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ORIGINAL ARTICLE

Superiority of Bone Flab over Burr Hole in Management of Acute Pediatric Subdural Empyema.

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ABSTRACT

Background: Intracranial infectious suppurative lesions are serious and life-threatening conditions that are difficult to diagnose. Contrast-enhanced CT scan is the gold standard method for the diagnosis of subdural empyema. The two most surgical procedures that have been conducted for SDE are craniotomy and burr holes.This study aims to present the advantages of bone flab in the management of acute subdural empyema based on our institution's experience.**Methods**: This is a retrospective study conducted at Benha university, Department of neurosurgery. The study duration was from January 2019 to December 2020. **Results:** There were 9 males and 24 females, with ages ranging from 6 months to 12 years (mean 9 years). Their mean hospital stay was 11 days. The surgical approaches used in this work were burr holes in 12 out of 33 patients while in 21 patients we did full wide craniotomy. The size of the evacuated empyema ranged from 40 to 80 cc calculated by the radiology specialist as it couldn't be collected and measured intraoperatively. **Conclusions:** Empyema is a medical emergency that mandates urgent surgical evacuation. Craniotomy may have superiority over burr hole evacuation to prevent residual or recurrence.

Keywords: Bone Flab, Intracerebral Suppurative Infections, Acute Subdural Empyema.

INTRODUCTION

Intracranial infectious suppurative lesions are a serious and life-threatening condition that is difficult to diagnose and can have serious long-term morbidity and even mortality if not diagnosed and managed appropriately and as early as possible. When present, no age is immune as they are found in adolescents and children with no age privilege. [1,2] Subdural Empyema (SDE) can occur anywhere in the subdural space where it can be classified into supra-tentorial, infra-tentorial, or spinal. [3]

Probable causes may be trauma, neurosurgical procedures, hematogenous [2], and contiguous spread of infection from neighboring areas [3]. The mortality is related to the late time of diagnosis and is nearly about 10%. More than half of patients experience neurological deficits and fits (4]. The patients are present with headaches, fever, nausea, neurological deficits, and seizures. [5]

Contrast-enhanced CT scan is the gold standard method for the diagnosis of subdural empyema where the empyema may be manifested by a hypodense area over the hemisphere or along the falx. The margins are better delineated with the infusion of contrast material MRI also has a nice capability for diagnosis and delineation of the extent of damage Magnetic resonance imaging (MRI) has a sensitivity of 93%. Diffusion-weighted imaging (DWI) can be used to monitor antibiotic therapy. [5]

Conservative treatment is indicated when empyema is localized and limited in locations other than the posterior fossa along with no focal neurological deficits. However, this approach with variable duration of antibiotic administration will need continuous follow-up for the SDE through frequent imaging. One of the practical examples recommends starting with the intravenous route for at least 14 days followed by 45 days of oral therapy

for up to 60 days If osteomyelitis concurs with SDE. [6]

The surgical procedures that have been described to manage SDE are either craniotomy or burr holes. The Burr hole technique has many disadvantages being associated with a higher recurrence rate of SDE due to incomplete evacuation of the SDE as well as it is not optimal for multi-loculated subdural collections. On the other hand, a craniotomy is considered the technique of choice where it provides complete evacuation of the empyema for both eradication of the lesion and decompression of the underlying brain. [7] Ramamurthi et al., documented that the mortality rate was 28% among patients with SDE, where it dropped to 23.3 % if the burr holes technique is performed and significantly reduced to 8.4: 11.5 % if craniotomy is done. [3]

PATIENTS & METHODS

This is a retrospective study conducted at Benha university, Department of neurosurgery. The study duration was from January 2019 to December 2020. The study was conducted as per our institutional ethics. and approved by our ethical committee. Children up to 16 years of age with a diagnosis of pyogenic SDE were included in the present cohort study .

For comprehensive analyses during chart review, special attention was directed to the following:

Demographic data (age, sex), etiology related (otogenic and nonotogenic), clinical data (Glasgow Coma Scale (GCS) score, seizure), duration of symptoms (≤ 7 days and > 7 days), radiological features, site (right and left), compartment (convexity, interhemispheric, and both), microbiology(gram-positive and gram-negative), results of routine laboratory studies, the technique used for surgery(craniotomy and burr holes), postoperative complications as well as the presence of recurrence as an indicator for the outcome .

Craniotomy was used to describe a technique in which a bone flap was elevated, and subdural space was exposed. The outcome was reviewed and classified into favorable outcomes, i.e., GOS score of 5 or 4 (good recovery and moderate disability), and unfavorable outcomes, i.e., GOS score 1–3 (death, vegetative state, and severe disability). Statistical analysis was performed to determine the effect of previous variables on survival .

Written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Benha University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

STATISTICAL ANALYSIS

The collected data were coded, processed, and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA).

RESULTS

There were 9 males and 24 females, with ages ranging from 6 months to 12 years (mean 9 years). Their mean hospital stay was 11 days. The duration of symptoms varied from 5 days to 2 months (mean 33 days). The commonest etiological factor was thought to be otitis media as 8 of 11 patients had a history of OM. Diagnostic CT scan was the diagnostic procedure in all patients while MRI was done in some patients .

All, except 6 patients, received a combination of more than 2 antibiotics. However, the remaining 27 patients received 2 antibiotic regimens. Antibiotics were frequently changed depending upon the sensitivity report of the organisms cultured from the pus. The surgeons tried to irrigate the empyema cavity with antibiotics in 3 patients and a drainage tube was inserted for 2 days in 5 patients.

The surgical approaches used in this work were burr holes in 12 out of 33 patients (fig. 1&2) while in 21 patients we did full wide craniotomy (fig. 3&4). The size of the evacuated empyema ranged from 40 to 80 cc calculated by the radiology specialist as it couldn't be collected and measured intraoperatively. 3 out of 33 evacuated empyema` recurred and required evacuation. We didn't record any mortality in our 33 cases. All except 2 cases had no post-operative deficit while in these 2 cases weakness persisted despite the total successful evacuation of the empyema .

Table 1: Lumbar CSF Findings.

_ Increased white blood cell count (predominantly polymorphonuclear neutrophils). A significant increase (>50/mL) may be seen, although a slightly elevated cell count of 5–20 mL (reference range, 0–5/mL) does not rule out the possibility of SDE.
_ Increased protein level greater than 100 mg/dL may be seen (reference range, 20–40 mg/dL), although less substantial elevations (50–90 mg/dL) do not rule out the possibility of SDE.
_ Decreased glucose levels of 40 mg/dL (reference range, 50–80 mg/dL) or less usually are seen. The CSF glucose levels should be normalized with a blood glucose level obtained concurrently.
_ Occasionally, the CSF is normal and sterile in these cases.

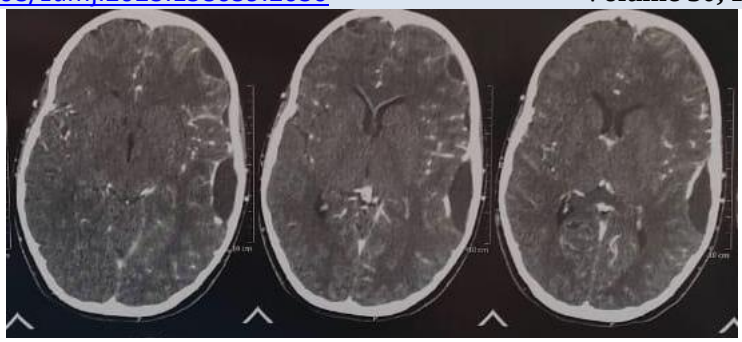

Fig.1: Preoperative CT brain with contrast, axial views show Lt temporal encysted extra-axial collection of hypodense fluid with enhanced wall.

