

Case Report

Surgical Control over Superior Sagittal Sinus Injury Due to Metallic Ceiling Fan-blade Injury

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Abstract

The most serious dural sinus accident following traumatic brain injury is superior sagittal sinus (SSS) injury. It is usually resulted from depressed skull fracture extends to the midline. We present a traumatic superior sagittal sinus injury triggered by the metal ceiling fan blade with its surgical management. Injuries of the SSS have an increased mortality rate in head injured patients. Metallic ceiling-fan head injury differs from the classic traumatic brain injury concerning the presentation, radiology, management, and outcomes.

Keywords: Ceiling-fan, children, head injury, lancet injury, superior sagittal sinus injury

INTRODUCTION

The most serious dural sinus accident following traumatic brain injury is superior sagittal sinus (SSS) injury, often attributed to a collapsed fracture of the skull over the midline or extending to the midline.^[1,2]

In cases of open depression skull fractures, operative interventions are usually applied to minimize the complications. The surgical steps include (1) elevation of the depressed bone fragments (2) removal of foreign materials and (3)-duroplasty or dural direct suturing.^[3] When a depressed skull fracture is found directly overlying the SSS, then there is a risk of intraoperative bleeding or occlusion of the venous sinus and subsequent cerebral venous infarction.^[4,5] In such cases, the ideal way is to decompress the depressed bone and enhance venous flow in the SSS.^[6,7] Patients with symptoms of increased intracranial pressure after depressed skull fracture over the SSS must undergo angiographic imaging (computed tomography angiography and magnetic resonance venography) for early detection of SSS thrombosis to provide the required operative management.^[8]

In the tropics, using ceiling fans is common, as it is a simple and cheap tool for cooling.^[9] Injuries caused by metallic-ceiling fan blades can potentially cause serious skull and brain injuries, especially when the fan rotates at high velocity, forming dangerously sharp cutting edges. The metallic

ceiling fan-related head injury has the following general characteristics: good initial Glasgow coma scale, always brain computed tomography (CT) scan has a positive finding of fracture with or without underlying brain injury and hematoma, the majority of cases require surgical intervention and usually have a good clinical outcome. Thus, the clinical presentation, radiological findings, management, and outcomes of metallic ceiling-fan head injuries are different from the usual traumatic brain injuries.^[10] Most of the ceiling fan head injuries present with compound (opened) depressed fracture accompanied by pneumocephalus and brain lesions. The trauma may also drive the hair intracranially, posing a significant infection risk and necessitating operative management.

This is not the common scenario for a low-velocity penetrating head injury.^[10] Herein we present a case of SSS injury due to open depression fracture caused by metallic ceiling fan head injury.

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CASE REPORT

A 5-year-old male child was presented to the emergency department with lacerated head injury. The mechanism of injury was a high speed spinning ceiling fan that hit his head as he was jumping from the top of a bunk-bed. In an initial assessment, the patient was conscious and had no seizure, vomiting, or neurological deficit. There was an oozing, right frontal, a linear wound that extended to the midline within driven hairs noticed in the depth of the wound. There was no brain tissue out and no active bleeding from the injury site. After stabilization and securing the intravenous lines, a cranial CT scan was obtained, which revealed an open full-thickness depression skull fracture with an underlying fracture hematoma, pneumocephalus, and a suspected SSS injury [Figure 1a-d].

The patient was prepared for surgery, including urgent brain CT scan, basic lab investigations, blood preparation, prophylactic antibiotics, prophylactic antiepileptic injection, and the family consented. Ninety minutes later, the patient underwent craniectomy operation: A circumferential craniectomy with exposure to the SSS both above and below the injury was done. Elevation of depressed fracture was performed a piece by piece until the last bone spike that was stuck inside the SSS was removed. The elevation of the last bone piece was associated with profuse venous bleeding from the sinus. The bleeding was first secured by pressure and gel foam; then the linear sinus injury was closed by primary suturing using 3.0 nonabsorbable silk stitches followed by a periosteal flap to secure the defect. The adjacent convexity dura was intact. Hemostasis and closure are achieved in layers. The postoperative course was uneventful; a follow-up CT scan

showed no residual hematoma or bone spikes, and the patient was discharged home 4 days later fully conscious without any neurological deficit [Figure 1e-g].

