

Original Article

Subdural Empyema: Clinical Presentations and Management Options for an Uncommon Neurosurgical Emergency in a Developing Country

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ABSTRACT

Background: Controversy regarding the best management strategy for subdural empyema (SDE) attests to the persisting poor outcomes for this uncommon life threatening intracranial suppurative process. Late presentation confounds the problem in developed countries. While craniotomy is commonly recommended, it is not always possible in late presentation with advanced morbidity. The aim of this study was to identify the pattern of clinical presentation and explore the outcomes following management of SDE using burr hole, aspiration, and drainage (BAAD) in resource poor settings. **Materials and Methods:** This is a retrospective review of prospectively collected data of 18 patients presenting with SDE over a period of 10 years from two neurosurgical centers. Data was abstracted on patients' demographic characteristics, sources of SDE, clinical presentation and site of infection, methods of diagnosis, organisms isolated, treatments received, and outcome. Collected data was entered into the Statistical Package for the Social Sciences version 17 software and subjected to descriptive analysis for all variables. **Results:** Majority of the patients presented late with Glasgow Coma Scale score GCS of 9/15. Altered sensorium was noted in 14 (77.8%) of the patients, 11 (61.1%) out of the 14 patients had \leq grade 3 of Bannister and Williams level of consciousness. The mainstay of treatment for all patients was BAAD of abscess and administration of appropriate antibiotics. Fourteen patients (77.8%) were discharged on grade A of H.W. Mauser's grading system. Three mortalities were recorded only in patients who had grade 4 Bannister and Williams grading. **Conclusion:** BAAD is the near approximated option to standard craniotomy management in a limited resource facility and it has a very good clinical outcome. However, more studies are required to draw the final conclusion.

KEYWORDS: Burr hole, drainage, outcome, presentation, SDE

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INTRODUCTION

Subdural empyema (SDE) is an uncommon, life threatening pyogenic infection localized between the dura and arachnoid mater.^[1] It is a rare emergency that was reported in the literature approximately 100 years ago. Although the incidence of SDE has declined significantly with improvements in health care services, such as antibiotics sensitivity testing of organisms and provision of appropriate antibiotic regimen, SDE still accounts for 30.5% of all intracranial suppurations and 15–20% of localized intracranial infections.^[2] Depending on the virulence of the organism and host immune mechanisms,

SDE may progress rapidly with diffuse vascular ischemic changes that result in significant and irreversible neurological deficits if treatment is delayed or inadequate.

Early intervention demands early diagnosis. A major challenge with management of SDE has been linked to nonspecific patterns of clinical presentation that make

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diagnoses difficult.^[3] This is more so in developing countries such as Nigeria where most practitioners have to depend mainly on clinical presentations to initiate care.^[4] In addition to the challenge of making a diagnosis, practitioners in developing countries have to face limited availability of diagnostic and treatment facilities. Patient awareness regarding available treatment options and limitations imposed by finances result in late presentation often after exploring cheaper alternative treatment that may include inappropriate antibiotic dosing.

Controversies about the best method of surgical management have converged on craniotomy or burr hole drainage, irrigation of abscess cavity, and antibiotic therapy. Use of appropriate antibiotics has considerably improved outcomes following SDE, and it has been argued that management of SDE does not always require surgery.^[5-7] This, however, can only be applicable in special circumstances and under strictly controlled environment.

The mainstay of management of SDE however remains surgical. The choice of method of drainage of abscess [craniotomy vs. burr hole, aspiration, and drainage (BAAD)] depends on the clinical state of the patient at presentation.^[8] Although there is some debate around the superiority of craniotomy over BAAD in the management of SDE, some authors have reported that early aggressive removal of the source of infection, regardless of the method used, correlates favorably with patient outcome.^[3,9]

In nonrandomized studies, the outcomes of SDE appear to be similar for BH and craniotomy.^[10] The factors that influence outcomes such as conscious level at presentation, extent of associated sepsis, age of patient, and the choice of procedure suggest that availability of resources and health seeking practices may determine management protocols.^[11]

Owing to the paucity of literature on management of SDE in resource poor settings, particularly sub-Saharan Africa, this study was conducted to identify patterns of presentation and to share experiences on management and outcomes of SDE in Nigeria using a multipronged approach to treatment.

