



PEDIATRIC INFRATENTORIAL SUBDURAL EMPYEMA: BIOPSYCHOSOCIAL INTERVENTION

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Objective

The goal of this report is to highlight and share informations with my colleague students about a rare disease with an explanation of signs and symptoms, diagnostic tools, drug therapy, surgical procedures and the outcomes in this case.

INTRODUCTION

Background

Definition

A subdural empyema is defined as: the focal intracranial collection of purulent material between the dura and the arachnoid mater.

Most often, it presents as a complication of other pathologies such as: sinusitis, mastoiditis, and bacterial meningitis or post traumatically.

It is a medical emergency requiring prompt identification and treatment with surgical evacuation and intravenous antibiotics; delay in therapy is associated with increased morbidity and mortality.

Subdural empyemas are only rarely located in the posterior fossa.

Their rarity and the limitations of computed tomography (CT) imaging in the evaluation of the posterior fossa make subdural empyema especially prone to delayed diagnosis.

In this report, I present a case of infratentorial subdural empyema that was successfully treated in our institution at European Gaza Hospital.

Pathophysiology

Subdural empyema is a primarily intracranial infection located between the dura mater and the arachnoid mater.

It has a tendency to spread rapidly through the subdural space until limited by specific boundaries (eg, falx cerebri, tentorium cerebelli, base of the brain, foramen magnum).

The subdural space has no septations except in areas where arachnoid granulations are attached to the dura mater.

Subdural empyema is usually unilateral.

With progression, subdural empyema has a tendency to behave like an expanding mass lesion with associated increased intracranial pressure and cerebral intraparenchymal penetration.

Cerebral edema and hydrocephalus also may be present secondary to disruption of blood flow or cerebrospinal fluid (CSF) flow caused by the increased intracranial pressure.

Cerebral infarction may be present from thrombosis of the cortical veins or cavernous sinuses or from septic venous thrombosis of contiguous veins in the area of the subdural empyema.

In infants and young children, subdural empyema most often occurs as a complication of meningitis.

In such cases, subdural empyema should be differentiated from reactive subdural effusion (ie, sterile collection of fluid due to increased efflux of intravascular fluids from increased capillary wall fenestrations into the subdural space).

In older children and adults, it occurs as a complication of paranasal sinusitis, otitis media, or mastoiditis.

Infection usually enters through the frontal or ethmoid sinuses; less frequently, it enters through the middle ear, mastoid cells, or sphenoid sinus.

This often occurs within 2 weeks of a sinusitis episode, with the infection spreading intracranially through thrombophlebitis in the venous sinuses.

Infection also may extend directly through the cranium and dura from an erosion of the posterior wall of the mastoid bone or frontal sinus.

Direct extension also could be from an intracerebral abscess.

Rarely, infection spreads hematogenously from distant foci, most commonly from a pulmonary source or as a complication of trauma, surgery, or septicemia.

The sphenoid sinus also could be a source of infection.

CASE REPORT

A 9.8 year-old girl presented to the pediatric emergency department with symptoms of cerebellar ataxia and gait disturbances. she arrived confused with left arm weakness noted as well.

***Assessment**

Pt. had no past history of seizures.

Two weeks prior to that, her parents had consulted a primary care physician due to her Right earache and fever.

No purulent discharge from the ear was evident at the time.

Then, the patient was **diagnosed with otitis media** and was prescribed oral amoxicillin-clavulanic acid (augmentin).

Due to symptoms persistence, treatment was subsequently switched to oral cefuroxime.

Her medical history was unremarkable, and her immunizations were up to date.

She lived at home with her family, none of whom were ill.

Her father denied any allergies.

Physical examination revealed a drowsy, but arousable, she was only oriented to person.

She is 135 cm height and 32 kg weight.

Her vital signs included a temperature of 38.5°C, pulse of 118, respiratory rate of 24, blood pressure of 108/54 mmHg, and an oxygen saturation of 100% on room air.

