Subdural empyema due to mixed infections successfully treated medically: a case report with review literature.

Mostafa Meshref[1], Anas Nourelden[2], Alaa Elshanbary[3], Yossef AbdelQadir[3], Mohamed Zaazouee[2], Khaled Ragab[4], and Sarya Swed[5]

[1]Al-Azhar University
[2]Al-Azhar University Faculty of Medicine
[3]Alexandria University Faculty of Medicine
[4]Minia University Faculty of Medicine
[5]University of Aleppo Faculty of Medicine

March 9, 2022

Abstract

Subdural empyema is a rare intracranial infection with an accumulation of purulent material between the dura and arachnoid matter. We report a case of 17 years old presented with altered conscious level .CSF analysis showed increased WBCS. His situation has improved after treating by acyclovir, ceftriaxone, vancomycin and dexamethasone.

Subdural empyema due to mixed infections successfully treated medically: a case report with review literature.

Mostafa Mahmoud Meshref[1], Anas Zakarya Nourelden[2,6], Alaa Ahmed Elshanbary[3,6], Yossef Hassan AbdelQadir[3,6], Mohamed Sayed Zaazouee[4,6], Khaled Mohamed Ragab[5,6*], Sarya Swed[7*].

[1]MSc neurology, Al-Azhar University, Cairo, Egypt.

[2]Faculty of Medicine, Al-Azhar University, Cairo, Egypt.

[3]Faculty of Medicine, Alexandria University, Alexandria, Egypt.

[4]Faculty of Medicine Al-Azhar University, Assiut, Egypt.

[5]Faculty of Medicine, Minia University, Egypt.

[6]International Medical Research Association (IMedRA)

[7]Faculty of Medicine , Aleppo University , Aleppo , Syria

*Corresponding author: Sarya Swed

Affiliation: Faculty of Medicine , Aleppo University , Aleppo , Syria

Tel: +963936500813

Email: saryaswed1@gmai.com

Abstract

Subdural empyema is a rare intracranial infection with an accumulation of purulent material between the dura and arachnoid matter. We report a case of 17 years old presented with altered conscious level .CSF analysis

showed increased WBCS. His situation has improved after treating by acyclovir, ceftriaxone, vancomycin and dexamethasone.

Keywords: Subdural empyema, viral infection, bacterial infection, medical treatment, Meningeal irritation.

Introduction:

Subdural empyema (SDE) is a collection of pus between the dura and arachnoid layers of the meninges (1). It is a rare infection of the brain, and it is an almost fatal condition if left untreated, but Since using antibiotics, the mortality rate has decreased and now ranges from 14% to 28% (2,3). In infants, it complicates neonatal meningitis, but in older children, it develops mostly as a consequence of ear, sinus infection, or spread from hematogenous source (1,3–8). In males, SDE is more frequently seen in males and it is the most commonly encountered intracranial complication of infection(4,5), The patient usually presents with fever, sinusitis, and neurological deficits with less frequent some other symptoms include headache and seizure with alteration of the level of consciousness (1,6–10). Laboratory investigations vary from blood to imaging. Computed tomography (CT) and magnetic resonance imaging (MRI) are the most important (4,11). Also, white blood cell count, erythrocyte sedimentation rate, and C-reactive protein level may be helpful. Imaging is recommended for every patient suspected to have a subdural abscess. In some cases, when the diagnosis by CT and MRI is unclear, hollow screws have a diagnostic value (12). Broad spectrum antibiotics are usually the first line management and they may be enough to control the infection (13–15). However, surgical intervention must be considered if the antibiotics fail to control or with other surgery indications (16,17).The most common surgical procedures are craniotomy and burr holes (13,14). If the surgical intervention has been done within 72 hours, the chance for disability is 10% compared to 70% when done after 72 hours (18).

Because of its rarity, many doctors may not have seen a case in recent years. Therefore, the topic should be re-visited to remind them to be aware of it. Also, it is difficult to distinguish from meningitis; hence the attending clinician must have a high suspicion index.

In this report, we presented subdural empyema case that was successfully treated by medical treatment in our hospital. Also, we systematically summarized the previous published case reports about SDE.

Literature review

We searched for published case reports in four electronic databases: PubMed, Scopus, Web of Science, and Cochrane Central Register of Controlled Trials (CENTRAL) in October 2020 using the following query: ("Empyema, Subdural"[Mesh]). We included all English case reports about subdural empyema in adolescent patients (10-19 years).