MATERIALS AND METHODS

Computed tomography (CT) and magnetic resonance imaging (MRI) of the brain, microorganism isolate from purulent aspirates and/or cerebrospinal fluid cultures, and intracranial abscess were observed intraoperatively or during histopathological examination. Case folders of patients with parenchymal and epidural abscesses were excluded from this study. A total of 18 cases of SDE were identified for data extraction.

Data collection and analysis

Data was extracted over a 2-week period using a questionnaire checklist that was primarily developed for this study. The type of information collected were patients' demographic characteristics such as age and gender, sources of SDE, clinical presentation and site of infection, methods of diagnosis, organisms isolated, treatments received, and outcome. One of the researchers was trained to extract data from the case folders using the checklist.

Study area

The study was undertaken in two hospitals in southeast Nigeria – Memfys Hospital for Neurosurgery and University of Nigeria Teaching Hospital (UNTH), Ituku/Ozalla. Memfys Hospital is a private hospital that offers primarily neurosurgical services. At present, there are five neurosurgical centers in southeast Nigeria, with approximately 12 trained specialists serving a population of approximately 16.2 million people.^[12]

Study design and sampling

This was a retrospective longitudinal study. Secondary medical data was collected from case folders of neurosurgical emergencies seen between January 2004 and December 2014. All available case folders were examined to select patients who had SDE. For the purpose of this study, SDE was defined as an infection with purulent materials located in the space between the dura and the subarachnoid mater within the brain ambient, confirmed by routine brain CT scan

Data was cleaned manually and 18 case folders of patients with SDE; all checklists were found to be adequately filled for entry into the Statistical Package for the Social Sciences version 17 software analysis.

Descriptive analysis was done for all variables. Means and standard deviations were calculated for numeric variables whereas frequencies and proportions were calculated for categorical variables. Bannister and Williams grading of level of consciousness was used to categorize patients that presented with altered sensorium.^[13]

Ethical approval

This study was reviewed and approved by the Health Research Ethics Committee of the University of Nigeria Teaching Hospital, Enugu state, Nigeria. Anonymity of patients was maintained by noninclusion of self-identifiers in the checklist.

RESULTS

Patients' demographics and sources of infection are presented in Table 1. Out of the 18 patients studied, 14 (77.8%) were males and 4 (22.2%) were females, giving a male-to-female ratio of 3.5:1. Their ages ranged from 3

Table 1: Patients' demographic characteristics and sources of infection for SDE

Variables	Frequency	Percentage (N = 18)
Average age		
• Mean = 17.3 (±)		
• Minimum = 3		
• Maximum = 64		
Age category (years)		
• <5	2	11.1
• 6–10	1	5.6
• 11–15	8	44.4
• 16–20	5	27.8
• >21	2	11.1
Gender		
• Males	14	77.8
• Females	4	22.2
Source of infection		
• Otorrhinosinusitis	10	55.5
• Head trauma	2	11.1
• Diabetes mellitus	1	5.6
• Post meningitis	1	5.6
• Not recorded	4	22.2

to 64 years with a mean of 17.3 (±) years. Most patients were within aged 11-15, i.e., the pediatric age category. Otorrhinosinusitis accounted for more than half (55.5%) of the sources of SDE in these patients.

Table 2 shows the clinical presentation of patients. Fifteen out of 18 (83%) patients presented after 10 days of initial symptoms, and 50% presented after 3 weeks. Major cause of delays was in making the right diagnosis. Clinical diagnosis was delayed because of the rarity of condition and nonavailability of neuroimaging, which was done for the first time on presentation. The most common clinical feature was altered sensorium, which was observed in 14 (77.8%) of the patients. Out of the 14 patients who had altered sensorium, 11 (61.1%) had ≤ grade 3 of Bannister and Williams's level of consciousness. The classical triad of headache, fever, and vomiting was seen in less than one-third of the patients, which may probably be not unrelated to late presentation and inappropriate use of antibiotics. Seizure episodes were present in 8 (44.4%) of the patients, and hemiparesis was seen in 7 (38.9%). (This is interesting and raises the possibility that the more virulent cases may have died before presentation-natural selection).

