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## Revision Stapedectomy

### Introduction

The need for a revision surgery arises under the following circumstances:

- When the patient says that there is no improvement in the hearing following the first surgery.
- When the patient says that there was an improvement in the hearing following surgery in the beginning, which lasted only for a few days to months, followed by decreased hearing.
- Worsening of hearing following stapedectomy usually associated with vertigo which is severe at times. The deafness may be fluctuating sometimes.

When investigated, the deafness in the categories 1 and 2 is mostly found to be conductive in nature and there is no need to hurry in revising these cases.

Deafness in category 3 is found to be sensorineural and early intervention is needed to prevent further and permanent damage.

It is important to remember the following facts:

- The revision surgery is more difficult than the first surgery.
- The revision surgery is not as successful as the first surgery.
- Prosthesis (Teflon piston), which has been inserted in the first surgery is in very close contact with the utricle and the saccule, with the possibility

of adhesions between them. If this prosthesis is pulled blindly, there is a possibility of damage to the utricle and saccule, leading to deaf ear.

The decision of a revision stapedectomy should be taken carefully because of the following reasons:

- As mentioned earlier, the revision surgery is not safe and not as successful as the primary surgery.
- There are varieties of situations, which are faced during the revision surgery, which affects the ultimate outcome.
- There are more chances of getting sensorineural hearing loss (SNHL) following revision surgery and high chances of nonclosure of the air-bone (AB) gap after revision stapes surgery.

Before revision surgery is planned, good hearing assessment, including fresh audiogram with perfect masking, should be done.

Undiagnosed unilateral SNHL in the operated ear with false-negative Rinne test should always be ruled out, which might have been missed before the first surgery. Proper Rinne and Weber tests should be done to confirm SNHL in the ear to be operated on.

A review of the audiogram conducted before the first surgery should always be done, which at times is confusing. A fresh audiogram with proper masking should be done.

The surgeon, if he is revising his own case, if possible, should try to recollect all the steps of the surgery that he has performed. He will definitely be able to recollect and point out where things went wrong. If the procedure has been recorded, then the surgeon can review the recordings and find out the mistake, which can be corrected during the revision surgery.

If the surgery was performed by another surgeon, try to get the discharge summary and go through the operation notes, which at times are misleading. Many times, a discharge summary is not available with the patient.

High-resolution computed tomography (HRCT) of the temporal bone should be done before revising the case.

## Causes of Residual or Reappearance of Conductive Hearing Loss Following Stapedectomy

Reappearance of conductive hearing loss following stapedectomy could be due to some immediate and late causes. These causes are discussed briefly in the following sections.

### Immediate Causes

Immediate causes of the reappearance of conductive hearing loss include:

- **Migration or displacement of the prosthesis (piston):** This can be prevented by performing stapedotomy rather than stapedectomy, by creating a clean and discrete fenestra, putting a piston of exact length (it should neither be short nor long), and proper crimping of the piston. The length of the piston is of utmost importance.

- **Loose piston:** This could be due to improper crimping of the piston causing a gap between the incus and the piston, leading to conductive hearing loss. In few patients, the long process of the incus is thin and the piston remains loose in spite of firm crimping. This situation can be handled by using a piston with a narrow loop (e.g., Shea's piston).
- **Short piston:** This indicates that the piston is not touching the oval window membrane. Short piston is due to faulty calculation of the distance between the incus and the footplate of the stapes. It can also occur due to improper crimping of the piston. Short piston can get easily displaced while sneezing.
- **Malleus head fixation:** This was probably missed during the first surgery. Hence, the mobility of each individual ossicle should always be checked during surgery.

In addition the surgeon should also look for the following:

- Whether a round window obliteration (which is very rare) has been missed.
- Whether a superior semicircular canal dehiscence (third window) has been missed. This is again a very rare situation.

### Late Causes

Reappearance of conductive hearing loss following stapedectomy could be due to:

- Displacement or migration of the prosthesis from the center of the fenestra touching the edges of the fenestra. During healing, the connective tissue seal at the fenestra, if very thick, may shrink, pushing the piston

out, causing conductive hearing loss. Among all the tissue seals, the vein graft is the most suitable as it is thin and there is no chance of shrinkage.

- Fibrous adhesions may develop around the prosthesis between the incus and the promontory causes late conductive hearing loss.
- Displacement of the prosthesis from the incus, which may be complete at times.
- Incus erosion or necrosis: It is rare with teflon piston. It is common with metallic prostheses. Ideally, there should not be any movement between the incus and the loop of the prosthesis (piston). Incus necrosis usually takes place due to relative movements between the long process of the incus and the loop of the piston. this movement is due to either loose piston or tight fit of the piston in the fenestra preventing free movement of the Teflon piston in the fenestra.

