CLINICAL FEATURES AND OUTCOME OF CEREBRAL ABSCESS IN CONGENITAL HEART DISEASE

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Background: Cerebral abscess is a serious life threatening complication of several diseases. The objective of this study was to look at the clinical profile, microbiology and outcome of children with cerebral abscess having an underlying congenital heart disease as compared to other predisposing conditions. **Methods:** Thirty children aged less than 15 years were reviewed. There were 15 males and 15 females. The mean age of presentation was 5.6±4.4 years. **Results:** The duration of illness at the time of admission was 17.6±24.6 days. Typically patients presented with fever, vomiting, headache and seizures. The predisposing conditions found were cyanotic congenital heart disease in 11 (37%) of children, meningitis in 6 (20%), septicemia in 7 (23%) and no underlying cause was found in 5 (17%) children. The most common microbe in children with cyanotic congenital heart disease was of the Streptococcus milleri group (52%). Computerized tomography confirmed the diagnosis and the most common location of the abscess was the parietal lobe of the cerebral hemisphere. All abscesses were large, more than 2 cm in diameter and were aspirated surgically. Excision was performed in 6 children. Five children expired, one due to a intracranial bleeding and the others due to severe cerebral edema and tentorial herniation. Complications were seen in 20 children and 16 had sequelae, hemiparesis in 11 and seizure disorder in 5. **Conclusion: B**rain abscess is a serious infection with poor outcome if diagnosed late. Delayed surgical drainage has high morbidity and mortality. The threshold for diagnosis should be low particularly in children with a predisposing condition like cyanotic congenital heart disease.

Key words: Brain abscess, cyanotic congenital heart disease

INTRODUCTION

Brain abscess is a serious life threatening infection of brain parenchyma.[1]It results from spread of infection from contiguous non-neuronal tissue, hematogenous seeding or a direct introduction into the brain.[2,3]

Predisposing factors identified include congenital heart disease with a right to left shunt, infections of the middle ear, mastoid, paranasal sinuses, orbit, face, scalp, penetrating skull injury, comminuted skull fracture or intracranial surgery including insertion of ventriculo-peritoneal shunts, dermal sinuses and abnormal immune functions.[2-6]

The objective of this study was to look at the clinical profile, microbiology and outcome of children with cerebral abscess having an underlying congenital heart disease as compared to other predisposing conditions.

MATERIAL AND METHODS

Thirty consecutive children admitted over the last ten years with the diagnosis of brain abscess were reviewed retrospectively. The clinical presentation, predisposing factors, diagnosis, management and outcome were noted. There were 15 males and 15 females. The mean age at presentation was 5.6±4.4 years (range 1 month -14 years).

RESULTS

The mean duration of illness at the time of presentation was 17.6±24.6 days (range 1 day to 120 days). All children, except one neonate, presented with fever. Other symptoms at presentation included vomiting (60%), headache (45%) and seizures (45%).

Eleven children (37%) had a cyanotic congenital heart disease (Table 2) of which 5 (45%) had tetralogy of Fallot and its variants, 3 (27%) had transposition of great arteries and 3 (27%) had tricuspid atresia. One patient with tetralogy of Fallot had coexisting Factor IX deficiency and one with tricuspid atresia had infective endocarditis. Previous palliative operation in the form of Blalock Taussig shunt was done in 8 patients. Polycythemia was present in 9 (88%) patients in whom the mean hemoglobin and hematocrit were 18.2 (±3.4) gm/dl and 54 (±9) % respectively.

Meningitis was proven in 6 (20%) children of whom one was a neonate. One had a previous history of insertion of a ventriculo-peritoneal shunt. Septicemia without meningitis was seen in 7 (23%). No patient had ear, paranasal sinus or skin infection as a preceding symptom.

Sensorium was deranged in 9 (30%) children on admission. Glasgow coma scale was <10/15 in 6 patients, 10/15-14/15 in 3 and 15/15 in 23 children, hemiparesis and cranial nerve palsy (VI

and VII) were seen in 11. Other acute neurological abnormalities included hypertonia (23%), hypotonia (13%), papilledema (13%) and aphasia (20%).

The mean and hemoglobin and hematocrit in children without CCHD were 10.3±3.2 gm/dl and 31.5±7.8 % respectively. Leucocytosis was seen 22(73%) children with a mean white blood cell count of 16.4±8 thousand per deciliter. The mean erythrocyte sedimentation rate was 28±22 mm in 1st hour. Electrolytes were normal in all except 4 patients who had hyponatremia due to syndrome of inappropriate secretion of antidiuretic hormone. Microbial pathogens that were isolated from blood and pus are shown in Table 3. Sterile cultures from pus was noted in 3 (10%) of children. The most common pathogens were those belonging to the Streptococcus milleri group (SMG), namely Streptococcus milleri and streptococcus intermedius (9/17, 52%).

