ORIGINAL ARTICLE

Surgical management of interhemispheric subdural empyemas: Review of the literature and report of 12 cases

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ABSTRACT

BACKGROUND: Subdural empyemas (SDEs) are rare intracranial infections mostly secondary to sinusitis. Incidence of SDEs is 5–25%. Interhemispheric SDEs are even rarer, which makes their diagnosis and treatment difficult. Aggressive surgical interventions and wide-spectrum antibiotics are needed for treatment. In this retrospective clinical study, we intended to evaluate the results of surgical management supported by antibiotics in patients with interhemispheric SDE.

METHODS: Clinical and radiological features, medical and surgical management and outcomes of 12 patients treated for interhemispheric SDE have been evaluated.

RESULTS: 12 patients were treated for interhemispheric SDE between 2005 and 2019. Ten (84%) were male, two (16%) were female. Mean age was 19 (7–38). Most common complaint was headache (100%). Five patients were diagnosed with frontal sinusitis prior SDE. Initially, three patients (27%) underwent burr hole aspiration and ten patients (83%) underwent craniotomy. In one patient both were done in the same session. Six patients were reoperated (50%). Weekly magnetic resonance imaging and blood tests were used for follow-up. All patients received antibiotics for at least 6 weeks. There was no mortality. Mean follow-up period was 10 months.

CONCLUSION: Interhemispheric SDEs are rare, challenging intracranial infections that have been related to high morbidity and mortality rates in the past. Both antibiotics and surgical interventions play role in treatment. Careful choice of surgical approach and repeated surgeries if necessary, accompanied by appropriate antibiotic regimen, leads to good prognosis reducing morbidity and mortality.

Keywords: Interhemispheric; intracranial infection; parasagittal craniotomy; sinusitis; subdural empyema.

INTRODUCTION

Subdural empyemas (SDEs) are rare intracranial infections that are located between the dura mater and arachnoid mater causing mass effect, seizures, focal neurological deficits, coma, and death. Incidence of SDE is reported from 5 to 25% of all intracranial infections.[1] SDEs, not only cause mass effect but also trigger inflammatory responses and result in encephalitis, cortical vein thrombosis, vasospasm and hydrocephalus, necessitating emergency intervention.[2] Interhemispheric or infratentorial SDEs are even more uncommon and surgical approaches and treatment strategies may be controversial and challenging.[3] Mostly they occur as an extension of frontal sinusitis however, cases that are secondary to thrombophlebitis are also known.[4] Management includes surgical evacuation of the pus, treatment of increased intracranial pressure and antibiotics. Surgical procedures include burr hole aspiration and craniotomy.[5] Even though prognosis improves with use

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of better and wider spectrum antibiotics in recent years, high mortality rates (around 10%) are still reported.[6]

MATERIALS AND METHODS

Records of 12 patients treated for interhemispheric SDE between 2005 and 2019 were reviewed retrospectively. Patients' clinical features, possible source of infection, radiological imaging studies, surgical intervention (burr hole or craniotomy or both), antimicrobial therapy and outcome are evaluated.

Informed Consent

Institutional review board approved our study. All patients or relatives signed informed consents.

Surgical Technique

According to location, patient status and surgeon's choice, only burr-holes or a craniotomy was used for drainage. Location of burr holes was planned for optimal access and drainage of infected material. If needed, a parasagittal craniotomy extending to the other side over sagittal sinus was made (Fig. 1a). Dissection of the interhemispheric fissure allowed us to evacuate the empyema and irrigate the cavity (Fig. 1b and c). Cranial magnetic resonance imaging (MRI) and biochemical markers were evaluated every week during treatment (Fig. 2). Normalized serum markers and sufficient regression of contrast enhancement in neuroradiological imaging's under neuroradiologist approvals led us to terminate inpatient treatment.

RESULTS

12 patients were treated for interhemispheric SDE. Ten (84%) were male, two (16%) were female. Mean age was 19 (7–38). Headache was present in all patients. Nine patients had fever (75%), seven had nausea and vomiting (63%), four had cognitive decline (36%), and five had various degrees of hemiparesis (42%). One patient had Wernicke dysphasia and two patients had seizures.

All patients were treated with β-lactam antibiotics before neuroradiological imaging due to sinusitis, preceptal cellulitis, or fever of unknown origin. They underwent MRI and were referred to our clinic after SDE was shown.

Five patients were diagnosed with frontal sinusitis prior to admission. Three of them had undergone endoscopic sinus surgery (FESS) for the frontal sinusitis and one had only received antibiotics. For the fifth patient, sinus drainage was performed at the same session with craniotomy. Remaining patients were initially treated for fever of unknown origin and were diagnosed after neurological deterioration. They were also diagnosed with sinusitis and drainage was performed for these patients by ear-nose-throat (ENT) surgeons. Mean duration of symptoms until SDE diagnosis was 21 days (4–45).

