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CASE REPORT

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Bifrontal decompressive craniectomy for acute subdural empyema

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Abstract *Introduction:* Subdural empyema is an uncommon but serious complication of sinusitis. Despite the use of advanced imaging facilities, modern antibiotic therapy and aggressive neurosurgical protocols, this condition still carries significant morbidity and mortality. *Case report:* We report an unusual case of sinusitis-associated acute subdural empyema in a 13-year-old patient, presenting in a catastrophic manner with acutely raised intracranial pressure. Emergency bifrontal decompressive craniectomy was necessary both to reduce the intracranial pressure and to drain the subdural empyema. *Results:* The full range of intracranial complications subsequently occurred, including brain abscesses, recurrent subdural empyema and ventriculitis. Despite this, the patient's outcome was good, with minimal intellectual deficits. *Conclusion:* In cases of severe intracranial infection, we therefore advocate an aggressive surgical approach coupled with appropriate antibiotics to ensure a good outcome.

Keywords Subdural empyema · Sinuses · Treatment · Outcome

Introduction

Acute subdural empyema has been described as 'the most imperative of neurosurgical emergencies' [16]. With aggressive treatment, the mortality rate has declined steadily from 42% in the 1950s to about 10% in the 1990s [10, 12]. It is still a common disease entity in many Third World countries, such as South Africa [1, 12]. Young male patients in the second or third decade are most often affected with paranasal sinusitis being the most common cause, followed by meningitis, otologic infections, trauma and dental caries [9, 12]. While fever, headache, vomiting, neck stiffness and seizures are among the more common presenting symptoms in children, acute coma hardly occurs. In this article, we report the case of a young teenager with acute subdural empyema, presenting with rapidly deteriorating conscious level from acutely raised intracranial pressure (ICP). His clinical course warranted a large decompression craniectomy to reduce the ICP. The intracranial complications, neurosurgical management and outcome of this case are discussed.

Case report

V.R., a 13-year-old Indian boy presented to the Accident and Emergency Department with drowsiness, preceded by fever, headaches and nausea for 1 week. Physical examination revealed a toxic febrile child with signs of meningism. His blood pressure was 90/60 mmHg and the pulse rate was 200/min. His left eye was proptosed with florid chemosis, and pupils were unequal (5 mm on the right and 2 mm on the left) but reactive to light. In the Emergency Department his Glasgow Coma Scale (GCS) score dropped from 10 to 6, and he was intubated. He was then transferred to the neurosurgical unit for further management.

CT (computerized tomographic) scan of the brain showed a small hemorrhagic infarct in the right frontal lobe, cerebral edema and parafalcine collections (Fig. 1). Blood investigations revealed a raised total white cell count of 23,300/µl, with 90% neutrophils, thrombocytopenia (41,000/µl) and a prolonged prothrombin time. An initial diagnosis of acute meningoencephalitis and subdural empyema, with septicemia and disseminated intravascular coagulopathy was made. Intravenous ceftriaxone (2 g every 12 h), metronidazole (500 mg every 8 h), crystalline penicillin (3 µ every 6 h) and cloxacillin (1 g every 6 h) were started. He also required intravenous adrenaline to support his blood pressure.

In view of the deteriorating conscious level (GCS 10 to 6), dilated pupils and severe cerebral edema on CT, a bifrontal decom-

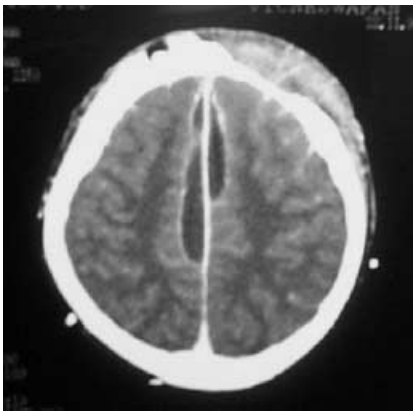

Fig. 1 CT scan of the brain showing the significant parafalcine collections of pus

