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Sommayya Aftab
The Children Hospital and Institute of Child Health, Lahore

Amir Usman
The Children Hospital and Institute of Child Health, Lahore

Tipu Sultan
The Children Hospital and Institute of Child Health, Lahore

FREQUENCY OF CEREBROVASCULAR ACCIDENTS AND BRAIN ABSCESS IN CHILDRENS WITH TETRALOGY OF FALLOT

Sommayya Aftab[1], Amir Usman[2], Tipu Sultan[3]
[1] *Department of Paediatric Medicine, The Children Hospital and Institute of Child Health, Lahore, Pakistan*
[2] *Department of Surgery, The Children Hospital and Institute of Child Health, Lahore, Pakistan*
[3] *Department of Paediatric Neurology, The Children Hospital and Institute of Child Health, Lahore, Pakistan*

Correspondence to: *Dr. Tipu Sultan, 598-D, Johar Town, Lahore, Pakistan E-mail: tipusultanmalik@hotmail.com*
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ABSTRACT

OBJECTIVE: To determine the frequency of cerebrovascular accidents and brain abscess in children of Tetralogy of Fallot presented with neurological manifestations. **PATIENTS AND METHODS:** It was a cross-sectional descriptive observational study done at the Pediatric Cardiology and Pediatric Neurology departments of The Children's Hospital & Institute of Child Health, Lahore from Dec 2009 to Nov 2010. A total 75 patients of Tetralogy of Fallot (TOF) up to the age of 15 years with neurological manifestation meeting the inclusion criteria were enrolled in this study. CT brain with contrast was conducted in all patients to look for evidence of cerebrovascular accident (stroke) and/or brain abscess. **RESULTS:** Out of total 75 patients of Tetralogy of Fallot (TOF) presented with neurological manifestation 48 (64%) were having brain abscess, 24 (32%) were having cerebrovascular accident (CVA), 2 (2.6%) were having intracranial bleed and 1 (1.3%) was having meningoencephlitis. Disease breakdown according to age showed increasing frequency of brain abscess as age increases with maximum cases above 10 years of age. However maximum cases of CVA reported in patients below age of 2years. **CONCLUSION:** Brain abscess have found to be more frequent than cerebrovascular accidents in patients with tetralogy of fallot. Therefore, we should have a high index of suspicion of brain abscess in every unoperated patient of tetralogy of fallot presenting with neurological manifestation.

KEY WORDS:

Brain abscess, Cerebrovascular accidents, Tetralogy of Fallot.

INTRODUCTION

Tetralogy of Fallot (TOF) is a most common cyanotic congenital heart disease characterized by ventricular septal defect (VSD), overriding of aorta, obstruction to right ventricular outflow tract and hypertrophy of right ventricle [(1)]. Children with TOF are susceptible to serious neurological complications like cerebrovascular accidents (stroke) and brain abscess, which are mainly responsible for mortality and morbidity in these patients [(1, 3)]. The incidence of cerebrovascular accidents and brain abscess in patients with TOF has been documented in Western literature as 8.6% and 13.7% respectively 2. Cerebrovascular accident is more common in children less than 2 years of age while brain abscess usually occur above 2 years of age. Brain abscess is a life threatening infection of brain parenchyma, but it is less common than cerebrovascular accidents because most patients of TOF are repaired at younger age [(1)]. The extent of the neurological deficit depends largely upon the early detection of these complications. The early diagnosis of cerebrovascular accidents is important to prevent further recurrences [(4)], while the early detection of brain abscess is helpful for prompt management [(5, 6)]. The advent of CT scan has resulted in fourfold decrease in mortality in these patients due to prompt identification and early intervention [(7, 8)]. We observed that unlike developed countries, in developing countries like Pakistan children with TOF are more susceptible to adverse neurological complications especially the brain abscess due to delay in the surgical repair of TOF. To-date limited data is available regarding the frequency of these complications in children with TOF. We speculated that by documenting the frequencies of these neurological complications, we can have high index of suspicion of these complications especially the brain abscess in patients of TOF. The early detection and prompt treatment of these patients will help in reducing the mortality and morbidity in them.

MATERIAL AND METHODS

It was a descriptive cross-sectional study done at the Pediatric Cardiology and Pediatric Neurology Depart-

ments of The Children's Hospital and Institute of Child Health, Lahore from Dec 2009 to Nov 2010. Total 75 unoperted echocardiographically proven cases of tetralogy of fallot up to the age of 15 years presented with neurological manifestation were included in this study. Patients are said to have neurological manifestation if they exhibit any one of the following i.e. persistent headache, unexplained recurrent vomiting, seizures, altered sensorium, hemeparesis, hemeplegia, aphasia, cranial nerve involvement, nystagmus, ataxia, dysmetria or papilloedema on history and clinical examination. Patients presented with spell or operated for Blalock-Taussing shunt or primary repair were excluded from study. After taking informed consent by parents' demographic data including age, gender and address were recorded on pre-designed Proforma. CT Brain with contrast was conducted in all these patients to look for cerebrovascular accident (hypodense non enhancing lesion) and brain abscess (hypodense ring enhancing focal lesion). The data was analyzed using SPSS v. 12.0. A quantitative variable like age was presented by calculating mean and standard deviation. Qualitative variables like gender, cerebrovascular accident and brain abscess were presented by calculating frequencies and percentages.

