Petrositis

Synonyms: infection/osteomyelitis of petrous temporal bone, petrous apicitis, Gradenigo's syndrome (a particular syndromal presentation of petrositis)

Petrositis is infection and inflammation of the apical portion of the petrous temporal bone. It is usually a complication of suppurative mastoiditis.

Anatomy

The petrous temporal bone is contiguous with the mastoid and its air cells. It has numerous air chambers within it and this, combined with its highly vascular marrow, means that it is prone to infection that has spread from the middle ear to the mastoid.

The petrous temporal bone is directly related to important vascular and neurological tissues in the middle cranial fossa, so infection at this site can have severe and damaging consequences. Of particular relevance is the close proximity of the Gasserian ganglion (of the Vth cranial nerve), the abducens nerve (VIth cranial nerve), the carotid artery and the dural venous sinuses.

Pathogenesis

Infection is often due to Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus or Pseudomonas spp. and follows obstruction of the air cell system due to inflammation, or other lesions of the petrous temporal bone or mastoid. Occasionally, tuberculosis may be the cause of the infection especially when the patient is under 20 years of age.\(^1\)

Effective antibiotics have meant that the condition is much less common than previously. Its complications are also much less likely to ensue. However, petrositis still occurs rarely. An awareness of its existence and appropriate levels of suspicion of the condition are necessary to prevent severe damage or death in those affected.\(^2, 3\)

Epidemiology

There are no reliable recent figures. A study of outcomes following mastoiditis, which showed UK hospital admission figures in 2002 of 8.2 per 100,000 population, showed that around 7% suffered significant intracranial complications, of which a small subset was due to petrositis.\(^4\) Thus, it appears to be a rare complication of a relatively unusual outcome of acute otitis media.

Presentation

The illness may present an acute or chronic course:

- In the acute form there is a rapid onset of symptoms caused by obstruction and pressure build-up in the air cells of the petrous temporal bone.
- Chronic petrositis follows a more indolent course and the symptoms of intracranial irritation may come on slowly following a long period of otorrhoea.

The classical triad of symptoms and signs of petrositis, known as Gradenigo's syndrome, is:\(^5\)

- Otorrhoea.
- Deep retro-orbital pain, facial pain or headache (Vth cranial nerve irritation, as the Gasserian ganglion lies in close relation to the petrous apex).
- VIth (abducens) cranial nerve paresis, leading to a lateral rectus palsy, or an inability to look outwards with one eye (the patient experiences diplopia).

However, it is now unusual (due to the availability of antibiotics) for the infection to spread to the dura and cause abducens nerve paralysis, so the condition must be suspected in patients who complain of deep, severe facial/retro-orbital pain/headache with otorrhoea. Other associated symptoms/signs include (in approximate order of frequency):

- Otalgia.
- Fever.
- Confusion, impaired consciousness or coma.
- Other cranial nerve palsies, particularly trigeminal, facial and vestibulocochlear.
- Rarely, there may be symptoms or signs of dysfunction due to palsies of the Xth cranial nerve (nasal speech and bovine cough) or IXth cranial nerve (pseudobulbar palsy but only if there is bilateral disease).

Less than half the cases in Gradenigo's original series presented with the full triad.
Differential diagnosis

- Petrous apex effusion without infection.
- Cholesterol granuloma in the petrous temporal bone.
- Cholesteatoma in the petrous temporal bone.
- Meningioma on the petrous temporal bone.
- Extension of acoustic neuroma (schwannoma).
- Metastatic carcinoma affecting the petrous temporal bone (late metastatic site for breast, lung, kidney, prostate and stomach cancers).
- Intracranial carotid artery aneurysm.
- Arachnoid cysts of the petrous apex.
- Langerhans’ cell histiocytosis (histiocytosis X - rare).
- Chondroma and chondrosarcoma of the petrous temporal bone (exceedingly rare).
- Chordoma of the petrous temporal bone (very unusual tumour of notochordal remnants).

Investigations

- Fluid from otorrhoea should be sent for culture and sensitivity testing - preferably prior to administering antibiotics.
- Fluid from the middle ear may be obtained by myringotomy, or direct drainage if the eardrum is perforated, for culture and sensitivity testing.
- FBC - may show leukocytosis.
- Erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP) - may be elevated.
- U&E and blood glucose - may give clues as to underlying causes of increased susceptibility to infection - eg, diabetes, chronic kidney disease or other metabolic disturbance.
- CT/MRI and single-photon emission computed tomography (SPECT) may be used to give detailed images of the petrous temporal bone and draw conclusions about the nature of any pathology in that region, with careful interpretation by an appropriately experienced radiologist. MRI findings are superior to CT in differentiation between infection and neoplasia.
- Radioisotope bone scan - increased uptake in the petrous apex, aiding localisation of the disease process.
- Rarely, a biopsy of the petrous apex may be performed (via neurosurgical intervention), where the cause is uncertain.
- Audiometry is useful to quantify and monitor any hearing loss.

Management

Historically a variety of ingenious surgical approaches were employed to gain and drain this extremely difficult-to-reach area of the middle cranial fossa.

Pharmacological

Close observation under radiological control with intravenous antibiotics sometimes avoids surgery.

Surgical

Surgical intervention may be necessary for patients whose symptoms do not respond to appropriate antibiotics, or who develop complications from the infection - eg, cranial nerve deficits, abscess formation or venous sinus thrombosis.

- A number of surgical approaches have been developed. In most patients a transmastoid approach will allow the petrous to be drained via the temporal bone. This involves a complete mastoidectomy.
- Some surgeons also place a drain from the infected site into the mastoid or hypotympanum, to maintain the patency of the drainage pathway and prevent recurrence of the infection.
- Occasionally, more complex surgical intervention may be undertaken where the response to therapy is inadequate or there is reason to suspect an alternative cause of a petrous apex lesion.

Complications

- Cranial nerve palsies including sensorineural ± conductive deafness.
- Bony destruction and erosion.
- Dural venous sinus thrombosis.
- Carotid artery spasm, occlusion, rupture or septic emboli to the brain.
- Meningitis or a variety of intracranial abscesses.
- Brain damage and death.

Prognosis

Formerly, the prognosis was very poor with death a common occurrence. It is difficult to be certain of modern outcomes, due to the rarity of the illness:

- Outlook has certainly improved in the antibiotic era and most case reports describe successful therapy with antibiotics ± myringotomy/further surgery.
- However, unsuccessful outcomes or undiagnosed cases are less likely to be reported, and there is probably still a significant morbidity with appreciable low-level mortality due to the condition.
- Cranial nerve palsies tend to resolve over a few weeks after antibiotic therapy.
Appreciable hearing loss is sometimes a sequela and can be a particular consequence of translabyrinthine or transcochlear surgery.\[8\]

**Prevention**

Using appropriate antibiotics in cases of acute otitis media (where they are felt to be indicated) may help to prevent chronic presentations due to partially treated mastoiditis.

**Further reading & references**


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