
Neuroimaging Highlight

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Low-Energy Penetrating Nail Injury Through the Petrous Segment of the ICA

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CASE REPORT

We report an 88-year-old male patient with pre-existing hearing loss in the left ear and mild cognitive decline who attempted suicide by nailing an 11.5 cm nail through his right ear with a hammer. Upon examination, the nail protruded from his right external auditory canal (EAC) (Figure 1). He was neurologically intact with the exception of complete right and partial left hearing loss. Cranial X-Ray revealed an 11.5 cm nail that coursed anteromedially through the petrous bone until reaching the dorsum sellae of the sphenoid bone (Figure 2). Because of the proximity to petrous internal carotid artery (ICA), computed tomographic angiography (CTA) was performed, confirming the trajectory of the nail which cannulated the petrous carotid canal, resulting in proximal and distal thrombosis of the ICA (Figure 3A and B). There was no evidence of haemorrhage or infarction. The right hemisphere received adequate perfusion by the ipsilateral ophtalmic artery and left ICA through a patent anterior communicating artery. There was no right posterior communicating artery. There was no pseudoaneurysm formation.

After administration of prophylactic antibiotics and tetanus vaccine, the patient was taken to the angiography suite for treatment. He underwent endotracheal intubation and conventional digital subtraction angiography (DSA) (Figure 4). To secure the carotid occlusion before retrieving the nail, the patient underwent proximal embolisation of the right ICA with detachable coils (Figure 5). Following proximal ICA occlusion, the nail was extracted under sterile conditions using a haemostatic forceps. Immediate DSA and brain computed tomogram (CT) scan confirmed the absence of immediate complications. The patient was placed on Aspirin 80 mg daily. He later developed mild left sided weakness and gait imbalance from a delayed right frontal subcortical cerebral infarction, as documented on CT scan at last follow-up.



Figure 1: Protrusion of the nail from the external auditory canal without hemorrhage.

DISCUSSION

Low-energy penetrating craniocerebral nail injury is extremely rare^{1,2}. When the nail approaches the major intracranial vessels, preoperative angiography is warranted in order to rule out severe vascular compromise^{3,4}. When nail penetration is associated with ICA injury, trapping of the ICA is indicated before nail removal to prevent a bleeding or ischemic

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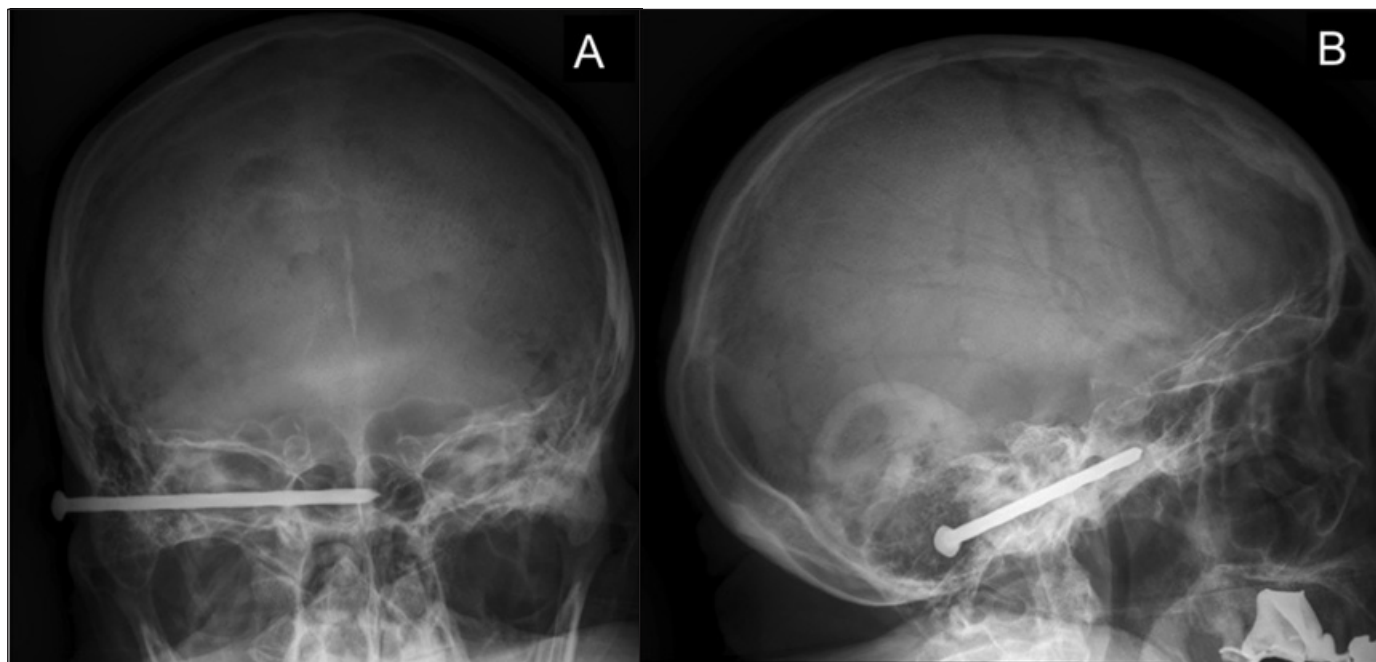