Incus erosion was said to be due to decreased blood supply to the incus after section of the stapedius tendon, but it is the bone marrow in the incus that provides sufficient blood supply to the incus. Another cause for incus erosion is found to be foreign body reaction to the piston, causing local bony erosion with granulation. Clinically the incus erosion presents with the hearing loss, which is conductive in nature and fluctuates in the beginning with the head movements, but later it becomes persistent.

- Regrowth of the otosclerotic focus: It is more common with the obliterative otosclerosis. Hence, the footplate fenestra in these patients should be

made much larger than the piston to prevent fixation of the piston due to new bone formation.

## Surgical Steps in Revision Surgery

Revision surgery preferably should be done under local anaesthesia. The incision is either endomeatal or endaural, depending upon the surgeon and the situation. If the surgeon feels that the exposure is going to be inadequate with an endomeatal incision, then he or she should start the surgery by an endaural incision rather than struggling with inadequate exposure with the endomeatal incision, especially in a narrow external auditory canal.

Once the middle ear is entered, the first structure seen is the incus with the piston, which was placed during the previous surgery. Most of the time, the incus is covered by adhesions between the incus, tympanic membrane, and the middle ear promontory mucosa, which are to be cut either by a sickle knife or by microscopic scissors.

One must look for a loose or displaced piston.

The piston should not to be removed suddenly unless its lower end into the footplate area is defined. Usually, there are mucosal adhesions around the piston, which are to be broken and removed. CO<sub>2</sub> laser is very useful in performing this task atraumatically.

Examine the stapes footplate for any fenestra. if a fenestra is present in the footplate and the piston is in the fenestra, it should not to be removed. Look for round window reflex.

If round window reflex is present, the piston should not to be removed.

If round window reflex is absent, gently dissect the piston out of the fenestra, if possible by using CO<sub>2</sub> laser.

Palpate the malleus and incus for mobility. Check for any fixation of the malleus or incus, which might have been missed in the previous surgery.

If bony fixation of the malleus or incus is found, that should be taken care of before making a new fenestra and putting a piston.

Look for any incus erosion or necrosis. If the incus lenticular process is destroyed and is not useful, the incus is removed and malleostapedotomy can be planned.

If the malleus and the incus are normal and mobile, stapedotomy is performed.

Examine the fenestra. Get an idea about the diameter of the fenestra; if it is inadequate, it can be enlarged by microdrill or laser.

If the previous fenestra has been closed by highly active otosclerotic focus, then a new fenestra is to be made by using a microdrill and/or laser.

Get an idea about the length of the piston required by measuring the distance between the footplate and the undersurface of the incus and add 0.25 mm to it for the thickness of the footplate.

If it is not a case of obliterative otosclerosis, cover the fenestra with the vein graft and place the already-prepared piston.

In obliterative otosclerosis, the vein graft interposition technique is not done. The direct piston technique is used instead.