Cerebral imaging consisted of computerized tomography in 23 children and magnetic resonance imaging in 7. Abscess was present in the right side in 12 (40%) of patients, on the left side in 9(30%) and bilateral in 8(27%) of children and multiple abscesses in one patient. Frontal abscesses were seen 28%, parietal location was seen in 55%, temporal lobe location was seen in 13% patients and occipital location was observed in 4% of patients. All abscesses measured more than 2 cm in diameter. Midline shift and cerebral edema was noted in 19 and 17 children each (Table-4).

Abscess was drained by burr hole in all. Repeated drainage and excision were done in14 and 6 patients respectively. Management included mannitol in 18 (60%), antibiotics (ceftrioxone in 92%, cloxacillin, metronidazole, benzyl penicillin in others) were given according to sensitivities, initial therapy for anaerobes with metronidazole in all and anticonvulsants in 5 patients. Duration of antibiotic therapy ranged from 14 to 40 days. Duration of hospitalization was more in children with congenital heart disease (Table4).

Life threatening complications encountered were syndrome of inappropriate secretion of antidiuretic hormone in 4 (13%) children, cerebral edema in 11 (37%), massive bleeding into the abscess cavity in one and tentorial herniation in four. None of the children had intraventricular rupture of brain abscess (IVROBA). Five (16%) children died, all soon after abscess drainage. The child with Factor IX deficiency died due to uncontrolled cerebral hemorrhage and others succumbed to tentorial herniation due to severe cerebral edema. The overall bad prognostic features included deranged sensorium, midline shift and cerebral edema, the last two were found to complicate children with CCHD more than the non-cardiac group (p=0.045 and p=0.03 respectively, Table 4).

Table- 1: Predisposing factors in children with brain abscess

Disease	Number (%)
Congenital heart disease	11 (37)
Previous operations	
Blalock Taussig shunt	08 (26)
Ventriculo-peritoneal shunt	01 (3)
Septicemia	07 (23)
Meningitis	06 (20)

Table- 2: Type of predisposing cyanotic congenital heart disease

Diagnosis	Number (%)
Tetralogy of Fallot	4
Tricuspid atresia	3
d- TGA, VSD, PS	2
Pulmonary atresia, VSD	1
d- TGA, single ventricle	1

Abbreviations: *VSD, ventricular septal defect, TGA- transposition of great arteries, PS- pulmonary stenosis*

Table-3: Microbial isolates in children with brain abscess

Predisposing Disease	Blood culture (numbers)	Pus culture (numbers)
Cyanotic congenital Heart disease	Bacillus species (1) Staphylococcus epidermidis (1) No growth (9)	Streptococcus milleri (8) Peptostreptococcus (1) Streptococcus intermedius (1) No growth (1)
Meningitis	E. coli (1) Enterococcus (1) No growth (3)	E. coli (1) Pseudomonas stutzeri (1) Streptococcus species (1) No growth (2)
Septicemia	Hemophilus influenzae (3) Streptococcus pneumoniae (3) Staphylococcus aureus (1)	Streptococcus C(1) Streptococcus G (1) Staph epidermidis (1)

Long term outcome included complete recovery without sequelae in 9 (30%) children, hemiparesis in 11 (37%) and seizure disorder in 5 (16%). Sequelae were more commonly encountered in children with CCHD (7/11) as compared to the 9/19 in the non-cardiac group (Table 4). Significantly higher mortality was seen in the group with CCHD.

Table-4: Differences in children with congenital heart disease and other predisposing factors

Factors	Congenital heart disease (n=11)	Other diseases (n=19)	P value
Age (yrs)	7.5± 3.4	4.46±4.6	**0.04**
Duration of illness	25.5±35.4	12.6±13.1	**0.04**
Glasgow Coma Scale	13.5±3.0	13.8±3.2	0.98
WBC count	16.0±4.4	16.7±9.9	0.10
ESR	22.8±24.8	32.6±21.5	0.92
Serum Sodium	136±3	135±9	0.7
Midline shift	8/11	10/19	**0.045**
Cerebral edema	9/11	8/19	**0.03**
Sequelae	7/11	9/19	**0.05**
Duration of hospitalization	18.6±13.8	14.2±9.6	0.57
Death	4/11	1/19	**0.02**

DISCUSSION

Cerebral abscess is a serious infection of the brain parenchyma. Several predisposing factors are causally related, but in 14-25% of patients no cause can be found.[7,8] In our series 5 (17%) children did not have an identifiable associated disease. In one study, otogenic source was the commonest predisposing factor, found in 34% of patients.[5] However, proper treatment of infections of middle ear, mastoid, scalp and face has reduced the incidence of this source.[2] In our study, no patient had these infections as a preceding event.

