

Complete Mid-Superior Sagittal Sinus Transection*

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ABSTRACT

Foreign body impalement and subsequent penetrating head injury is uncommon in clinical practice hence no standard management protocol is available for such cases. Additionally, injury to the superior sagittal sinus is one of the most significant event even in neurosurgery due to the probability of massive blood loss at the time of trauma or surgery resulting in a high mortality rate. This report, presents a case of penetrating brain injury with a metal rake crossing the skull bone with entry point in the parietal bone along the midline transecting through the posterior 2/3 of the superior sagittal sinus with the tip situated just before the body of the corpus callosum. The foreign body was removed which resulted to massive bleeding, uncontrolled by suture ligation, chemical and heat coagulation. Bleeding was managed by digital compression and packing using gelfoams and cottonoids with noted favorable outcome.

KEYWORDS: Foreign body impalement, head trauma, metal rake, penetrating injury, superior sagittal sinus.

INTRODUCTION

Foreign body impalement to the brain though extremely uncommon, is significant due to the challenge of the uniqueness of the involved areas and its presentation, and that there is no existing standard management protocol for such cases. On top of this, traumatic involvement of dural venous sinus is one of the most noteworthy cases even in neurosurgery due to the probability of massive blood loss at the time of trauma or surgery resulting in a high mortality rate during the perioperative period even in the absence of a

notable hematoma. Of all head injuries, significant dural sinus injury occurs in 1.5-5% of these cases, with injury to superior sagittal sinus in 70-80%¹. In this case report, we present a case of penetrating head injury with a metal rake involving the superior sagittal sinus, the surgical challenges and clinical outcome after its successful removal.

CASE REPORT

This is a case of a 26 year-old male with known case of schizophrenia, who presented to our emergency department with impaled foreign body, a metal rake, in the mid-parietal region, allegedly self-induced, few hours from consult. The patient was GCS 14 (E4V4M6), drowsy but easily arousable, calm, with monosyllabic answers to questions, and follows simple commands at the time of examination. Vital signs were stable and within normal limits with BP of 130/80 mmHg, CR of 84 bpm, RR of 21 cpm, temperature of 37 degrees Celsius and SPO2 of 97%. There was no active bleeding coming from the impalement site. Pupils were 2-3mm, equally reactive to light. No noted sensory deficits, but with noted paresis on right lower extremity. The patient was kept flat on bed; prevention of unnecessary displacement of the impaled foreign body, as well as escape, suicide and assault precautions were instituted. Patient was given tetanus prophylaxis and started on broad spectrum antibiotics.

Skull APL showed penetrating foreign body into the skull. CT scan and CT angiogram of the head showed penetrating brain injury with a sharp metallic object crossing the skull bone with entry point in the parietal bone along the midline through the sagittal suture. The tip is situated just before the body of the corpus callosum. The adjacent brain

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parenchyma cannot be adequately assessed due to streak artifacts. The penetrating object appears to pass through the mid-sagittal sinus. Dilated cortical veins noted predominantly in the frontal region. Unremarkable circle of Willis.

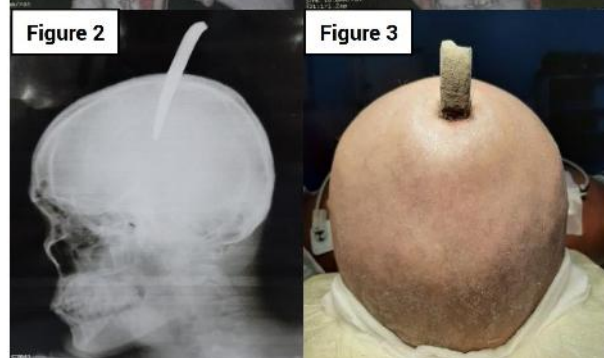
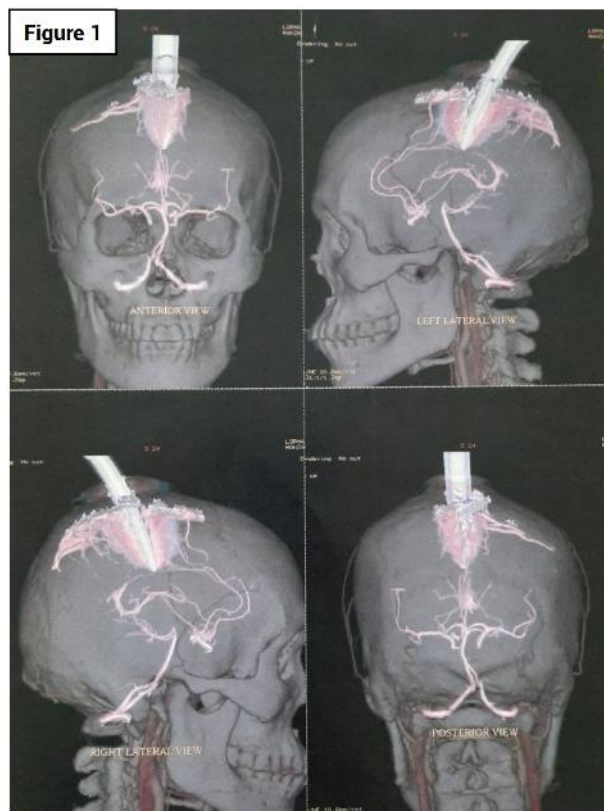