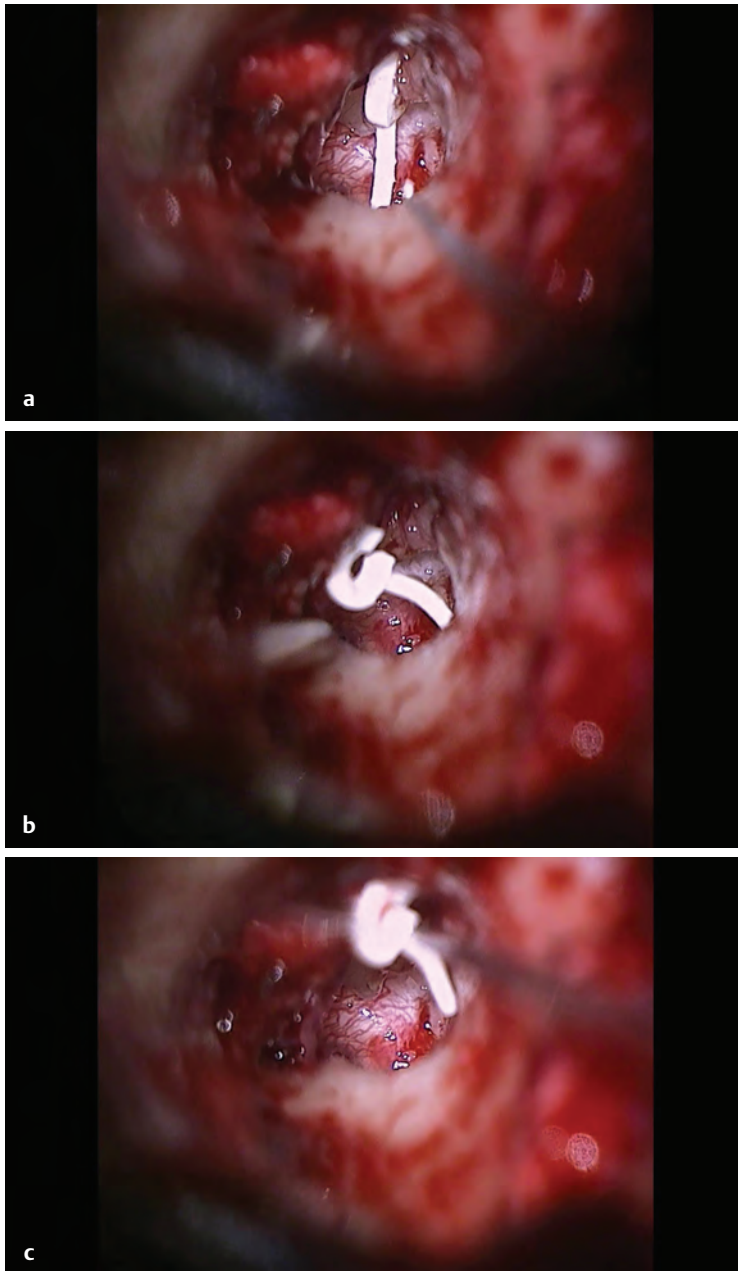
The tympanomeatal (TM) flap is repositioned, and on table hearing is tested.

## Case 1

This is a case of revision Surgery in a patient who was operated on few months back at a different center. The same ear was reexplored for persistent conductive hearing loss after the first surgery. There was no fenestra in the footplate. the footplate was obliterative, which was thinned out (saucerized) by a microdrill and the fenestra was made by CO<sub>2</sub> laser. A proper size piston was then placed (**Fig. 26.1**).

## Recommendations for Surgeons

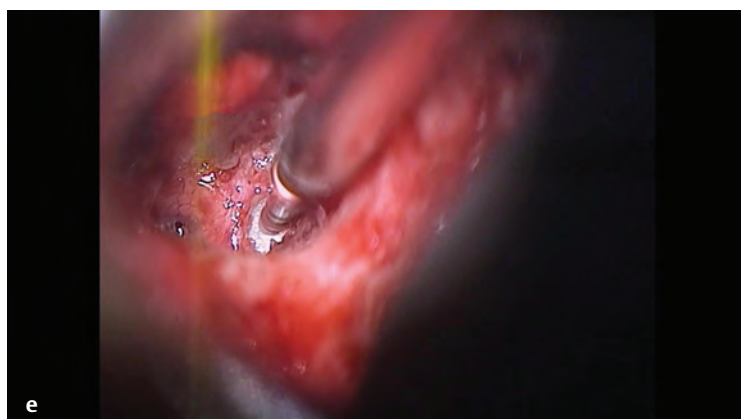
- For conductive hearing loss, there is no hurry. Wait for 6 to 8 months so that the middle ear mucosa comes back to normal and surgery can be performed without any difficulty.
- Avoid general anesthesia. Local anesthesia with light sedation is always preferred as under local anesthesia, if the patient experiences any vertigo on the operation table while manipulating the piston, which was placed in the previous surgery, it implies that there are adhesions between the piston and the membranous labyrinth. this is a warning for the surgeon to be cautious. In addition, hearing assessment can also be done on the operation table immediately after surgery.
- Both these assessments are not possible under general anesthesia.
- Blind manipulation of the piston, in the oval window fenestra should be avoided as that may damage the inner ear.



