Necrotising otitis externa
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Section: Head & neck imaging
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Patient: 73 years, male

Clinical History:
Right-sided severe otalgia and facial weakness

Imaging Findings:
This patient presented with severe right-sided otalgia and a right facial nerve weakness which had been developing over 2 months. He had a mastoidectomy as a child and had intermittent right ear infections ever since. He was non-diabetic. Right ear swabs grew pseudomonas aeruginosa. A CT and MRI scan were performed. The CT scan demonstrated that the right mastoid process was smaller and more sclerotic than on the left consistent with chronic infection. The mastoidectomy cavity communicated with the middle ear cleft, both were opacified. There was cortical bone erosion with a defect of the tegmen tympani and erosion extending along the upper surface of the petrous ridge. The labyrinthine portion of the right facial nerve canal was widened. The MRI (axial and coronal T1 pre and post contrast, axial SPAIR and coronal SIR through the skull base and neck) showed that the marrow of the right petrous bone had lost its normal high T1 signal, had intermediate T2 signal and demonstrated enhancement following gadolinium. The abnormality was seen to extend into the right middle cranial fossa and distort the temporal lobe. There is reactive dural enhancement but no temporal lobe parenchymal signal change. He was commenced on oral ciprofloxacin and hyperbaric oxygen therapy. He had an early baseline gallium-67 SPECT/HAWKEYE CT scan, which showed only minimal gallium uptake in the right petrous bone, a subsequent study for clinical deterioration showed increased tracer uptake in this area. He subsequently had surgical debridement and drainage of the right mastoid.

Discussion:
Necrotising otitis externa (NOE) is a severe, invasive infection which may extend to involve deep soft tissues and produce skull base osteomyelitis. Previously termed malignant otitis externa due to the high mortality rate. There is no single criterion for diagnosis which depends on clinical, laboratory and radiological findings. Whilst anyone may be affected the condition usually affects elderly diabetic patients or occasionally other immunocompromised individuals. There is often a history of recent aural irrigation. Common presenting features are severe otalgia, headache and otorrhoea. As in this case patients may present with complications of the disease- Cranial nerve palsies occur with the facial nerve most commonly involved. IX, X and XI may be involved at the jugular foramen, XII at the hypoglossal canal. V and VI may be affected by disease at the petrous apex. Venous sinus thrombosis is another life threatening complication. Examination generally reveals granulation tissue within the external canal. The key differential diagnosis is malignancy, if there is any question of this then biopsy is essential. More than 98% of patients will grow pseudomonas aeruginosa. Inflammatory markers (PV/ESR/CRP) are generally high, the white cell count is frequently normal. CT, MRI and radionuclide imaging may be used in assessing the disease. CT may show cortical bone erosion. This is the hallmark of the condition but is seen in only approximately 70% of cases. Soft tissue abnormalities on CT include non-specific features such as soft tissue within the external auditory canal and opacification of the middle ear and mastoid. Where soft tissue is seen extending to involve the infratemporal region, with loss of normal fat planes the findings are highly suggestive of NOE. MRI demonstrates the soft tissue changes...
as well as or slightly better than CT. The key advantages of MRI are in detecting alteration in signal of the marrow of the medial skull base and for showing dural enhancement and intracranial extension. Bone scintigraphy may be used in assessing the extent of disease at presentation, it is of limited value in follow-up as increased tracer uptake often persists even when infection has been eliminated due to bone repair. Gallium-67 SPECT can be used; tracer uptake is non-specific occurring in areas of active inflammation, infection and neoplasia. Images can be combined with CT to give improved anatomical localisation. Its key role is in follow-up, as whilst there may be a small degree of uptake in healing bone persistent uptake is highly suspicious for ongoing infection. Treatment is generally with a prolonged course of anti-pseudomonal antibiotics (e.g. oral ciprofloxacin for 6-8 weeks). Hyperbaric oxygen also forms a part of current therapy. Some patients may require 6 months of antibiotics and 60 treatments of hyperbaric oxygen. Imaging and monitoring of inflammatory markers are of use in monitoring therapy as clinical symptoms may resolve early in the treatment course. CT is of limited use in following up disease as it is rare for cortical erosion to resolve. The soft tissue changes on both CT and MRI may be seen to resolve with successful treatment.

**Differential Diagnosis List:** Right-sided necrotising externa.

**Final Diagnosis:** Right-sided necrotising externa.

**References:**


Description: Axial CT image demonstrates the previous mastoidectomy cavity is seen (arrow). The right middle ear is opacified and is eroded anteriorly, communicating with the right middle cranial fossa.

Origin:
**Description**: There is expansion of the right labyrinthine portion of the facial nerve canal (arrow) **Origin**:

**Description**: There is erosion of the tegmen tympani (arrow). The middle ear is opacified and soft tissue can be seen within the right external auditory canal. **Origin**:
Description: The erosion extends along the upper surface of the petrous bone (arrows). Origin:
Description: Axial T1 weighted image. There is loss of the normal high signal within the right petrous bone (compare this to the normal high signal within the clivus and left petroud apex) Origin:
Description: Axial T2 weighted fat saturated image shows abnormal intermediate signal within the right petrous bone, this is seen to surround the right intra-petrous carotid artery and extends to encroach on the right middle cranial fossa. Origin:
**Description:** Axial T1 post gadolinium at the same level shows increased enhancement of the soft tissue within the right petrous bone and middle cranial fossa. **Origin:**
Description: T2 weighted fat saturated image shows the very bright signal of fluid within the right mastoidectomy cavity, there is intermediate signal of the petrous bone medial to this. Compare to the normal low signal on the left side. Origin:
Description: T1 post contrast. The enhancing tissue displaces and compresses the right temporal lobe. The enhancement surrounds non-enhancing fluid within the mastoidectomy cavity. Origin:
**Description:** Coronal T1 post gadolinium shows enhancing inflammatory tissue elevating and compressing the right temporal lobe. There is a thin line of reactive dural enhancement extending up the lateral aspect of the temporal lobe. The cerebral substance does not show abnormal enhancement.

**Origin:**
Figure 3

Description: Serial gallium-67 SPECT scans with simultaneously acquired CT images superimposed to allow anatomical localisation. Scan A was an early post-treatment scan with minimal tracer uptake, scan B taken approximately two months later shows increased uptake in keeping with deterioration.

Origin: