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Case Review

Bacterial Infections of the Central Nervous System in Pediatric Intensive Care Unit: A Case Series

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ABSTRACT

Bacterial infections of the central nervous system (CNS) are considered serious infections and medical emergencies in children, requiring immediate treatment and diagnosis by clinical diagnosis and laboratory and radiological investigation. Acute bacterial meningitis, subdural empyema, intracerebral abscess, and ventriculitis are the most common central nervous system (CNS) bacterial infections admitted to the pediatric intensive care unit, with a 30% mortality rate and neurological disabilities impacting one-third of survivors. In this case series, we reveal two pediatric patients admitted to the intensive care unit at Benghazi Hospital. The first case is a 10-year-old girl with uncorrected cyanotic congenital cardiac disease, and she presented with a history

of fever, headache, and left-side hemiparesis. A computerized tomography scan of the brain (CT) revealed a large brain abscess that was treated with intravenous antibiotics and brain abscess drainage by a neurosurgeon. The second patient, a 9-year-old girl admitted with a history of fever, headache, photophobia, and meningeal signs, had been diagnosed with pyogenic meningitis by cerebrospinal examination (CSF) complicated by epidural empyema. Both patients' signs and symptoms improved significantly, and both were discharged from the hospital with no neurological deficit. The purpose of presenting this case is to emphasize the importance of early diagnosis and treatment of intracranial infections to prevent major consequences resulting in childhood mortality and morbidity. Healthcare professionals have to maintain a high index of suspicion for the diagnosis of such serious infections in children, as well as the importance of a multidisciplinary team in the diagnosis and management of such patients.

KEYWORDS: Congenital Heart Disease, Brain Abscess, Subdural Empyema.

INTRODUCTION

Bacterial infections of the central nervous system are considered a medical emergency, necessitating immediate treatment and diagnosis. Acute bacterial meningitis, subdural empyema, intracerebral abscess, and ventriculitis are the most common CNS bacterial infections admitted to the pediatric intensive care unit. Infections can be acquired in the community or the hospital following neurological interventions, as a result of neurotrauma, or as a consequence of ventriculostomies. Epidural and subdural empyema are rare intracranial infections that occur as a consequence of Pyogenic bacterial meningitis in children, Brain abscesses are frequently associated with local or metastatic infection sites such as infective endocarditis, mastoiditis, sinusitis, and pneumonia (Pandian et al.2000). Clinical signs of CNS infection include fever, cognitive impairment, (convulsions, and neurological deficiencies (Ashraf et al.2017). A brain abscess, which can affect 5% to 18.7% of people with CHD, is an uncommon but serious infection of the brain parenchyma (Lakhan et al.2020). The main risk factors involve chronic hypoxia, resulting in polycythemia, hyperviscosity, an increased risk of thromboembolic emboli, and poor host immunity. Delays in surgical correction of congenital heart disease put children at increased risk of having adverse neurological consequences, including brain abscesses, in developing countries, including Libya. Infections of the central nervous system (CNS) are a leading cause of mortality and morbidity in children, with a 30% mortality rate and neurological disabilities impacting one-third of survivors. In CT and MRI, IV contrast is applied to improve imaging sensitivity and specificity, which is frequently helpful for identifying lesions to minimize the differential diagnosis.

Antibiotic treatment is determined by local epidemiology and regional antibiotic resistance patterns among common: organisms and the result of culture (Joshi et al.2020). These case series aim to emphasize the importance of early diagnosis and treatment of intracranial infections to prevent major consequences resulting in childhood mortality and morbidity and the importance of a multidisciplinary team in the diagnosis and management of such patients.

MATERIALS AND METHODS

Case Report (1)

A 10-year-old girl was admitted to the pediatric intensive care unit of a pediatric hospital in Benghazi with complaints of low-grade fever, headache, and left-side weakness. She was diagnosed with complex congenital heart disease in infancy and had no surgical repair because cardiac surgery financial resources were not available.

The patient had a significant history of fever, headache, and weakness in the left side of the body. However, there was no history of any previous medication or surgery. On general examination, there is clubbing and cyanosis

were present. His temperature was 38 ◦C, pulse rate 106 beats/minute; blood pressure was 100/75 mmHg, and respiratory rate of 25 breaths/ minute, and his SpO2 was varying in between 60%–65% in room air. There were no obvious peripheral signs of infectious endocarditis in the patient. On cardiac examination, a grade 3/6 ejection systolic murmur was present at the left upper sternal border.

Patient was unwell, alert, and had left-sided hemiparesis. The rest of the systemic exams were normal. Her laboratory tests indicated that she had a hemoglobin of 13 g/dl and a hematocrit of 63% showing that she has polycythemia.

The total leukocyte counts wa14 with neutrophils accounting for 70 %. The underlying bacteria was Staphylococcus aureus identified by the culture of pus from the abscess. Illustration of Echocardiography Sever pulmonary stenosis with large ventricle septal defect with AV-discordance and VA discordance with double outlet left ventricle with no vegetation. A contrast-enhanced computed tomography (CT) scan of the brain showed a well-defined right temporal ring-enhancing lesion, supporting the diagnosis of a brain abscess fig (1).

