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Otogenic lateral sinus thrombosis: CT and MRI imaging features.

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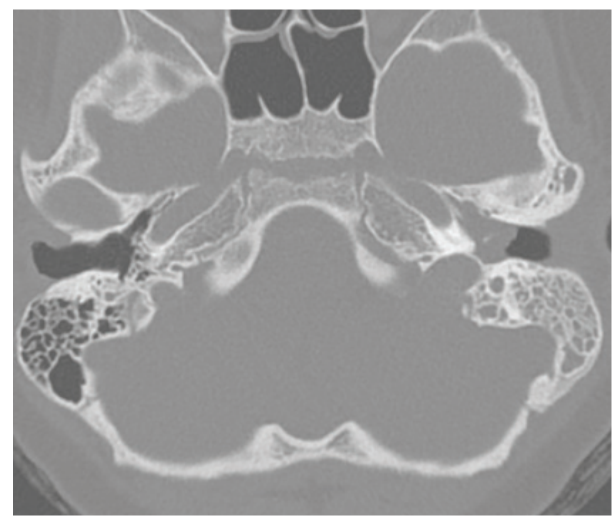
INTRODUCTION

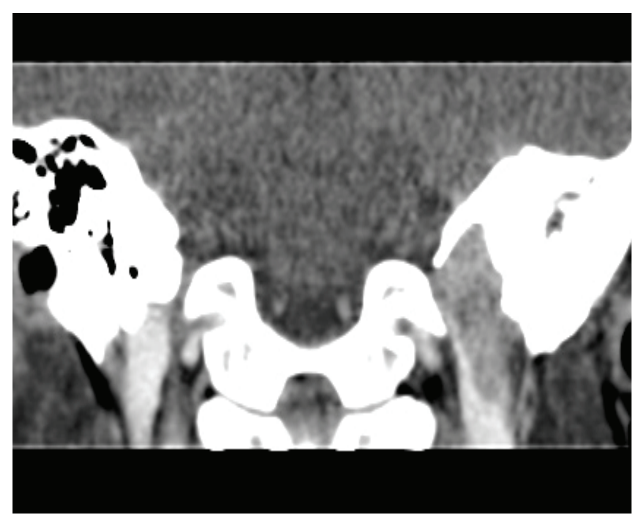
Acute otitis media (AOM) represents the most common localised infection in children. By the age of five, at least 70% have had one or more episodes of AOM (1). This is due to existing adenoids and horizontal Eustachian tube in children under five that leads to retention of middle ear secretion and increased risk of AOM. In rare circumstances this common infection may be associated with serious complications. One of those rare complications is acute mastoiditis (AM), which may affect 4 per 100000 patients a year (2). Despite the introduction of antibiotics, its incidence has been on the rise in the last two decades (3). Accompanied with this rise of acute mastoiditis, other serious complications have risen too (4). This includes subperiosteal abscess, epidural abscess, subdural empyema, venous sinus thrombosis (VST), petrous apicitis or even meningitis (5). VST may complicate up to 3% of AM cases with mortality rate as high as 10% if not diagnosed and managed early (6) (7).

1a



1b

1c



1d

Figure 1: (a,b) Axial HRCT of the temporal bones showing fluid density in the left middle ear (1a) and the left mastoid air cells with sigmoid plate subtle erosion (1b) consistent with acute otomastoiditis. (1c) Axial post contrast CT brain of the posterior fossa showing sizable filling defect in the left sigmoid sinus due to thrombosis. A small focus of air density is seen anterior to it (pneumocephalus). (1d) Coronal post contrast CT brain also showing the left sigmoid sinus filling defect extending into the left internal jugular vein due to thrombosis.

In this case report, we present a case of acute otitis media complicated by lateral venous sinus thrombosis.

CASE REPORT

An eight years old female was referred to Farwaniya hospital with a one week history of left ear pain, two days history of worsening headaches, vomiting and fever. ENT examination showed erythematous and edematous left post auricular area with ipsilateral red bulging tympanic membrane. No ear discharge was noted. Fundocscopic examination revealed bilateral grade four papilledema. Labs results revealed leukocytosis, mostly neutrophils, elevated CRP with negative blood cultures and normal lumbar puncture.

Initially, the child was suspected to have ear/intracranial infection. Thus CT brain was requested and broad-spectrum IV antibiotics were started.

