] first described the use of an endoscope to visualize the structures of the middle ear in 1967. However, the last 2 decades have seen a dramatic

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increase in the use of transcanal endoscopic ear surgery (TEES). TEES is now used to perform stapes surgery along with other otologic procedures, including tympanoplasty, cholesteatoma surgery, ossiculoplasty, and for the removal of middle ear and intracanalicular pathology.[6–13]

ADVANTAGES AND DISADVANTAGES OF TRANSCANAL ENDOSCOPIC EAR SURGERY

Supporters of TEES advocate that the endoscope might improve surgical outcomes as a result of improved visibility of the middle ear structures when compared with the microscope.[14] Specifically about stapes surgery, the wide angle of view allows for better visibility of the stapes and footplate, easy identification of anatomic or pathologic variations, the ability to visualize beyond the shaft of the surgical instruments, and close visualization and confirmation of prosthesis coupling. With these advantages, endoscopic stapes surgery provides similar audiologic results when compared with the microscopic technique as summarized by Hunter and Rivas in 2016.[15] Other potential surgical advantages include decreased scutum removal and reduced chorda tympani manipulation and injury.[16]

Disadvantages of TEES include the loss of stereopsis, one-handed surgery, and the potential risk of thermal injury to the inner ear resulting in sensorineural hearing loss and vestibular dysfunction secondary to the proximity of the light source. Analyzing these risks, Dundar and colleagues[17] measured oval window temperature changes during endoscopic stapedotomy in a guinea pig model. They concluded that the greatest risk comes with the use of a xenon light source in a 4-mm endoscope, whereas the least temperature elevation was found with the LED light source with a 3-mm endoscope.[17]

EQUIPMENT

The increased interest in TEES has stimulated the creation and adaptation of new endoscopes, special endoscopic equipment, and microinstruments designed to facilitate this type of surgery. The instruments and equipment required for TEES are listed in **Box 1**.

A high-definition monitor and 3-chip cameras provides ideal resolution and appropriate combination of contrast. Previous generation cameras create an oversaturation of the red color, which in turn decreases resolution in an already bloody field.

Rigid endoscopes frequently used for ear surgery are 2.7 mm, 3 mm, or 4 mm in diameter. A larger diameter endoscope provides increased illumination, and improved visual resolution of the operative field at the expense maneuverability within the narrow external auditory canal. The available working lengths include 18 cm, 14 cm, 11 cm, and 6 cm. Image stabilization, arm and hand fatigue, and an increased risk

Box 1
Equipment for endoscopic stapes surgery

- High-definition 3-chip camera
- High-definition monitor
- Rigid endoscopes 0°, 30°, 45°, 14 cm long, 3 mm in diameter
- Standard otologic instruments for stapes surgery
- Laser, micro drill, or hand drill