

near-normal adjacent mucosa, at the time of initial surgery, preventing recidivism and potentially preventing repeat otologic surgical interventions. 'Something borrowed' is using new magnetic resonance imaging (MRI) techniques from radiology to image either nascent cholesteatomas or to use MRI as the 'second look' procedure. The goal is to enable minimally invasive techniques of complete cholesteatoma removal while preserving hearing function either naturally or by immediate reconstruction, and avoiding 'clean' second look surgeries. Details of using all of these techniques, including pitfalls that should be avoided, will be discussed.

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### Advances in Understanding of Eustachian Tube Dysfunction and Cholesteatoma (N675)

**ID: 675.4**

#### Controversies in Aetiology and Management of Cholesteatomas (N675) 6-6

Presenting Author: **Richard Chole**

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*Learning Objectives:* The objective of this presentation is to critically evaluate the different theories of cholesteatoma pathogenesis and to discuss the evidence for and against various theories.

It is clear that cholesteatomas arise due to a number of different mechanisms. Clinical and experimental observations support the etiologies of cholesteatoma formation. Cholesteatomas clearly can arise by the ingrowth of keratinizing epithelium from the lateral surface of the tympanic membrane and ear canal into the middle ear. These so-called secondary cholesteatomas arise from implantation of keratinizing epithelium or ingrowth of a perforation. Experimental and clinical evidence supports this etiology.

Cholesteatomas may also arise by formation of retract pockets in the pars tensa or pars flaccida. The retraction pockets develop because of Eustachian tube malfunction and inflammatory degradation and weakening of the tympanic membrane. These retraction pockets are sometimes benign, but sometimes accumulate keratin debris. Once the keratin debris accumulates in a retraction pocket, expansion of the retraction pocket into a cholesteatoma is usually relentless.

Experimental and human temporal bone evidence has shown that cholesteatomas may arise by perforation of the basal lamina of the keratinizing epithelium of the tympanic membrane and the development of micro-cysts in enlarging intramural cholesteatomas.

A theory of mucosal traction by ciliated cells of an attic retraction pocket has been proposed. However, the epithelium of most of the middle ear and attic regions does not contain ciliated cells (Chole & Lim). Furthermore, recent evidence (Thompson & Tucker) has shown that the epithelium of the attic and around the ossicles is of neural crest origin and the area near the Eustachian tube is of endodermal origin. Neural crest derived epithelium does not form cilia.

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### Imaging for Cholesteatoma and ear structure (R676)

**ID: 676.1**

#### Labyrinthine Artery Detection in Patients with Idiopathic Sudden Sensorineural Hearing Loss by 7 T-MRI

Presenting Author: **Hiroaki Sato**

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*Learning Objectives:*

*Objective:* The pathogenesis of idiopathic sudden sensorineural hearing loss (ISSHL) is still unknown, but an inner ear circulatory disturbance has been considered to be one possible pathogenesis. To date, there have been no reports evaluating the possibility of the labyrinthine artery infarction in ISSHL patients by ultra-high-field MRI. The present study aims to compare the detection rates of the labyrinthine artery in subjects with idiopathic sudden sensorineural hearing loss and in normal hearing controls using 7-T MRI.

*Study Design:* cross sectional study

*Setting:* Tertiary referral center

*Subjects and Methods:* In 22 patients (11 males, 11 females) with ISSHL and 43 volunteers (29 males, 14 females) with normal hearing, 7-T MRI (Discovery MR950, GE Medical Systems) was performed with the 3D time-of-flight spoiled gradient echo (3D TOF SPGR) sequence to compare the detection rates of the labyrinthine artery.

*Results:* MRI scans were performed from 3 to 173 days after onset. Of the 22 patients with ISSHL, 8 showed complete recovery, 10 showed partial recovery and the rest showed no recovery. The labyrinthine artery was depicted in 44 of 44 ears (100%) in the ISSHL group and 85 of 86 (98.8%) ears in the normal hearing group, with no significant difference in detection rates. Two ISSHL patients out of 4 patients with no recovery showed total deafness, but the labyrinthine artery was also depicted in both patients.

*Conclusion:* The present study is the first to report depiction of the labyrinthine artery by 7-T MRI. These preliminary results indicate occlusion of the labyrinthine artery would be rare in the pathogenesis of ISSHL and they also demonstrate that the labyrinthine artery could be detected by ultra-high-field MRI.

