



Subdural empyema: an unusual complication of pediatric pyelonephritis

Empiema subdural: una complicación inusual de pielonefritis en el paciente pediátrico

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Summary

We present a case involving a 6-month-old female patient who was admitted to the hospital due to symptoms of fever and difficulty with feeding. The patient's medical history is significant, as she had previously experienced a septicemia episode originating from a urinary infection, which was accompanied by multifocal bilateral pyelonephritis and bacteremia one month earlier. While hospitalized, the patient suffered from a febrile status epilepticus, prompting investigations into potential involvement of the central nervous system. These investigations revealed the presence of a left subdural empyema, as seen on magnetic resonance imaging. This case highlights an uncommon complication of pyelonephritis and bacteremia, where the involvement of the central nervous system carries a significant risk of morbidity and mortality. Despite negative results from blood and cerebrospinal fluid tests for infection, computed axial tomography and magnetic resonance imaging of the brain are crucial in assessing the patient's condition. The initial treatment approach for this condition involves medical management with neurological observation and antibiotic therapy, with surgical intervention considered as an alternative option.

Resumen

Se describe el caso de una paciente de 6 meses de nacida ingresada al hospital por picos febriles e intolerancia a la vía oral; como antecedente de importancia tuvo un cuadro de septicemia de origen urinario asociada a pielonefritis bilateral multifocal y bacteriemia un mes antes. Durante la hospitalización sufrió un episodio de estatus epiléptico febril, por lo que se iniciaron estudios de compromiso del sistema nervioso central, los cuales revelaron un empiema subdural izquierdo en las imágenes de resonancia magnética. Este caso destaca una complicación poco usual de pielonefritis y bacteriemia, en la que el compromiso del sistema nervioso central conlleva morbilidad y mortalidad muy altas. Las imágenes de tomografía axial computarizada de cráneo y resonancia magnética cerebral son indispensables en el enfoque del paciente con compromiso neurológico, quien, como en este caso, se presentó con resultados de laboratorio negativos para infección tanto en sangre como en líquido cefalorraquídeo. El manejo médico con observación neurológica y antibioticoterapia son las medidas iniciales en el tratamiento de esta patología. El manejo quirúrgico se considera una alternativa.

Introduction

Subdural empyema (SDE) is a collection of purulent fluid that accumulates in the virtual space between the dura mater and the arachnoid (1), which represents between 15% and 20% of localized intracranial infections in the pediatric population (2). Among its causes are direct dissemination from the paranasal sinuses or middle ear, hematogenous dissemination, trauma, neurosurgical procedures and meningitis. Since the hematogenous route allows the pathogen to move and not use the contiguity mechanism, the most

common sources of initial infection in adults are pyogenic pulmonary diseases, especially lung abscesses, bronchiectasis, empyema and cystic fibrosis; they can also occur from skin infections, osteomyelitis, pelvic infections, cholecystitis and intra-abdominal infections. It should be taken into account that in the pediatric age the immaturity of the blood-brain barrier makes the child more prone to suffer infection of the nervous system secondary to bacteremia (3). Symptomatology may be subtle, ranging from fever and headache to status epilepticus and coma. A high index of suspicion is necessary for early diagnosis and timely treatment,

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since morbidity and mortality are directly proportional to the time that treatment is delayed. This pathology is considered a neurological emergency that can progress to coma and death in 24 to 48 hours (4).

The most common causative microorganisms are anaerobes, aerobic *streptococci*, *staphylococci*, *H. Influenzae*, *S. Pneumoniae* and other gram-negative bacilli (4). However, the microorganism depends on the mechanism of infection and the age of the patient; for example, in neonates the prevalent germs are enterobacteria, group B *Streptococcus* or *Listeria Monocytogenes*. In the present case, infection by *Salmonella Enteritidis*, a facultative intracellular microorganism, present in nervous system complications in infants in 2-10% of cases, was confirmed. The first report of meningitis caused by this microbiological agent was made in 1907 by Ghon, and to date, isolated cases are limited and have been described in neonates with risk factors including birth trauma, increased permeability of the blood-brain barrier and immaturity of the immune system for opsonization of these microorganisms (5).