Figure 1. CT angiogram of the head showed penetrating brain injury with a sharp metallic object crossing the skull bone with entry point in the parietal bone along the midline through the sagittal suture. The tip is situated just before the body of the corpus callosum. The adjacent brain parenchyma cannot be adequately assessed due to streak artifacts. The penetrating object appears to pass through the mid-sagittal sinus. Dilated cortical veins noted predominantly in the frontal region. Unremarkable circle of Willis.

Figure 2. Skull APL showing penetrating foreign body into the skull.

Figure 3. Impaled metal rake in the mid-parietal region

The dilemma at this time was whether to operate on the patient to remove the foreign body and risk the possibility of massive bleeding from the sagittal sinus or to retain the foreign body in-situ but with the possible consequences of infection or undue dislodgement and terrible demise. After thorough assessment and weighing of the benefits and the consequences, we proceeded with the removal of the foreign body. The patient was prepared for immediate surgery. Patient was intubated and put under general anesthesia. He was placed into prone position to provide adequate exposure of the parietal region. Markings, asepsis and antisepsis were done. An I-shaped incision was made around the foreign body, at midline, over the sagittal suture. Craniectomy was done on the parietal bone surrounding the impaled object while ensuring non-displacement of the foreign body as to avoid bleeding and trauma to the sagittal sinus.

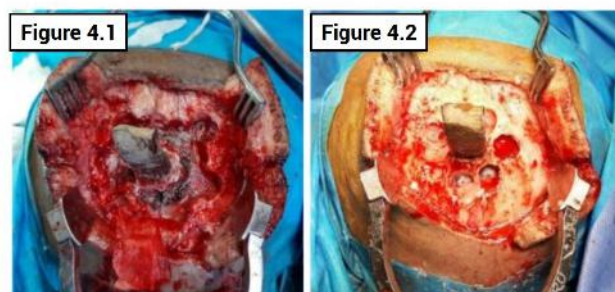


Figure 4 Craniectomy was done on the parietal bone surrounding the impaled object while ensuring non-displacement of the foreign body as to avoid bleeding and trauma to the sagittal sinus.

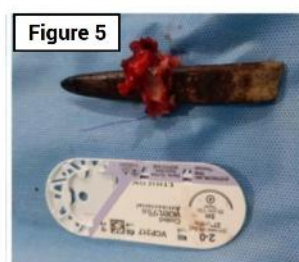


Figure 5. Metal rake measuring 15 cm x 2 cm x 1 cm removed from the brain parenchyma

The foreign body was then carefully removed along with the attached bone fragments exposing a 2 cm transection along the posterior 2/3 of the superior sagittal sinus and underlying brain parenchyma which was accompanied by massive bleeding. Suture ligation, chemical and heat coagulation of the dural sinus defects were

attempted but massive, uncontrolled bleeding still ensued. Hence, digital compression followed by packing of the dural sinus defect using gelfoams and cottonoids were done. Layer by layer suturing of the galea up to the skin was done over the packing. Patient was maintained under permissive hypotension along with adequate blood transfusion during and after the operation. The patient was admitted to surgical ICU for close monitoring post-operatively. Patient was stable and extubated on post-operative day 1. Antibiotics and antipsychotic medications were continued. Daily wound care and neuro rehabilitation was provided. Repeat CT-scan of the head post-surgery, revealed minimal subarachnoid hemorrhage. Patient was subsequently discharged, improved, with minimal motor weakness on right lower extremity after two weeks of treatment and rehabilitation.

