

# Primary interhemispheric subdural empyemas: A report of three cases and review of literature

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## ABSTRACT

**Background:** Interhemispheric subdural empyema is an uncommon condition and is considered neurosurgical emergency. These are generally seen following neglected otorhinological infection, but may be posttraumatic or iatrogenic in origin. The source of infection can be frequently found, but in few cases no source of infection can be identified, called idiopathic empyemas. These idiopathic interhemispheric subdural empyemas are even rare. They can present with a rapid progression of symptoms and can carry poor prognosis. Early intervention with craniotomy and appropriate antibiotics can improve the condition of these patients.

**Materials and Methods:** We present three cases of idiopathic interhemispheric empyemas who underwent emergency craniotomy and evacuation followed by antibiotics for 6 weeks. **Results:** All the patients had excellent recovery on mean follow-up of 10 years.

**Conclusion:** Early diagnosis and treatment of interhemispheric subdural empyema can lead to excellent recovery and outcome.

**Key words:** Craniotomy, interhemispheric subdural empyema, neurosurgical emergency, primary empyemas

## INTRODUCTION

Subdural empyema has been a well-recognized entity for more than a hundred years.<sup>[1]</sup> The term “subdural empyema” was coined by Kubik and Adams<sup>[2]</sup> in 1943. Subdural empyemas are generally located over the cerebral convexities. Location of empyema in the interhemispheric fissure is rarely seen, following otorhinological infection, trauma, and meningitis or at times can be iatrogenic.<sup>[3-6]</sup> Patients present with headache, seizures, and lower limb weakness “cerebral falx syndrome.” Contrast-enhanced CT scan and MRI scan of brain are the preferred investigations. Early diagnosis and intervention with craniotomy and complete evacuation of the empyema collection followed by long-term appropriate antibiotics gives excellent outcome.

## MATERIALS AND METHODS

### Case 1

A 15-year-old boy presented to the casualty with history

of continuous left frontal headache of 3 days duration, associated with multiple episodes of vomiting and focal seizures involving right lower limb with secondary generalization with sparing of the face. There was history of low-grade fever and neck pain for 3 days duration. There was no history of meningitis or history of trauma in the past. On clinical examination, he had right lower limb weakness of 4/5 power (MRC grade). CT scan brain plain study showed hypodense lesion in the interhemispheric area. On contrast-enhanced CT scan, a well-loculated, hypodense, interhemispheric collection with peripheral rim enhancement with mass effect was seen [Figure 1]. He underwent emergency midline craniotomy and complete evacuation of the interhemispheric pus. The pus was grown positive for streptococci. No primary source of infection was identified on ENT and oral evaluation. Echocardiogram showed mild mitral and tricuspid valve prolapse with no vegetations and his blood cultures were negative. Following surgery he was continued on intravenous antibiotics for 3 weeks followed by oral antibiotics for another 3 weeks as per the sensitivity. He was continued on anticonvulsants. He had a follow-up of 10.5 years and is leading a normal life.

### Case 2

A 12-year-old girl was admitted with a history of episodic global headache associated with vomiting and multiple episodes of focal seizures involving right

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lower limb with no secondary generalization of 10 days duration. She was seen by a general physician who was treating her symptomatically for headache and seizures. She developed diplopia and weakness of right-sided limbs, (lower limb more than upper limbs). Clinical examination revealed papilloedema, isolated VI<sup>th</sup> nerve paresis, and right hemiparesis of upper limb 4/5 and lower limb 3/5 (MRC grade). Her contrast-enhanced CT scan showed midline hypodense collection with enhancement of the adjacent falx [Figure 2]. She was taken up for emergency craniotomy and complete evacuation of pus was done. On opening the craniotomy, pus was not seen on the surface. Only after gentle arachnoidal dissection and retraction, pus could be reached and evacuated. A thorough search for primary source of infection including ENT evaluation, echocardiogram, and blood cultures were negative. The pus culture did not grow any organism. She improved in her symptoms following surgery and was continued on intravenous antibiotics for 3 weeks followed by oral antibiotics for another 3 weeks. Her VI nerve palsy and papilloedema resolved following surgery. She is having a follow-up of 6 years and presently perusing her higher education.