CT scan of the head with contrast was used to make the diagnosis of intracranial subdural empyema in all 18 patients; 3 (16.7%) of these patients additionally underwent MRI brain. The SDEs were mostly seen on the left side of the brain, 15 (83.3%). The parafalcine,

Table 2: Clinical features of patients diagnosed with SDE*

Clinical features	Frequency	*Percentage (N = 18)
Altered sensorium	14	77.8
Vomiting	10	55.5
Headache	9	50
Seizure	8	44.4
Hemiparesis	7	38.9
Fever	6	33.3
Scalp swelling	3	16.7
Neck stiffness	3	16.7
Dysphagia	2	11.1
Bannister and Williams grading for loss of consciousness		
Grade I – Awake and alert	4	22.2
Grade II – Drowsy and disoriented	3	16.7
Grade III – Responsive to stimuli	6	33.3
Grade IV – Unresponsive	5	27.8

*Each patient presented with a combination of clinical features. Therefore, the proportions do not add up to 100%.

frontal, and frontoparietal convexities of the dura were the most common sites, accounting for over half of the presentations. Posterior fossa right-sided SDE was seen in 3 (16.7%) patients, and multiple SDE sites were found in 5 (27.8%) patients [Table 3].

Microbiological analysis of the subdural aspirates was not recorded for five case folders. For the 13 cases recorded, negative culture was obtained in 11 (61.1%); *Staphylococci* was isolated in 1 (5.6%) of the patients whose source of infection was head trauma, and multiple isolates of.

All the patients alluded to antibiotic use before diagnosis, which may add to the number of negative culture results recorded. The mainstay of treatment for all patients was surgical evacuation and antibiotic therapy. The choice of antibiotics was informed by sensitivity results where it was available or empirical treatment where it was not. The 2 patients who had sensitivity results were therapeutically commenced on the appropriate regimen, which included flucloxacillin, vancomycin, or meropenem depending on the financial viability for the patient. Empirical broad-spectrum combination antibiotic therapy was used for the rest of the patients. The most common combinations were ceftriaxone + gentamicin + metronidazole and gentamicin + metronidazole + ceftazidime. Seizure prophylaxis was routinely given to all the patients.

The surgical evacuation methods used were BAAD of the abscess cavity and craniotomy. All 18 patients had BAAD as first line surgical treatment followed by craniotomy. Craniotomy was necessitated by a calcification of the abscess wall and recurrence of the SDE 20 months after a BAAD was done. Passive intracavitary drain was kept

Table 3: CT findings of sites of SDE lesion in the patients*

Sites on CT scan	Left side, n (%)*	Right side, n (%)*
Frontal	4 (22.2)	1 (5.6)
Parietal	0 (0)	1 (5.6)
Posterior fossa	0 (0)	3 (16.7)
Parafalcine	4 (22.2)	1 (5.6)
Frontoparietal	3 (16.7)	1 (5.6)
Frontotemporal	2 (11.1)	0 (0)
Hemisphere	2 (11.1)	1 (5.6)

*Some patients had lesions in multiple sites. Therefore, the proportions do not add up to 100%. N = 18.

Table 4: Patients' treatment outcome for SDE

Outcome variables	Frequency	Percentage (N = 18)
H.W. Mauser grading system for survival		
A – Survival ± minor non-disabling focal deficit	14	77.8
B – Survival without disabling seizures ± minor focal deficit	1	5.6
C – Survival with severe disability	0	0
D – Death	3	16.7
Postoperative complications*		
Pain at operation site	3	17
Fever	3	17
Hemiparesis	3	17
Expressive dysphagia	1	6
Seizure	1	6
Osteomyelitis	1	6
Recurrence of SDE	1	6

*The totals here do not add up to 18 or 100% because records of postoperative complication were not found in some folders, and for those that were found patients had a combination of postoperative complications

in situ for 48-72 h in all the patients. Following insertion of intracavitary drain, 3 patients dislodged their drains and had them re-passed within 4 hours post-operation.

Out of the 18 patients who were managed for SDE in UNTH and Memfys over a 10-year period, 3 mortalities were recorded among the 5 patients who presented with grade 4 of Bannister and Williams grading for loss of consciousness. Among most other patients, 14 (77.8%), were discharged on a good clinical grade A of H.W. Mauser's system for morbidity of survivors of intracranial subdural empyema, which was used to measure outcome [Table 4].