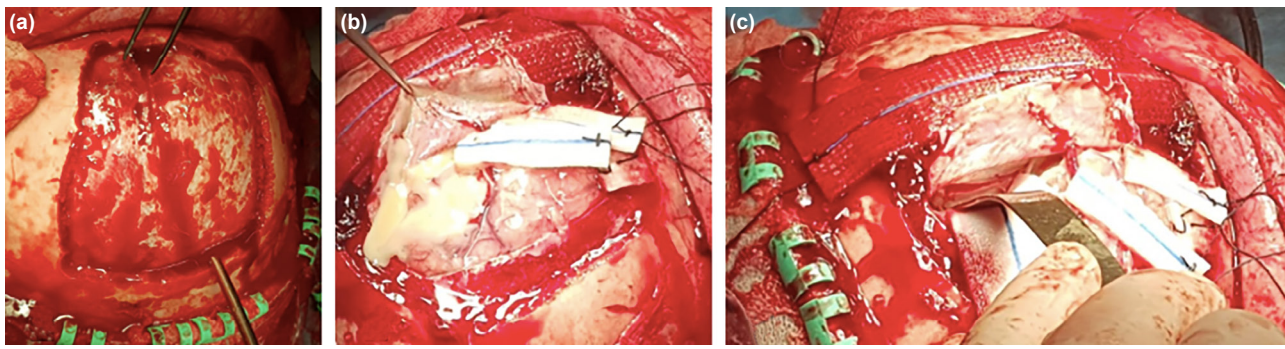

Figure 1. (a) Parasagittal craniotomy extending to contralateral side. Burr holes are placed on either side of the superior sagittal sinus. **(b)** Sinus-based opening of the dura and dissection of the interhemispheric fissure helped us to evacuate the empyema. **(c)** Leyla retractor was used when necessary to reach interhemispheric space.

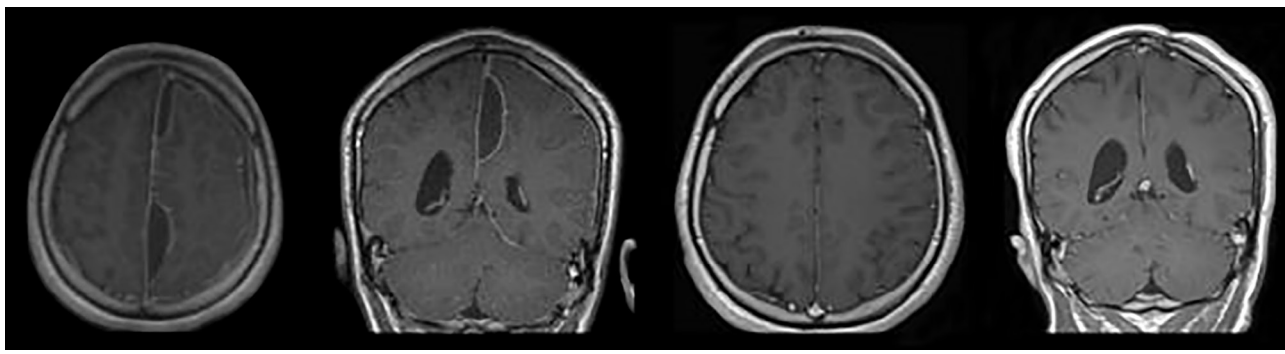

Figure 2. Pre-operative and post-operative MRIs of a patient with multiloculated interhemispheric subdural empyema treated with craniotomy.

All patients underwent surgery, either craniotomy or burr-hole aspiration. The choice between burr hole and craniotomy was made by the surgeon according to exact location and size of empyema and clinical status of patient. Resistant empyemas, cases with more edema and worse neurological status led us to choose craniotomy to achieve more decompression. Drain was left in the epidural space in eight patients, if postoperative hemorrhage was suspected, no drains were placed in the interhemispheric area. There were three burr-hole aspiration procedure and ten craniotomies. One patient had both. For this one patient, burr hole aspiration was found to be insufficient perioperatively, which led surgeons to perform craniotomy in the same session. Six patients needed second evacuation for recurrence (50%). Decision for reoperation was made according to at least one of the following factors: Reaccumulation of infective material in control MRI's, clinical deterioration, and progressive worsening of laboratory markers. Four patients underwent craniotomy, and two patients underwent burr hole aspirations for second intervention. All six of these patients had craniotomies in their previous surgeries (Table 1).

Microbiological studies were done for all patients. Culture results revealed nonhemolytic streptococcus in three patients and *Fusobacterium* in one patient. Cultures of the remaining eight patients ended up sterile.

