

Original Article

Brain Abscess in Cyanotic Congenital Heart Disease: A Preventable Complication with Heavy Financial Burden and Poor Outcome

1. Muhammad Sohail Arshad 2. Muhammad Aslam 3. Sara Rubab

1. Asstt. Prof. of Paediatric Cardiology 2. Asstt. Prof. of Paediatric Cardiology 3. Sr. Registrar, of Paediatric Cardiology, The Children's Hospital & The Institute of Child Health, Multan.

ABSTRACT

Objectives: To evaluate the financial burden and outcome of the children with brain abscess and underlying congenital cyanotic heart disease. To emphasize the need of early diagnosis and surgery of congenital cyanotic heart disease.

Study Design: Cross Sectional Descriptive Study.

Place and Duration of Study: This study was conducted at the department of paediatric cardiology The Children's Hospital and The Institute of Child Health, Multan from February 2010 to January 2012.

Patients and Methods: All the patients presenting with brain abscess and having underlying congenital heart disease were included in the study. All the patients underwent transthoracic echocardiography and computed tomography (CT) scan of the brain. Data was taken on a written proforma after proper consent.

Results: A total of 58 patients with cyanotic congenital heart disease presented with CNS manifestations including headache, fever, focal neurological signs, fits or altered sensorium during the study period. Out of these 24 turned out to have brain abscess. Multiple brain abscesses were found in 7 patients. All the patients were given broad spectrum IV antibiotics. 19 of the patients required surgical intervention. Repeat CT scan was performed in all the patients. Only 5 patients recovered without any neurological sequelae. 7 patients expired during hospital stay. All of the remaining 12 patients survived but with some permanent neurological deficit. IV antibiotics, supportive treatment, CT scan, other laboratory investigations and surgery, all have a lot of cost. Around 1500 to 2000 US \$, on an average, were spent by the government on one patient during hospital stay.

Conclusion: The only way to avoid CNS complications of CCHD is early diagnosis and early surgical treatment. But unfortunately, in this country because of lack of paediatric cardiology services and deficiency of paediatric cardiac surgery centers, corrective surgery of congenital cyanotic heart disease is delayed. It increases the risk of brain abscess formation which in turn leads to excessive financial burden on government resources and also increases the risk of long term neurological sequelae. Establishment of more and more paediatric cardiac surgery centers in this country is urgently required.

Key Words: Congenital cyanotic heart disease, Brain abscess.

INTRODUCTION

Central nervous system (CNS) complications of congenital cyanotic heart disease (CCHD) include cerebral infarction leading to stroke and cerebritis leading to abscess formation. Both have high morbidity and mortality. Cerebral infarction usually occurs in younger kids < 2 years of age, while abscess formation occurs in older children > 2 years of age. A brain abscess is a focal collection of infectious material with in the brain, which can arise as a complication from a variety of causes including infection trauma and surgery¹. A wide variety of organisms (bacteria, fungi, protozoa, and parasites) can cause abscess formation. Brain abscesses occur relatively infrequently because of the abundant blood supply to the brain and the protection of the brain by the blood – brain barrier². Congenital cyanotic heart diseases (CCHD) are one of the common predisposing factors of brain abscess in our setup. In the patients with congenital cyanotic heart disease with decreased pulmonary blood flow, hypoxia

polycythemia and relative iron deficiency anemia take the patient to a greater risk of developing brain abscess. These factors cause hyperviscosity and sludging of RBCs in the micro circulation of brain parenchyma which lead to micro infarctions and encephalomalacia. These infarcted areas then serve as a nidus for brain abscess. The hematogenous spread through right to left shunting in these cardiac lesions further increases the risk³.

PATIENTS AND METHODS

This is a cross sectional descriptive study conducted at the department of paediatric cardiology The Children's Hospital and The Institute of Child Health, Multan from February 2010 to January 2012. All the patients presenting with brain abscess and having underlying congenital heart disease were included in the study.

Inclusion criteria:

- ♦ All the patients presenting with brain abscess and having underlying congenital cyanotic heart disease diagnosed on the basis of computed tomography (CT) scan of brain.