DISCUSSION

SDE is a severe form of intracranial suppuration, contributing to approximately 15–25% of pyogenic intracranial infections.^[1,2] In our cohort, males were more

affected than females and all but one of the patients were under 18 years. Other studies have noted higher rates of infections in children and young adults.^[14,15] The incidence of SDE in the study sites was found to be 1–2 patients per annum. SDE constitutes a rare neurosurgical emergency with an annual incidence that rarely exceeds 3–4 patients.^[1,16] The lower incidence recorded in our study could be explained by the lack of awareness with regards to neurological illness in the community. Because as many as 60% of the patients reported having seen a clinician or pharmacist before getting to neurosurgery services, the lack of awareness for the condition goes much deeper. It may be that clinicians first attempt to manage patients with SDE, albeit unknowingly, with antibiotics and only make referrals to the available centers when they are unsuccessful. This referral pathway for SDE could prove expensive in financial terms as well as in both morbidity and mortality.

SDE most frequently results from direct spread of infection from contiguous structures or through hematogenous spread.^[17-20] Other sources include craniocervical procedures and trauma, retrograde thrombophlebitis, and occasionally, cryptogenic spread.^[15] In our study, direct spread from infections of the ear, nose, and throat (otorrhinosinusitis) accounted for more than half of the SDE cases recorded. Spread of bacterial infections from contiguous structures such as the middle ear and sinuses (frontal, ethmoidal, sphenoidal, and mastoid) to the subdural space have been reported as the most common source of SDE.^[15,21,22]

The classical clinical triad of headache, fever, and vomiting is not as common as previously believed. Although this may be a partial consequence of late presentation and/or previous antibiotic therapy, a more common triad of altered sensorium, headache, and vomiting is a predominant presentation in this series. Most patients studied presented clinically with grade 3 or lower of Bannister and Williams grading.^[13] This clearly depicts the severity of infection and could also be a direct consequence of the delays in presentation resulting from long referral paths for neurosurgical cases. As was found in the study, the mean period of presentation of patients for neurosurgical care is 10 weeks, which is enough time to deteriorate. Some nonspecific clinical presentations that were observed could be closely related to the mass effect of purulent accumulation and inflammation of the meninges and surface of the brain. The absence of fever is a classical symptom, and negative culture results obtained in most of the patients could be explained by the unrestricted prescription of antibiotics by clinicians.

Seizures occurred in 44% of the patients in this series. This is similar to other studies.^[23] Appropriate siting of

burr-holes using well-guided CT and/or MRI were seen to be very beneficial for drainage of purulent collection in the subdural space. This contributed significantly to good patient outcome recorded in this study as well as provided sufficient material for microbiological diagnosis.^[16] The outcome in our study compares favorably with other studies,^[24-26] which is an improvement on Ivanov's study that recorded 27.3% mortality in patients who underwent surgical evacuation using burr-hole.^[1] Although some cases of SDE may respond well to treatment with antibiotics alone,^[5-7] our study shows that surgical evacuation using CT or MRI guided burr-hole aspiration combined with appropriate antibiotic treatment may well be a more appropriate method of treatment of SDE in our subregion. Concerning SDE, a thoughtful multidisciplinary approach is crucial to securing a favorable outcome.^[17,25] The overall good outcome (mortality of) may be because of selection bias from delayed presentation. Dill *et al.*, showed that if, patients presented in coma, mortality rates are higher (57-80%) compared to those who present conscious (0-7%).^[27]

CONCLUSION

Patients with a positive history of otorrhinosinusitis who present with altered level of consciousness, headache, and vomiting should trigger a "red flag" of suspicion for SDE. The gold standard for diagnosis of SDE still remains CT and/or MRI cranial imaging. However, drug sensitivity testing of cultured organisms would ensure appropriate use of antibiotics. Surgical evacuation using BAAD for SDE patients presenting with very low level of consciousness should be promoted in resource poor settings, even though this will require more studies to affirm this assertion.

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Conflicts of interest

There are no conflicts of interest.

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