All patients were treated with wide spectrum intravenous antibiotics for at least 6 weeks (6–10, mean: 7.5 weeks). Most commonly used combination of antibiotics was vancomycin, meropenem and metronidazole (6/12, 50%). Four patients received a combination therapy of vancomycin, ceftriaxone, and metronidazole, while one patient received only vancomycin and meropenem. One patient, who was found to be infected by *Fusobacterium*, was treated with vancomycin, piperacillin/tazobactam, clindamycin, and additional amphotericin B. Antibiotic regimens were determined on patients' microbiological studies under infectious disease consultation.

All patients were discharged with Glasgow Outcome Scale 5 out of 5 and oral antibiotics were continued at least 2 months. 3-months-interval neuroimagings were done in outpatient clinic. Mean follow-up period was 10 months (6–18 months) (Table 1). All patients' neurological deficits improved following treatment, except for one patient who was discharged with minor motor deficit.

Table 1. Patient characteristics

Patient No	Age	Sex	Complaint	Sinusitis	First surgery	Second surgery	Bacteriology	Antibiotic regimen	Antibiotherapy duration (weeks)	Previous antibiotherapy
1	38	M	H/A, motor deficit	+	BH	None	Sterile	V + M + Met	7	+
2	14	M	H/A, fever	+	BH	None	Sterile	V + M + Met	8	+
3	34	M	H/A, dysphasia	+	Craniotomy	None	Fusobacterium	V + Pip + Cl + A	10	+
4	18	M	H/A, motor deficit	+	Craniotomy	None	Sterile	V + M + Met	8	+
5	7	M	H/A, N/V, fever	+	Craniotomy	Craniotomy	Sterile	V + C + Met	7	+
6	11	M	H/A, N/V, AMS, fever, seizure	+	Craniotomy	Craniotomy	NHS	V + M + Met	8	+
7	29	M	H/A, N/V, AMS, motor deficit, fever	+	Craniotomy	Craniotomy	Sterile	V + C + Met	9	+
8	17	M	H/A, N/V, fever	+	Craniotomy	BH	Sterile	V + M + Met	8	+
9	14	F	H/A, N/V, AMS, fever	+	Craniotomy	BH	NHS	V + C + Met	9	+
10	20	M	H/A, N/V, AMS, motor deficit, fever	+	Craniotomy	None	Sterile	V + M + Met	10	+
11	10	F	H/A, N/V, fever, seizure	+	Both	None	NHS	V + C + Met	10	+
12	12	M	H/A, fever, motor deficit	+	Craniotomy	Craniotomy	Sterile	V + M	8	+

M: Male; F: Female; H/A: Headache; N/V: Nausea and vomiting; NHS: Nonhemolytic streptococcus; AMS: Altered mental status; BH: Burrhole aspiration; V: Vancomycin; M: Meropenem; Met: Metronidazole; Pip: Piperacillin/tazobactam; Cl: Clindamycin; A: Amphotericin B; C: Ceftriaxone.

Illustrative Cases

Patient 1

A 34-year-old male patient admitted to the ENT unit of another hospital for chronic sinusitis causing headache and an endoscopic sinus surgery was made. Since his complaints did not resolve postoperatively and a Wernicke dysphasia came up in postoperative day 1, cranial MRI was done. He was diagnosed with the left temporal and interhemispheric SDE in

addition to empyema in frontal sinuses (Fig. 3a and b). He was referred to our hospital and an emergency craniotomy was done for left temporal SDE immediately. Since the underlying reason for Wernicke dysphasia was tought to be temporal SDE, we only tried to evacuate this one and try medical therapy for interhemispheric SDE. Culture results yielded *Fusobacterium* as the infectious agent. His antibiotics regimen was adjusted as penicillin G, metronidazole, and moxifloxacin. 2 days after his surgery, ENT team performed an endoscopic drainage to evacuate the empyema in the frontal sinus. However, as control MRI after 1 week revealed the interhemispheric SDE to be enlarged in spite of medical treatment, a second craniotomy over the midline was performed. He continued to get IV antibiotics for 2 more weeks and was discharged home without any deficit on oral antibiotics. Follow-up MRIs of the patient showed no residual SDE in an outpatient clinic appointment 2 months after discharge (Fig. 3c and d).

Patient 2

A 12-year-old male patient was evaluated for headache and mild fever and prescribed wide spectrum antibiotics for fever of unknown origin. On the 10th day of his treatment swelling of his right eye occurred and he was hospitalized with the diagnosis of preceptal cellulitis. On his follow-up he developed left sided hemiparesis and cranial MRI was made (Fig. 4a). He was diagnosed with SDE with accompanying sinusitis. As his hemiparesis was worsening, he had emergency craniotomy. ENT team also joined the surgery for FESS procedure. Postoperatively his motor deficit improved, and immediate postoperative control MRI showed minimal pus (Fig. 4b). His microbiological studies remained sterile. He needed a second craniotomy due to recollection of infective tissue in his postoperative 1-week MRI, more posteriorly this time (Fig. 4c). He was discharged home 8 weeks after second surgery with follow-up MRIs showing no residual collection (Fig. 4d).