Her neurologic examination revealed isolated 0/5 weakness in the left upper extremity and confusion to time and place.

Her leg strength and reflexes were normal, but her gait was not tested.

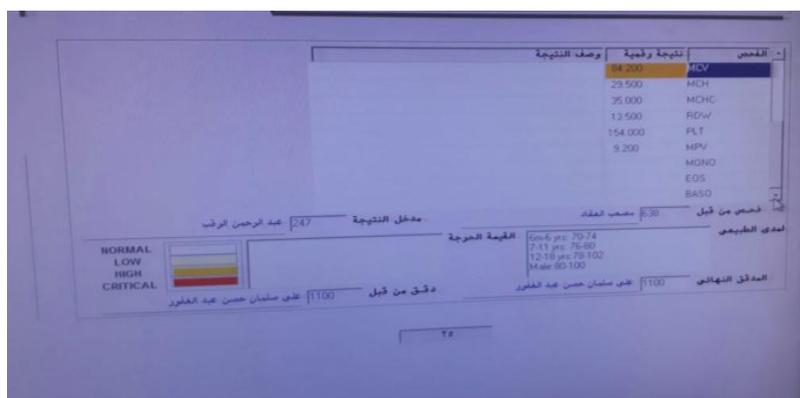
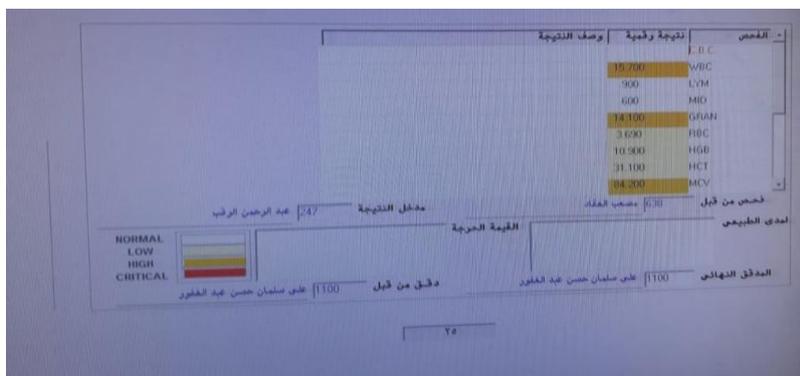
The remainder of her examination was normal.

***Diagnostic Tools included:** CT scan, MRI and laboratory Investigations.

Upon presentation to our emergency department, a complete blood count showed leukocytosis and neutrophilia.

Lab. Investigations

CBC tests



Chemistry tests

الفحص	نتيجة رقمية	وصف النتيجة
ALT	33.000	
Alk.Ph.	189.000	
Creatinine Serum	800	
Total Calcium (Seru	8.200	
AST	44.000	
Urea	56.000	
Glucose (Random)	124.000	

فحص من قبل: محمد عبد الرحيم محمد الاسفل | 167
 لدى الطبيعي: Child: 11 - 45 U/L Male: 1 - 43 U/L Fema
 المدقق النهائي: هشام ابراهيم الشاعر | 59