Since 1990, approximately 35 studies with 53 patients have reported similar cases in this specific age group; most of them were males (86.7%). The observed pattern of predisposing events is sinusitis, otitis media, or an upper airway infection. Patients have usually suffered from fever, headache, and drowsiness. The neurological manifestations started with nuchal rigidity (17 % of cases), hemiplegia (11.3 % of cases), or seizures (18.8 % of cases).

Details of each case and the organism isolated from culture and the outcome are presented in table 1.

Case report

A 17 years old male patient referred to our hospital. He had no history of co-morbid illnesses. At first sight, he seemed distracted and altered conscious level was noted. By history, seven days ago, the condition was started with a headache and low-grade fever without apparent septic focus; no tonsillitis or upper respiratory tract infection (URTI). The patient came to our hospital with his family member (from whom the history had been taken). They complained that the patient had a fever, which was not improved by analgesics associated with malaise and disturbing consciousness level in the form of drowsiness and confusion; the patient was inattentive and disoriented to time, place, and persons. On examination, the patient was feverish (38.5), drowsy, confused, and no focal neurological deficit with positive meningeal irritation signs;

neck stiffness, positive kerning's and stretch leg signs. C.T Brain at once showed mild diffuse brain edema of the right cerebral hemisphere with a suspected thin rim of overlying extra-axial fluid collection, with mildly expanded frontal sinus suspected mucocele formation and obliteration of the sphenoid, right ethmoid sinuses as well as right mastoid air sinuses (Figure 1). We asked for a lumbar puncture (after taking consent from the family) to obtain a CSF sample for analysis. Septic screen samples; urine analysis and cultures, nasal swab, axillary culture, throat culture, blood culture, and sputum culture were also withdrawn. Routine labs were withdrawn as well, including complete blood count with differential, kidney and liver functions, and electrolyte levels.

Few days later, the results of CSF analysis showed that CSF was clear colorless fluid, RBCs 400 cells/cmm, WBCs 66 cells/cmm (neutrophils 30%, lymphocytes 65%, mononuclear cells 5%), CSF glucose was 4.8 mmol/liter which is high (normal range 2.2-3.9 mmol/liter), CSF protein was 52.7 mg/dl which is also high (normal range 15-45 mg/dl). Also, CSF cultures were negative for any bacterial growth, including gram bacteria and acid-fast bacilli). Acid-fast bacilli PCR is also negative.

Septic screen results also were negative to any bacterial growth. The rest of the tests were normal except for increased W.B.Cs count 14x103 with increased neutrophils 87.9.

Low-grade fever at first, high glucose level, and predominance of lymphocytes in CSF are evidence of viral infection. In addition to, mucocele and the presence of sinusitis are bacterial infections, so a treatment that covering possible causes of CNS infection was initiated; acyclovir (10 mg/kg IV ter in die (tid); three times a day), ceftriaxone (2 gm IV bis in die (bid); twice a day), vancomycin (750 mg IV bid), and dexamethasone (4 mg IV quater in die (qid); four times a day).

The next morning, an MRI brain with contrast was conducted and showed mild diffuse thickening of the pachy/leptomeninges overlying the right cerebral hemisphere with mild intervening fluid collection seen eliciting low signal on t1 and high signal on t2 weighted images with evidence of diffusion restriction, features suggestive right-side meningitis with mild subdural empyema. Evidence of right-sided mild mass effects that was manifested by effacement of the underlying cortical sulci with mild compression on the right lateral ventricle. In addition to that, there was obliteration and mildly expansion of frontal sinus showing a high signal on both t1, t2 weighted images, likely representing mucocele formation. Also, obliteration of the sphenoid, right ethmoid sinuses and right mastoid air cells has occurred (Figure 2).

At the end of the second day after admission, the patient developed serial attacks of generalized tonic colonic fits, controlled by giving loading phenytoin (15 mg/kg), after that, we kept him on levetiracetam (500 mg po BID). Also, EEG was done which showed slowness activity figure (3). The patient's condition improved on the 5th day regarding consciousness level, and no more fits had occurred. The patient was continued on the same treatment measures, and a follow-up MRI brain with contrast was done after one week, which showed a reduction of the right-sided meningeal enhancement, with the same picture of the subdural collection with an improvement of the mass effects (Figure 4).

The patient was continued on the same treatment plan for three weeks with decreased dexamethasone doses till the stop. A follow-up MRI brain with contrast was done after 3 weeks, which showed considerable regression of the meningeal thickening and enhancement for the right subdural empyema (Figure 5).

The patient was discharged with marked improvement up to his normal state with no complaints.