### Case 3

A 22-year-old man presented with a history of poliomyelitis of the left lower limb presented with severe headache, fever, left lower limb seizures, and increased difficulty in walking of 1 week duration. There was no history of meningitis, trauma, or any significant history. He was not a smoker or alcoholic. Clinical examination was normal except for left lower limb paresis of 3/5 (MRC grade). Contrast-enhanced CT scan brain showed parasagittal, hypodense, subdural collection extending from frontal to the occipital region with minimal edema [Figure 3]. He was taken up for craniotomy and evacuation of the collection. Initially frontal interhemispheric craniotomy was done and collection was evacuated. The collection was thick and significant amount was evacuated, but on repeat CT scan imaging in the immediate postoperative period [Figure 4], there was a residual collection in the occipital area. He underwent occipital interhemispheric craniotomy and complete evacuation of the collection [Figure 5]. The culture growth was negative. He was managed with appropriate antibiotics for a total of 6 weeks. He had a follow-up of 5.3 years and was doing well with no further similar episodes.

## DISCUSSION

“Subdural empyema” is a collection of pus within the

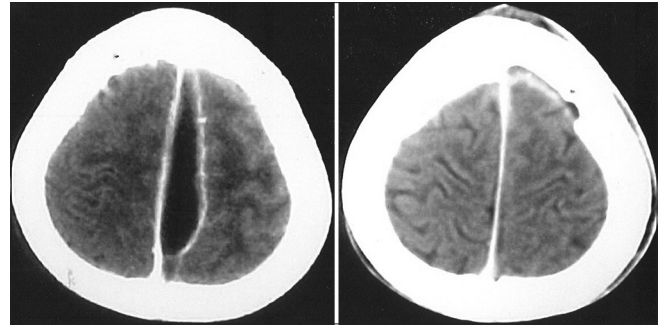


Figure 1: Preoperative and postoperative CT scan of case 1

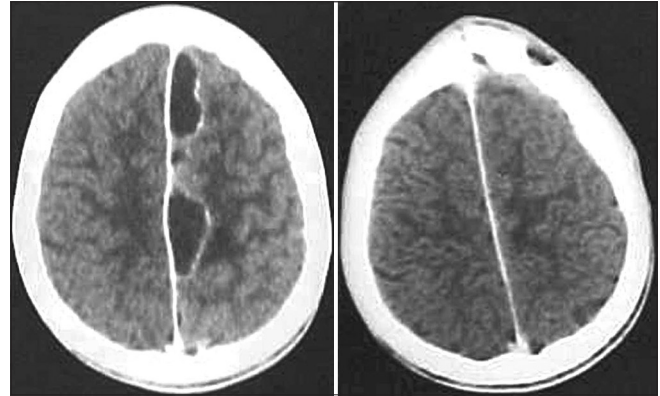


Figure 2: Preoperative and postoperative CT scan of case 2

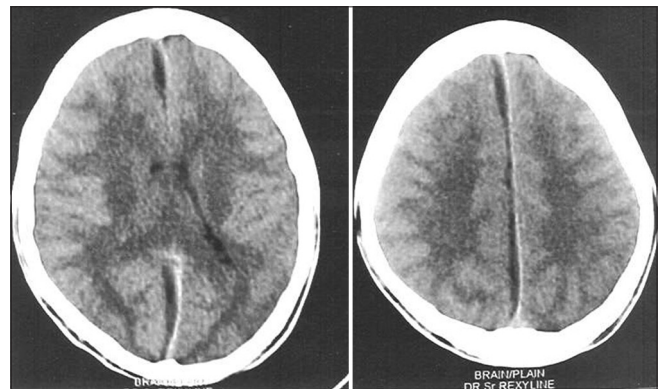
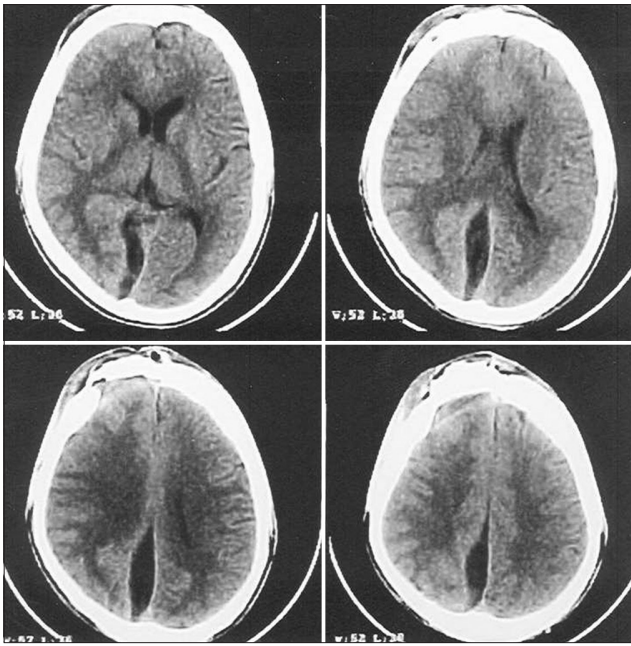


Figure 3: Initial preoperative CT scan of case 3

subdural space. This entity was seen for more than a hundred years<sup>[1]</sup> after its early description by Ceci and Onetti<sup>[7]</sup> in 1886. The term “Subdural empyema” was coined by Kubik and Adams<sup>[2]</sup> in 1943.

### Epidemiology

These represent 13-20% of all intracranial suppurations.<sup>[8]</sup> Most of the cases of interhemispheric empyemas were reported as individual cases. Very few series of cases have been presented in the literature on interhemispheric subdural empyemas.<sup>[9,10]</sup> These are more common in the younger age group and more commonly seen in males. The source of infection can be identified in most of the cases, but in about 10-37% of patients the cause remains



**Figure 4:** Postoperative CT scan of case 3 after the first surgery

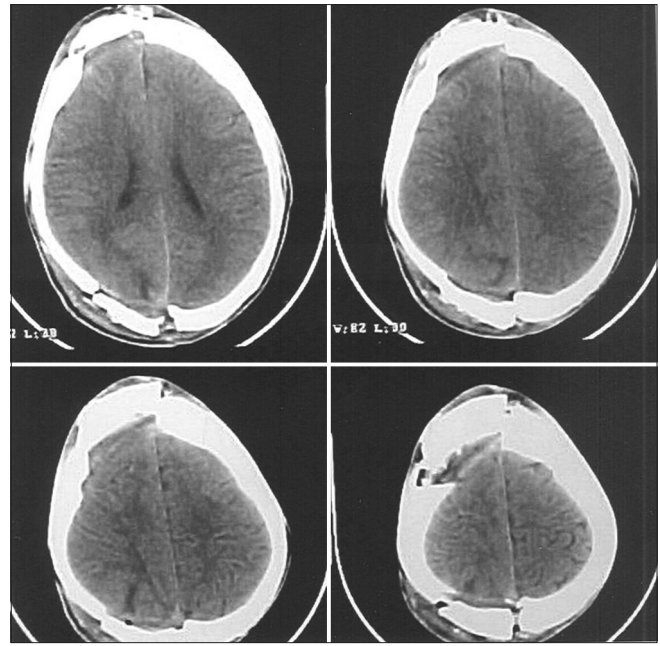
obscure.<sup>[11]</sup> Almost 80% of subdural empyema occurs over the cerebral convexities and 12% in the interhemispheric fissure.<sup>[12]</sup>