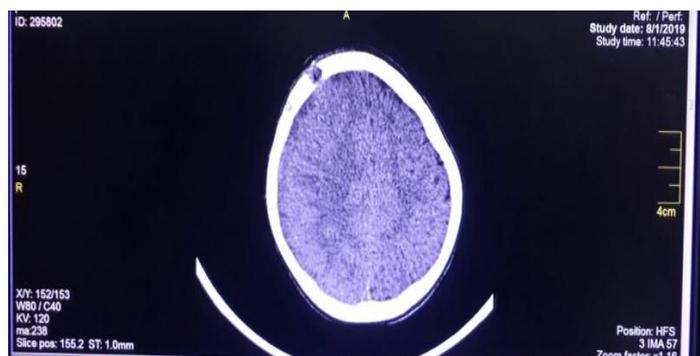
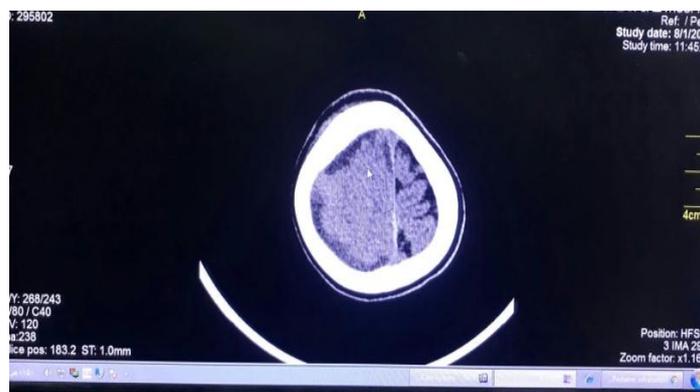
الفحص	نتيجة رقمية	وصف النتيجة
T. Bilirubin	900	
D. Bilirubin	300	
Creatinine Serum	900	
Magnesium	2.000	
Phosphorus	3.300	
Total Calcium (Seru	8.900	
AST	29.000	
Urea	40.000	
Glucose (Random)	150.000	

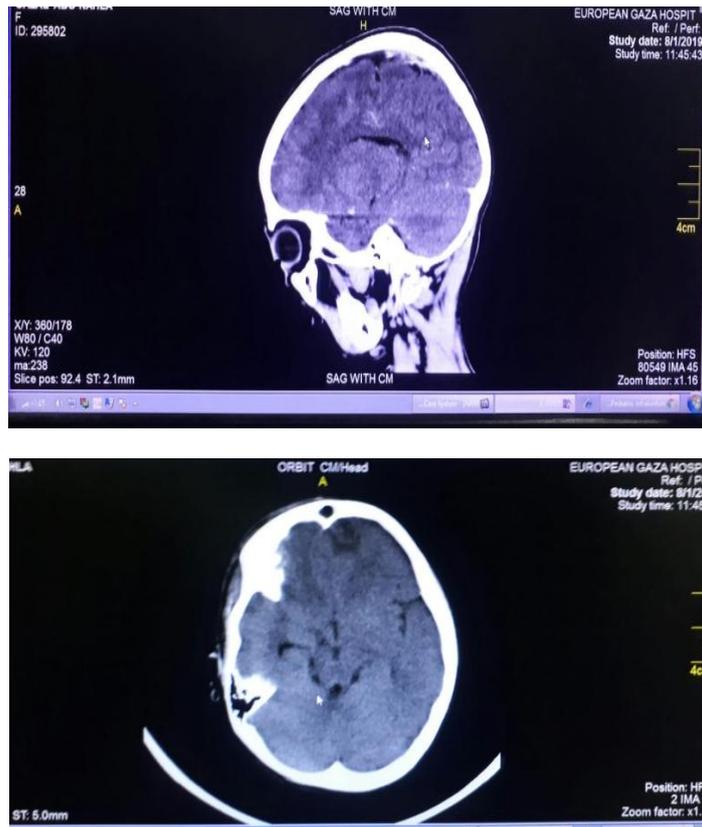
فحص من قبل: أروى صقر | 7766
 لدى الطبيعي: 5 days-60 years: 0.3-1.2 mg/dl
 60-90 Years: 0.2-1.1 mg/dl
 المدقق النهائي: باسم زكي سليمان ابو اسحاق | 14324

The prominence of cerebellar symptoms raised suspicion for an intracranial pathology and thus an emergency contrast-enhanced CT scan was performed.

The scan revealed a multi lobular cystic lesion with peripheral contrast enhancement, located in the subdural space of the posterior fossa, in contact with the tentorium cerebelli superiorly.

Ct Scan





The lesion was compressing the Right cerebellar hemisphere, which appeared edematous and the cerebellar midline was displaced by 8 mm.