Figure 2: Anteroposterior (A) and lateral (B) cranial X-Ray showing the nail's trajectory through the petrous bone to the body of the sphenoid bone.

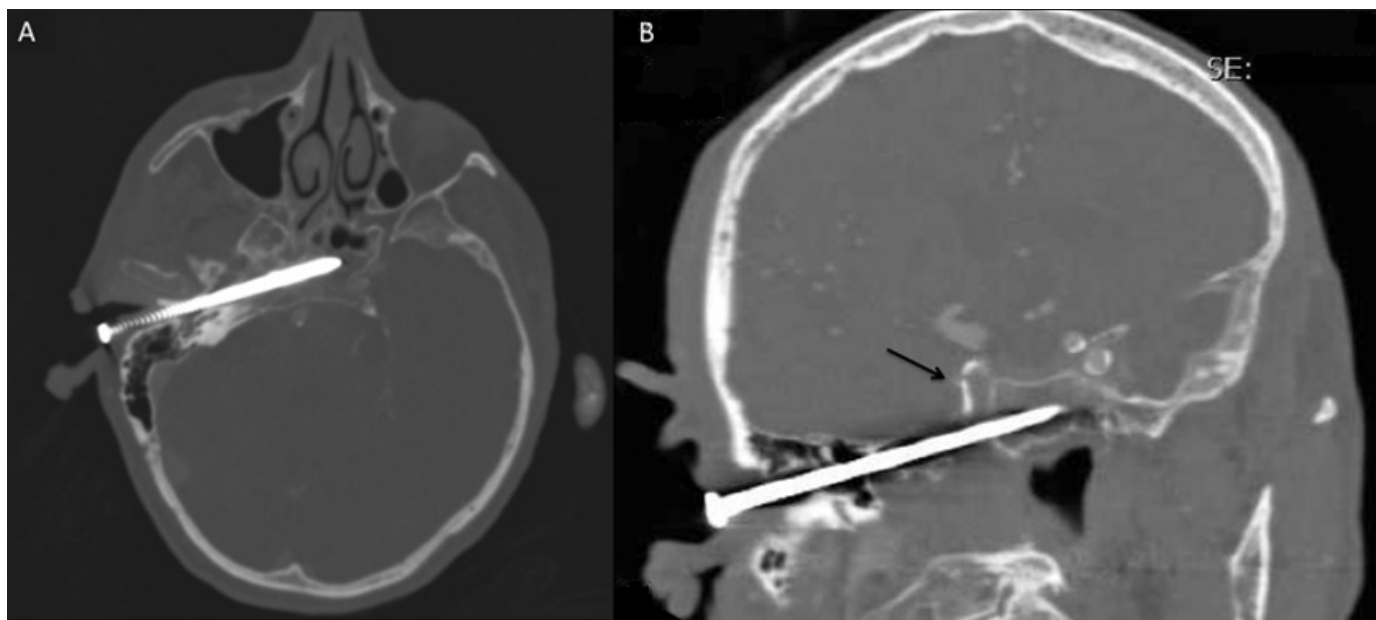


Figure 3: Axial (A) and coronal oblique (B) reconstructed CT angiography showing penetration of the nail through the right mastoid bone with an anteromedial trajectory cannulating the right petrous carotid canal to reach the sphenoid bone. The ICA laceration resulted in distal thrombosis of the ICA (arrow).

