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Role of Subdural Antibiotic Therapy in the Management of Pediatric Bilateral Subdural Empyema

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Abstract

Introduction

Use of intrathecal antibiotic therapy in the management of intracranial infections is a practice often required, usually administered through lumbar punctures or ventricular drains placement. Antibiotic administration through subdural drains is not a common practice in subdural empyemas treatment and limited evidence to date exists in the literature. To our best knowledge, this practice has not been previously reported in pediatric patient.

Case report

We present the case of a pediatric patient with bilateral subdural hematomas with posterior superinfection, who was treated by surgical evacuation and direct administration of Gentamicin through subdural drains. Resolution of the infection was achieved after institution of subdural antibiotic therapy.

Conclusion

Despite limited experience and evidence regarding administration of subdural antibiotic therapy as part of subdural empyema treatment, this practice may be beneficial in properly selected patients in addition to surgical management and intravenous antibiotic therapy.

Keywords: Subdural Empyema, Gentamicin, Subdural Antibiotic Therapy

Introduction

Intracranial infections refractory to surgical treatment and intravenous antibiotic often require administration of intrathecal antibiotic therapy, by lumbar puncture or through ventricular drains placement.

Subdural empyemas represent approximately 20% of total intracranial infections [4, 11].

Conservative management with intravenous antibiotic results appropriate when the subdural collection is small and the patient remains clinically stable. Otherwise, subdural empyema can be a life threatening process. In that case it is necessary to evacuate the collection in addition to the intravenous antibiotic therapy, either by craniotomy or burr holes.

Limited evidence to date exists regarding direct subdural administration of antibiotic therapy and no previous reports have been found in the literature about this practice. We present the case of a pediatric patient with bilateral subdural hematomas with sobreinfection who was operated trough burr holes and subdural drains placement. Resolution of infection was possible once subdural Gentamicin treatment was instituted through subdural drains placement.

Case Report

A three-month-old male patient with history of cesarean delivery, negative maternal serologies and progressive macrocephaly (head circumference at birth 33 cm, p50) was referred to the emergency department suffering from fever (39, 8 ºC) and irritability. Shaking baby syndrome was suspected due to bilateral retinal hemorrhage.

On physical examination, the patient presented with irritability, with correct muscle tone without hypertonia or clonus. He also presented general skin pallor and highlighted macrocephaly with head circumference of 43 cm (p90) and bulging fontanelle without tension. Analytically, he presented increased levels of C-Reactive Protein without leukocytosis or neutrophilia.

A transfontanelar ultrasound was performed and bilateral subdural collections were observed. The study was completed by cranial CT scan. Corticotherapy was administered.

Given the suspicion of sepsis due to the fever and rised inflammatory markers, blood cultures were taken and broad spectrum antibiotic therapy with Cefotaxime, Vancomycin and Meropenem was initiated. Blood cultures were positive for Escherichia

Coli a few days after.

The patient remained hemodynamically stable with persistence of fever. The patient underwent a brain MRI (Fig 1) showing the subdural collections with different densities and hyper-signal in DWI sequences. No images suggesting encephalitis or cerebritis were observed.

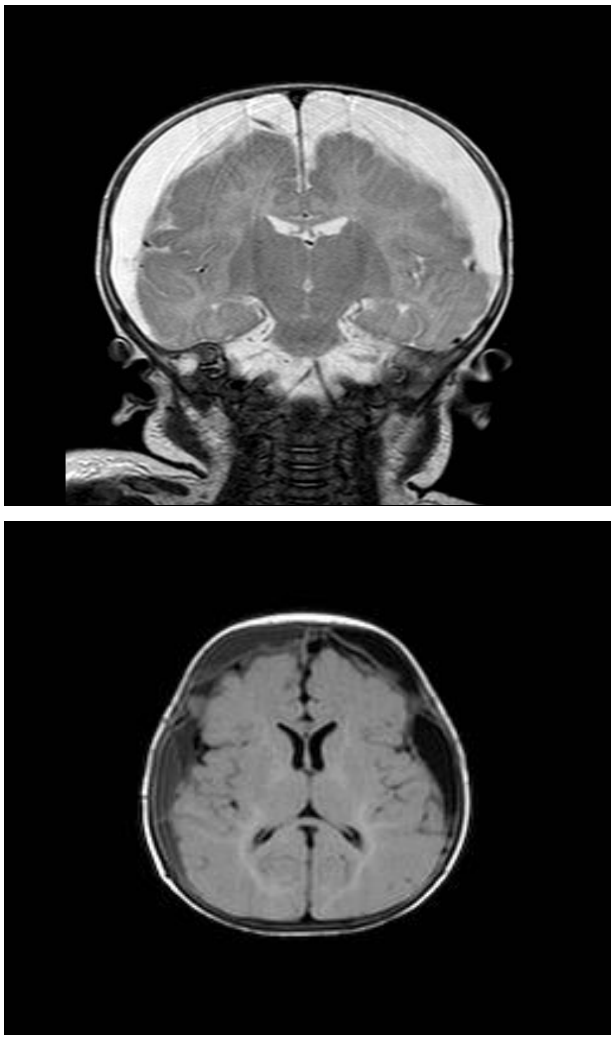

Fig 1: 1A y 1B: MRI T2 and T1 sequences in coronal plane (1A) and axial plane (1B) showing bilateral subdural empyemas