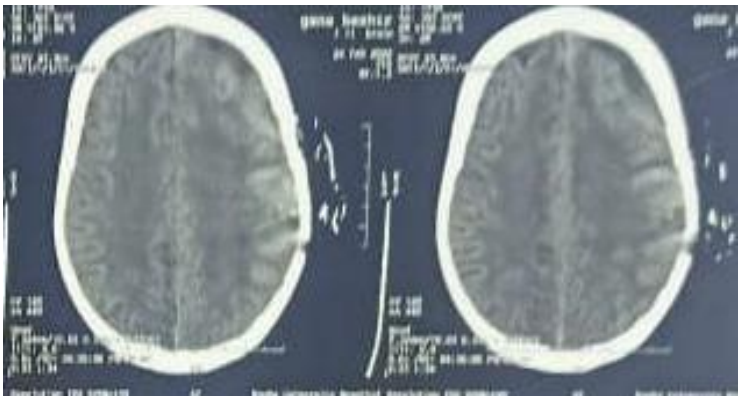

Fig.2: Postoperative CT brain, axial views show evacuation of the collection through left temporal burr hole.

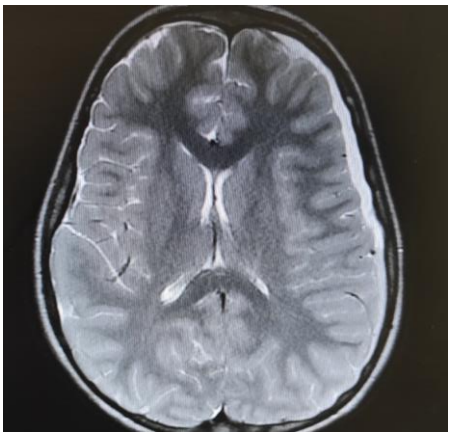

Fig.3: Preoperative MRI brain with contrast, axial views show Lt fronto-temporal subdural collection.

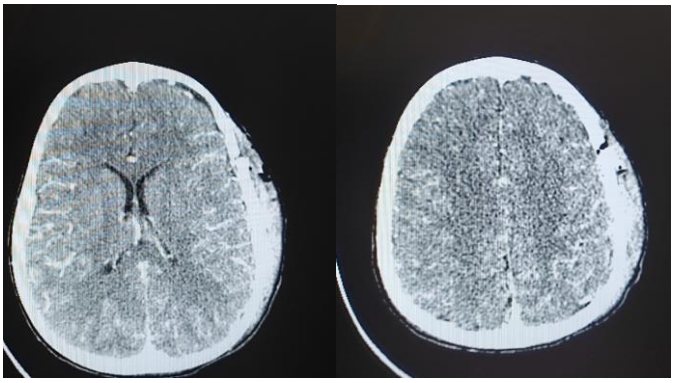

Fig.4: Postoperative CT brain, axial views show evacuation of the collection through left tempro-parietal bone flab.

DISCUSSION

Intracranial infectious suppurative lesions are serious and life-threatening are difficult to diagnose and can have serious long-term morbidity and even mortality if not diagnosed and managed appropriately and as early as possible. When present, no age is immune as they are found in adolescents and children with no age privilege. [1,2]

Probable causes may be trauma, neurosurgical procedures, and the hematogenous and contiguous spread of infection from neighboring areas. The patients present with headaches, fever, nausea, neurological deficits, and seizures. Contrast-enhanced CT scan is the gold standard method for the diagnosis of subdural empyema, MRI also has a nice capability for diagnosis and delineation of the extent of damage.[6]

SDE may develop in 39-60% of patients with pyogenic meningitis, compared to only 1-2% in patients with bacterial meningitis. [8] SDEs constitute 15-25% of pyogenic intracranial infections [9] with male predominance compared to females. [6] The mortality – if present – is related to the late time of diagnosis and is nearly about 10%. More than half of patients experience neurological deficits and fits. [4]

SDEs can be associated with other suppurative lesions like extradural collection, brain abscess, or osteomyelitis. [10] Intracerebral suppurative infections especially meningitis can cause most SDE in children and infants. [8] However, in older children, otitis media and chronic sinusitis are the most common causes. [11] If the source of SDE is sinusitis, then the frontal sinus is the most common culprit followed by the ethmoid, sphenoid, and maxillary sinuses. [2] Where the infection can spread from the paranasal sinuses via either bone erosion (direct route) or the hematogenous (indirect) route to reach the subdural space. [10] Other iatrogenic causes of SDE are drainage of subdural hematoma, craniotomy, and intracranial pressure monitoring. [12] Lumbar punctures can be a cause of spinal SDE. [3]

Seizures disturbed conscious levels, and /or signs and symptoms of intracranial pressure may be the clinical presentation in young children with SDE. [6]