DISCUSSION

SDEs are rare intracranial infections that are usually secondary to sinusitis in spite of continuously developing antibiotic regimes.[7] They need to be managed as a neurosurgical emergency, because patients' neurological status may worsen rapidly due to ischemic and inflammatory changes, thrombosis, and edema underneath the empyema. Previously published case reports are summarized in Table 2.[1,2,5,7–28]

In the literature, most patients are reported to be young adult males.[28] In our series, 84% of the patients are male and mean age is 19, consistent with the literature. Seven patients were in the pediatric age group (58%).

Spread of infection into the intracranial space occurs through different ways such as septic thrombophlebitis and direct extension due to close proximity of frontal sinuses. In our series, only five patients had previously known sinusitis, but our imaging studies revealed sinusitis of the remaining patients as well. Similarly, in the case series of Kapu et al.,[28] three patients could not be diagnosed with neither sinusitis nor mastoditis; furthermore there were no history of meningitis and trauma, which lead them to attribute the origin of the

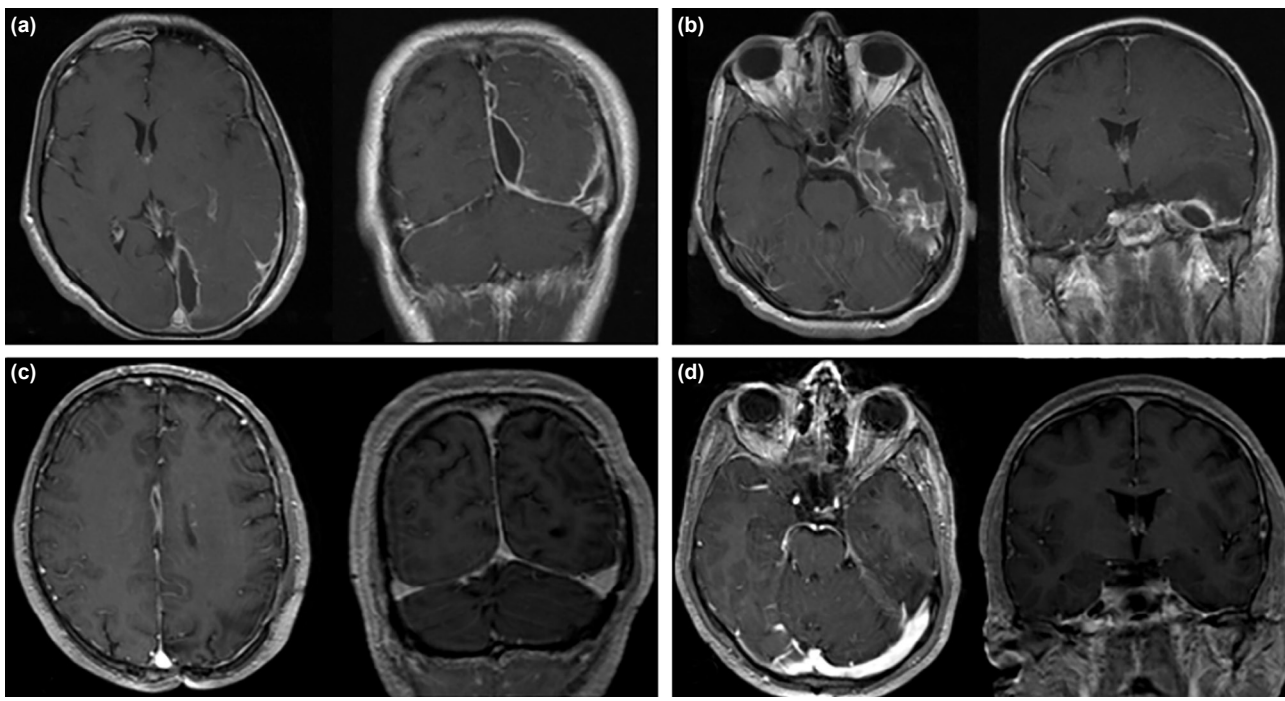

Figure 3. (a) First MRI of the patient when he became symptomatic showing interhemispheric SDE. **(b)** Initial MRI of the patient showing temporal SDE. **(c and d)** Follow-up MRI of the patient 2 months after discharge, without residual empyema can be seen both in interhemispheric space and temporal lobe.

