INTRACRANIAL SUBDURAL EMPYEMA: A REVIEW OF FOURTEEN CASES.

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ABSTRACT

INTRODUCTION: Intracranial subdural empyema is a collection of pus in the preformed space between the cranial dura mater and arachnoid mater. It is a potentially fatal disease. The aim of this study was to present the incidence, clinical presentation, localization, treatment, and outcome of subdural empyema. The results of a literature review are also presented.

PATIENTS AND METHODS: This retrospective study included 14 patients with intracranial subdural empyema who were admitted at the Gabriel Toure Teaching Hospital in Bamako, Mali, between January 2011 and December 2012. Computed tomography (CT) scanning was performed in all patients. Patients were managed medically including antibiotics and surgically by performing a single burr hole or craniotomy with aspiration of the pus. Outcomes of these patients are reported.

RESULTS: The mean age ranged from 7 years to 24 years, with an average of 13.7 years, and the male to female ratio was 6:1. Headache was the predominant symptom in 14 patients (100%) and fever in 11 (78.6%). Vomiting was present in 9 patients (64.3%), hemiparesis in 8 (57, 1%) while seizure and coma were found respectively in 4(28.6%) and 3(21.4%) at the time of diagnosis. Predisposing factors were sinusitis in 7 patients (50%), Suppurative otitis media in 5 (35.7%). No predisposing factors could be identified in 2 patients (17.65%). The surgical treatment was indicated in all patients (craniotomy in 9 patients (64.3%) and aspiration via a burr hole in 5 patients (35.7%)). The evolution was favorable in 13 patients (92.9%). One patient in the craniotomy group showed worsening of his neurological status with complete hemiplegia. Three patients had recurrent seizures. No patients in this study died of their infections.

CONCLUSION: Intracranial subdural empyema is still a prevalent disease in Mali. Identification of the responsible microorganism through neurosurgical drainage followed by long-term antibiotics remains the mainstay in treating subdural empyema. Optimal outcome is achieved with early diagnosis and treatment.

KEY WORDS: Subdural empyema, burr hole, craniotomy, sinusitis

INTRODUCTION

Subdural empyema is defined as a collection of pus in the preformed space between the cranial dura mater and arachnoid mater (18). It is an important neurological infection requiring immediate neurosurgical treatment. Unlike most first-world countries where infection of the brain and its coverings is relatively rare, subdural empyema is still a common neurosurgical problem in developing countries. The disease is expected to be more common in a setting with poor sanitation and medical facilities. Infectious diseases are usually common in tropical countries. Here, the authors describe their experience in the diagnosis and management of subdural empyemas. The clinical, microbiological, and pathological parameters with neurological outcome and recovery were reported.

MATERIALS AND METHOD

This study reviews retrospectively all cases of subdural empyema treated in the department of neurosurgery at Gabriel Toure hospital between January 2011 and December 2012. Medical record of all patients with a discharge diagnosis of subdural empyema were analyzed for demographics, presenting signs and symptoms, predisposing factors, imaging, microbiological results, treatment and short term outcome. Preoperative computed tomography (CT) was obtained in all patients. Empirical administration of intravenous antibiotics was started on suspicion of subdural empyema and was changed to definite therapy based on the culture findings. Subdural empyema was aspirated during surgery via a burr hole or open craniotomy according to the clinical and radiological findings or surgeon preference. Antibiotic therapy was continued for more than 6 weeks in accordance with the therapeutic response and neuroimaging findings with patients showing good response needing only 2 weeks of intravenous antibiotics followed by a 4-week oral therapy. Antiepileptic medication was given in cases with seizure. In this study, the neurological status of the patients was assessed preoperatively and postoperatively. Therapeutic outcome of patients was assessed by comparing with the pre-treatment status and post-treatment status. All post-operative complications were recorded.