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### Imaging for Cholesteatoma and ear structure (R676)

**ID: 676.2**

#### Combine MR and CT imaging in cholesteatoma

Presenting Author: **Issam Saliba**

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**Learning Objectives:** 1) To learn the importance of MRI diffusion in cholesteatoma followup 2) to understand how fusion of mastoid CT scan and MRI diffusion can localize precisely residual cholesteatoma.

**Objective:** To evaluate the ability of a preoperative mastoid Computerized tomography scan (CT scan) fusion with the postoperative diffusion weighted magnetic resonance imaging to accurately localize a residual cholesteatoma thus sparing an unnecessary postoperative CT scan radiation.

**Study design:** Prospective study

**Setting:** Tertiary care center.

**Patients and methods:** We followed up prospectively a consecutive group of patients presenting with middle ear cholesteatoma using preoperative mastoid CT scans, postoperative mastoid CT scan and diffusion weighted-MRI between 2008 and 2009.

Postoperative Diffusion Weighted-MRI images were fused to both: the preoperative and postoperative mastoid CT scans. Fused images were evaluated for their ability to detect accurately the location of residual cholesteatoma. If any, results were correlated to surgical findings.

**Results:** Twenty-seven patients were included in the study; only nine patients showed middle ear opacity on the postoperative CT scans; the remaining negative patients were excluded. Diffusion weighted MRI had detected residual cholesteatoma in 3 out of the nine patients. Both CT scans; preoperative and postoperative, were able to precisely localize the residual cholesteatoma when fused to the postoperative diffusion-weighted MRI. Intraoperatively, two patients had a residual cholesteatoma that correspond to the fused radiological images. The third was cholesteatoma free.

**Conclusion:** Diffusion weighted MRI / CT scan fusion combines the advantages of cholesteatoma detection and precise localization. Preoperative CT scan performed before the first surgery can be used for the fusion to spare the patient an unnecessary another CT scan and thus decreasing radiation exposure.

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### Imaging for Cholesteatoma and ear structure (R676)

**ID: 676.3**

#### DWI imaging in extensive petrous bone cholesteatoma

Presenting Author: **Simon Lloyd**

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Scott Rutherford, Charlotte Ward, Andrew King  
TBC

**Learning Objectives:** To assess the utility of DWI imaging in the assessment of recurrence of extensive petrous bone cholesteatomas.

**Methods:** A prospectively updated database of patients who had undergone surgery for extensive petrous bone cholesteatoma was interrogated. All patients had undergone annual DWI imaging. Data was collated including extent of disease, surgical approach and recurrence based on clinical assessment and DWI imaging. Analysis of factors associated with recurrence was undertaken.

**Results:** 63 patients were included. Age range was 10 to 83 years. 60% presented with good facial function (House-Brackmann grade I or II) and 33% presented with useable hearing. The most common location of disease was supralabyrinthine 33%) although 28 (44%) had apical disease. Complications were limited with one patient developing a CSF leak, one patient an abdominal wall haematoma, and one patient an infection in the wound. 11% had residual hearing following surgery. 63% had good facial function at 1 year post operatively. 5% had clinically apparent residual/recurrent cholesteatoma but 30% had residual/recurrent disease on DWI imaging. 70% of recurrence was initially managed conservatively but 60% eventually required repeat surgery.

**Conclusions:** DWI MRI is a useful technique for confirming the diagnosis and assessing extent of petrous bone cholesteatoma. It has also become the gold standard for identification of recurrent disease and has much better sensitivity and specificity than clinical assessment. Its extensive use has demonstrated that recurrence rates of petrous bone cholesteatoma are much higher than historic papers based on clinical assessment would suggest. Not all recurrence requires treatment, however.

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### Imaging for Cholesteatoma and ear structure (R676)

**ID: 676.4**

#### How the use of CBCT and MRI has changed our management of cholesteatoma

Presenting Author: **Thomas Somers**

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Cholesteatoma remains a clinical diagnosis but today imaging has become an important cornerstone in the diagnostic work-up of this condition. Conebeam CT offers a much higher resolution of the interface between bone, air and soft tissue, while the associated irradiation dose is substantially lower, as compared to multi-detector CT scans. As such, CBCT has become very useful for the pre-op work-up of patients with cholesteatoma showing with precision bony erosion of the ossicular chain and erosion of the petrous bone (as fistulae, perilyabyrinthine erosion, intracranial invasion). Also the aeration of the