Exclusion criteria:

- The patients with brain abscess without underlying congenital heart disease.
- The patients with congenital heart disease with CNS complications other than brain abscess like cerebritis or infarction.

Toshiba Nemio XG machine was used for transthoracic echocardiography of all the patients which were performed by the trained paediatric cardiologist. CT scan brain with contrast was performed of all the patients. Toshiba Aquillion 16 slice CT scan machine was used for this purpose. The data was taken on a written proforma after proper consent.

RESULTS

A total of 58 patients with cyanotic congenital heart disease presented with CNS manifestations including headache, fever, focal neurological signs, fits or altered sensorium during the study period. CT brain with contrast was performed of all these patients. Out of these 24 turned out to have brain abscess. Multiple brain abscesses were found in 7 patients. All the patients with brain abscess were more than 4 years of age with a range of 4-13 years and a mean of 8.5 ± 2.1 years. A majority, 17 of the total brain abscess patients had tetralogy of Fallot (TOF) as underlying cyanotic congenital heart disease.

Table No. 1: Types of underlying congenital cyanotic heart disease (CCHD)

Congenital cyanotic heart disease	No. of patients n = 24 (%)
TOF	17 (70 %)
TGA VSD ,PS	3 (12.5 %)
Tricuspid atresia	1 (4.2%)
Univentricular heart with pulmonary stenosis	2 (8.3%)
Pulmonary atresia with VSD	1 (4.2%)

TOF = tetralogy of Fallot, TGA = Transpositional of great arteries,

VSD = Ventricular septal defect, PS = Pulmonary stenosis.

Table No. 2: Types of surgical procedures

Surgical Procedure	Number of patients n = 24 (%)
Single Burr hole	11 (45.8%)
Twice Burr hole	05 (20.8%)
Thrice Burr hole	01 (4.2%)
Craniotomy	02 (8.3%)

All the patients were given empirically broad spectrum IV antibiotics in the form of ceftriaxone, vancomycin and metronidazole. After culture & sensitivity reports and clinical response antibiotics were reviewed. 19 of the patients required surgical intervention. Burr hole was performed in 17 of the patients, out of these 5 underwent burr hole aspiration twice and 1 patient

thrice. 2 patients required craniotomy and surgical excision of the abscess. Hospital stay ranged from 23 to 42 days with a mean of 34 ± 3 days. Repeat CT scan was performed in all the patients and few of them required multiple scans to see the response.

Table No. 3: CT scan exposures

Number of patients	Number of CT scans n = 24 (%)
09	02 (8.3%)
11	03 (12.5 %)
04	04 (16.8%)

Only 5 patients recovered without any neurological sequelae. 7 patients expired during hospital stay. All of the remaining 12 patients survived but with some permanent neurological deficit.

Table No. 4: Outcome of the patients

Outcome	Number of patients n = 24 (%)
Fully recovered	05 (22%)
Expired	07 (28%)
Neurological deficit	12 (50%)

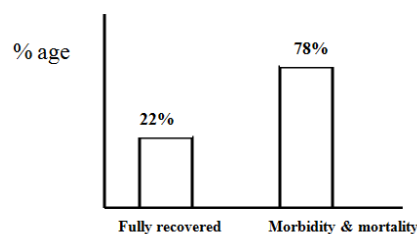


Figure No. 1: Mortality and Morbidity

Table No.5: Neurological Sequelae

Neurological deficit	Number of patients n = 24 (%)
Fits	07 (29.1%)
Blindness	01 (4.2 %)
Aphasia	01 (4.2 %)
Facial palsy	02 (8.3%)
Hemiplegia (motor deficit)	03 (12.5%)

Table No. 6: Expenses (disposable items)

	Pk Rs	US \$
IV antibiotics	60,000/-	705
Supportive treatment	30,000/-	352
Lab investigations	10,000/-	117
CT scan	15,000/-	176
Surgical procedure	25,000/-	294
Total	140,000/-	1644/-

IV antibiotics, supportive treatment, CT scan, other laboratory investigations and surgery, all have a lot of cost. Around 1500 to 2000 US \$, on an average, were spent by the government on one patient during hospital stay. This calculation is only for the expenses of disposable items. While the financial burden in the

form of hospital stay charges, nursing care and operation theater charges, consultant and other medical personnels charges is much more.