On follow up, one month post injury, patient was GCS 15, conversant, coherent and not in distress. He has no complaints of headache, dizziness, slurring of speech, blurring of vision, sensory deficit or seizures; still with residual weakness on right lower extremity with muscle strength of 4/5, but able to ambulate with minimal support.

Magnetic resonance venography was done revealing complete flow gap at the posterior 2/3 of superior sagittal sinus and a prominent vein of Trolard. This connects the SSS and the vein of Sylvius which preventing another fatal complication of venous infarct and subsequent death.

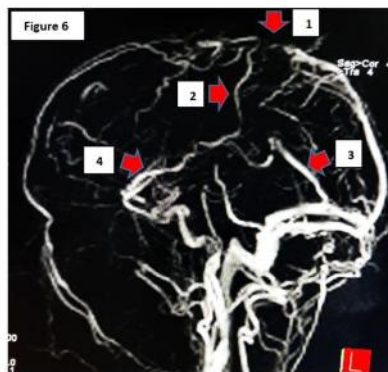


Figure 6. MRV showing flow void (1) at the transected area. The vein of Trolard (2), Vein of Labbe (3), including Middle Cerebral Vein (4) are all prominent.



CASE DISCUSSION

The superior sagittal sinus (SSS) is a dural venous sinus in the sagittal groove, beginning from foramen caecum and terminating at the confluence of sinuses where it merges with the straight sinus and corresponding transverse sinus.² It is the largest among the dural sinuses, triangular in section, narrow in front, and gradually increases in size as it passes backward.⁴ The SSS is strictly avoided during neurosurgical procedures such as craniotomy due to its propensity for massive, uncontrollable bleeding which may lead to intraoperative mortality hence minimum SSS to bone flap distance of 20 mm is recommended.^{5,6} Traumatic dural venous sinus injuries are rare and mostly unreported due to its high mortality rate. The incidence of traumatic dural sinus injuries ranges between 4 - 12% at times of war and about 1% in peace time, with a high mortality rate of about 41%.⁷ In a study conducted from January 1999 to December 2014, there were only 20 patients with a dural venous sinus injury out of the 1,200 patients with severe head injuries who underwent neurosurgery in their institution. Literature search revealed claims of dural sinus injuries reported but a case of major injury to the superior sagittal sinus has not been cited thoroughly. In a case report, a nail gun injury resulted in damage to the lateral edge of the superior sagittal sinus which was treated via a parasagittal craniotomy and suturing of the hole in the inner superior sagittal sinus leaflet.⁸ Another case report of alleged SSS injury, with the tip of the nail penetrating the right ventricle, but angiography showed that the nail was only very close to the SSS and that the venous flow was normal. The nail was removed without bleeding and injury to SSS.⁹

The incidence of penetrating dural sinus injuries is rare, and to date, not many relevant studies have been published worldwide.¹⁰ Of the few published studies, some are even controversial, hence treatment guidelines for dural sinus injury are still yet to be established. Penetrating intracranial foreign bodies can be managed on a case by case

basis. Surgical removal of the foreign body may cause secondary brain parenchyma and vascular injuries, but without the removal of the foreign body, the patient would have been at increased risk for morbidity and mortality due to bleeding from the sagittal sinus, increasing intracranial pressure, or infections.¹¹ In this case, the large transection of the superior sagittal sinus which resulted to massive bleeding upon removal of the foreign body which was uncontrolled by conventional suture ligation or coagulation techniques was effectively managed by packing of the dural sinus defect using gelfoams and cottonoids. Our case demonstrated how the basics of trauma such as direct pressure packing along with systemic vascular control is also effective in managing massive hemorrhage even in rare traumatic neurovascular injuries. Another major factor that contributed to the very good outcome in the prognosis of the patient are the major veins: Trolard, Labbe and Middle Cerebral Vein. These promoted good venous drainage from the affected cortical territories thereby preventing gross venous infarcts and ischemia which could lead to catastrophic outcome for the patient.

SUMMARY

Penetrating brain injury resulting to transection of superior sagittal sinus is highly fatal and requires prompt management. The dilemma vis-à-vis removal and conservative management of penetrating foreign body in the brain is vital, but surgery in penetrating Traumatic Brain Injury is still the treatment of choice if possible. Pre-operative planning with the aid of imaging is essential for the success of surgery. More importantly, this case demonstrated how the basics of trauma such as direct pressure packing along with systemic vascular control is also effective in managing massive hemorrhage even in rare traumatic neurovascular injuries with noted favorable outcome.

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