Since the introduction of antibiotics, the mortality rate has decreased significantly, today it is between 14 and 28 %, approximately. In the pre-antibiotic era, the mortality rate was 100%, even in developed countries. Therefore, this infectious pathology with probable fatal outcome should be treated with optimal early antibiotic management, surgical drainage and imaging follow-up. In this context, computed axial tomography (CT) is a cost-effective, accessible and fast imaging method; however, it can be normal in up to 50% of cases, so magnetic resonance imaging (MRI) is the study of choice, with a sensitivity to diagnose this pathology in up to 93% of cases.

In the patient of the present case, third generation cephalosporins via parenteral route were the antibiotics of choice to attack the causative agent; as an alternative, carbapenemics were available. In general, in relation to the above, the treatment of subdural empyemas is broad-spectrum intravenous antibiotics. Surgical treatment is recommended in cases with focal neurological deficit, altered mental status and absent or inadequate response to antibiotics and includes craniectomy, *Burr Hole* (trepanation), endoscopic evacuation or percutaneous aspiration in patients with open anterior fontanel (3). Despite all the advances in treatments for this entity, approximately 50% of cases present long-term sequelae such as hemiparesis, seizures and cognitive-behavioral problems.

The following is a case of subdural empyema in a six-month-old female patient with a history of urinary sepsis secondary to acute bilateral multifocal pyelonephritis and *Salmonella Enteritidis* bacteremia.

Case report

Six-month-old female patient presented to the emergency department with clinical symptoms of three days of evolution consisting of febrile peaks associated with oral intolerance. One month prior to the consultation, she had urinary septicemia secondary to *K. Pneumoniae* and *E. Coli*, associated with acute bilateral multifocal pyelonephritis, diagnosed by renal and urinary tract ultrasonography (Figure 1), with positive blood cultures for bacteremia due to *Salmonella Enteritidis* spp. The patient completed five days of intravenous antibiotic treatment directed by urine culture and blood culture, and subsequently five additional days of outpatient oral antibiotic treatment; there is no other significant pathological and perinatal history.

On the second day of the current admission, the patient presented febrile status epilepticus manifested by focal seizures of clonic movements that started in the right upper limb, required several doses of benzodiazepines, anticonvulsants and transfer to the intensive care unit. The patient was found to be drowsy, responsive to stimulus, with no apparent motor or sensory deficit. Initially, a lumbar puncture was performed to obtain cerebrospinal fluid (CSF): normal opening pressure with no findings suggestive of central nervous system infection.

A simple cranial CT scan was performed (figures 2 and 3), which showed benign enlargement of the subarachnoid space with a cranio-cortical distance of 12 mm and asymmetry of the wide space density due to greater attenuation on the left side. Brain MRI confirmed the occupation of the left frontal subarachnoid space by material isointense to the cerebral cortex, better visualized in sequences with T2 information (figure 4), and high signal in DWI and low in ADC due to diffusion restriction (figure 5), associated with hemispheric dural enhancement (figure 6) and superior frontal leptomeningeal enhancement on the same side (figure 7). These findings in the clinical context of the patient were compatible in the first term with subdural empyema and left frontal meningitis.

With the findings described above, the patient was evaluated by the neurosurgery service who did not initially consider neurosurgical intervention, recommending only antibiotic management for six weeks. On the 34th day of treatment, the patient presented a new seizure episode due to a focal seizure of the same characteristics as the initial ones, a new MRI was performed which showed an increase in the left hemispheric subdural collection with accentuation of the ipsilateral dural enhancement (Figure 8). Given the persistence of symptoms and the imaging control after four weeks of antibiotic therapy, it was decided to perform a meningeal biopsy plus drainage of the subdural collection, in order to rule out infiltrative versus infectious process. The procedure, performed without complications, and the CSF tests taken intraoperatively showed abundant polymorphonuclear cells, with gram and culture negative for microorganisms, as well as Chinese ink. Meningeal biopsy showed mild chronic inflammatory infiltrate with no other findings. The patient continued treatment under the neuro and infectopediatrics services with antibiotic management (ceftriaxone and metronidazole), and anticonvulsant (valproic acid) with good adherence to the latter and without neurological deficit.