Pre and post-contrast CT of the brain were performed and high resolution CT (HRCT) images of temporal bone were included. HRCT of temporal bone revealed fluid density in the left middle ear cavity (figure 1a) and in the left mastoid air cells, the latter being associated with a tiny left sigmoid plate erosion (figure 1b) and with small air foci representing pneumocephalus (1c). Post contrast CT brain revealed filling defect in the sigmoid sinus with surrounding peripheral dural enhancement (Figure 1c). Reconstructed coronal CT brain showed the sigmoid sinus filling defect was extending into the left internal jugular vein (Figure 1d).
A brain MRI and MR Venogram (MRV)

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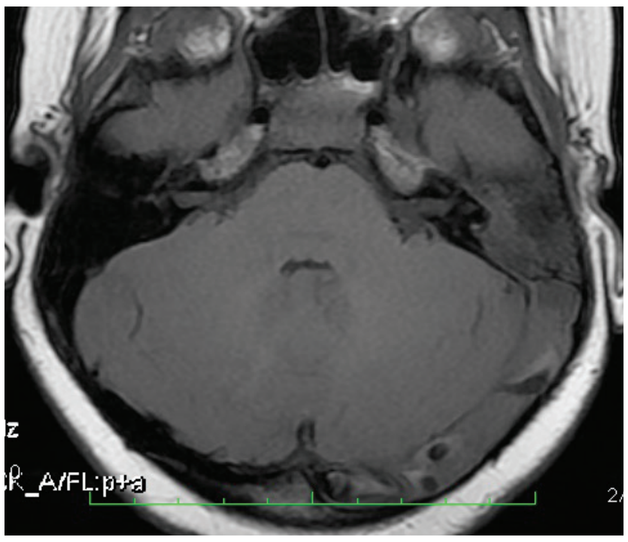

Figure 2(a)
Axial T1WI of the brain shows dilated left transverse sinus with isointense signal as compared to the signal void of the normal contralateral transverse sinus.

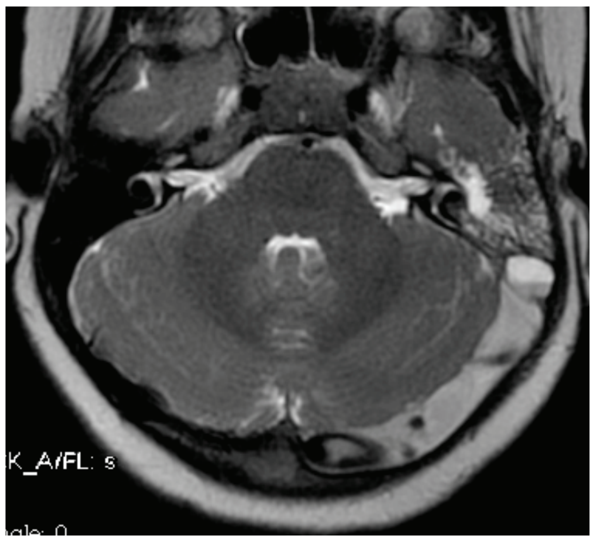

Figure 2b
Axial T2WI shows hyperintense signal of the left transverse sinus due to acute thrombosis.

were performed for better delineation of brain parenchyma and the venous sinus thrombosis (VST).

MRI sequences included SE, FSE, GRE, Flair, DWI MRI Venography (2D TOF and contrast enhanced Venography).

MRI brain showed dilated left sigmoid sinus with isointense signal on T1 weighted images and hyperintense signal on T2 weighted images (figures 2a and 2b).

In addition, 2D TOF showed absence of signal intensity in the left transverse, sigmoid sinuses and extension of thrombus into the left internal jugular vein (figures 3a).

There was no evidence of accompanying brain parenchymal complications.The patient was scheduled for operative management with left cortical mastoidectomy. Post-operative course was uncomplicated. However, the headaches persisted. She was started on anti-coagulant and continued the antibiotics course. There was clinical improvement one week post-op. She was continued on anticoagulant therapy. Followup contrast enhanced MRI at two months showed recanalisation of the previously thrombosed venous sinuses (figure 5a and 5b).