Un-operated cyanotic congenital heart disease (CCHD) is an important predisposing factor for brain abscess, accounting for 25-46% of cases.[6, 7, 11, 13] In our study 11 (37%) had CCHD. The risk of brain abscess complicating CCHD is inconstant but is more common after 2 yrs of age and increases continuously until the age of 12 years. Instantaneous risk at that time is quoted as 1.75±0.12%, but decreases thereafter.[3]

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 microthrombi formation and focal encephalomalacia. It also alters blood brain barrier permeability.[3] In our study, the mean hematocrit in this group of children was 54±9%. Shunted blood from the right side escapes the bacterial phagocytosis in the lungs and contains infectious organisms that seed these sites causing focal cerebritis.[6, 9] One study demonstrated reduced bactericidal and phagocytic functions of leucocytes in children with CCHD.[4] Although it could occur in any CCHD, the commonest CCHD associated is tetralogy of Fallot.[9, 10] In our series 45% of children had tetralogy of Fallot. Meningitis was seen in 6 (20%) of children and septicemia in 7(23%).

Microbial isolates in this series were interesting. Streptococcus milleri was the most common microbe isolated from pus in children with CCHD. Studies from Malaysia also found streptococcus milleri as the most common organism in this cohort of patients.[8, 11] Another regional study from Sri Lanka showed this microbe to be the most frequent pathogen, found in 35% cases of cerebral abscess, unrelated to underlying disease.[12] Streptococcus milleri group of organisms, comprising of S. constellatus, S. intermedius, S. anginosus, are a newly recognized cause of pyogenic infections. They are often associated with localized lesions and abscess formation in various organs like brain, lungs, hepatobiliary system, etc.[13-15] In our study, Hemophilus influenzae and Streptococcus pneumoniae were the common isolates in children with septicemia. Anaerobes accounted for 23% of isolates in one study[12] whereas in our series anaerobes were seen in only one case.

Accurate diagnosis requires imaging studies like computerized tomography, magnetic resonance imaging and radioisotope brain scan.[1] Abscesses were all single located except in one case where multiple abscesses were seen and the patient who had infective endocarditis. Most common location was in the parietal region (in 55%) in our cases. In other series, multiple abscesses were more common in immunocompromised children and infective endocarditis.[2, 16]

Treatment is with systemic antibiotics and abscesses which are larger than 2 cm in diameter have to be drained surgically. Medical therapy is usually initiated before results of bacteriology are obtained with a properly selected drug that has good intracranial penetration. The combination of ampicillin and chloramphenicol has been proposed as the treatment of first intention. Adaptation of antimicrobial therapy then depends upon clinical, biological and bacteriological outcomes and results of cerebral imaging.[17]

The surgical options include burr hole and aspiration and in cases with recurrent reaccumulation, excision is required. Multi-loculated nature of abscesses demands frequent aspirations.

In our series, children with congenital heart disease had a significantly older age of presentation, prolonged duration of illness at the time of admission, also had significant cerebral complications like midline shift and cerebral edema (Table 4). They also had more sequelae and a significantly higher mortality as compared to the non-cardiac group (p=0.05 and p=0.02 respectively)

Prognosis largely depends on early diagnosis and appropriate therapy.[15] Delayed presentation was obvious in our series. Presence of coma, IVROBA, multiplicity of brain abscesses, severe cerebral edema and immunocompromised host are associated with bad prognosis.[1,5,19] Epilepsy is related to scars which are more common with excision rather than with aspiration.[7]

CONCLUSION

Brain abscess is a serious infection which must be diagnosed early and treated aggressively. Awareness of this disastrous complication of infections of scalp, face, ear and paranasal sinuses would lead to proper therapy of this group of predisposing factors. In patients with un-operated cyanotic congenital heart disease, a high index of clinical suspicion with early intervention would definitely have a better outcome. Early corrective surgery for these cardiac malformations would be a definitive way of preventing this catastrophe.

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