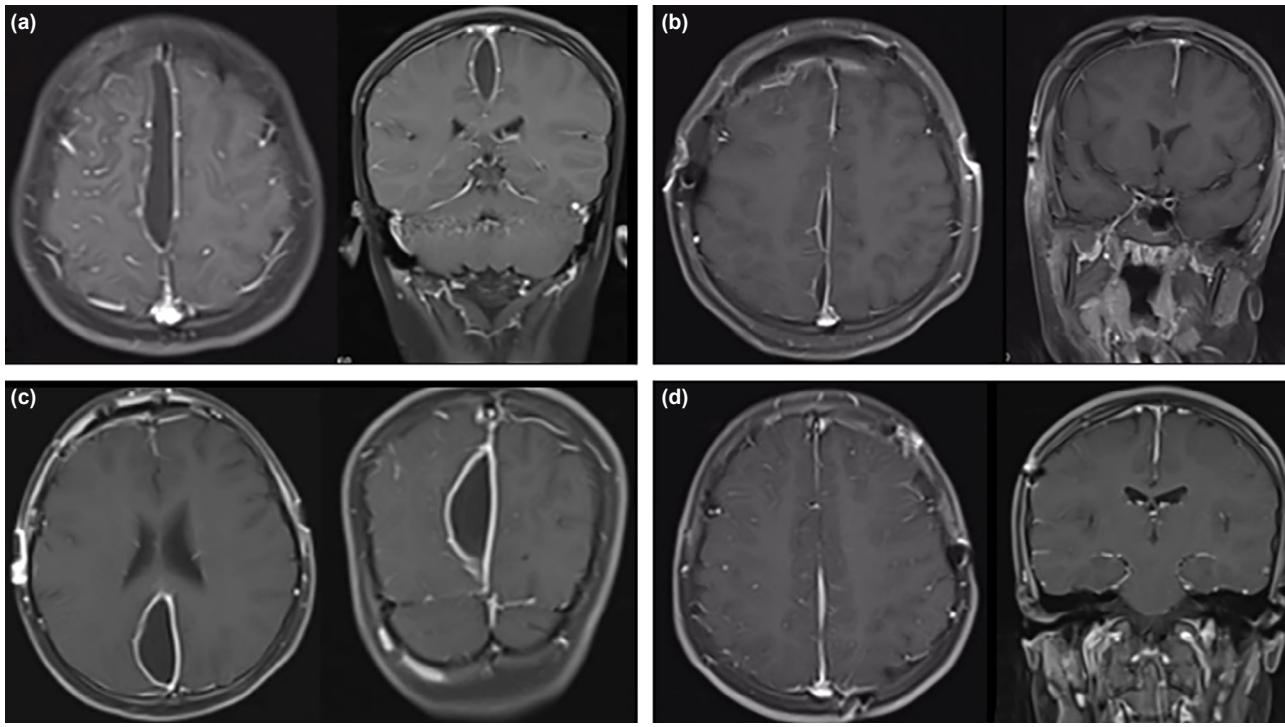

Figure 4. (a) Initial MRI of the patient, after motor deficit developed. **(b)** First post-operative MRI immediately after surgery of the patient revealed no further pus collections. **(c)** Post-operative 1 week MRI showing enlargement of the collection more posteriorly. **(d)** Control MRI in post-operative 6th month showed no residual collection.

infection to be subclinical sinusitis, which was the case with our seven patient who could not be diagnosed with sinusitis prior the diagnosis of SDE.

Most common pathogens causing SDE are known to be anaerobes, aerobic *Streptococci, Staphylococci, Haemophilus influenza, Streptococcus pneumoniae*, and other gram-negative bacilli. Most common pathogens that specifically cause SDE secondary to sinusitis are *Streptococcus milleri* group. In our series, only in four patients, pathogens could be isolated. Most common pathogen isolated was nonhemolytic streptococcus. In patients with known sinusitis, 66% of the cultures were sterile. This is a little above the rate of 7–53% reported by other studies, but it can be related to the fact that patients were already on antibiotics when they were admitted.[22]

In one of our patients, *Fusobacterium* was identified as a causative agent, a rare one for SDE. *Fusobacterium* is an anaerobic, Gram-negative pathogen which causes Lemierre's disease, described as postanginal sepsis and thrombophlebitis of internal jugular vein. Even though there are some reported cases of *Fusobacterium* causing intracranial abscess, meningoencephalitis and internal carotid artery aneurysms; SDEs are extremely rare. In a recent case report of Haddad, they report a 2-year-old female patient who had *Fusobacterium* tonsillitis complicated by SDE.[29] In all case reports published in English language, patients were diagnosed with tonsillitis before SDE. But our patient did not have any oral or peritonsillary infection previously.

Neurological manifestations of SDEs may mimic other intracranial infections and are not pathognomonic. Headache is one of the most common complaints among patients, which was similar in our series, followed by focal neurologic deficits, altered mental status, nausea, and vomiting and seizures. Falx syndrome, which is characterized by convulsions starting in the lower extremity and then progressing to generalized seizures sparing the face, can be seen among these patients.[30] In our series, only two patients had seizures on admission. Four patients of ours were neurologically intact. All of them complained of headache, while two had additional nausea and vomiting and three had high fever along headache.