DISCUSSION

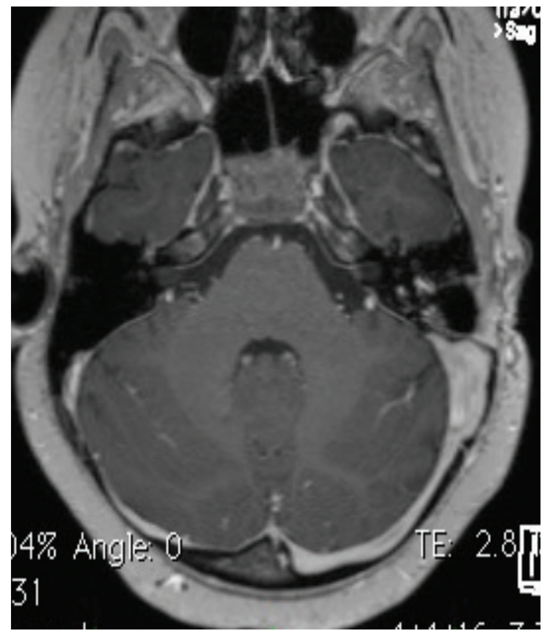

Figure 5a

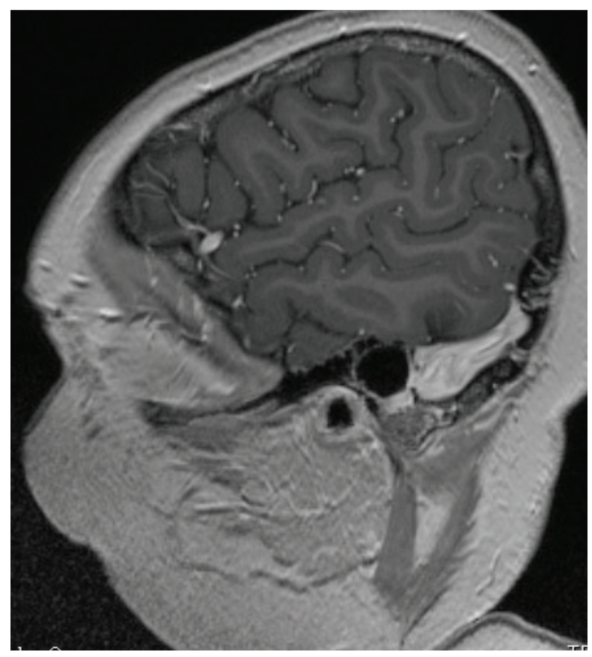

Figure 5b

Figure 5: Post contrast enhanced MRV: (a) axial (b) sagittal images show better visualisation of the re-canalized left transverse and sigmoid sinuses.

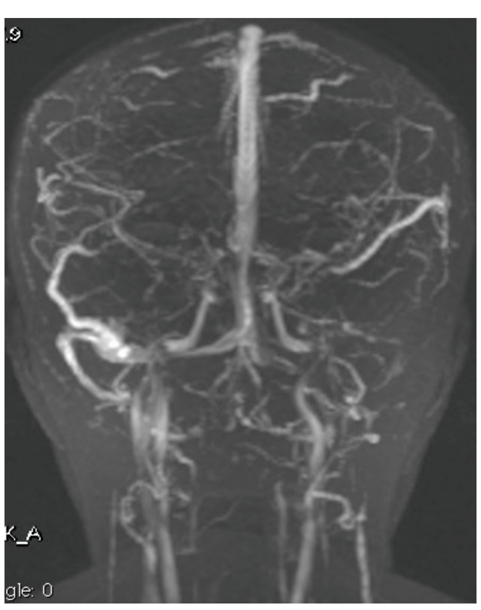

Figure 3a

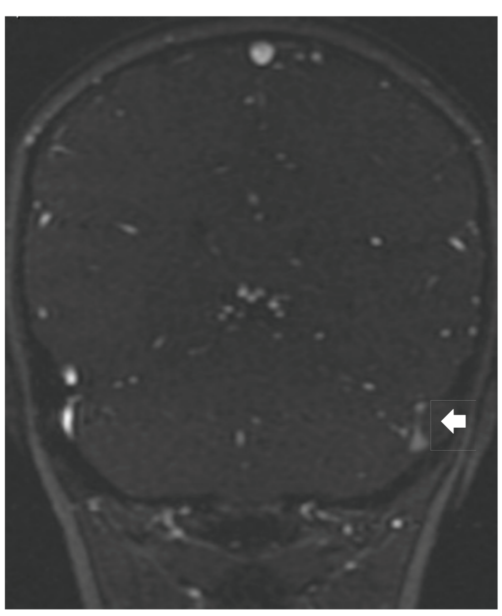

Figure 3b

Figure 3
(3a) Coronal 2D TOF MRV dural venous sinuses revealed absence of normal signal intensity of the left transverse and sigmoid sinuses extending into the proximal internal jugular vein as compared to the normal signal intensity on the right side. (3b) Source images of the 2D TOF revealing filling defect of the left transverse sinus (white arrow).

Figure 4a

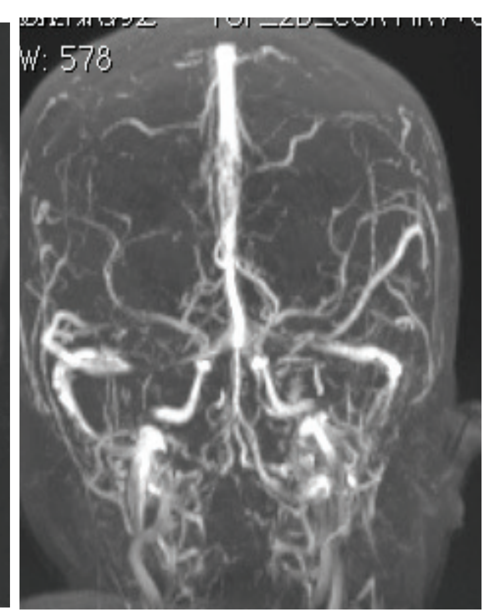

Figure 4b

Figure 4
(4a) pre-treatment Coronal 2D TOF image shows better demonstration of the thrombosis involving left transverse and sigmoid sinuses extending into internal jugular vein. Two months post treatment follow up, Coronal 2D TOF MRV image (4b) shows normal signal intensity of the left transverse and sigmoid sinuses as well as the proximal internal jugular similar to the normal right side representing patent venous sinuses.