RESULTS

The mean age of patients with subdural empyema was 13.7 years. The youngest patient was 7 years old, and the oldest patient was 24 years old. The male to female ratio was 6: 1 (12 men and 2 women). The major presenting symptoms and signs are summarized in Table 1. A review of their symptomatology showed that headache and fever were the most commons symptoms on initial presentation noted respectively in 14 patients (100%), and 11 (78.6%). The next commons symptoms were vomiting in 9 patients (64.3%), hemiparesis in 8 (57.1%), seizures in 4 (28.6%). Three patients (21.4%) had loss of consciousness while cerebellar signs were found in one patient. Among the predisposing factors, sinusitis predominated with 7 patients (50%). Suppurative otitis media was found to be the predisposing factor in 5 patients (35.71%) while no predisposing factors could be identified in 2 patients (14.3%) (Table 2). Computed tomography (CT) scanning was the investigation of choice in all patients (figure 1). Table 3 summarizes the number and location of subdural empyema as depicted by CT

scan. Subdural empyema was most frequently located in the supratentorial region in 13 patients (92.9%). Infratentorial subdural empyema was seen only in 1 patient (7.1%) with otogenic infection. Routine hematological investigation revealed polymorphic leukocytosis in 11 patients (78.6%), elevated erythrocyte sedimentation rate and serum C- reactive protein in 9 patients (64.3%). Ten patients (71.4%) had positive culture whereas 4 patients (28.6%) had negative culture. The commonest organism was *Streptococcus pneumoniae* in 6 patients (42.9%) followed by *Staphylococcus aureus* in 3 patients (21.4%), *Haemophilus influenzae* in 1 patient (7.1%). All patients were started on empirical intravenous antibiotics (combination of third generation cephalosporin, metronidazole and ciprofloxacin) which were changed to specific intravenous antibiotics as soon as cultural reports were available.

A total of 9 patients (64.3%) underwent craniotomy (figure 2) whereas 5 patients (35.7%) underwent aspiration via a burr hole. One patient in the aspiration group had to undergo second aspiration to get the desired results.

In this study, 13 patients (92.9%) showed significant improvement of neurological status within one month following surgery. One patient in the craniotomy group showed worsening of his neurological status with complete hemiplegia. Three patients had recurrent seizures. No patients in this study died of their infections.

Table 1. Clinical presentation of subdural empyema in 14 patients

Signs and symptoms	No of cases
Headache	14
Fever	11
Vomiting	9
Hemiparesis	8
Seizures	4
Loss of consciousness	3
Cerebellar signs	1

Table 2. Predisposing factors of subdural empyema in 14 patients

Predisposing factors	No of cases
Sinusitis	7
Suppurative otitis	5
unknown	2

Table 3. Site of subdural empyema in 14 patients

Site	No of cases
Supratentorial	
Convexity only	
Right	7
Left	4
Interhemispheric	1
Interhemispheric and convexity	1
Infratentorial	1

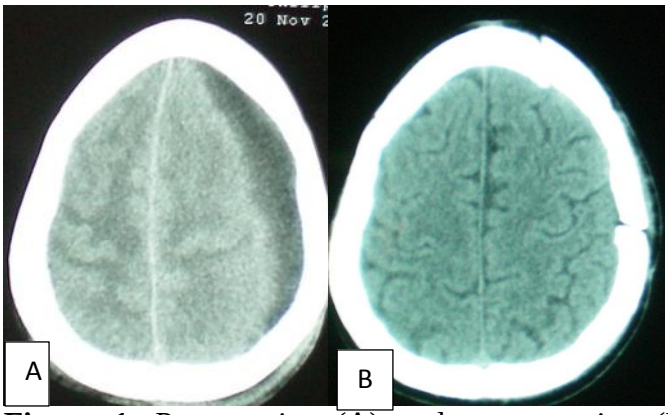

Figure 1. Preoperative (A) and postoperative (B) CT scan of left convexity subdural empyema