Diagnostic tools include neuroradiological imaging studies and laboratory studies. Computerized tomography (CT) with contrast can visualize an infectious intracranial event very well but MRI is the gold standard. However, there are some groups which supports CT as first-line choice since it is easier to assess and faster than MRI.[7] All of our patients underwent MRI before treatment. However, few patients also underwent CT scan with contrast either at their first admission to hospital before diagnosis or to use as navigation tool when endoscopic procedures are planned.

White cell count, neutrophile percentage and infection markers such as erythrocyte sedimentation rate and C-reactive protein may be elevated. Blood culture may not always be diagnostic.[1] All of our patients were screened with these parameters weekly along with MRI. These parameters not

Table 2. Patient characteristics summary of previously published case reports

Author	Age	Sex	Complaint	Origin of infection	Surgery type	Bacteriology	Antibiotic regimen	Duration of antibiotics (weeks)
Baerlocher[9]	7	M	Fever, H/A, motor deficit, seizure	Otitis media	Craniotomy	Staphylococcus intermedius	NA	4
Rasazza[10]	14	M	Fever, H/A, motor deficit	Sinusitis	None	NA	Ampicillin, chloramphenicol	6
	11	M	Fever, H/A	Sinusitis	Craniotomy	Staphlycoccus	Ampicillin	6
Luken and Whelan[11]	15	F	Fever, H/A, motor deficit	Sinusitis	Craniotomy	Staphylococcus epidermidis	Methicillin, chloramphenicol	4
Borovich[12]	16	F	H/A, motor deficit, fever, seizure, AMS	Sinusitis	Craniotomy	Strept. B.hemolyticus, Bacteroides, Bacillus fusiformis	Chloramphenicol, bacitracin	4
Leys[13]	29	M	Fever, motor deficit, aphasia, seizure, AMS	Sinusitis	Craniotomy	Sterile	Ampicillin, sisomicine, trimethoprim-sulfamethoxazole	6
	19	F	Fever, motor deficit, seizure	Sinusitis	None	NA	Ampicillin, sisomicine, trimethoprim-sulfamethoxazole	6
	24	F	Fever, aphasia, seizure, AMS	Sinusitis	None	NA	Ampicillin, sisomicine, pristinamycine	16
Mauser[14]	21	M	Fever, H/A, aphasia, seizure, AMS	Sinusitis	None	NA	Ampicillin, chloramphenicol, flucloxacillin	6
Kagawa[15]	22	M	H/A, N/V, motor deficit, AMS	Sinusitis	Craniotomy	Sterile	NA	4
Lalkaka[16]	16	M	Fever, N/V, H/A, seizure, AMS	NA	None	NA	NA	NA
Dill[17]	35	M	Fever, H/A, aphasia, seizure	Sinusitis	Burrhole	Sterile	Nafcillin, chloramphenicol	4
	41	M	Fever, H/A, motor deficit, aphasia	Sinusitis	Craniotomy	Bacteroides fragilis	Penicillin, metronidazole	4
	23	M	Fever, H/A, motor deficit, seizure, AMS	Sinusitis	Craniotomy	Sterile	Penicillin, metronidazole,ceftriaxone	4
Mitsuoka[18]	14	M	Fever, H/A, motor deficit, seizure, AMS	Sinusitis	Craniotomy	Streptococcus	Cefotaxime, amikacin sulfate	NA
Inamasu[19]	25	M	Fever, H/A, motor deficit, seizure, AMS	Sinusitis	Craniotomy	Staphylococcus intermedius	Cefotaxim	NA
Stephanov[8]	56	M	Fever, H/A, motor deficit, AMS	Meningoencephalitis	Burrhole	Sterile	NA	4
Kawano[20]	29	M	Fever, H/A, motor deficit, AMS	Sinusitis	Craniotomy	NA	NA	NA
Klein[21]	0.4	M	Fever	Otitis media	Craniotomy	Pneumococcus	Amoxicillin/clavulanic acid	NA
	7	M	Fever, seizure, motor deficit, AMS	Sinusitis	Craniotomy	Streptococcus intermedius	Cefaclor, claritromycine, amoxicillin, amikacin	NA
Salunke[22]	12	M	Fever, H/A, N/V, motor deficit, seizure	NA	Craniotomy	Sterile	NA	6
	24	M	Fever, H/A, N/V, motor deficit, seizure	NA	Craniotomy	Nonhemolytic streptococci	NA	6
	5	M	Fever, H/A, N/V	NA	Craniotomy	Sterile	NA	6
Ramates[23]	12	M	H/A, motor deficit	Sinusitis	Craniotomy	NA	NA	12
	8	F	Fever, H/A, N/V	Sinusitis	Craniotomy	Staphylococcus intermedius	NA	12
Kazemi[24]	16	M	Fever, N/V, motor deficit, seizure	Sinusitis	Craniotomy	Sterile	NA	NA
Saravu[25]	39	M	Fever, motor deficit, seizure	Disseminated melioidosis	None	B.pseudomallei	Ceftazidime, cotrimoxazole, doxycycline	8
Sammartino[5]	13	M	Fever, H/A, seizure, AMS	Sinusitis	Burrhole	Streptococcus intermedius	Ceftriaxone	4
Yüksel[26]	17	F	Motor deficit, seizure	Sinusitis	Craniotomy	Sterile	Ceftriaxone, metronidazole, vancomycin	3
Arifianto[7]	17	M	Fever, H/A, motor deficit, seizure, AMS	NA	Craniotomy	Staphylococcus epidermidis	Ceftriaxone, metronidazole, gentamycin	NA
Akhaddar[27]	14	F	NA	NA	Craniotomy	NA	NA	NA
Shen[2]	13	F	Fever, motor deficit, AMS	Sinusitis	None	NA	NA	2 days
Prieto[1]	21	F	Fever, H/A, motor deficit, seizure	Sinusitis	Craniotomy	Sterile	Ceftriaxone, vancomycin	10
Kapu[28]	15	M	HA, N/V, seizure, motor deficit	Subclinical sinusitis/mastoiditis	Craniotomy	Streptococci	NA	6
	12	F	HA, N/V, seizure	Subclinical sinusitis/mastoiditis	Craniotomy	Sterile	NA	6
	22	M	HA, fever, seizure, motor deficit	Subclinical sinusitis/mastoiditis	Craniotomy	Sterile	NA	6