Discussion

Subdural empyema (SDE) is defined as a collection of purulent material between the dura mater and arachnoid, develops in 60% of patients with pyogenic meningitis, constitutes 15-25% of intracranial infections, with a 60% higher incidence of presentation in males than in females. Meningitis is the most common cause in infants while sinusitis and otitis media are the main source of infection in older children (6).

The spectrum of evolution of subdural empyema is wide, including soft tissue infection, intracranial abscess, osteomyelitis, extradural collections and systemic infections. The clinical presentation can be very subtle at onset, usually beginning with alterations in consciousness, febrile syndrome without focus, symptoms or signs of meningeal irritation, as well as signs of endocranial hypertension. Up to 40% of patients with subdural collections have convulsive episodes. It should

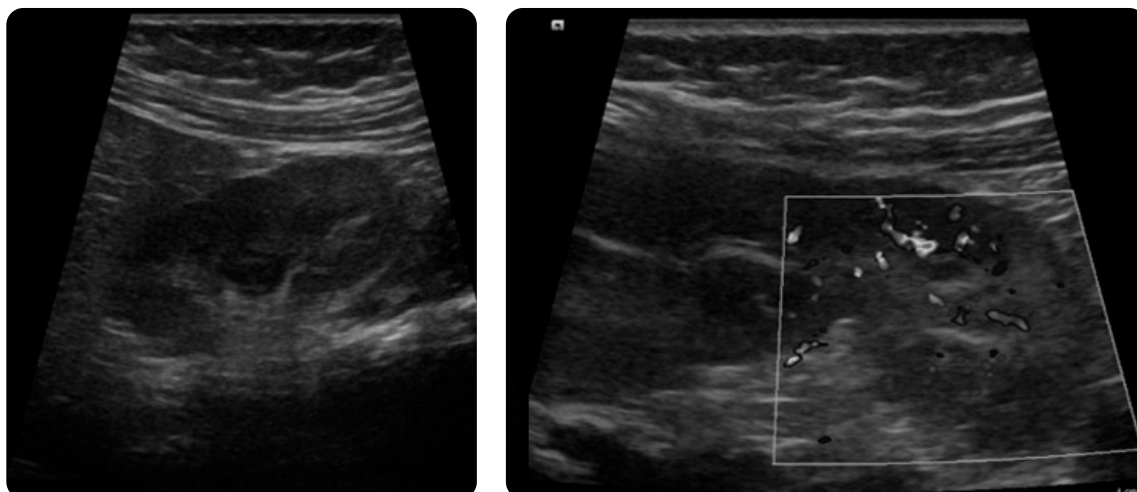


Figure 1. Kidneys with normal shape and size. Towards the anterior cortical region of the upper pole of the right kidney, as well as in the lower pole of the left kidney: foci of increased echogenicity of the cortex with triangular morphology associated with hypervascularization.

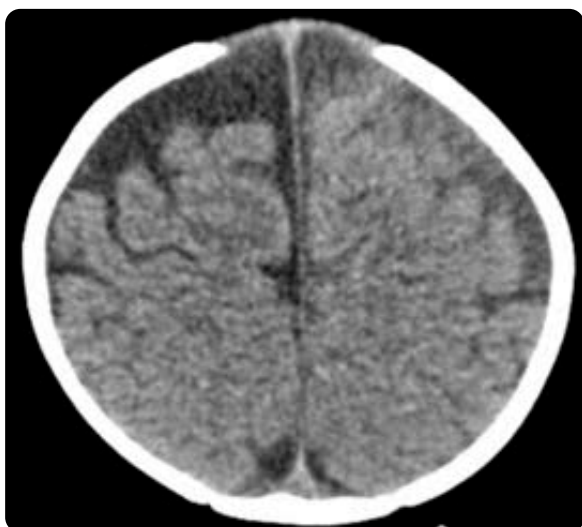


Figure 2. Axial CT: benign enlargement of the subarachnoid space. Subdural space enlargement with frontal predominance and asymmetry due to subarachnoid hyperdensity with a craniocortical distance of 12 mm (normal value to subdural on the left side, 10 mm) and left hyperdensity suspicious of extraaxial collection is confirmed.