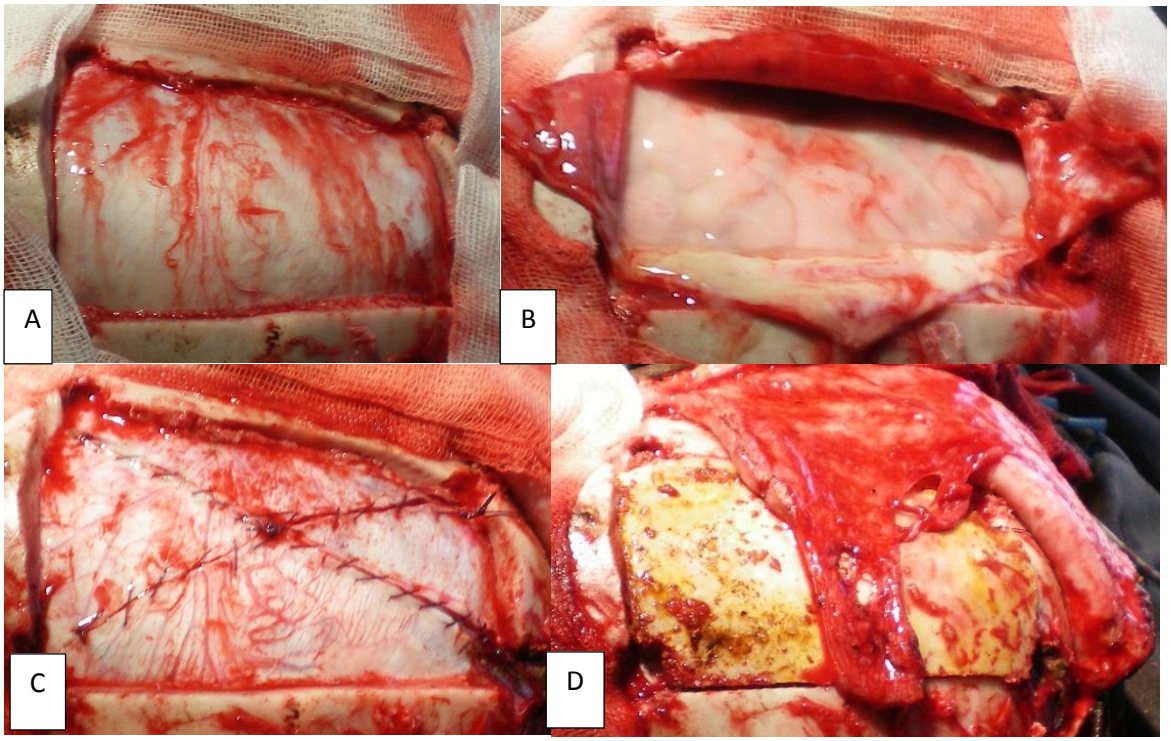

Figure 2. Intraoperative images of subdural empyema treated via craniotomy. Craniotomy (A), after the opening of the dura and aspiration of the pus (B), after the closing of the dura (C) and after the putting of the bone flap (D).

DISCUSSION

Subdural empyema is defined as a collection of pus in the preformed space between the cranial dura mater and arachnoid mater (18). It is rare in the developed world due to early and judicious use of antibiotics. It remains, however, a relatively common disease entity in developing countries (2, 10, 15 19). Its high incidence in our study (7 cases a year) likely reflects prevalent socioeconomic conditions and consequent limited access to medical care. The illness is usually characterized by a rapid deterioration accompanied by major hemispheric dysfunction, raised intracranial pressure, ophtalmoplegia, fever, seizures and meningism([20). Headache was the most predominant symptom in our study. In the pediatric population, subdural empyemas are more common in 2 distinct age groups, corresponding to