Moreover, the Right middle ear cavity, ipsilateral mastoid air cells, and partially the Right ethmoid air cells were occupied by fluid.

The Right transverse sinus could not be recognized in the scan.

Subsequently, in order to evaluate more accurately the extent of the posterior fossa collection and to address the CT findings suggesting Right transverse sinus thrombosis, a magnetic resonance imaging (MRI) scan and a magnetic resonance venography (MRV) were conducted.

MRI confirmed the presence of extensive infratentorial subdural empyema over the Right cerebellar hemisphere, accompanied by displacement and edema of the Right cerebellum.

MRV revealed diminished flow through the Right transverse sinus and no flow through the Right sigmoidal sinus, and these findings were consistent with sinus thrombosis.

*Planning

Consecutively, an emergency operation was scheduled.

* Medical and Surgical Interventions

A Right suboccipital craniotomy was performed.

The transverse sinus was recognized and the dura was incised.

Following traction of the cerebellum, the subdural space was expanded and the purulent collection was encountered.

Cultures from the purulent fluid were obtained and the empyema was evacuated.

Note: MRI and MRV images were not available and in this section data collected from neurosurgeon progress notes from hospital file for the patient.

*Nursing Interventions

1. Vital Signs and level of consciousness monitoring.
2. Medications and Fluids Administration.
3. Wound dressing under sterile technique and infection control.
4. Emotional and Psychological Support for the pt.

Finally, The nurse must demonstrate the main nursing roles toward the pt. in the therapeutic process.

MEDICATIONS AND FLUIDS

Antibiotics

Rocephin 500mg every 12 hrs then after a day changed to Meropenem 500 mg every 8 hrs.

Cryst. Penicillin 2 million international units every 6 hrs.

Falgyl 125 mg every 8 hrs.

Lasix 5 mg every 8 hrs.

IV Fluids

NaCl 0.9% 500 cc contains: Ca10% 5 cc, Kcl 5 meq and Rantidin 12.5 mg.

This fluid is on infusion rate 70 ml/ hr.

*Prognosis

After 4 days the patient had no fever, no neurological deficits, and was ambulatory.

Follow-up MRI scan documented the successful evacuation of the empyema and subsiding inflammation.

Three weeks into the treatment, a morbilliform skin rash was developed on the patient's trunk, face, and limbs consistent with drug allergic reaction.

The antibiotic treatment was then switched to oral clarithromycin, which was administered for 3 more weeks, for a total of 6 weeks of antibiotic treatment.

The patient was discharged from the hospital 4 weeks after the operation.

DISCUSSION

Infratentorial subdural empyema is an extremely rare clinical entity both in children and in adults.

Apart from the Madhugiri *et al.* case series, which consisted of 27 patients with mean age of 10 years, there is remarkable paucity in the literature.

Sengul reports one such case in a 15-year-old boy, whereas Gupta *et al.* reported a case of 17-year-old patient.

In both studies, the empyema followed a middle ear infection and presented mimicking pyogenic meningitis.

There is also a case report of a posterior fossa subdural empyema in a 14-month old boy arising from a dermal sinus tract.

Finally, the Farah *et al.* case series of 20 pediatric subdural empyemas includes just one case where posterior fossa was involved. The large Nathoo *et al.*

case series of infratentorial empyemas aims to provide an estimate for the incidence of this clinical entity; their 13 cases of subdural infratentorial empyemas accounted for about 0.4% of all the intracranial suppuration cases they encountered during their study period.

*The Table below provides an overview of all the cases of pediatric infratentorial subdural empyemas described in the literature.