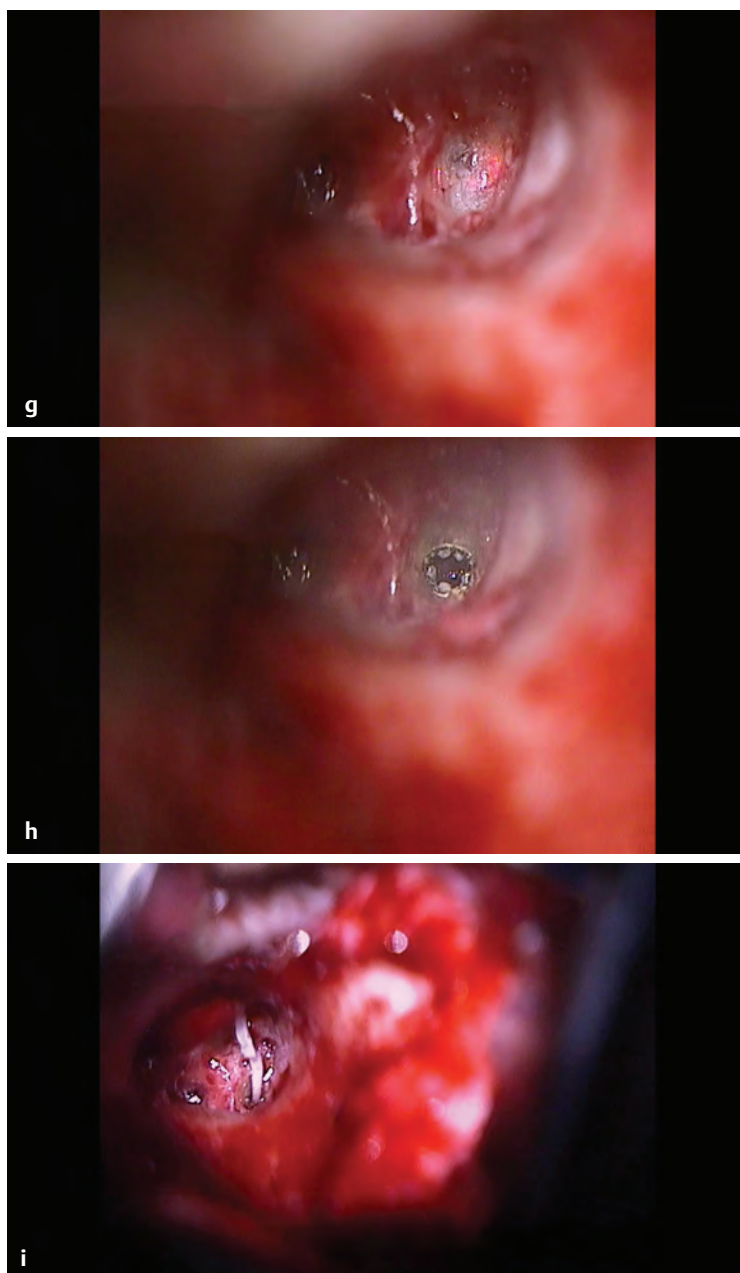
**Fig. 26.1** (a) A case of revision surgery. On exploration, it was observed that the teflon piston was displaced laterally away from the stapes footplate but still attached to the incus. There was no stapes superstructure and no footplate fenestra. The stapes footplate was thick and obliterative. (b) The piston is taken out from the incus. (c) The piston is removed from the middle ear. No stapes superstructure is seen. (Continued)



**Fig. 26.1** (Continued) **(d)** The footplate of the stapes is exposed. It is thick and obliterative. The mobility of the incus and malleus is checked and both were found to be mobile. **(e)** The footplate of the stapes is saucerized by the microdrill with diamond bur of 0.6 mm. **(f)** Complete footplate of the stapes is thinned out uniformly and *bluelined*. (Continued)







**Fig. 26.1** (Continued) **(g)** CO<sub>2</sub> laser beam is focused over the footplate to make a fenestra. **(h)** A 0.8-mm fenestra is made by CO<sub>2</sub> laser in the posterior part of the footplate. A single shot is enough to make a discrete fenestra in the stapes footplate. **(i)** A 0.4-mm piston of suitable length is placed between the incus and the footplate fenestra by the direct piston technique. The tympanomeatal (TM) flap is repositioned back after crimping the piston.

- If the surgeon is not able to find any fault during the revision surgery, he or she should close the middle ear.
- CO<sub>2</sub> laser is very useful during the revision surgery. The introduction of laser for revision stapedectomy has improved the hearing results.
- A rare but undoubtedly an important point of consideration is that obliteration of the round window by the otosclerotic focus should always be kept in mind and its patency should always be checked during the primary surgery.

## Results

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Results of revision surgeries are not as good as those of primary surgeries. A revision

surgery provides a good closure of the AB gap in more than 75% of cases with a little more risk of SNHL following the surgery than the primary surgery.

There are less chances of complete closure of the AB gap in a revision surgery as compared to the primary surgery and some AB gap (around 30 dB) remains in spite of a good uneventful surgery. The reason for this is not known.

There are more chances of developing SNHL in the revision surgery as compared to the primary surgery. This could be due to trauma to the inner ear and blind manipulations in the area of the footplate fenestra. Hence, it is essential to be careful before taking the decision to perform a revision stapedectomy. Using CO<sub>2</sub> Laser in revision surgery is advisable as it has been found to provide better results.