INTRODUCTION

Brain abscess is defined as a localized collection of pus within the brain parenchyma. It starts as localized area of cerebritis, followed by formation of pus that is surrounded by a capsule. Infectious process that affects CNS, may threaten vital neurological functions and even life as well. The prognosis of these patients has improved over the past 25 years, largely as a result of technological advances in diagnostic and treatment modalities as CT and MRI. However, in spite of these advances, CNS infections still lead to neurological morbidity and mortality.

In patients with cyanotic heart disease, there is a right-to-left shunt of venous blood in the heart, thus the blood bypasses pulmonary circulation. This leads to blood being not passing and filtering through the pulmonary circulation. So, microorganisms in this blood are not filtered and removed by phagocytosis in pulmonary circulation. Patients with cyanotic heart disease usually have low-perfusion areas in the brain because of chronic severe hypoxemia and metabolic acidosis along with increased viscosity of blood due to secondary polycythemia. These low-perfusion areas, present at the junction of gray and white matter of brain, are invaded by microorganisms present in the bloodstream. Abscess formation starts at subcortical location as the mode of spread is hematogenous. Sometimes, it may be deep seated near the ventricular system and multiple as well. The abscess has ring enhancement on contrast enhanced CT scan due to breakdown of blood brain barrier along with hyper vascularity of granulation tissue of affected part of brain. Compromised cardiopulmonary status of patients with cyanotic heart disease along with variety of coagulation defects make them poor candidates for extensive surgical procedures and prolong anesthesia. Such patients can be managed by minimal access surgical technique of aspiration of abscess through a burr hole. Burr hole is made at Kocher's point for abscess in frontal and temporal region, at Keen's point for parietal region and at Frasier's point for occipital region.

The objective of the present study was to determine the efficacy of burr hole aspiration of brain abscess in children with cyanotic heart disease in terms of number of aspirations and residual abscess.

METHODOLOGY

It was an experimental study prospectively conducted in the Department of Pediatric Neurosurgery at The Children's Hospital and Institute of Child Health, Multan.
Children's Hospital and The Institute of Child Health, Multan, from July 2010 to June 2014 after approval from the Institutional Ethical Committee. All the patients having brain abscess with cyanotic heart disease were admitted through outpatient department or referred from department of cardiology of this hospital. After taking history and clinical examination, necessary investigation like complete blood cell count, viral marker for hepatitis B and C, PT, APTT, echocardiography and CT scan brain both plain and with contrast were performed. Mannitol (20%) was given intravenously, if signs of raised intracranial pressure were present.

Surgical intervention was planned in those patients having brain abscess with size more than 2 cm, mass effect, neurological deficits or any signs of raised intracranial pressure, and these patients were included in the study. Cases where abscess size was less than 2 cm without mass effect, treated without surgical interventions, were excluded.

Patients were assessed for fitness for general anesthesia and surgical intervention. Pus was aspirated through a burr hole at appropriate site with brain cannula, and sent for culture and sensitivity. In case of multiple abscesses, only larger size abscesses were aspirated. Intravenous benzyl penicillin (2-5 lac Int. Units/kg/QID), ceftriaxone (150-200 mg/kg/TDS) and metronidazole (1.5ml/kg/TDS) were started initially and changed according to culture and sensitivity report of pus later on. Check scan was performed next postoperative day (Figure 1A). Re-aspiration was performed in case of residual pus next day. Same procedure was repeated in case of residual abscess again and if clinical features of recollection of abscess appeared during the course of therapy. Intravenous antibiotics were continued for 4 to 6 weeks and shifted to oral rout for another 4 to 6 weeks depending upon clinical and radiological response. Follow-up CT scan was obtained at the completion of therapy routinely and in between, if required (Figure 1B).

Data collected on a pre-designed proforma and analyzed through statistical package for social sciences (SPSS-20). Nominal variables such as gender, number of complete aspiration and residual abscess and pus culture were presented in frequency and percentage and continuous variable which was the actual age of the patients presented as mean and standard deviation. The results were compared with national and international literature.