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Lateral sinus thrombosis is a rare but severe complication of AM with clinical presentation being sometimes subtle in pediatric population [8]. Its development is reasoned to two main pathophysiological mechanisms. First mechanism is by the penetration of the inflammatory process through mastoid wall leading to the formation of perisinual abscess. This perceived by the venous system as a threat that needs to be localised, thus, thrombus formation. The second mechanism is osteothrombophlebitis with intact sinus plate and subsequent thrombus formation [9].

Radiological investigations are an essential part of the hospital journey of AM patient. It enables early detection and management of accompanying complications [9]. High resolution CT of the brain and temporal bone plays a huge role in initial evaluation of patients with AM [5]. CT scan with contrast was performed for the initial evaluation of our case.

CT scan is extremely important in cases of Otitis media and AM. It is widely viewed by Radiologists and Otorhinolaryngologists as the best method to examine the bony changes in AM. Unfortunately it has poor detection rate for venous sinus thrombosis. In CT scan without contrast, hyperattenuated venous sinus may be seen in only 20-25 % of cases [10]. However, false positive maybe seen in dehydration, increased hematocrit, subdural subarachnoid hemorrhages (10). Thus, a comparison with adjacent arterial attenuation could help differentiate false positives from actual thrombosis. On the other hand, CT scan with contrast may show VST as filling defects or “empty delta” sign. The latter is considered pathognomonic in sigmoid venous sinus thrombosis but could be absent in 71% of cases. Overall, CT scan with contrast can still miss 40% of VST cases [12].

MRI is more sensitive to detect thrombosis and accompanying brain parenchymal changes than CT. When looking for sinus thrombosis, multiple sequences can be examined. On T1 and T2 spin echo images, patent vessels will demonstrate flow void and low signal intensity. While thrombosed vessels appear of various intensity depending on the age of thrombus. Newly formed thrombi <5 days, may appear as isointense and hypointense on T1 and T2 weighted images respectively, making diagnosis more difficult on regular MRI sequences. Thus, MRV is recommended in that stage. However, after five days the thrombus would be easier to pick as hyperintense signal in both T1 and T2. After 2 weeks or more, it becomes challenging again to detect the thrombosis, as it is often iso-intense on T1 and either hyper-intense or iso-intense on T2 weighted images. This alteration in thrombus appearance with age is related to chemical changes to hemoglobin and iron in blood, giving signal changes[3].

When VST is suspected, other sequences such as MRV are performed for better visualisation and detection of VST. MRV includes two-dimensional Time of Flight (TOF) MR venography, phase contrast MRV and contrast enhanced MRV. In two-dimensional TOF MR, the venous flow is assessed with areas of normal flow visualised as high signal intensity and areas of low or absent flow as low intensity[11]. The use of TOF MR is sometimes limited with in plane saturation and anatomical variation such as venous sinus hypoplasia, the latter may present in around 39% of cases[12]. Compared with 2D-TOF MRV, Contrast enhanced MRV overcomes the flow artefacts and considered more sensitive. As the signal coming from venous sinuses is actual contrast instead of flow dependent intensity seen in TOF MRV[11]. Other sequences include phase-contrast MRV which may help detect small cortical veins thrombosis. However due to its dependence on operator pre-set velocity parameters, it not widely used[3]. The overall, sensitivity of MRI and MRV in detecting sinus venous thrombosis is 90% and 100% respectively[12].

CONCLUSION

High resolution CT scan has a significant role in evaluating temporal bone structures including middle ear, inner ear and mastoid air cells but it has its own limitation in evaluating venous sinus thrombosis. However, the diagnosis can be made or suggested by pre-contrast and post-contrast CT scan in highly suspected clinical presentations. Magnetic resonance venography (2D TOF MRV) along with review of its source images and conventional MRI sequences, enable to reach a definite diagnosis of venous sinus thrombosis. Those MRI sequences are the preferred non-invasive techniques. Contrast enhanced MRV shows better visualisation of venous sinus thrombosis and has fewer pitfalls. However, it is an invasive procedure requiring intravenous contrast medium.

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