variation in etiology. Post-meningitic infections are more common in infants, and paranasal sinus related infections are most common in males 6–20 years old (11, 13, 16). This age and male dominance has been noted in our series, although the reason for this preponderance is not clear (2, 3, 5, 15, 17). It may be the result of relatively large nasal sinuses, more vigorous nose-blowing habits, or the rapid growth of frontal sinuses in males after 7 years of age (4, 5). There was no infant in our series because those cases are managed in the neuropediatric department. The literature suggests significant variability in the etiology of subdural empyema (1, 7, 8, 12, 13, 15, 18). Sinusitis and otitis are the most common cause of subdural empyema (5, 6, 8). Other series have reported meningitis or postoperative infections as the most common cause of subdural empyema (18, 21, 22). In many cases, the cause of subdural empyema remains cryptogenic (2). No predisposing factors could be identified in 2 patients in our series. Subdural empyema of otorhinological origin occurs via direct and indirect mechanisms of dissemination (1, 2, 13). Erosion through the posterior wall of the frontal sinus, which has one-half the thickness of the anterior wall, is a known mechanism of direct infection (13). Indirect spread occurs hematogenously by retrograde thrombophlebitis involving the valveless interconnecting venous systems of the extracranial and intracranial spaces. Once in the subdural space, infection can spread widely over the cerebral convexity and into the interhemispheric fissure due to the lack of intervening structures. Contralateral spread underneath the falx may also occur (13).

Clinical manifestations are due to increases in intracranial pressure, focal disturbances of brain function, and constitutional symptoms due to infection (18).

Computed tomography scanning may be the most cost-effective imaging modality in subdural empyema because of its accessibility and sensitivity (2, 14). Magnetic resonance imaging (MRI), if available in the acute setting, may be the imaging modality of choice as it provides a better anatomical delineation of any collections present than does CT scanning, and it can adequately display areas of localized meningeal infection (6, 14). Magnetic resonance imaging is not available in our hospital; therefore, CT was the neuroimaging investigation of choice obtained in all patients. Historically, the most significant determinants of outcome in patients with subdural empyema have been aggressive early removal of the source of infection, drainage of the pus and treatment of the infection with the appropriate antibiotic medications. Three of our patients with sinusitis and 3 with otitis underwent concurrent surgical treatment of their predisposing factors in addition to drainage of their intracranial infections. Consultation with otorhinolaryngological colleagues is therefore recommended as soon as possible in the course of the disease. Many publications have suggested that craniotomy is the preferred method of treatment. Survival rates of nearly 90% were obtained with this approach, and procedure using burr hole and was condemned because the results were suboptimal, with survival rate of less than 52% (3, 20). Both methods of surgical treatment have been practiced in our department, depending on surgeon preference. In our study, craniotomy was undertaken in nine cases and burr holes in five patients. If a craniotomy is performed primarily, fewer initial procedures and CT investigations are needed but the morbidity may be more significant. In our series, neurological worsening occurred in one patient in craniotomy group because of brain swelling and infarction occurred during the surgery of inter-hemispheric empyema. Aspiration via burr hole is a non-aggressive procedure performed in 5 cases in our series and one patient in this group had to undergo a second aspiration. The advantages of aspiration via burr hole are that it is simple, and it has less potential morbidity than surgical trauma. On the other hand, in our third-world socioeconomic conditions, repeating CT scan may be difficult.

Our decision to use three antibiotic agents has been guided by the knowledge of the spectrum of organism encountered in this study was sensitive to at least one of the agents chosen. *Streptococcus pneumoniae* was the commonest organism isolated in 6 patients followed by

Staphylococcus aureus in 3 patients, *Haemophilus influenzae* in 1 patient. We persisted with the three antibiotic medication regimen after culture in 4 patients because the culture was sterile. This could represent inadequate collection and processing techniques, especially for anaerobic organisms or previous antibiotic usage given prior to the diagnosis of empyema. Seizures are frequently seen in subdural empyema. Hitchcock and Andreadis (9) recorded acute seizures in 89% of their cases, although after 3 years of review only 26% of survivors were still having seizures. In our study, 3 patients had recurrent seizures.

CONCLUSION

Intracranial subdural empyema is still a prevalent disease in Mali. Identification of the responsible microorganism through neurosurgical drainage followed by long-term antibiotics remains the mainstay in treating subdural empyema. Optimal outcome is achieved with early diagnosis and treatment.