Authors	No. of cases	Age	Cause	Preoperative imaging modality	Microbiology	Operation	Antibiotic Treatment	Complications	Outcome
Madhugiri <i>et al.</i> ^[16]	27	Mean age: 10 years old	Middle ear infection in all but one	CT scan in all MRI in one patient with sinus thrombosis	Sterile in 7 Polymicrobial in 5 Streptococci, Pneumococcus, Bacterioides and others	Burr holes in 7 patients (prone to recurrence) Craniotomy in 20 patients	6 weeks of antibiotics (cefotaxime or ceftriaxone, metronidazole, aminoglycoside)	Reoperation of 6 patients Hydrocephalus in 20 patients, permanent shunt in 6 Sinus thrombosis in 1 patient	GOS 5: 7 patients GOS 4: 18 patients GOS 2: 1 patient 1 death.
Sengul ^[12]	1	15 years old	Middle ear infection	CT and MRI	Sterile	Craniectomy	6 weeks of antibiotics (ceftriaxone, vancomycin)	Hydrocephalus (requiring EVD)	Recovery
Gupta <i>et al.</i> ^[14]	1	17 years old	Middle ear infection	CT (negative) and MRI	Sterile	Craniectomy	10 days of antibiotics	Hydrocephalus	Complete recovery
Kanev <i>et al.</i> ^[15]	1	14 months old	Dermal sinus tract	CT and MRI	Polymicrobial (<i>Staphylococcus aureus</i> and <i>Escherichia coli</i>)	N.S.	4 weeks of antibiotic treatment (nafcillin, ceftriaxone)	Hydrocephalus (permanent shunt)	Complete recovery
Osman Farah <i>et al.</i> ^[18]	1	N.S. <16 years old	Sinusitis with mastoid involvement	N.S.	Coag. negative <i>Staphylococcus</i>	Burr hole for evacuation of infratentorial collection Craniotomy for evacuation of supratentorial collection	12 weeks of antibiotic treatment (flucloxacillin)	Hydrocephalus (requiring EVD)	N.S.

GOS: Glasgow outcome score, EVD: External ventricular drainage, NS: Not specified

Our patient presented with cerebellar signs and a recent history of otitis media.

In the Madhugiri series, 40% of the patients and just 13% of patients of the Nathoo series presented with cerebellar symptomatology.

The most common presenting symptoms in both series were meningism, depressed level of consciousness, fever, and ear discharge.

Seizures, hemiparesis, or cranial nerve palsy could also be part of the presentation.

Furthermore, the patients of the Borovich and Morgan series described similar symptoms and signs.

It is noteworthy that subdural empyemas without treatment are invariably fatal.

Prompt diagnosis and treatment with intravenous antibiotics and neurosurgical intervention are necessary

in order to not only increase the survival rates but also to decrease the gravity of any neurological sequelae.

The primary cause of infratentorial empyemas is a complicated otogenic infection.

This is the case for our patient who underwent a prolonged antibiotic treatment for an otitis media infection that proved resistant. The same course was described in 19 out of 22 Nathoo's patients, 26 out of 27 Madhugiri patients, in all 3 Borovich cases, and 5 out of 7 Morgan's patients.

Despite the greater accuracy of MRI scans in diagnosing intracranial pathologies, the initial imaging study of choice is CT scan, due to its speed and availability.

However, the complex osseous posterior fossa anatomy produces imaging artifacts that may obscure the purulent collection.

As a result, diagnosis of posterior fossa empyemas may be initially overlooked, thus delaying appropriate treatment.

MRI scan is more time-consuming—a consideration that is taken into account for a patient with altered mental state—but it is the preferred imaging modality, especially diffusion weighted imaging sequences, which can distinguish suppurative collections from reactive subdural effusions.

The culture of the purulent collection we obtained intraoperatively did not identify any pathogens.

This is a frequently encountered mischief in subdural empyemas.

Sterile collections are reported in the Nathoo series (5 out of 22 cases), Madhugiri series (7 out of 27), and Morgan series (3 out of 7 cases).

In other smaller reports, for example the two Taha patients, cultures of the suppurative fluid were sterile.

Nevertheless, when a pathogen was to be isolated, *Proteus mirabilis* was the most frequent causative species in Nathoo *et al.* study, and poly microbial culture was the second most frequent culture result.