Clinical manifestations of patients with SDE due to sinusitis have a wide range of clinical nonspecific presentations like fever, headache, and purulent rhinorrhea (typical symptoms of sinusitis) [2] which precede the diagnosis of SDE by a period range from 2: 6 weeks. Extracranial manifestations such as peri-orbital edema, proptosis, facial swelling, diplopia, or pain when moving the extraocular muscles are associated with (37%) of patients with SDE.[12]

Different pathogens depending on the route of the infection and the age of the patient can cause SDE such as Enterobacteriaceae, Group B streptococci, or Listeria monocytogenes which cause SDE in neonates. [11] Streptococcus milleri is the most common pathogen of SDE due to sinusitis. [2] S. aureus, S. epidermidis, and Enterobacteriaceae are acquired in cases of trauma. [11]

Wu et al documented that the most common organism is Streptococcus pneumoniae (16.1%), followed by group B Streptococcus (12.9%), Haemophilus influenzae type b (12.9%), Salmonella spp. (12.9%), Escherichia coli (9.7%) and Pseudomonas aeruginosa (9.7%). [13] Mycobacterium tuberculosis SDE was also reported in some cases. [14]

Reports mentioned that co-infection of either Streptococcus intermedius with Streptococcus pneumonia [15] or Streptococcus constellatus with Actinomyces viscosus can exist in some patients. [16]

Bacterial meningitis can be the major source of SDE in infants meanwhile CSF sample (Table 1) with culture is the "gold standard" for the diagnosis in such cases. [17]

CT brain scans are accessible and cost-effective and are considered the modality of choice if the patient is comatose or critically ill. High-resolution, contrast-enhanced CT scanning is the standard technique for quick and noninvasive diagnosis of SDE. However, Non-enhanced CT alone lacks sensitivity, it can be misleading or false negative in up to 50% of patients with SDE. When using CT as an imaging modality, SDE will appear crescentic in shape over the cerebral convexity with a surrounding rim that is enhanced with the use of contrast. [2,19]

Magnetic resonance imaging (MRI) has a sensitivity of 93% [12] while diffusion-weighted imaging (DWI) can assist in antibiotic therapy monitoring. [18]

Conservative treatment is indicated when patients have no neurological deficits, no mental status affection, and empyema is limited and localized except in the posterior fossa however, following the conservative approach will require frequent imaging to follow up on the SDE. [6] The antibiotics protocol should be chosen after culture identification and sensitivity. [8] Oxacillin plus ceftriaxone/cefotaxime plus metronidazole are recommended when the organism is unknown. Vancomycin instead of oxacillin is advised if

methicillin-resistant strains for S. aureus, are suspected [6] Linezolid is an alternative treatment in case of conventional antibiotic regimen failure. [9] High intracranial pressure should be managed through elevation of the head, mannitol, or ventriculostomy. [12] Anti-convulsions medications should be used as prophylaxis owing to the high rate of seizures associated with SDE. [12] Failure of conservative management clinically or radiographically, indicates that neurosurgical intervention is required. [20] The most common surgical procedures that have been performed for SDE are craniotomy and burr holes. Burr hole compared to craniotomy has a higher rate of SDE recurrence [3,7,21,22,23,24] However, Liu et al., in their study showed that there was no difference between the two procedures in terms of recurrence rate, antibiotic therapy duration, neurological outcome, and complications. [8]

A craniotomy (fig. 3&4) is considered the technique of choice because it allows complete evacuation of the empyema, and decompression of the underlying brain, However, injury of the bridging veins might be a complication of this procedure. There are situations where burr holes (fig. 1&2) are recommended over craniotomy like patients with septic shock or with parafalcine empyemas. [3,7]

percutaneous needle aspiration of SDE via the fontanelle in infants or Functional endoscopic sinus surgery (FESS) may help in the drainage of the SDE. [12] The idea of Hollow screws for both diagnosis and treatment of SDE is supported by Aldinger et al., especially when CT and MRI studies are inconclusive. [18]

CONCLUSION

Empyema is a medical emergency that mandates urgent surgical evacuation. Craniotomy may have superiority over burr hole evacuation to prevent residual or recurrence.

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