Discussion:

This case report presents a patient with subdural empyema resulted from a mixed bacterial and viral infection. The patient suffered from sinusitis seven days before our investigation. The CSF analysis showed an increasing number of WBCs (66 cells/cmm) and 30% neutrophils, and the CT scan showed mild diffuse brain edema of the right cerebral hemisphere with suspected mucocele formation, which is considered evidence of bacterial infection. Also, CSF analysis showed an increase in the number of lymphocytes 65% and glucose 4.8 mmol/liter which is considered evidence of viral infection. Our case showed a thin rim in CT and no significant midline shift in MRI, so it is considered a mild case. Although surgery is the first line

in the treatment of SDE, there is a widely unutilized option to use antibiotics in mild cases (18, 19), So we treated our patient medically with acyclovir (10 mg /kg IV tid) for viral infection; ceftriaxone (2 gm IV bid), vancomycin (750 mg IV bid) for bacterial infection and dexamethasone (4 mg qid). The treatment was effective, and the patient had recovered with no severe side effects or disability.

What makes this case unique is a mixed infection; the patient was also treated medically, while a limitation was no PCR analysis for causative organisms. The case was diagnosed as SDE depending on the clinical history (fever, disturbed conscious level, meningeal irritation signs, fits and preceding infection), CSF findings (which showed the proof of mixed infection) and MRI brain findings. Also, there was evidence of EEG changes in the form of slowness activity which is going with Mauser H.W et al. as they found multiple EEG changes which may occur with SDE cases including diffuse slowness (19). Thus, diagnosis depends only on clinical history, signs, labs, EEG and radiology findings.

Ruth et al. concluded that a nonsurgical strategy might be considered for patients with a good clinical condition with a minor shift from the midline on radiology results (21). Musa et al. reported evidence of pre-surgical treatment with I.V chloramphenicol and metronidazole for four weeks and resulted in an increase in a Glasgow coma scale from 8/15 to 15/15 with no seizures (23). Subdural empyema had reported getting negative in culture test; a case series by Madhugiri et al. consisted of 27 patients with a mean age of 10 years reported that 26% of patients get negative in culture test (22).

Based on our case, physicians should consider the treatment of viral and bacterial infections in similar cases. Medical treatment of mild SDE patients can be effective and safe. Future research is needed to investigate the merits and limitations of using medical treatment alone in SDE with mild and moderate cases. In conclusion as there were multiple conflicts in differentiation between SDE and meningitis, all attending doctors must suspect it. Start medical treatment as soon as possible for all suspected cases depending on the clinical, radiological and lab findings. Early intervention in those cases whether medical or surgical according to case degree can improve the patient outcomes and lead to good prognosis. In spite our case showed marked improvement only on using medical treatments. Multiple researches should be conducted for clarification and putting criteria for either medical or surgical treatments for SDE patients.

Acknowledgements

N/A

Conflicts of interest

There is no conflict of interest.

Funding

N/A

Ethical approval

Consent to case study report given by Nassau University Medical Centre, NY

Consent for publication

We obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient knew that his name and initials would not be published, and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Guarantor

Sarya Swed

References:

1. Gormley WB, del Busto R, Saravolatz LD et al. Cranial and intracranial bacterial infections. Neurol Surg. 1996;5:3191–322.

2. Hlavin ML, Kaminski HJ, Fenstermaker RA, White RJ. Intracranial suppuration: A modern decade of postoperative subdural empyema and epidural abscess. Neurosurgery. 1994 Jun;34(6):974–81.

3. Nathoo N, Nadvi SS, Van Dellen JR, Gouws E. Intracranial subdural empyemas in the era of computed tomography: A review of 699 cases. Neurosurgery. 1999 Mar;44(3):529–36.

4. Rich PM, Deasy NP, Jarosz JM. Intracranial dural empyema. Br J Radiol. 2000 Dec;73(876):1329–36.

5. Demaerel P. A. J. Barkovich: Pediatric neuroimaging, 3rd edn. Eur Radiol. 2001;11(11):2347–2347.

6. Quraishi H, Zevallos JP. Subdural empyema as a complication of sinusitis in the pediatric population. Int J Pediatr Otorhinolaryngol. 2006 Sep;70(9):1581–6.

7. Tewari MK, Sharma RR, Shiv VK, Lad SD. Spectrum of intracranial subdural empyemas in a series of 45 patients: Current surgical options and outcome. Neurol India. 2004 Sep;52(3):346–9.

8. Greenlee JE. Subdural Empyema. Curr Treat Options Neurol. 2003 Jan;5(1):13–22.

9. Adame N, Hedlund G, Byington CL. Sinogenic intracranial empyema in children. Pediatrics. 2005 Sep;116(3):e461-7.

10. 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. 2006;42(5):293–8.