The patient was treated for weeks with intravenous antibiotics (Vancomycin, Meropenem), and intravenous metronidazole with draining of the brain abscess by a neurosurgeon.

The patient's symptoms improved significantly, and then she received her discharge. After one month of monitoring, there were no neurological deficits, and the patient fully recovered. After six months after her discharge, she underwent cardiac surgery For her cardiac lesion with no residual neurological deficits or convulsion, she waiting for the next cardiac surgery.

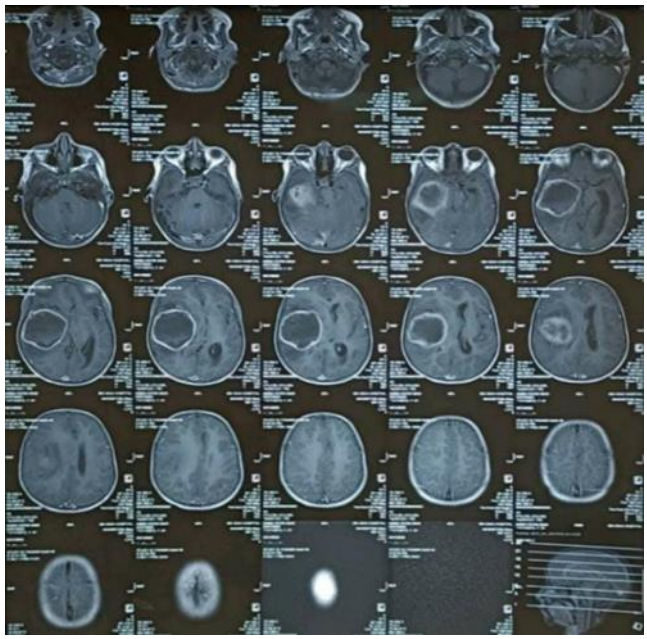

Figure (1) Brain CT with contrast well-defined right temporal ring-enhancing spaced occupied lesion.

Case Report (2)

A 10-year-old girl presented to the pediatric outpatient clinic of a pediatric hospital in Benghazi complaining of a low-grade fever and

headache for the previous two days. No history of runny nose or cough. At admission, she was ill, weak, and febrile, with positive meningeal signs, normal ear examination, and no skin rash with no neurological deficit.

The total leukocyte count was 20, with neutrophils accounting for 80%, CRP 200, WBC in cerebrospinal fluid (CSF) 50, and no bacterial growth in CSF and blood culture. The MRI brain shows subdural empyema. She was treated with IV vancomycin in combination with Meronem and Metronidazole.

Patient showed clinical improvements and received her discharge from the hospital after a month. (Fig 2,3).

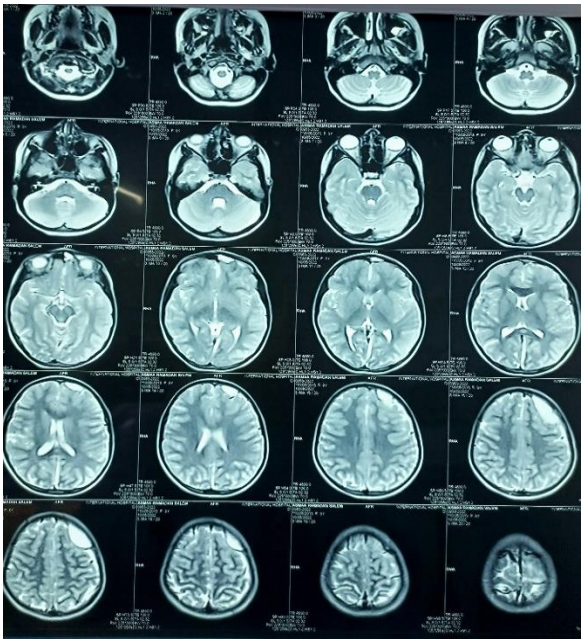

Figure:(3). MRI subdural empyema with no midline shift

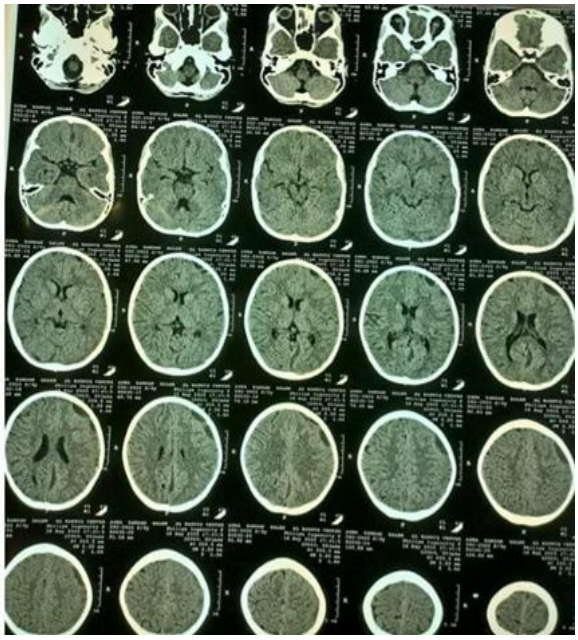

Figure :(3). MRI show resolved of empyema

RESULTS AND DISCUSSION

In the first case with cyanotic complex CHD in developing countries when congenital heart disease surgery is delayed, cerebral abscess, which is typically thought of as an infectious condition, is expected to be more common Several factors lead to the occurrence of a brain abscess in CCHD patients (Prasad et al.2020) .