M: Male; F: Female; H/A: Headache; N/V: Nausea and vomiting; AMS: Altered mental status; BH: Burrhole aspiration; NA: Not available.

only showed the progress of the infection but also helped us to screen systemic changes of the patients who were under multidrug antibiotics.

Cerebrospinal fluid (CSF) analysis may show elevated white cell count, elevated protein levels, and decreased glucose levels as in many intracranial infections. However, because of high intracranial pressure, lumbar puncture is usually avoided. We did not use it in any of our patients either.

Treatment of SDEs is still controversial. Evacuation of the pus is recommended for good prognosis, but conservative treatment with antibiotics is still a modality that some groups prefer for small collections.[14] There are studies which showed unusual development of meningeal arteries into the SDE, which are believed to transport antibiotics and to be the reason why sample cultures are very frequently sterile.[11,17] On contrary, it is known that surgical evacuation within 72 h of the diagnosis reduces the disability rate from 70% to 10%.[5] Furthermore, in case of failed medical therapy and worsening neurological status, rapid surgery is lifesaving.[31]

Neurosurgical intervention not only reduces the amount of pus but also helps to decompress the elevated intracranial pressure and to identify to organism to further reshape the antibiotic regimen. Burr hole aspiration and craniotomy are the main procedures that are being widely used.[3] Choice of the procedure usually depends on multiple factors such as size and location of empyema, patient's clinical status, and surgeon's preference. In our series, three out of thirteen procedures were burr hole aspiration, and the remaining, craniotomies.

Burr hole aspiration is an effective method to evacuate SDEs. However, since interhemispheric empyemas are usually multiloculated, large craniotomies may be required as well as second surgeries. In addition, since interhemispheric space is a narrow area which is difficult to reach and SDEs cause further adhesions, craniotomies take advantage over burr holes. Another disadvantage of burr holes is that they can lead to further damage of the friable cortex.[31]

To perform less invasive procedures but also to increase the evacuation amount of the pus, Sammartino et al.[5] performed endoscope assisted burr hole aspiration and published their results. In our series, three patients underwent burr hole aspiration and ten patients underwent craniotomy, one patient needed craniotomy in the same session when burr hole aspiration failed. Recollection on control MRI was the main indication for a second operation even in patients with decreasing laboratory signs of infection. All six patients (50%), who required second surgeries, had craniotomies as first surgery. Out of these six patients, four underwent craniotomy and two underwent burr hole aspiration. This was not consisted with the literature data, which shows initial surgeries of patients that underwent second surgery is usually burr hole aspiration. We believe, burr hole aspiration for the second intervention worked for our patients because previous craniotomies were helpful to reduce the majority of the pus and ongoing antibiotics ease aspiration. Furthermore, in these cases, we observed a change of pus location after first craniotomy and therefore, instead of performing a new craniotomy, we used burr holes.

