ORIGINAL ARTICLE

Management Options of Brain Abscess in Children with Cyanotic Heart Disease (CHD), Craniotomy vs Burr hole in a Developing Country

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ABSTRACT

Objective: The aim of our study was to compare the advantages and disadvantages of burr hole and craniotomy methods in management of brain abscess in children secondary to cyanotic congenital heart disease (CHD). The parameters used to compare these two methods were outcome of the treatment, improvement of Glasgow coma score, CT appearance of abscess and re-operation.

Materials and Methods: Retrospective study was conducted over 6 year's period. A total of thirty three (33) paediatric patients were included in this descriptive study which was carried out in the Neurosurgery Department of Foundation University Medical College Rawalpindi, Pakistan from June 2003 to May 2009. Patients having the following criteria were selected for burr hole procedure: Intracranial abscess in patients of congenital heart disease, no previous surgical intervention, Patient's history and CT brain films available. Following patients were excluded from the study; postoperative, post traumatic and fungal abscess, age more than 15 years old and abscess less than 25mm

Patients having low risk of anaesthesia and absence of above mentioned risk factors were selected for craniotomy and excision.

Results: Our study results showed that patients who underwent the burr hole aspiration of abscess had a decreased mortality, shorter hospital stay, significant improved progress in neurological and radiological status as compared to craniotomy and excision group.

Conclusion: Our study results suggested that burr hole aspiration is more efficient procedure as compared to craniotomy in terms of surgical intervention and postoperative outcome in a selected group of brain abscess in patients with CHD. It is also a cost effective procedure.

Keywords: *Burr hole aspiration, craniotomy, congenital cyanotic heart disease Brain abscess.*

Introduction

The under-develop countries have a higher incidence of brain abscess in children as compared to developed countries.[1,2] Although brain abscesses don't occur frequently but are always challenging for the pediatric neurosurgeon.[3,4] Decline in the incidence of brain abscess could be due to use of antibiotic for the treatment of predisposing factors such as otitis media, sinusitis, etc.[5-7] in the past few years the outcome of brain abscess has been improved due to use of modern diagnostic modalities and use of broad-spectrum antibiotics.[6,8,13] One of the most common causes of brain abscess in children is cyanotic congenital heart disease due to fallot's tetralogy.[4,14,15] Patients with CCHD are prone to hypoxia which leads to polycythemia and hyperviscosity. The latter leads to sluggish blood flow in cerebral microcirculation, microthrombi formation and focal encephalomalacia. Focal cerebritis occurs due to shunting of blood from the right side, as it escapes the bacterial phagocytosis in the lungs and contains infectious organisms.[16] The patients presents with complaints of vomiting, headache refractory to therapy, papilloedema, focal neurological deficits, and convulsions.[5,8,10,15,17] The management of brain abscess includes timely diagnosis, quick surgical removal of pus, with elimination of source of primary infection and usage of approprate intravenous antibiotics.[11,18] The aim of our study was to compare the advantages and disadvantages of two procedures in the treatment of brain abscess in children secondary to cyanotic congenital heart disease (CHD). The parameters used to compare these two methods were outcome of the treatment, improvement of Glasgow coma score, CT appearance of abscess and re-operation.

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Materials and Methods

Retrospective study was conducted over 6 year's period. A total of thirty three (33) pediatric patients were included in this descriptive study which was carried out in the Neurosurgery Department of

Foundation University Medical College Rawalpindi, Pakistan from June 2003 - May 2009.

Inclusion criteria:

- Intracranial abscess in patients of congenital heart disease
- No previous surgical intervention
- Patient's history and CT brain films available

Exclusion criteria:

- Postoperative, post traumatic and fungal abscess
- More than 15 years old
- Abscess less than 25mm

Each patient's data were evaluated and analyzed for the following criteria: (1) Age at presentation, (2) Gender, (3) Symptoms, (4) Surgical intervention as aspiration of abscess vs. excision of abscess capsule, (5) Recurrence, (6) Duration of hospital stay, (7) Duration of antibiotic use

Thirty three children admitted with the diagnosis of brain abscess were reviewed retrospectively over the six years duration. Following parameters were noted; clinical features, diagnosis, management and outcome. There were 15 male and 16 female children. The age range was 1 month to 14 years).

The choice of surgical procedure:

Patients having the following criteria were selected for burr hole procedure because of high risk of anaesthesia and postoperative complications:

1. Children less than 1 year of age; patients with poorly compensated congestive heart failure (CHF), severe cyanosis or pulmonary hypertension. Patients for emergency surgery and with multiple coexisting diseases were also included.
2. Non availability of pediatric anesthetic and pediatric ICU.

Patients having low risk of anaesthesia and absence of above mentioned risk factors were
selected for craniotomy and excision.

None of these patients had prior cardiac surgery for cyanotic heart disease. Three patients were seen in cardiac centre and were awaiting elective surgery. Six (6) patients undergone craniotomy and twenty seven (27) patients had burr hole aspiration of abscess with intravenous antibiotics. Patients were followed up for up to 4 years. The burr hole and drainage procedure is defined as making a small vent in the skull using a drill, and then to insert a brain cannula into the abscess to aspirate the pus.

Craniotomy and removal of the abscess is an operative procedure to remove a bone flap and duotomy and removal of abscess.