Alveolar phagocytes do not filter the blood in these patients as it bypasses the pulmonary circulation. This raises the risk of infectious microorganisms reaching the brain's circulation. This, along with the fact that the brain is hypo-perfused as a result of severe hypoxemia and metabolic acidosis resulting from secondary polycythemia, allows microorganisms to colonize the under-perfused sites. The brain abscess is commonly associated with hematogenous dissemination from a distant source. Streptococcus miller was the most prevalent microorganism in children with cyanotic congenital heart disease (52%) and Brain abscess diagnosis was confirmed by computer tomography (Mehnaz et al.2006) . In our hospital, we utilized both brain CT and MRI for the diagnosis of intracranial infection.

(Pandian et al.2000). Staphylococcus aureus reported in our patient is one of the common organisms of infective endocarditis and also a Reported case of brain abscesses. The patient should be administered appropriate antibiotic therapy that targets the organism detected by culture. Larger abscesses should be aspirated immediately (Nasir Ahmad et al.2018) . Subdural empyema is an unusual complication of bacterial meningitis, Early suspicion of empyema should be considered when a patient fails to improve after 48 hrs. and early appropriate intravenous antibiotics mean that the patient fully recovered. Both patients were treated with antibiotics in addition to surgical drainage of a big abscess in the first case. In most pediatric hospitals with intensive care units, they utilize magnetic resonance imaging (MRI) or computed tomography (CT) in the diagnosis and follow-up of children with an intracranial bacterial infection.

CONCLUSION

Bacterial Infections of the Central Nervous System in pediatric treatment options include medication and surgery. Surgical therapy includes puncture and draining of the abscess. Since that brain abscess complicates uncorrected cyanotic congenital cardiac diseases, healthcare professionals have to maintain a high index of suspicion and manage a case of CHD-related brain abscess to avoid unnecessary delays in diagnosis and therapy which result in high mortality and morbidity rates and the importance of a multidisciplinary team in managing such patients.

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I would like to express my appreciation to the laboratory staff, doctors, and nurses who work at the intensive care unit at Benghazi Children's Hospital for their roles in saving the lives of these two children

ETHICS

The hospital's ethical committee provided clearance and agreement to publish these cases and the family of the patients provided their permission to use the images and other details in publications.

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الملخص

تُعدّ العدوى البكتيرية للجهاز العصبي المركزي من الحالات الخطيرة والطارئة لدى الأطفال، وتتطلب علاجًا وتشخيصًا فوريًا من خلال الفحص السريري والفحوصات المخبرية والشعاعية. يُعدّ التهاب السحايا البكتيري الحاد، والتهاب السحايا القيحي تحت الجافية، وخراج الدماغ، والتهاب البطينات الدماغية من أكثر أنواع العدوى البكتيرية شيوعًا التي تُدخل الأطفال إلى وحدة العناية المركزة، حيث تصل نسبة الوفيات إلى 30%، ويُصاب ثلث الناجين بإعاقات عصبية. في هذه الدراسة، نعرض حالتين لطفلين أُدخلا إلى وحدة العناية المركزة في مستشفى بنغازي. الحالة الأولى لطفلة تبلغ من العمر 10 سنوات، مصابة بمرض قلبي خلقي زرقي غير مُعالج، وقد حضرت إلى المستشفى وهي تعاني من الحمى والصداع وشلل نصفي في الجانب الأيسر. كشف التصوير المقطعي المحوسب للدماغ عن وجود خراج دماغي كبير، عُولج بالمضادات الحيوية الوريدية وتصريف الخراج الدماغي على يد جراح أعصاب. المريضة الثانية، وهي فتاة تبلغ من العمر 9 سنوات، أُدخلت إلى المستشفى بعد معاناتها من الحمى والصداع وحساسية الضوء وعلامات التهاب السحايا، وشُخِّصت إصابتها بالتهاب السحايا القيحي عن طريق فحص السائل النخاعي، والذي تعقد بوجود خراج تحت الجافية. تحسنت أعراض المريضتين بشكل ملحوظ، وغادرتا المستشفى دون أي عجز عصبي. يهدف عرض هذه الحالة إلى التأكيد على أهمية التشخيص والعلاج المبكرين للعدوى داخل الجمجمة للوقاية من المضاعفات الخطيرة التي قد تؤدي إلى وفيات وامراض فى الأطفال. يجب على العاملين في مجال الرعاية الصحية توخي الحذر الشديد عند تشخيص مثل هذه العدوى الخطيرة لدى الأطفال، بالإضافة إلى أهمية وجود فريق متعدد التخصصات في تشخيص وعلاج هؤلاء المرضى.

الكلمات المفتاحية: أمراض القلب الخلقية، خراج الدماغ، خراج تحت الجافية.