Conservative management with antibiotic therapy was continued. Then the patient suffered from seizures with tonic-clonic movements in the left side, with difficult control despite antiepileptic treatment.

In addition, despite the broad-spectrum intravenous antibiotic management, inflammatory parameters continued raising, fever remained and a new CT scan showed larger size of subdural collections. Given the possibility of hematomas superinfection, the patient was proposed to surgical evacuation of the empyemas, avoiding the lumbar puncture due to the presence of mass effect intracranial collections.

The patient underwent surgical evacuation of the subdural hematomas through bilateral burr holes and subsequent placement of subdural drain on the right side due its greater size, to allow drainage of the residual collection postoperatively. During surgery subdural fluid purulent was found and cultures were taken, showing positivity for Escherichia Coli a few days later.

After evacuation, patient's fontanelle was less bulging and CT scan showed global improvement with decreased size of both collections and greater right brain hemisphere re-expansion. Cultures taken during the surgery showed positivity for Escherichia Coli a few days later.

Broad spectrum antibiotic therapy was continued but one week after surgery the patient still kept on fever and seizures didn't resolve. On blood test inflammatory markers continued to go up. CT scan and MRI showed increasing size in both collections despite the surgical evacuation and antibiotic therapy.

So at that point the patient needed to be re-operated and two options were possible: To reopen the previous burr holes with bilateral drains placement and intrathecal antibiotic therapy or to perform bilateral craniotomies. Given the aggressiveness of the latter one, despite the fact that the indication for a worsening subdural empyema was probably to perform a craniotomy, we decided to give a chance to the less aggressive option and the patient was operated for second time by reopening of burr holes and subdural drains placement in both sides with the aim to administrate antibiotic therapy in the subdural space with Gentamicin.

After institution of subdural Gentamicin treatment, significant clinical improvement was observed. Complete resolution of seizures was observed the day after the subdural treatment was introduced as well as gradual decrease of inflammatory parameters day by day, with normalization five days after that. CT scan two days after the second surgery showed significant decreased size of both subdural collections with both brain hemispheres re-expansion (Fig 2).

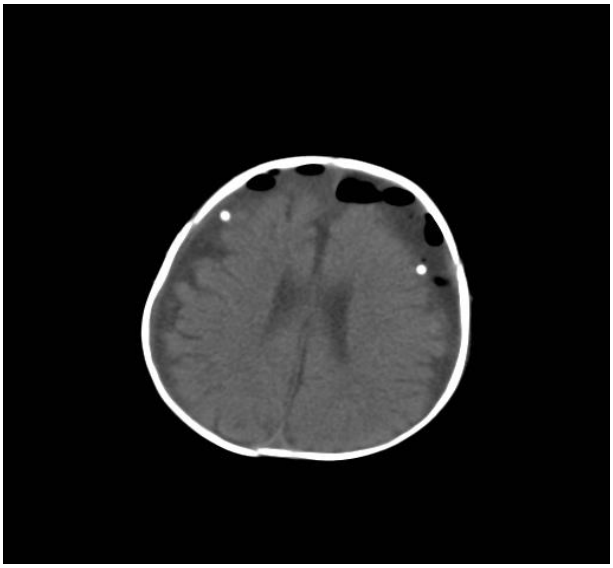

Fig 2: Postoperative CT scan in axial plane showing bilateral subdural drains

Intravenous antibiotic therapy was maintained during six weeks. MRI one month upon completion of treatment showed complete resolution of empyemas (Fig 3).