Figure 3. CT, coronal reconstruction. Subarachnoid space enlargement is confirmed with a craniocortical distance of 12 mm (normal value up to 10 mm) and left hyperdensity suspicious of extraaxial collection.

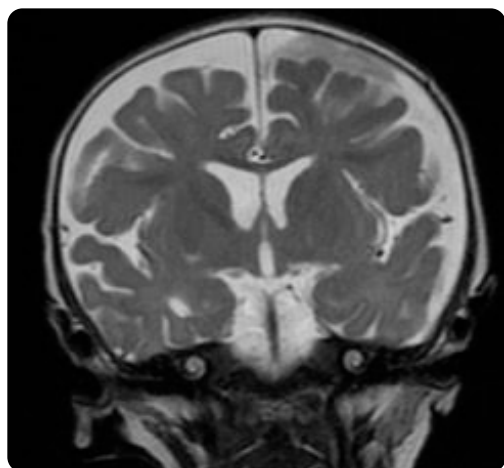


Figure 4. MRI with T2 information in coronal plane. Occupation of the left frontal subarachnoid space by material isointense to the cerebral cortex.

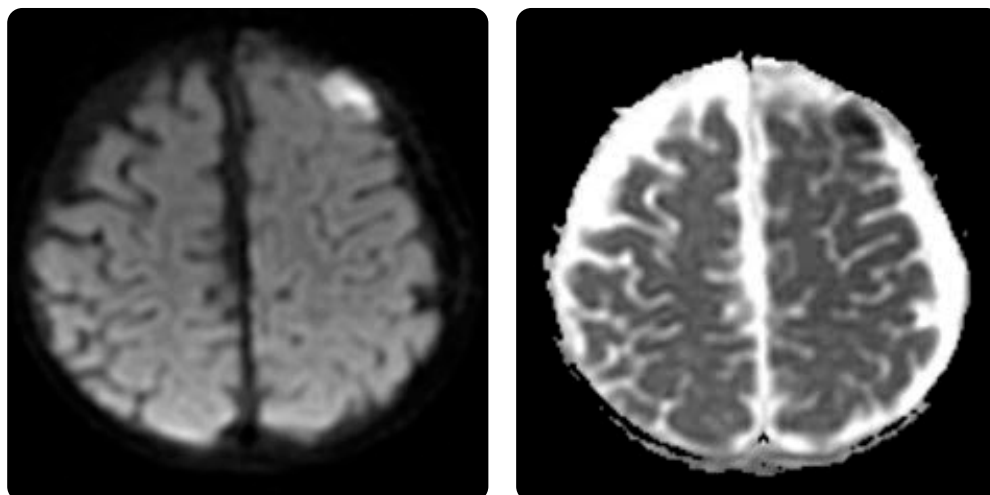


Figure 5. MRI, diffusion sequences and ADC map. Restriction of the left frontal subarachnoid focus, a finding that allows considering infectious etiology (empyema).

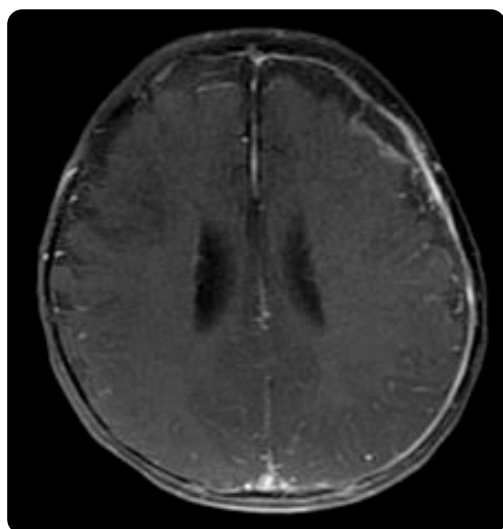


Figure 6. MRI sequences with T1 information with contrast medium with fat saturation. Thick and continuous left hemispheric dural enhancement and ipsilateral frontal leptomeningeal enhancement.