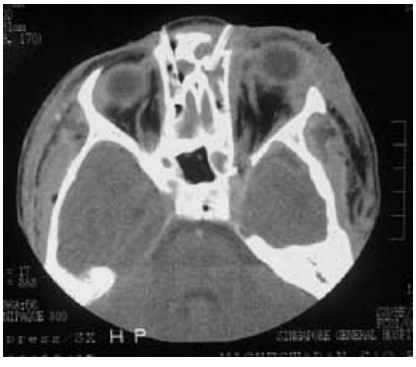

Fig. 2 CT scan showing that the frontal and ethmoidal sinuses were opaque, with the drains in situ

pressive craniectomy was urgently performed. Intraoperatively, subdural pus in the parafalcine space was found with thrombosis of the cortical veins, cerebral edema and cerebritis. A ventricular catheter was placed for intracranial pressure (ICP) monitoring. Postoperatively, the ICP was persistently high (above 30 mmHg), requiring mild hyperventilation, regular mannitol, sedation, paralysis and the use of cooling blankets. Repeat CT scans of the brain and paranasal sinuses the following day showed increasing frontal lobe edema and hemorrhages with new parafalcine fluid collections. In addition, there was pansinusitis involving the frontal, anterior ethmoidal and right maxillary sinuses with right preseptal cellulitis (Fig. 2). Since the ICP continued to rise (40 mmHg), a frontal lobectomy had to be performed with simultaneous drainage of the sinuses by the ENT surgeon. Bilateral frontal trephines were performed with endoscopic frontal sinusotomies and anterior ethmoidectomies. Necrotic mucosa and granulation tissue with pus were found in the frontal, maxillary and anterior ethmoid sinuses. Frontal sinus drains were left behind for twice-daily flushing with normal saline (Figs. 2, 3).

Cultures subsequently grew *Streptococcus constellatus*, which was sensitive to penicillin. At the same time, the boy developed proptosis of his left eye, in which CT scans of the orbits showed an abscess at the medial and superior aspects of the orbital cavity. This also required drainage and tarsorrhaphy.

Over the following 4 weeks, two further procedures were required for drainage of recurrent abscesses and empyema in the frontal lobes (Fig. 4). On day 29, he developed *Enterococcus ven-*

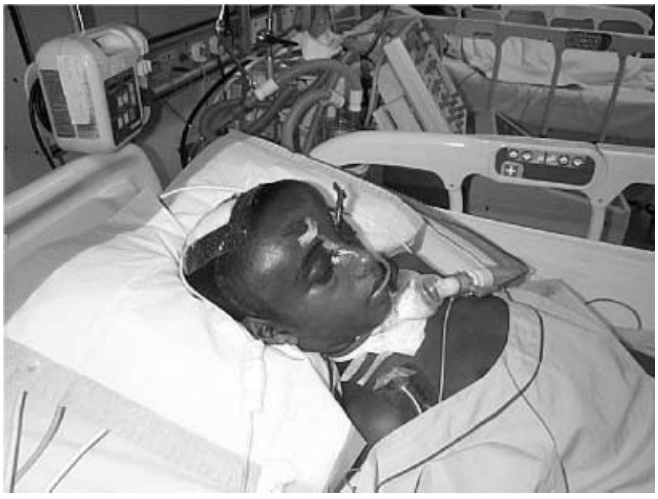

Fig. 3 Clinical picture showing the frontal sinus drains, which were left in situ for irrigation

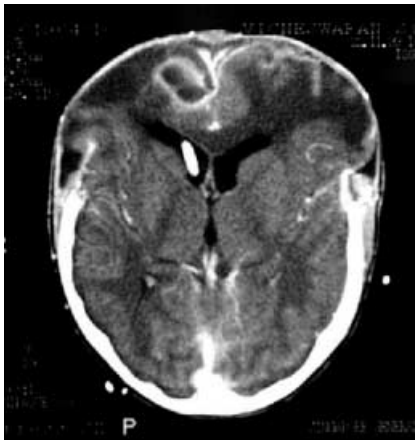

Fig. 4 CT scan of the brain, showing the intense bifrontal edema and abscess, with the frontal craniectomy (bone flap removed)

triculitis, which progressed to coagulase-negative staphylococcus and *Klebsiella* infections, for which intravenous vancomycin and then meropenam were given. Eventually a ventriculoperitoneal shunt was inserted. In total, he received 66 days of antibiotics together with prophylactic anticonvulsants.