### Etiology

Subdural empyema commonly occurs as a complication of adjacent infection of the paranasal sinus or mastoid or middle, but, less commonly, these can occur following a penetrating injury, missile injury, and meningitis.<sup>[3,13]</sup> Iatrogenic causes like intracranial pressure monitoring, craniotomy, and subdural hematoma drainage have also been implicated in causing subdural empyemas.<sup>[14]</sup> Rarely these may be secondary to congenital heart disease, lung abscess, dermal sinus, and urinary tract infection due to a posterior urethral valve.<sup>[15]</sup> Interhemispheric empyemas were reported to occur following allergic rhinitis, pansinusitis, and frontal sinusitis. The frontal sinus matures between the age of 15-18 years and the infection is hypothesized to spread intracranially by retrograde thrombophlebitis.<sup>[7]</sup> Stephanov *et al.*<sup>[16]</sup> have reported subdural empyema following meningoencephalitis which was successfully treated by single posterior frontal parasagittal burr hole, irrigation with saline, and aspiration of the empyema. Other causes like midline craniotomies for transcallosal approaches, superior sagittal sinus thrombosis, meningitis,<sup>[17]</sup> and trauma may also predispose to interhemispheric subdural empyema.

### Clinical Features

Patients with interhemispheric subdural empyema generally present with features of raised ICP, lower limb



**Figure 5:** Postoperative CT scan of case 3 after the second surgery

weakness, neck pain, vomiting, and seizures.<sup>[9]</sup> Seizures can be focal type<sup>[12]</sup> or secondary generalized. “Cerebral falx syndrome” characterized by focal seizures beginning in the lower extremities with secondary generalization, without involvement of face, is seen in interhemispheric subdural empyema as described by List.<sup>[18]</sup> Similar picture was seen in Case 1, where the patient had lower limb focal seizures with secondary generalization with sparing of the face. The other two cases had focal seizures but with no secondary generalization. Weakness of the lower limbs was seen in all the three patients. Features or raised intracranial pressure with VI<sup>th</sup> nerve paresis and papilloedema was seen in one of our patients. The spectrum of presentation can range from mild headache and neck pain to profound neurological deficits and rapid deterioration, if the infection spreads causing thrombosis of the underlying cortical veins.<sup>[17]</sup>

### Investigation

The clinical examination in these patients should include a thorough evaluation of the nose and paranasal sinuses for any sinusitis, middle ear for mastoiditis or any pyogenic infection, oral cavity for any orodental infection, echocardiogram for evaluating the heart valves, and presence of vegetations and blood cultures for identifying primary source of infection. Jaswal *et al.*<sup>[17]</sup> have suggested that in primary cases with no apparent source of infection, a possibility of a history of meningitis should be considered. In our three cases no primary source of infection was detected even after thorough systemic clinical evaluation. There was no history of meningitis or trauma in the past in all the three cases.

We attribute the origin of these primary interhemispheric subdural empyemas to subclinical sinusitis/mastoiditis which is more commonly unnoticed.

Before the CT and MRI era, Yerdura *et al.*<sup>[19]</sup> have described the angiographic diagnosis of interhemispheric subdural empyema. Hideyuki *et al.*<sup>[20]</sup> have proposed that the hypertrophied anterior falx artery on angiography was pathognomonic of interhemispheric subdural empyemas. Similarly, hypertrophic tentorial arteries secondary to these interhemispheric empyemas were also reported by Krishnan *et al.*<sup>[21]</sup>

