Definition of Exostosis

Exostosis is an abnormal benign bony growth within the external ear canal. It is frequently multiple and bilateral and is very common in individuals with repeated exposure to cold water and wind. Patients may develop conductive hearing loss and/or recurrent ear infections due to trapped water and earwax between the tympanic membrane and the exostosis.

Indications for Canalplasty

Retention of cerumen and keratin in the external ear canal (EAC) associated with recurrent episodes of external otitis.

Preoperative assessment

Otomicroscopy

The findings are partial or total obstruction of the bony external ear canal and retention of cerumen. In some cases it is not possible to visualize the eardrum at all. It is important to assess the cartilaginous entrance to the ear canal in order to plan for a meato-plasty at a later stage (Figures 1, 2)

Audiometry

The audiogram may be normal in case of partial obliteration or may reveal a conductive hearing loss in cases of complete or almost total exostoses with retention of cerumen (Figures 3, 4).

Figure 1: Multiple exostoses

Figure 2: Exostoses

Figure 3: Conductive hearing loss in the left ear
**Imaging**

CT scan shows the extent of the exostoses and helps the surgeon to determine the amount of bone that needs to be removed and avoiding injuries to nearby structures (Figures 5, 6).

**Surgical Principles**

- Removal of external canal exostoses requires complete elimination of the overhanging bone lateral to the tympanic annulus
- The meatal skin should be kept intact and vital to promote rapid reepithelisation following enlargement of the bony ear canal
- With a narrow ear canal entrance, meatoplasty is combined with the canalplasty, removing the excess conchal cartilage and subcutaneous tissue, thereby yielding a large cartilagenous external canal that ensures excellent visibility of the exostotic posterior canal
- In cases of severe bilateral exostosis, wait three months to operate on the other side

**Surgical Approaches**

The pathology can be addressed by an endaural or a retroauricular approach. The endaural approach is well suited to less severe exostoses and for surgeons who are familiar with endaural approaches for other
pathologies. Less experienced surgeons may favour a retroauricular approach as the exposure is more familiar to them and there is a wider field of action.

**Endaural Approach**

**Video:** [http://youtu.be/IpCR8hPCyiA](http://youtu.be/IpCR8hPCyiA)

**General Considerations**

Although the surgery can be performed under local anaesthesia with sedation, we prefer general anaesthesia due to the uncomfortable drilling noise. Antibiotic prophylaxis is not required.

**Surgical Steps (left ear)**

- Infiltrate the site of the endaural skin incision as well as the ear canal in 4 quadrants with local anaesthetic (lidocaine 1% & adrenaline diluted to 1:200 000) (*Figure 7*)
- Using a nasal speculum, make a helicotragal incision with a #15 blade and (*Figure 8*)
- Make a posterior semicircular incision over the edge of the exostosis, meeting the endaural incision at 12 o’clock (*Figure 9*)

*Figure 7: Speculum aiding infiltration*  
*Figure 8: Helicotragal incision*  
*Figure 9: Posterior incision*  
*Figure 10: Prolong the posterior incision*  
*Figure 11: Prolong the posterior incision*
• An anterior semicircumferential incision is made along the lateral margin of the anterior exostosis
• Reflect the anterior canal skin and soft tissue laterally using a Fisch or Iowa microraspary and a Key raspatory. A round knife may also be used, but will get blunt when dissecting on bone (Figures 1, 2, 3)

Figure 11: Reflect posterior skin laterally

Figure 12: Elevate anterior skin laterally

Figure 13: Elevate anterior skin laterally

The anterior skin flap is kept elevated and retracted from the lumen with an aluminium strip anchored to the Fisch endaural retractor (Figure 14)

Elevate the skin over the exostotic bone using microraspatories and small gauze strips (1-1.5cm in length) soaked in adrenaline solution. The gauze strips allow careful dissection between skin and bone and avoid lacerations to the skin flaps (Figure 14)