REFERENCES

1. Adame N, Hedlund G, Byington CL: Sinogenic intracranial empyema in children. Pediatrics 116:e461–e467, 2005
2. Banerjee AD, Pandey P, Devi BI, Sampath S, Chandramouli BA: Pediatric supratentorial subdural empyemas: a retrospective analysis of 65 cases. Pediatr Neurosurg 45:11–18, 2009
3. Bannister G, Williams B, Smith S: Treatment of subdural empyema. J Neurosurg 55:82–88, 1981
4. Bok AP, Peter JC: Subdural empyema: burr holes or craniotomy? A retrospective computerized tomography-era analysis of treatment in 90 cases. J Neurosurg 78:574–578, 1993
5. Courville CB: Subdural empyema secondary to purulent frontal sinusitis: a clinicopathological study of 42 cases verified at autopsy. Arch Otolaryngol 39:211–236, 1944
6. Germiller JA, Monin DL, Sparano AM, Tom LW: Intracranial complications of sinusitis in children and adolescents and their outcomes. Arch Otolaryngol Head Neck Surg 132: 969–976, 2006
7. Gower DJ, McGuirt WF, Kelly DL Jr: Intracranial complications of ear disease in a pediatric population with special emphasis on subdural effusion and empyema. South Med J 78: 429–434, 1985
8. Herrmann BW, Chung JC, Eisenbeis JF, Forsen JW Jr: Intracranial complications of pediatric frontal rhinosinusitis. Am J Rhinol 20:320–324, 2006
9. Hitchcock E, Andreadis a : Subdural empyema: a review of 29 cases. J Nerol Neurosurg Psychiatry 27: 422-434, 1964
10. Keet PC: Cranial intradural abscess management of 641 patients during the 35 years from 1952 to 1986. Br J Neurosurg 4:273-278, 1990
11. Kombogiorgas D, Seth R, Athwal R, Modha J, Singh J: Suppurative intracranial complications of sinusitis in adolescence. Single institute experience and review of literature. Br J Neurosurg 21:603–609, 2007
12. Kraus M, Tovi F: Central nervous system complications secondary to oto-rhinologic infections. An analysis of 39 pediatric cases. Int J Pediatr Otorhinolaryngol 24:217–226, 1992
13. Nathoo N, Nadvi SS, van Dellen JR, Gouws E: Intracranial subdural empyemas in the era of computed tomography: a review of 699 cases. Neurosurgery 44:529–536, 1999

14. Osman Farah J, Kandasamy J, May P, Buxton N, Mallucci C: Subdural empyema secondary to sinus infection in children. Childs Nerv Syst 25:199–205, 2009
15. Pathak A, Sharma BS, Mathuriya SN, Khosla VK, Khandelwal N, Kak VK: Controversies in the management of subdural empyema. A study of 41 cases with review of literature. Acta Neurochir (Wien) 102:25–32, 1990
16. Smith HP, Hendrick EB: Subdural empyema and epidural abscess in children. J Neurosurg 58:392–397, 1983
17. Stephanov S, Joubert MJ, Welchman JM: Combined convexity and parafalx subdural empyema. Surg Neurol 11:147–151, 1979
18. Tsai YD, Chang WN, Shen CC, Lin YC, Lu CH, Liliang PC, et al: Intracranial suppuration: a clinical comparison of subdural empyemas and epidural abscesses. Surg Neurol 59:191–196, 2003
19. Venkatesh MS, Pandey P, Devi BI, Khanapure K, Satish S, Sampath S, et al: Pediatric infratentorial subdural empyema: analysis of 14 cases. J Neurosurg 105 (5 Suppl):370–377, 2006
20. Williams B: Subdural empyema. Adv Tech Stand Neurosurg 9:133-170, 1983
21. Wu TJ, Chiu NC, Huang FY: Subdural empyema in children— 20-year experience in a medical center. J Microbiol Immunol Infect 41:62–67, 2008
22. Yilmaz N, Kiymaz N, Yilmaz C, Bay A, Yuca SA, Mumcu C, et al: Surgical treatment outcome of subdural empyema: a clinical study. Pediatr Neurosurg 42:293–298, 2006