In the 6-month follow-up, that child had joined the primary school. The bone defect had ceased to half its initial size, and the possibility of cranioplasty was deferred

DISCUSSION

Traumatic brain injury generates an important number of people with disabilities, which implies an important cost burden to the health-care systems at a global level.^[11] Children, in particular, are extremely susceptible to head injuries.^[12] Metallic ceiling-fans are a well-recognized potential domestic cause of head injuries, especially in children. The open depressed fracture is often extremely contaminated due to the hairs driven intracranially during injury. Therefore, infection risk is a common indication of surgical intervention. Children are more prone to this type of injury because they are very physically active at home and are often lifted upward by adults.^[13]

In comparison to open, depressed skull fractures, closed depressed skull fractures are usually treated nonoperatively as the risk of intra-operative complications exceeds that of the injury.^[14] A critical reason for the surgical treatment of depressed skull fractures over the major venous sinuses is to prevent the occlusion and the resultant, fatal brain swelling and venous infarcts.^[4] In our case, the depressed skull fracture that injured the anterior third of the SSS and the sinus is relatively small, which is an expected finding given the young age of our

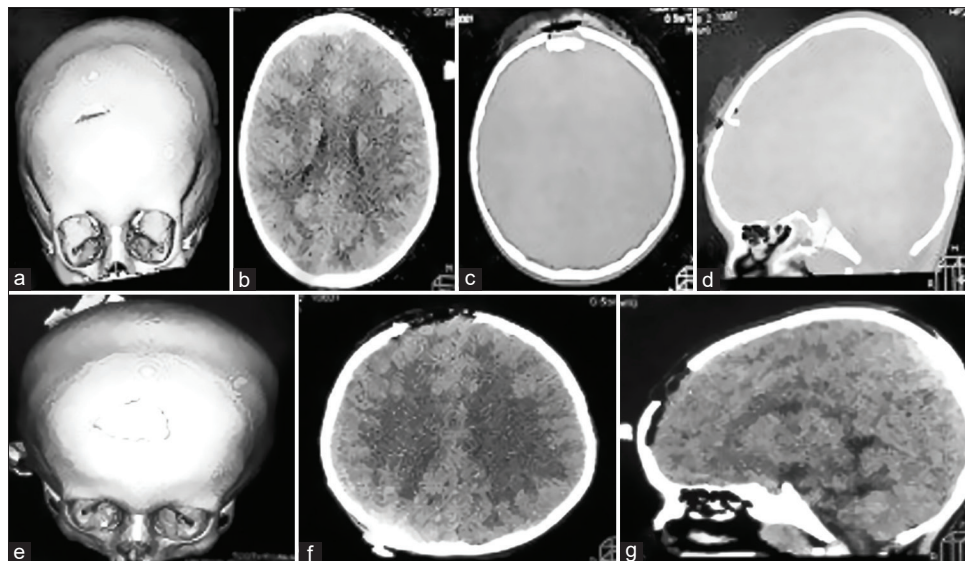


Figure 1: Cranial computed tomography scan showed right frontal open full-thickness depressed skull fracture extending to the midline with an underlying fracture hematoma, pneumocephalus associated with superior sagittal sinus injury. (a) three-dimensional skull reconstruction showed sharp right frontal bone depression fracture (b) axial brain section showed midline frontal extradural hematoma (c) axial bone section showed the depressed bone segment with overlying subgaleal hematoma and (d) midline sagittal bone section showed the depressed bone segment with aerocele. (e) postoperative three-dimensional skull computed tomography reconstruction showed the craniectomy defect. (f) Postoperative axial computed tomography brain section showed midline bone defect due to the removal of the depressed bone segment with evacuation of the frontal extradural hematoma (g) postoperative midline sagittal brain section computed tomography scan showed no residual hematoma or bone spikes

patient. Performing a circumferential craniectomy renders the venous sinus bleeding more manageable as it allows complete exposure of the sinus ends both above and below the site of injury along with the linear defect usually caused by fan-blade.

In general, a punctate small defect in the sinus wall can be managed by direct pressure followed by the application of gel foam threads. Direct primary suturing can be attempted for larger linear defects in the sinus wall; irregular defects in the sinus wall usually require more sophisticated procedures like sacrificing the injured sinus, particularly if the anterior third of the SSS is involved or bypassing the defect using a synthetic vein or saphenous vein grafts.

Prevention is a mainstay while managing such domestic injuries. For both family education and manufacturers, the new modifications will aid in minimizing the burden from injuries related to metallic ceiling fans.

CONCLUSION

Injuries to the SSS are critical cases with high-mortality rates. Surgical reconstruction of the sinus after the trauma may be a challenge to the neurosurgeon. Metallic ceiling-fan head injuries differ from the usual traumatic brain injuries in having more sharp injuries with a better outcome in general.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the legal guardian has given his consent for images and other clinical information to be reported in the journal. The guardian understands that names and initials will not be published and due efforts will be made to conceal patient identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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