Figure 14: Elevate skin with Fisch microraspary and adrenaline gauze

Figure 15: Sharp burr

Remove the excess bone along the canal wall. A sharp drill is only used at the outer entrance to the bony ear canal far away from the skin flaps. Once the dissection proceeds into the bony ear canal, diamond burrs are used. (Figures 15, 16)
• Since preservation of the ear canal skin is vital to allow proper wound healing, the following steps and tricks are helpful to achieve this goal:
  o The left hand (for right-handed surgeon) cleans the field holding otosclerosis suction tips and assists the right hand while drilling
  o Continuous irrigation is mandatory to see any colour changes within the bone (appearance of temporomandibular joint anteriorly or mastoid air cells posteriorly)
  o To protect the skin from damage, a groove or sulcus is made in the exostosis, leaving a thin layer of bone covering the elevated skin. Avoid drilling on the edge; always stays behind the edge of the groove/sulcus. The outer limits are the temporomandibular joint anteriorly and the mastoid air cells posteriorly
  o Elevate the skin with an adrenaline gauze, leaving the skin safe medial to the edge of bone (Figures 17-20)
• Drilling should be discontinued if a bluish colour in the bone is noted anteriorly while irrigating to avoid entering the temporomandibular joint
• Approaching the eardrum, drill at the edge, using a silastic sheet to protect the skin (Figure 21)
Figure 20: A groove is made, and the skin left protected medially

Figure 21: Silastic sheet

- When the tympanic annulus appears through the posterior side of the flap, the eggshell of bone protecting the meatal skin is removed with a Fisch microraspatory and curette (Figures 22, 23)

Figure 22: Curetting bone over annulus

Figure 23: Curetting bone over annulus

- The EAC is shaped into an inverted truncated cone
- Correct widening of the EAC requires elimination of all overhanging bone lateral to the tympanic annulus. Failure to open the tympanomeatal angle at the level of the annulus causes accumulation of keratin with recurrence of the exostoses
- The flap of ear canal skin is placed back in position. Releasing cuts are made at 11 and 7 o’clock (right ear) to accommodate the skin properly on the new bone canal (Figures 24, 25)

Figure 24: Incising at 1 & 5 o’clock

- The meatal skin flap is repositioned and covered with Gelfoam pledgets soaked in corticosporin (Figures 26, 27)
- The endaural incision is closed with 3/0 Vicryl and 4/0 Prolene sutures
Retroauricular Approach

Video: http://youtu.be/nkSq6w9uhmY

This approach allows better visualization of the canal.

Indications

- Total exostosis without lumen
- Less experienced surgeon (better landmarks, larger operative field, same outcome)

General Considerations

The surgery is performed under general anaesthesia (local anaesthesia is possible, but noise of drilling burr can be difficult for the patient to accept). Antibiotic prophylaxis is not required.

Surgical Steps (Left ear)

- Using local anaesthetic (lidocaine 1% and adrenaline diluted to 1:200 000), infiltrate the postauricular sulcus. Then advance the needle and infiltrate the tissues anteroinferiorly and anterosuperiorly
- Use a Lempert’s speculum to visualize the bony-cartilaginous junction and injecting the 4 quadrants of the skin of the ear canal
- Using a Lempert’s speculum, make a posterior transcanal incision over the edge of the exostosis, with an inferior extension. Reflect the skin flap laterally (Figures 28-30)
- Start the retroauricular approach like for tympanoplasty (Figures 32, 33) (Myringoplasty & tympanoplasty chapter)
- The end of the periosteal flap elevation meets the posterior transcanal incision
Figure 28: Posterior incision

Figure 29: Extending the posterior incision inferiorly

Figure 30: Reflecting the posterior flap

Figure 31: Retroauricular skin incision

Figure 32: Periosteal flap

- Incise the anterior canal wall with an #11 blade and reflect the skin laterally. Keep the anterior skin out of the surgical field with an aluminium strip (Figures 33-35)

Figure 33: Anterior incision
Perform the next steps as for Endaural approach (Figure 36)

- Cover the skin with Gelfoam pledgets soaked in corticospirin
- Suture the retroauricular incision with 3-0 Vicryl and 4-0 Prolene

**Videos**

Exostosis surgery: Endaural approach  

Exostosis surgery: Retroauricular approach  

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