**RESULTS**

The total number of patients were 50, in which 31 (62%) were male and 19 (38%) were female with male to female ratio 3:2. Patients' age was ranging from 5-10 years with a mean age 7.44 ±1.11 years. The majority of the patients 36 (72%) were in the age group of 7-8 years (Table I).

Single abscess in supra tentorial region was found in 44 (88%) patients. Frontal lobe was involved in 28 (46%) patients, temporo-parietal 14 (28%), occipital lobe 2 (4%). Multiple abscesses were present in 4 (8%) patients. Cerebellum was involved in 2 (4%) patients. Abscess was completely aspirated in single attempt in 37 out of 50 (74%) patients, two attempts in 9 out of 13 (70%) patients, and three attempts in 4 out of 4 (100%) patients (Table II).

No bacterial growth on culture was reported in 32 (64%) patients. Culture was positive in 18 (36%) with *streptococcus milleri* in isolated 09 (18%), *staphylococcus aurous* in 6 (12%), and *E.coli* in 03 (6%) patients. Postoperative hematoma developed in 2 (4%) patients. No mortality was reported in early post-operative period.

**DISCUSSION**

Patients with congenital cyanotic heart disease having a right-to-left shunt are at risk to develop brain abscess. Patients with cyanotic heart disease accounts for upto 70% of all cases of brain abscesses and the incidence reported is more in children. Cyanotic heart disease is one of the most commonly identified risk factors for development of brain abscess even in developed nations as well. Overall incidence of brain abscess in patients with cyanotic heart disease has been reported upto 20%. Causes of congenital cyanotic heart disease are multiple, out of which tetralogy of Fallot is the most common cardiac anomaly associated with brain
abscess. Other reported predisposing factors are ventricular septal defect, atrial septal defect, patent ductus arteriosus, transposition of great vessels and pulmonary stenosis. Location-wise these abscesses are mostly supra-tentorial.

This study revealed that the disease is more common in male child and majority of the cases with tetralogy of Fallot. Similar findings of male preponderance with male to female ratio of 2:1 has been reported in other studies conducted by Tan et al. and Jafri. These patients are suboptimal candidates for major surgical procedure and prolonged anesthesia due to compromised cardio-pulmonary system and multiple coagulation defects.

Aspiration of abscess through burr hole is minimal invasive procedure and requires short time for anesthesia. In this study, same method was adopted and provided good results. Abscess was completely aspirated in single attempt in 37 (74%) patients. Incomplete aspiration in the form of residual abscess was in 13 (26%) patients. Out of these 13 residual abcesses, 9 (69%) patients were cured on second attempt re-aspiration. Residual abscess was still present in 4 (31%) patients which were completely aspirated on third attempt. In case of multiple abscesses, only the larger one was aspirated.

Culture was positive in 18 (36%) patients. Streptococcus milleri was most common organism followed by Staphylococcus aureus and E. coli. Streptococcus milleri was the commonest organism isolated from pus in other studies conducted by Atiq et al. and Sineviratne et al. Staphylococcus aureus was the commonest organism reported by Bhand. Surgical intervention is required for abscesses more than 2 cm in diameter, causing mass affect and present in eloquent areas of the brain. Surgical intervention can be in the form of aspiration or excision. Excision is a major surgical intervention requiring craniotomy and long general anesthesia which have their own complications, especially in children with congenital cyanotic heart disease. While aspiration is less invasive technique performed through a burr hole in short duration of anesthesia and is a preferred technique reported by Barlas. The authors used the same technique in this study with good results.

Postoperative hematoma developed in 2 (4%) patients. No mortality was reported in early postoperative period upto three months. In one series, the mortality rate following craniotomy and excision was as high as 71%.

Prusty has reported that even with aspiration, nearly 17% of patients can develop cyanotic spells that could lead to life-threatening complications.

CONCLUSION

Burr hole aspiration of brain abscess in children with cyanotic heart disease is a successful and relatively safe procedure. It yields good results with less morbidity and mortality.