11. Weingarten K, Zimmerman RD, Becker RD, Heier LA, Haimes AB, Deck MDF. Subdural and epidural empyemas: MR imaging. Am J Roentgenol. 1989 Mar;152(3):615–21.

12. Aldinger FA, Shiban E, Gempt J, Meyer B, Kreutzer J, Krieg SM. Hollow screws: A diagnostic tool for intracranial empyema. Acta Neurochir (Wien). 2013 Feb;155(2):373–7.

13. Feuerman T, Wackym PA, Gade GF, Dubrow T. Craniotomy improves outcome in subdural empyema. Surg Neurol. 1989 Aug;32(2):105–10.

14. GLASS RL. Osteoplastic flap method in the treatment of subdural abscess. J Neurosurg. 1947 Jul;4(4):391–3.

15. Mauser HW, Van Houwelingen HC, Tulleken CAF. Factors affecting the outcome in subdural empyema. J Neurol Neurosurg Psychiatry. 1987 Sep;50(9):1136–41.

16. Mauser HW, Ravijst RAP, Elderson A, van Gijn J, Tulleken CA. Nonsurgical treatment of subdural empyema. Case report. J Neurosurg. 1985 Jul;63(1):128–30.

17. Leys D, Destee A, Petit H, Warot P. Management of subdural intracranial empyemas should not always require surgery. J Neurol Neurosurg Psychiatry. 1986 Jun;49(6):635–9.

18. Renaudin JW, Frazee J. Subdural empyema - Importance of early diagnosis. Neurosurgery. 1980 Nov;7(5):477–9.

19. Mauser H., Van Huffelen A., Tulleken CA. The EEG in the diagnosis of subdural empyema. Electroencephalogr Clin Neurophysiol. 1986 Dec;64(6):511–6.

20. Şahin S, Yazar U, Cansu A, Kul S, Kaya S, Özdoğan EB. Is Sinusitis Innocent?– Unilateral Subdural Empyema in an Immunocompetent Child. Indian J Pediatr. 2015;82(11):1061–4.

21. Yücel ÖT, Öğretmenoğlu O. Subdural empyema and blindness due to cavernous sinus thrombosis in acute frontal sinusitis. Int J Pediatr Otorhinolaryngol. 1998;46(1–2):121–5.

22. Arifianto MR, Ma'Ruf AZ, Ibrahim A, Bajamal AH. Interhemispheric and Infratentorial Subdural Empyema with Preseptal Cellulitis as Complications of Sinusitis: A Case Report. Pediatr Neurosurg. 2018;53(2):128–33.

23. Balfour-Lynn LM. Subdural empyema due to Burkholderia cepacia: An unusual complication after lung transplantation for cystic fibrosis. J R Soc Med Suppl. 1997;90(31):59–64.

24. Banerjee AD, Pandey P, Ambekar S, Chandramouli BA. Pediatric intracranial subdural empyema caused by Mycobacterium tuberculosis-a case report and review of literature. Child's Nerv Syst. 2010;26(8):1117–20.

25. Derin S, Sahan M, Hazer DB, Sahan L. Subdural empyema and unilateral pansinusitis due to a tooth infection. BMJ Case Rep. 2015;2015:2014–6.

26. Borovich B, Johnston E, Spagnuolo E. Infratentorial subdural empyema: Clinical and computerized tomography findings. Report of three cases. J Neurosurg. 1990;72(2):299–301.

27. Calik M, Iscan A, Abuhandan M, Yetkin I, Bozkuş F, Torun MF. Masked subdural empyema secondary to frontal sinusitis. Am J Emerg Med. 2012;30(8):1–4.

28. Conlon BJ, Curran A, Timon C V. Pitfalls in the determination of intracranial spread of complicated suppurative sinusitis. J Laryngol Otol. 1996;110(7):673–5.

29. Dolan RW, Chowdhury K. Diagnosis and treatment of intracranial complications of paranasal sinus infections. J Oral Maxillofac Surg. 1995;53(9):1080–7.

30. Dunn B, McCalla C, Hiestand B, O'Brien MC. The pediatric headache that would not go away. Pediatr Emerg Care. 2013;29(12):1283–6.

31. harris1987_2.pdf.

32. Heilbronn YD, Tovi F, Hirsch M, Ronen J. Subdural empyema of sinus origin in children. Int J Pediatr Otorhinolaryngol. 1984;6(C):205–11.

33. Holland AA, Morriss M, Glasier PC, Stavinoha PL. Complicated subdural empyema in an adolescent. Arch Clin Neuropsychol. 2013;28(1):81–91.