VR eventually made a satisfactory recovery and was discharged home on day 67. He was able to walk and was independent in his activities of daily living. A neuropsychological assessment found him to have an Intelligence Quotient (I.Q.) of 89, which was just below average. He was observed to be impulsive in his responses and increasingly impatient and inattentive, behavior deemed to be consistent with frontal lobe dysfunction. A cranioplasty to replace the bifrontal craniectomy defects was performed after a further 3 months, and at 6 months he was able to return to school.

Discussion

Although sinusitis is generally considered a mild disease in children, the intracranial complications can result in

high mortality and morbidity if not treated adequately. The complications include meningitis, epidural abscess, subdural empyema, intracerebral abscess and, occasionally, cavernous or superior sagittal sinus thrombosis. Subdural abscess with cortical thrombophlebitis is the complication that carries the worst prognosis [9].

Fever, headache, neck stiffness, vomiting and seizures are among the more common presenting symptoms in children. Obtundation and coma, both signs of acutely raised ICP, are very rarely encountered [5, 8, 13]. These features were all present in our patient, who presented with signs of acutely raised intracranial pressure. His pupils were dilated and his GCS deteriorated rapidly from 10 to 6 on admission. He was also in septic shock and developed disseminated intravascular coagulopathy needing both ionotropic support and transfusion of blood products.

In view of this situation, decompressive craniectomy had to be performed as a life-saving procedure, although it is not a procedure that has not been reported previously in this condition. The placement of an external ventricular drain system then allowed for ICP monitoring and management. Unfortunately, a further four repeated operations were required to control the intracranial infective process. This may be necessary in up to 30% of patients, as reported by Skelton et al. [15].

In the process of diagnosis, subdural empyema can often be confused with meningitis, which may result in inappropriate lumbar puncture being performed, with the attendant risk of transtentorial and foraminal herniation. Performance of an early contrast-enhanced CT scan for diagnosis can minimize this risk. Since sinusitis is the usual etiology in these cases, appropriate CT scans of the sinuses may also need to be done. Concurrent drainage of both the intracranial empyema and sinusitis is recommended to prevent reseeding of the intracranial sites from the infected sinuses [2, 3, 6, 8].

Common organisms isolated from subdural empyema include both anaerobes (*Peptostreptococcus* species, *Streptococcus constellatus*, *Bacteriodes* species) and aerobes (*Haemophilius influenza*, *Staphylococcus aureus*, *Streptococcus* spp.) [2, 8, 9]. About 20% of cases [2] yield sterile cultures, while in 14% of patients two or more organisms are cultured [12]. As such, initial antibiotic therapy should be broad spectrum until definitive culture and sensitivity results are available. Antibiotics commonly used are penicillin, cloxacillin, ceftriaxone and metronidazole. In most cases, 6–8 weeks of antibiotic therapy is necessary to prevent recurrent infection. In our case, ventriculitis developed, necessitating a longer duration of antibiotics. Clinical parameters and biochemical markers (erythrocyte sedimentation rate, C-reactive protein) were used to monitor our patient's response to treatment.

In this patient, there was an added complication of orbital abscess, which presented as proptosis and severe chemosis. This was drained successfully, and with concomitant aggressive antibiotic therapy the proptosis and chemosis resolved. Paranasal ethmoidal sinus disease is the commonest source of orbital infection, particularly in children [4]. The spread of infection can occur either by direct extension through the sinus wall or by local thrombophlebitis [11]. Although surgical drainage and antibiotics are the definitive treatment modalities, significant morbidity still remains in the form of visual loss, diplopia, proptosis and osteomyelitis [7]. A combined orbito-otorhinolaryngological approach is also recommended for cases with associated paranasal sinusitis [14].

With both medical and surgical treatment, the overall mortality rate for patients with subdural empyema has steadily decreased to about 12% [12]. The outcome is generally better in children than in adults [3, 5, 8, 13, 15].

Conclusion

This case report highlights several important principles in the management of pediatric patients with subdural empyema. The clinical presentation in children may be atypical, and hence a high index of suspicion is necessary to make an early diagnosis. Specific CT scans of the sinuses are needed to look for sinus involvement. When the presentation is catastrophic, aggressive surgery to decompress the brain and reduce the raised ICP may be necessary as an initial procedure. This has to be followed by prompt surgical drainage of both the intracranial abscesses and the sinuses together with appropriate anti-biotic therapy of adequate duration. A multidisciplinary team approach involving the neurosurgeon, otolaryngologist, anethestist, and infectious disease physician is very important to achieve a good outcome.

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