With the advent of CT scans and MRI imaging, angiographic diagnoses were less frequently used. Contrast-enhanced CT or MRI are the best investigations for accurate diagnosis of the interhemispheric subdural empyemas.<sup>[22,23]</sup> Weingarten *et al.*<sup>[24]</sup> studied the CT and MRI findings and stated that MRI is superior to CT scan in identifying these lesions. On contrast-enhanced CT scan images, interhemispheric subdural empyemas appear as multiloculated, hypodense collections with peripheral rim enhancement, caused due to neovascularization and compression of the surrounding cerebral cortex.<sup>[12]</sup> In all our patients the collection was hypodense to brain with peripheral rim enhancement and varying degrees of cerebral edema. Kowano *et al.*<sup>[25]</sup> have suggested that diffusion-weighted imaging can be more helpful in detecting these pathologies. The pus is seen generally either below or on either sides of falx.<sup>[26]</sup> A case of empyema between the leaves of falx with multiple cavitations and associated thrombosis of superior sagittal sinus was reported by Yende *et al.*<sup>[12]</sup>

### Treatment Options

Most neurosurgeons consider interhemispheric empyema as a neurosurgical emergency and intervene, though few authors have reported successful management using antibiotics alone.<sup>[27,28]</sup> Burrhole or craniotomy and evacuation along with antibiotics are the appropriate options in treating subdural abscesses.

Management of these interhemispheric subdural empyemas with Burrhole and aspiration was reported by many authors. Li NG<sup>[9]</sup> reported six cases of interhemispheric empyemas, which he managed with continuous drainage though a cranial burr hole or excision of abscess. Burrhole and evacuation could cause a breach in pia-arachnoid at two places, which is more likely chance to cause secondary injury to the cortex creating spread of infection.<sup>[7,29]</sup> Interhemispheric subdural collections are often multiloculated and care should be taken to evacuate all the pockets. This can be difficult with burr holes and many a times multiple burr

holes may be required. Moreover, the collections could be extensive and thick, as seen in our cases which are difficult to evacuate completely through burr holes.

Craniotomy and complete evacuation of the abscess was recommended by Bhandari and Sarkari,<sup>[11]</sup> supported by Nathoo and Nadvi.<sup>[5]</sup> Parasagittal craniotomy should be made on the side of the interhemispheric collection, wide enough to evacuate all the collections, without retracting or damaging the brain tissue. Care should be taken to avoid injury to the bridging veins. At times when the doubt of complete removal arises, continuous drainage was also indicated.<sup>[9]</sup> In Case 2, pus was not seen surfacing and only after gentle arachnoid dissection and retraction, pus could be reached and evacuated. Early craniotomy is mandatory and is more likely to be associated with a complete evacuation.<sup>[1,5]</sup> Serial imaging in the immediate postoperative period is mandatory which can confirm the extent of evacuation.<sup>[12]</sup> In Case 3 the patient underwent frontal craniotomy and evacuation, but his postoperative CT scan showed collection in the occipital region, for which he underwent occipital craniotomy and complete evacuation of the subdural empyema.

We suggest craniotomy and complete evacuation followed by appropriate antibiotics for long duration as per the culture sensitivity reports for a minimum period of 6 weeks, though antibiotics for 8 weeks was recommended by Jaiswal *et al.*<sup>[17]</sup>

### Prognosis

Timely intervention with appropriate management of these rare, serious conditions can give excellent outcomes. As highlighted by Farkas,<sup>[30]</sup> these are important conditions whose diagnosis should not be missed, as the overall mortality is related to delay in appropriate treatment and inability to correctly diagnose.

## CONCLUSION

Though idiopathic subdural empyemas are rare, it is a neurosurgical emergency and high suspicion is warranted when patients presents with typical clinical history of cerebral falx syndrome. CT and MRI are the investigations of choice. Craniotomy and complete evacuation of the abscess followed by intravenous antibiotics for 3 weeks and oral antibiotics for another 5 weeks is recommended to prevent recurrences. Repeat imaging following surgery is mandatory to look for residual collection and recollections which may require reintervention. Though high mortality was reported in the literature, in-time diagnosis and intervention followed by long-term antibiotics ensure excellent results as seen in our cases.

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