Results

Our study results showed that patients who underwent the burr hole aspiration of abscess had a decreased mortality and shorter hospital stay. They also showed early improvement in neurological function, and radiological clearance as compared to craniotomy and excision group. We performed craniotomy and excision of abscess in six patients and burr hole aspiration of abscess in twenty seven patients and treated them with intravenous antibiotics (Cefuroxime, metronidazole, amoxycillin) for a period of 4-6 weeks. All children presented with fever except one neonate. Other clinical features at presentation included vomiting (60%), headache (45%) and seizures (45%). Cerebral imaging techniques include computerized tomography in 26 children and magnetic resonance imaging in 7. On the CT brain findings, right side abscess was present in 15 (45%) patients, on the left side in 9(28%) and bilateral in 8(24%) children. Only one patient (3%) had multiple abscesses. 18 patients (55%) showed Parietal abscesses, 9 (28%) had frontal, 4 (13%) patients in temporal lobe and occipital location was observed in 2 (4%) patients. 19 patients showed midline shift and 14 patients revealed cerebral edema. Culture and sensitivity results were available in 20 patients (66%). In 14 patients (70%) pus was sterile and 6 cases (30%) showed positive cultures, Streptococcus followed by Staphylococcus was isolated. Brain CT with contrast was performed to assess the residual status of the abscess for all patients within one week after operative intervention. Twenty-two patients (88%) showed no evidence of abscess on brain CT and significant residual abscesses were present in three patients (12%). Mortality rate was 24% within one week after the first surgery (four were from the craniotomy group and four from aspiration group). 25 patients (75.7%) were alive at 3 months. 13 patients (52%) showed improvement in their neurological status after one week post-operatively. Patients who underwent burr hole aspiration showed more Improvement of neurological status as compared with the craniotomy group. At 3-months follow-up the difference in recovery of neurological status

between the two surgical methods was insignificant. On brain CT satisfactory clearance of the abscess was seen in those patients who underwent burr hole aspiration. Only three patients had recurrence. As their first surgical method, 4 patients (66.6%) died out of 6 patients who underwent excision of abscess. In burr hole aspiration, 4 (14.0%) patients out of 27 patients died. The survival burr hole aspiration of the patients who were significantly better. 16 patents had tetralogy of Fallot, 6 tricuspid atresia, 6 transpositions of great arteries and, 6 patients septal defect (Table I).

9 (36%) patients showed complete recovery without sequelae, hemiparesis was observed in 11 (44%) and seizure disorder in 5 (20%).

Table I: Type of Cyanotic Congenital Heart Disease

Diagnosis	Number (%)
Tetralogy of Fallot	**16**
Tricuspid atresia	**6**
Transposition of great arteries (TGA)	**6**
Ventricular septal defect (VSD)	**3**
Pulmonary stenosis (PS)	**2**

Table II: Analysis of results for Excision vs. Aspiration

	Burr hole aspiration	Craniotomy and excision
Total number of patients	27	6
Gender M/F	13/14	4/2
Duration of antibiotic use	6 weeks	6 weeks
Mortality	4 (15%)	4 (66%)

Discussion

An important and recognized predisposing factor for brain abscess is un-operated cyanotic congenital heart disease (CCHD). The brain abscesses with diameters of greater than 25 mm require the surgical intervention. Due to advances in neuroanesthesiology the surgical management of brain abscess has evolved significantly in recent decades, it could be either burr hole drainage of abscess cavity or excision of the abscess.[19] Management of brain abscess among cyanotic CHD patients is a complex procedure. The craniotomy procedure takes 3-4 hours and as these patients are extremely high risk for anaesthesia and surgery and post operative care is less than optimum in a developing country like Pakistan. Brain abscesses should be managed by less invasive aspiration methods to reduce operative and anaesthetic risk in these patients.[20] The mortality in these patients is exceptionally high in developing countries. It is difficult to determine the best method for treating cerebral abscess. The least invasive method of treatment is use of antibiotic alone.[21,22] However, large well-capsulated abscesses are resistant to antibiotic treatment alone. 15 out of 31 cases of brain abscess less than 2.5 cm were reported by Rousseaux, which were successfully treated by antibiotics alone.[23] On these basis abscesses <2.5 cm were excluded from our study. A major disadvantage of nonsurgical treatment is that culture and sensitivity of the organism cannot be determined. To address all possible organisms, broad-spectrum antibiotics had to be used.[9]

The best choice between two main surgical procedures remains controversial. The burr hole aspiration showed excellent outcomes[9,24,26] as in current study. Advantages of aspiration approach include; use of local anaesthesia, an ability to decompress lesions in senstive areas, access to multiple and deep-seated lesions without an increase in surgical complexity.[19] However, burr hole drainage were performed under radiological assisstance. In Pakistan only contrasted brain CT film was available and burr hole drainage was performed when appropriate. The mode of surgery is determined by stage of the abscess. The capsule is not well formed in the cerebritis stage and it is difficult to excise the abscess so medical treatment with or without burr hole aspiration during this stage is advocated.[9,19]

The craniotomy and excision in the management of brain abscess has been proposed in some recent studies.[27] It was observed that despite the adequate identification of location, these abscesses were not completely aspirated by burr hole. Burr hole aspiration cases required multiple surgeries as compared to craniotomy. Better antibiotic penetration and reduction in the mass effect is achieved with complete evacuation of the abscess.[9] In the literature there is no study found to compare burr hole drainage and removal of abscess by craniotomy in terms of outcome and cost-effectiveness.

Conclusion

Our study results suggested that burr hole aspiration is more efficient procedure as compared to craniotomy in terms of surgical intervention and postoperative outcome in a selected group of brain abscess in patients with CHD. It is also a cost effective procedure.

However further case control studies on larger patient population are suggested. In patients with un-operated cyanotic congenital heart disease, a high index of clinical suspicion with early intervention would have a better outcome. Early corrective surgery for these cardiac malformations would be a definitive way of preventing this catastrophe.

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