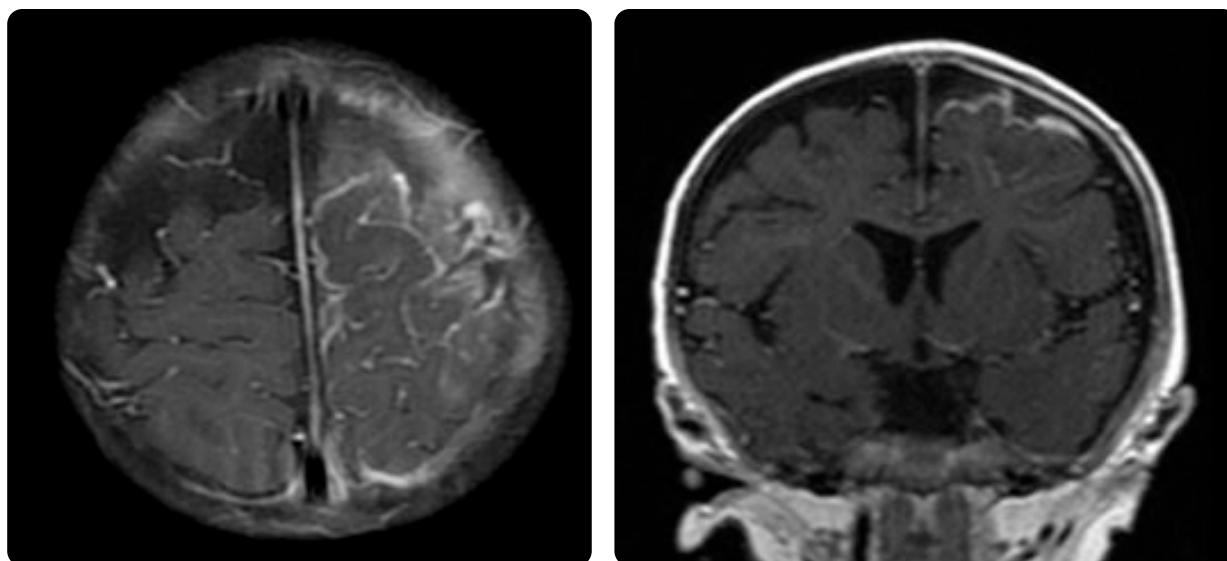


Figure 7. MR T1 sequences with contrast medium, axial plane. Upper slices: left frontal leptomeningeal enhancement. It is also evident in the coronal plane.