34. Jones BL, Wilcox MH. Subdural empyema due to Enterococcus faecalis. Scand J Infect Dis. 1997;29(6):627–8.

35. Kageyama G, Park KC, Yoshimine Y, Yokota J. Extensive subdural empyema treated with drainage and barbiturate therapy under intracranial pressure monitoring: Case report. Neurol Res. 2000;22(6):601–4.

36. Kuczkowski J, Narozny W, Mikaszewski B, Stankiewicz C. Suppurative complications of frontal sinusitis in children. Clin Pediatr (Phila). 2005;44(8):675–82.

37. Kwang Ong Y, Tan HKK. Suppurative intracranial complications of sinusitis in children. Int J Pediatr Otorhinolaryngol. 2002;66(1):49–54.

38. Lefebvre L, Metellus P, Dufour H, Bruder N. Linezolid for treatment of subdural empyema due to Streptococcus: case reports. Surg Neurol [Internet]. 2009;71(1):89–91. Available from: http://dx.doi.org/10.1016/j.surneu.2007.06.083

39. Manjila S, Singh G, Ndubuizu O, Jones Z, Hsu DP, Cohen AR. Endovascular plug for internal carotid artery occlusion in the management of a cavernous pseudoaneurysm with bifrontal subdural empyema: Technical note. J Neurosurg Pediatr. 2017;20(3):239–46.

40. Millar JS, Choksey MS. Case of the month: Size is not important. Br J Radiol. 1996;69(817):87–8.

41. Mitsuoka H, Tsunoda A, Mori K, Tajima A, Maeda M. Hypertrophic Anterior Falx Artery Associated with Interhemispheric Subdural Empyema: Case Report. Neurol Med Chir (Tokyo). 1995;35(11):830–2.

42. Morgan DW, Williams B. Posterior fossa subdural empyema. Brain. 1985;108(4):983–92.

43. Nica DA, Moroti-Constantinescu R, Copaciu R, Nica M. Multidisciplinary management and outcome in subdural empyema - A case report. Chir. 2011;108(5):673–6.

44. Pattisapu J V., Parent AD. Subdural empyemas in children. Pediatr Neurosurg. 1987;13(5):251–4.

45. Şengül G. İnfratentoryal Subdural Ampiyem. Turk Neurosurg. 2009;19(2):200–2.

46. Salunke PS, Malik V, Kovai P, Mukherjee KK. Falcotentorial subdural empyema: Analysis of 10 cases. Acta Neurochir (Wien). 2011;153(1):164–9.

47. Tankhiwale SS, Katkar VJ. Subdural empyma due to Mycobacterium fortuitum in a non-HIV patient. Indian J Med Microbiol. 2014;32(4):446–8.

48. Teelin K. New-onset Seizures in a 14-year-old Boy. 2017;

49. Teng HW, Chen CY, Chen HC, Chung WT, Lee W Sen. Fusobacterium septicemia complicated by cerebral subdural and epidural empyemas: A rare case of lemierre syndrome. J Emerg Med [Internet]. 2012;43(4):671–3. Available from: http://dx.doi.org/10.1016/j.jemermed.2010.04.033

50. Waseem M, Khan S, Bomann S. Subdural Empyema Complicating Sinusitis. J Emerg Med. 2008;35(3):277–81.

51. arifianto2017.

52. banerjee2010_2.

53. Martines F, Salvago P, Ferrara S, Mucia M, Gambino A, Sireci F. Parietal subdural empyema as complication of acute odontogenic sinusitis: A case report. J Med Case Rep. 2014;8(1):1–7.

54. Per H, Kumandaş S, Gümüş H, Öztürk MK, Çoşkun A. Meningitis and Subgaleal, Subdural, Epidural Empyema Due to Pasteurella Multocida. J Emerg Med. 2010;39(1):35–8.

55. westhout2007.

Figures:

Figure 1. CT Brain at presentation: Mild diffuse brain edema of the right cerebral hemisphere with mildly expanded frontal sinus suspected mucocele formation.

Figure 2. MRI brain with contrast at the next morning: Mild diffuse thickening of the pachy/leptomeninges over lying the right cerebral hemisphere with mild intervening fluid collection.

Figure 3. EEG sheet which showed slowness activity.

Figure 4. MRI brain with contrast after one week: Reduction of the right sided meningeal enhancement, with the same picture of the subdural collection but improvement of the mass effects.

Figure 5. MRI brain with contrast after 3 weeks: Appreciable regression of the meningeal thickening and enhancement and for the right subdural empyema.

Table 1: Summary of the previous case reports [21–56]