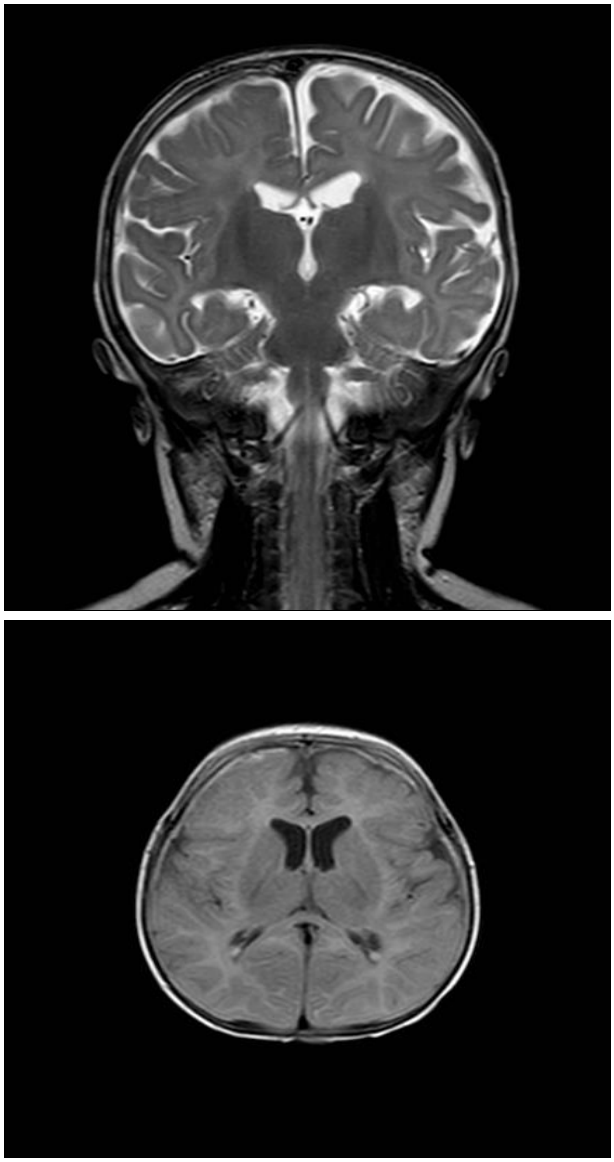

Fig 3: 4A y 4B: MRI three months after surgical evacuation and subdural Gentamicin administration, showing complete empyemas resolution with adequate brain re-expansion

Six months after surgeries, the patient presents is doing well without neurological deficits and no evidence of seizures on antiepileptic treatment. He presents a simple delay in motor skills development as well as postural plagiocephaly, treated with cranial orthosis.

Discussion

Subdural administration of antibiotic therapy was paramount to achieve the resolution of intracranial infection in our case. Intrathecal antibiotic therapy is usually performed by lumbar puncture or through ventricular drains. Available information in the literature about safety and efficacy of these procedures is limited [1, 10], with few studies available determining therapeutic efficacy and dose to be administered [2, 6, 7, 8]. Multiple antibiotics have demonstrated safety for intrathecal administration [2, 6, 8)] including Vancomycin, Teicoplanin, Amikacin and Gentamicin. Intrathecal aminoglycosides are increasingly used in intracranial infections management [3, 9].

Subdural empyemas constitute approximately 20% of total intracranial infections [4, 11]. Management of subdural empyema is usually performed by surgical evacuation of the collection according to clinical and radiological criteria, in addition to targeted intravenous antibiotic therapy. Mortality of this pathology has decreased since introduction of antibiotics, being around 14-28% at the present time [4].

Subdural empyema in children can be a life threatening entity if not handled properly [14]. Conservative management is recommended with intravenous antibiotic therapy if there is no neurological deficit or changes in the level of consciousness. Otherwise, evacuation by craniotomy or burr holes is mandatory [5, 12, 13, 14].

Subdural drains placement is a common practice to contribute to evacuation of remaining purulent collection; however, antibiotic administration through drains has not been previously reported in pediatric patient, to our best knowledge.

In our case, once the infection was confirmed, we decided to reopen the burr holes instead perform bilateral craniotomies given the aggressiveness of the latter to give a chance to the first option. We decided to place bilateral drains to allow evacuation of the remaining collection and to administrate Gentamicin with the aim to try to help to the resolution of the infection.

Subdural antibiotic therapy

In this case, Gentamicin diluted in saline was administered at a concentration of 1 mg / 50 ml.

The daily dose administered was 2 mg diluted in 20 ml of saline every 24 hours for five days. Drains were closed for one hour after antibiotic was applied (Fig 4). After this time, drains remained open without aspiration to favor the evacuation of remaining empyema.

Fig 4: Intensive Unit Care. Administration of Gentamicin through subdural drains

In this case, Gentamicin administration by subdural drains was a safe and effective practice in the management of the infection, so we consider that it may probably be useful in certain properly selected cases.

Conclusion

Subdural empyema in pediatric age can be a life threatening entity if not handled properly, requiring neurosurgical, intensive and multidisciplinary management.

Despite limited experience and evidence regarding administration of subdural antibiotic therapy as part of subdural empyema treatment, this practice may be beneficial in properly selected patients in addition to surgical management and intravenous antibiotic therapy. In this case, resolution of the infection was achieved once this treatment was started.

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Conflict of Interest

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Patient Consent

The patient's tutor has consented to the submission of the case report for submission to the journal.

Ethics approval

An institutional review board (IRB) has approved the present study.

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