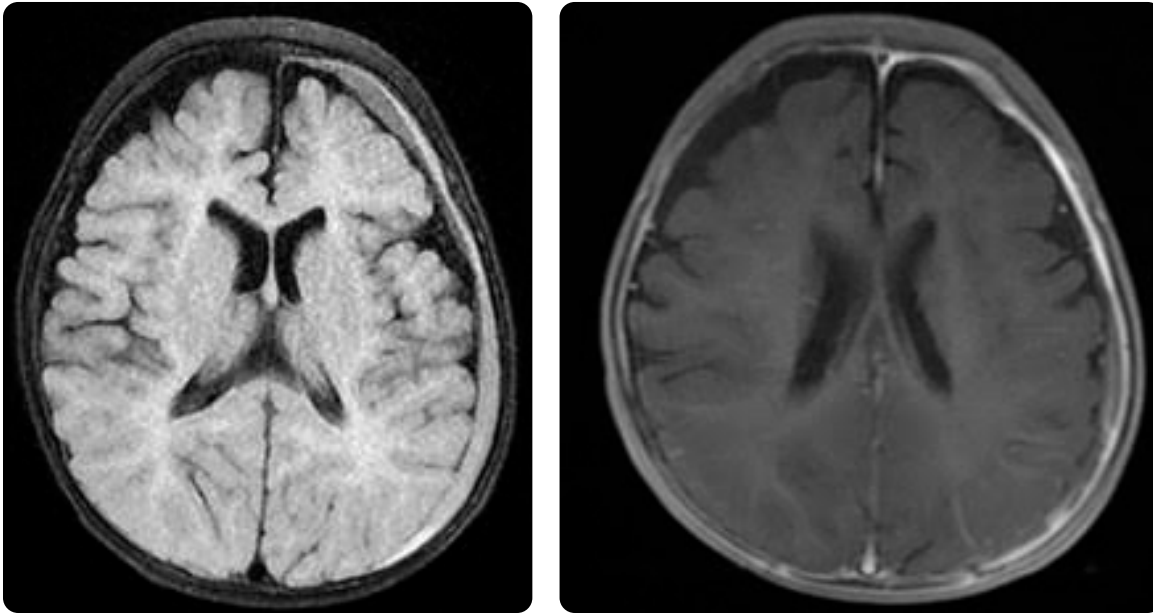


Figure 8. Control MRI FLAIR sequence. Left hemispheric subdural collection is identified without midline deviation or significant compressive effect. T1 with post-contrast fat saturation showing persistence of continuous and thick dural enhancement without associated leptomeningeal enhancement.

be noted that in pediatric patients the initial symptom is the primary focus of infection, whether of respiratory or gastrointestinal origin, or secondary to systemic infectious processes. In this case, fever, focal seizures and the patient's history alerted to a potential intracranial complication.

The diagnosis was reasonably confirmed by contrast-enhanced CT, followed by contrast-enhanced brain MR imaging. It is important to emphasize that negative blood and CSF studies, as in the present case, do not rule out the disease. It is considered a life-threatening condition, so it is essential to make a timely diagnosis and get the right treatment on track.

Initially, in a patient who is stable, with no signs of increased intracranial pressure, medical management and strict neurological surveillance correspond to first-line treatment, which should include broad-spectrum antibiotics (oxacillin, ceftriaxone, cefotaxime, metronidazole, linezolid, meropenem) depending on the etiological suspicion or isolation obtained; Ideally, intravenous antibiotic management is initiated for a minimum of two weeks, followed by six weeks of complementary oral treatment; however, the decision to switch to oral therapy should be based on control imaging studies in which a decrease in the collection, or even its complete resolution, is expected. There are no specific guidelines for the optimal duration of treatment; however, it is considered that antibiotic therapy should be continued for four to six weeks. The total duration of therapy is usually six to eight weeks, of which intravenous therapy may be given for two to six weeks, followed by oral therapy for the remainder of treatment. In the case reported here, antibiotic management with ceftriaxone and metronidazole was ineffective for initial control of intracranial infection (7).

Similarly, anticonvulsant drugs are recommended, since purulent material in the subdural cavity can trigger seizures. Generally, it is only administered during the acute phase of the disease, and should be

maintained for at least two years in case seizures are its initial manifestation. It should be kept in mind that if a patient, in spite of having an adequate antibiotic regimen, persists with neurological symptoms or when there is evidence of an increase in the lesion, he/she should undergo neurosurgical intervention in order to drain the collections (7, 8).

Needle aspiration through the open fontanel and craniotomy by *Burr Holes* are the interventions of choice, since they are less morbid for the patient and in a great proportion of cases complete drainage of the collections is achieved. The surgical indication in the patient of this case was mainly based on the persistence of the symptomatology associated with the enlargement of the lesion in the MR control images, with a subsequent satisfactory evolution without neurological deficit. The main advantage of surgical management is the ability to obtain the identity and sensitivity of the causative organisms and the establishment of appropriate antibiotics (7, 8).

Conclusion

Subdural empyema in the pediatric patient is a potentially fatal pathology with a high rate of neurological sequelae as a result of late diagnosis and treatment. Its symptomatology is related to the location of the primary infection; however, this can be varied and confusing, because in some cases fever is the only symptom developed. The focus can be otorhinolaryngologic, which includes paranasal sinuses, inner ear and mastoids, the most common regions, but there is the hematogenous route of a localized infection, such as urinary tract infection. We presented a case of subdural empyema with an atypical cause, pyelonephritis, in which, in spite of initiating adequate medical management and broad-spectrum antibiotics, we were able to corroborate the usefulness of imaging control, mainly brain MRI, and neurosurgical intervention for adequate management and resolution of the case. Nowadays, the

survival rate is 90% in the pediatric population, if the intervention was performed in a timely manner. It should be taken into account that if intervention is performed within 72 hours of the onset of symptoms, the probability of disability is 10%, and the probability increases to 70% if it is performed after this time (6, 9).

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