DISCUSSION

Congenital cyanotic heart disease is an important predisposing factor for brain abscess formation, accounting for 25 to 46%⁴ of cases. The risk of brain abscess complicating CCHD is inconstant but is more common after 2 years of age and increases continuously until the age of 12 years. Instantaneous risk at that time is quoted as $1.75 \pm 0.12\%$, but decreases thereafter⁵. Risk factors predisposing to the development of brain abscess in CCHD include hypoxia and its consequent polycythemia and hyperviscosity. The latter results in sluggish blood flow in cerebral microcirculation that allows micro-thrombi formation and focal encephalomalacia. It also alters blood brain barrier permeability⁵. Shunted blood from the right side escapes the bacterial phagocytes in the lung and contains infectious organisms that seed these sites causing focal cerebritis⁶. One study demonstrated reduced bactericidal and phagocytic functions of leucocytes in children with CCHD⁷. Although it occurs in any CCHD, the commonest CCHD associated is tetralogy of Fallot⁸. In our study 69% of the children have tetralogy of Fallot. Multiple brain abscesses are particularly associated with CCHD. Prusty has reported multiple abscesses in 10 % of 60 cases of brain abscess in patients of CCHD⁹. Whereas, Shehzad et al reported multiple brain abscesses in 36 % cases¹⁰. In our study, 29 % of the patients had multiple brain abscesses. Surgical intervention is required for abscesses which are larger than 2cm in diameter or situated in critical areas of the brain or causing significant mass effect^{11, 12, 13}. It can take the form of needle aspiration through a burr hole, CT guided stereotactic aspiration or excision of abscess by open craniotomy. Some advocate stereotactic aspiration as the method of choice, while others favor complete excision of abscess cavity¹⁴. In our study, 77% of the patients required surgical intervention. Needle aspiration through burr hole was done in 69 %, while excision of abscess cavity by craniotomy was performed in the rest of 8 % children. Fits were the commonest long term sequelae observed in our study. Similar high incidence of seizures disorder sequelae has been reported by Kao et al². This might be related to severe local inflammation or infection resulting in a more severe local cerebral reaction¹⁵. Overall mortality observed in our series was 29 %. While other local and international studies have reported mortality between 15 to 30 %^{8, 16, 17}.

As far as financial burden and excessive use of government resources is concerned, mean hospital stay of the patients was 34 ± 3 days along with the expenditure of 1500 to 2000 US \$ per patient during the hospital stay. In spite of this heavy expenditure and

excessive use of government resources the patients suffered a lot of agony, high mortality and morbidity, prolonged hospital stay and even those who fully recovered still lived with underlying congenital cyanotic heart disease. While a corrective cardiac surgery procedure for CCHD requires only 5 to 7 days of hospital stay and about the same amount of money as was spent on the management of brain abscess. The mortality and morbidity for these procedures is $< 1\%$ these days. Above all, the patient becomes free from his CCHD and also from its complications. In developed world, the incidence of CNS complications of CCHD has dropped markedly in past 20 years because of early diagnosis and surgery of CCHD. But unfortunately in our set up this incidence is still at the same level because of delay in diagnosis and availability of very few cardiac surgery centers.

CONCLUSION

Ideally, CCHD patient should be diagnosed early in neonatal or infantile age group and suitable medical and surgical treatment should be provided according to the indication at proper timings. This will help a lot in avoiding these CNS complications of CCHD. But unfortunately in our set up, the diagnosis is made very late because of ignorance and poor patient referral system. Even if the diagnosis is made early still we do not have much facilities for the surgical repair of these CCHD patients. That is why surgery is delayed and the incidence of CNS complications in CCHD patients is much higher than in the developed world. The need of the day is to establish more and more paediatric cardiology and cardiac surgery centers in this country. This will help in off loading burden of these cardiac patients from government health care facilities and also will avoid the lethal CNS complications.

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Address for Corresponding Author:**Dr. Muhammad Sohail Arshad**

Assistant Prof. of paediatric Cardiology

The Children's Hospital & The institute of child Health
Abdali Road Multan Pakistan.

Tel: + 92-300-6301798

E-mail: drsohailarshadchc@gmail.com