Large studies confirmed lower mortality rates in craniotomy-performed patients.[32] This is likely explained by better and faster decrease in intracranial pressure and better exploration of the narrow interhemispheric space. Nevertheless, there are also some studies that showed no difference in outcome and mortality rates between craniotomy and burr hole aspiration.[3] In our series, burr hole aspirations group did not require further surgical intervention whereas six patients of craniotomy group needed second surgery for recurrence (6/10, 60%). There was no mortality in our series. All patients' neurological examination, except one that had minor motor deficit at the time of discharge, was normal.

All patients received wide spectrum antibiotics combined with surgical treatment. Most common antibiotic combination was vancomycin, meropenem and metronidazole (50%). Furthermore, combination of other antibiotics that can pass blood-brain barrier, such as ceftriaxone, was used (4/12). Antibiotics regimens were consistent with literature. As summarized in Table 2 antibiotic regimens evolved over time from beta lactam antibiotics and chloramphenicol, which is hazardous, to broad spectrum antibiotics with lower side effects and higher penetration to CSF. One patient with *Fusobacterium* infection received additional antifungal medications. Medical therapy regimens were decided on patients' microbiological studies. Case-specific medical therapy was formed by infectious disease specialists. Overall intravenous antibiotics duration was decided on patient's clinical status, neuroradiological, and biochemical improvement. All patients received intravenous antibiotics for at least 6 weeks (6–10, mean: 7.5 weeks).

Conclusion

Interhemispheric SDEs are rare, life threatening infections mostly secondary to sinusitis. Treatment modalities include antibiotics and surgical evacuation. Surgery is helpful to reduce the amount of the pus, to identify the pathogen and to decrease the intracranial pressure when necessary. Burr hole aspiration and craniotomy are two mainstream surgical methods. Even though they are both shown to reduce mortality, case specific choice must be made. And in necessary cases, repeat surgeries should be considered.

Ethics Committee Approval: This study was approved by the Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (Date: 03.01.2022, Decision No: 2022-01).

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ORİJİNAL ÇALIŞMA - *ÖZ*

İnterhemisferik subdural ampiyemlerin cerrahi tedavisi: Literatür taraması ve 12 olguluk seri

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AMAÇ: Subdural ampiyemler çoğunlukla sinuzite sekonder gelişen nadir intrakranyal enfeksiyonlardır. Yıllık insidansları %5–%25 arasında raporlanmıştır. İnterhemisferik yerleşimli subdural ampiyemler ise daha da nadir olup tanıları ve tedavileri zordur. Agresif cerrahi girişimler ve geniş spektrumlu antibiyotikler tedavinin bel kemiğini oluşturmaktadır. Geriye dönük çalışmamızda, antibiyoterapinin yanı sıra cerrahi tedavi uygulanmış olan interhemisferik subdural ampiyemli hastaların irdelenmesi amaçlanmıştır.

GEREÇ VE YÖNTEM: İnterhemisferik subdural ampiyem tanısıyla opere edilen 12 hastanın klinik ve radyolojik özellikleri, tıbbi ve cerrahi tedavilerinin detayları ve prognozları geriye dönük olarak incelenmiştir.

BULGULAR: 2005 ve 2019 seneleri arasında interhemisferik subdural ampiyem tanılı 12 hasta tedavi edilmiştir. Hastaların onu (%84) erkek ve ikisi (%16) kadındır. Ortalama yaş 19 (7–38)'dur. En sık şikayet baş ağrısıdır (%100). Hastaların beşi ampiyem tanısından evvel frontal sinuzit tanısı almışlardır. İlk cerrahi girişim açısından üç (%27) hastaya burrholeden aspirasyon ve on (%83) hastaya kranyotomi uygulanmıştır. Bir hastada her iki cerrahi yöntem aynı seansta uygulanmıştır. Takiplerinde altı (%50) hastada ikinci cerrahi ihtiyacı olmuştur. Hasta takibinde haftalık manyetik rezonans görüntüleme ve kan testleri kullanılmıştır. Tüm hastalar en az altı hafta boyunca geniş spektrumlu antibiyotik kullanmıştır. Mortalite yoktur. Ortalama takip süresi 10 aydır.

TARTIŞMA: İnterhemisferik subdural ampiyemler nadiren rastlanan ve tedavisi zor intrakranyal enfeksiyonlar olup geçmişte yüksek mortalite ve morbidite ile ilişkilendirilmiştir. Tedavi seçenekleri arasında cerrahi ve antibiyoterapi bulunmaktadır. Cerrahi tekniğin dikkatle seçilmesi ve ihtiyaç duyulan olgularda ikinci cerrahiden kaçınılmaması, uygun antibiyotik rejimeni ile beraber, sağ kalımı iyileştirmektedir.

Anahtar sözcükler: İnterhemisferik; intrakranyal enfeksiyon; parasagittal kranyotomi; sinuzit; subdural ampiyem.

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