In the Madhugiri *et al.* study, poly microbial cultures and non hemolytic streptococci were the most prevalent results.

Madhugiri *et al.* noted that cases with sterile cultures tended to have higher chance for re-accumulation of the suppuration and, thus, necessitating a second operation for re-evacuation.

A repeat operation was required for 5 out of 7 cases with sterile cultures, compared to 1 out of 20 cases with nonsterile cultures.

Agrawal *et al.* considered sterile culture of the subdural collection as one of the unfavorable prognostic factors.

Finally, the course of our patient was complicated with Right transverse and sigmoid sinus thrombosis.

Sinus thrombosis was encountered in one of the Madhugiri patients, two of Nathoo's patients, two of Morgan's patients, and in a case report by Sahjpaul.

Nathoo *et al.* reported significant morbidity for their patients that exhibited this complication.

Infratentorial subdural empyemas compared to the more common supratentorial variants are associated with higher mortality.

This has been attributed to delays in diagnosis and treatment.

Therefore, it is worth including this threatening clinical entity in the differential diagnosis list, despite its rarity and despite an initial negative or inconclusive CT scan.

***Ethicolegal Issues Related to our case**

1. Psychosocial Issues:

- Fear related to uncertain outcomes as manifested by anxiety.
 - Body image disturbance related to scare formation on pt. head post surgery.
 - Family refused disease acceptance and bad society view to the disease.
 - How this girl with her condition and disability will marry and be a future wife and form a Family with her future partner.
- ##### 2. Spiritual Issues:
- Religious issues like pt. says why I have this bad condition not the others.
 - Mom thinks and says why Allah made my daughter suffering in her disease not another healthy colleague girls.
 - How to make family accepts and be patient with this disease from an Islamic view.

3. How to keep privacy and dignity for the patient while doing medical and nursing procedures.

4. Legal Issues:

- How to control Manipulations in informed consent for therapeutic procedures by medical staff.
- How to ensure Ideal care and treatment for the patient.

Nursing Care Plan

*Assessment: pt. shown frustration from her body image after surgery.

*Diagnosis: Disturbed body image related to alteration in self perception.

*Planning: the pt. will have a good perception about herself within my day shift by:

1. assess psychological and physiological state of the patient.
2. support the pt. psychologically and emotionally and though other closed family members or her closed friends.
3. Tell the pt. that a cosmetic surgery is widely available now so she can restore her good body image before disease and surgery.
4. Bring a real example with images for ill girls who restored their good self body image with same diagnosis after treatment and cosmetic surgery.

*Intervention

All the previous plan steps have done.

*Evaluation

Goals met as evidenced by

The pt. has a good perception about her body and became hopefully to get improved and to be better with time.

CONCLUSION

-Intracranial suppurative complications, such as subdural empyemas, are rare and difficult to diagnose because initial symptoms may be vague.

-In terms of diagnosis, high clinical suspicion is the first step.

-Patients with Otitis media and progressive headaches or any neurological deficits should be aggressively evaluated with CT or MRI imaging as needed to rule out intracranial spread.

-Because subdural empyemas have serious morbidity and mortality if not recognized and treated promptly, emergency physicians must be aware of the risks of subdural empyema and the need to emergency neurosurgical intervention.

- The nurse plays an important role in the therapeutic process for the pt. pre and post operatively.

- The nurse must demonstrate the main nursing roles toward the pt. in the therapeutic process.

-The pt. and family must be a partners in the therapeutic process and in decision making related to pt. health.

- The pt. has the right to have many therapeutic options as its possible.

- The instructions for the pt. and family must be clear and easy to understand.

-Emotional and Psychological support play an important role in the therapeutic process.

-Health education about the disease helps the affected family and society to accept the disease and to look for the treatment instead of standing and denial.

- The surgery leaves a big effect on the pt. and family bout body image especially if the pt. is a young female.

- Cosmetic surgery prevents a lot of the psychological problems resulted from surgical procedures.

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