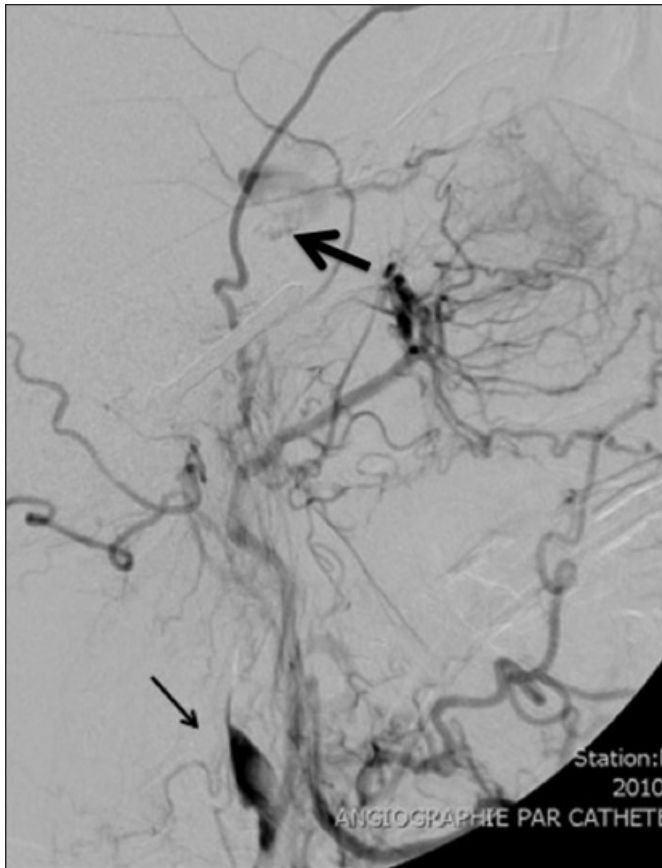


Figure 4: DSA (lateral view) showing thrombosis of the ICA proximally (thin arrow) and distally (thick arrow) to the ICA laceration.

event. Trapping can be performed safely without bypass in patients that tolerate ICA occlusion⁵. Although direct surgical trapping is the most effective method, endovascular embolisation on either side of the injury has been described as a less invasive, effective and safe alternative⁵. In this patient, the low-velocity nail followed the path of least resistance by cannulating the EAC and petrous carotid canal. This atypical trajectory resulted in laceration of the ICA without hemorrhage. When there is evidence of thrombosis proximal and distal to the ICA laceration, as in the present case, proximal coil embolisation is an efficient method to prevent distal embolization or fatal hemorrhage during or following nail removal⁶. However, this patient went on to develop delayed right frontal subcortical infarction. We believe that the likely cause is relative hypoperfusion in this patient who's circulation depends on collateral flow. Although stump emboli may be a possible explanation, the location of infarction is atypical for emboli and the fact that the patient was placed on post-occlusion Aspirin therapy make this explanation less likely.

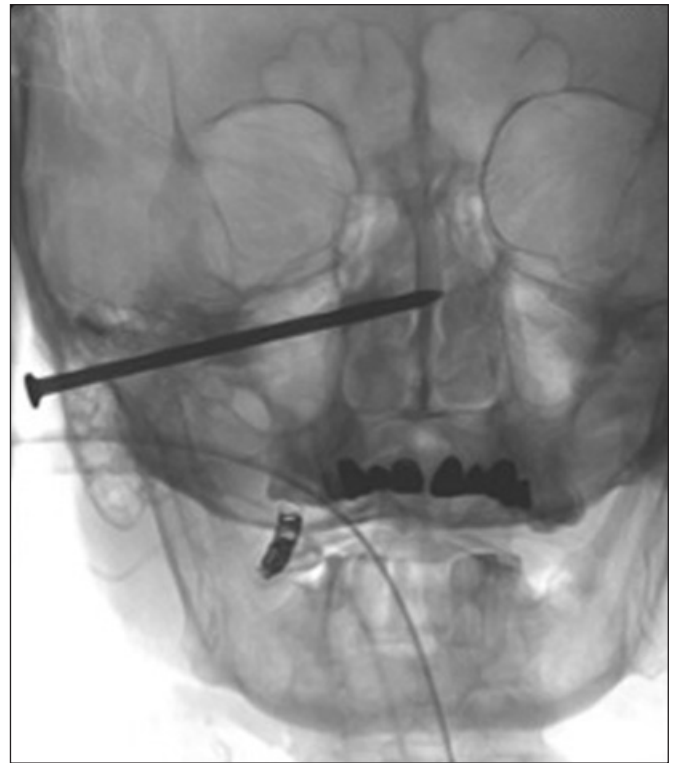


Figure 5: DSA (anteroposterior view) following embolisation demonstrating location of the coils in relation to the nail.

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