TABLE-1 CT BRAIN WITH CONTRAST FINDING

NEUROLOGICAL COMPLICATIONS	NUMBER	PERCENTAGE
Brain abscess	48	64%%
Cerebrovascular accidents	24	32%
Intracranial bleed	2	2.7%
Meningoencephlitis	1	1.3%
Total	75	100%

RESULTS

Out of total 75 patients of Tetralogy of Fallot (TOF) presented with neurological manifestation 48 (64%) were having brain abscess, 24 (32%) were having cerebrovascular accident (CVA), 2 (2.6%) were having intracranial bleed and 1 (1.3%) was having meningoencephlitis (Table-1). Distribution of cases by age showed 14 cases (18.6%) were 0-2 years of ages of age, 7 cases (9.3%) were >2-5 years of age, 18 cases (24%) were >5-10 years of age and 36 cases (48%) were >10-15 years of age with mean age of 9.7±3 (Table–2). Disease breakdown of brain abscess according to age showed 3 cases (6.25%) were 0 – 2 years of age, 4 cases (8.3%) were >2 – 5 years of age, 11 cases (22.9%) were >5 – 10 years of age, and 30 cases (62.5%) were >10 – 15 years of age with mean age of 10±3 years (Table-2). Disease breakdown of cerebrovascular accident (CVA) according to age showed 13 cases (54%) were 0 – 2 years of age, 1 cases (4.1%) were >2 – 5 years of age, 4 cases (16.6%) were >5 – 10 years of age, and 6 cases (25%) were >10 – 15 years of age with mean age of 4.7±3 years (Table-2). Distribution of cases by gender showed that 57 cases (76%) were male and 18 cases (24%) were female. Out of 48 cases of brain abscess 38 (79.1%) were male and 10 (20.8%) were female. However among 24 cases of cerebrovascular accidents 16 cases (66.6%) were male and 8 cases (33.3%) were female (Table-3).

TABLE-2 DISTRIBUTION OF CASES BY AGE

AGE (YEARS)	TOTAL PATIENTS	BRAIN ABSCESS	CEREBROVASCULAR ACCIDENT	OTHERS
0 – 2	14 (18.6%)	3 (6.25%)	13 (54%)	
>2 – 5	7 (9.3%)	4 (8.3%)	1 (4.1%)	
>5 – 10	18 (24%)	11 (22.9%)	4 (16.6%)	2
>10 - 15	36 (48%)	30 (62.5%)	6 (25%)	1
Total	75	48	24	3
Mean age	9.7±3	10±3	4.7±3	

DISCUSSION

Tetralogy of Fallot is a common cyanotic congenital heart disease, which occur in approximately 1 in 3600 live birth and account for 3.5 % of infant born with congenital heart disease. It is diagnosed by echocardiography and characterized by ventricular septal defect (VSD), overriding of aorta, obstruction to right ventricular outflow tract and hypertrophy of right ventricle [9]. The clinical presentation of tetralogy of fallot depends upon the severity of right ventricular outflow tract obstruction (RVOTO). When severe at birth, there is duct dependant pulmonary circulation and prostaglandin E is required to maintain duct patency. Moderate RVOTO give rise to a systolic murmur in an asymptomatic child. Cyanosis usually develops between 6-8 month as infundibular stenosis increases producing right to left shunt [9].

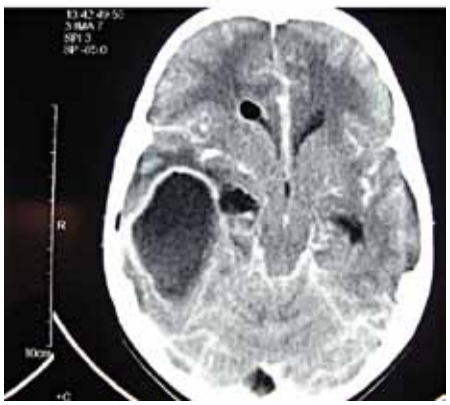
TABLE-3 DISTRIBUTION OF CASES BY GENDER

GENDER	TOTAL NUMBER	BRAIN ABSCESS	CEREBROVASCULAR ACCIDENT	OTHERS
Male	57 (76%)	38 (79%)	16 (66.6%)	3
Female	18 (24%)	10 (20.8%)	8 (33.3%)	
Total	75	48	24	3

Children of tetralogy of fallot are susceptible to serious neurological manifestation like brain abscess (Figure-I) and cerebrovascular accidents (stroke) which contribute significantly to mortality and morbidity in them [10, 11]. The main contributing factors for brain abscess in these childrens are chronic hypoxia leading to polycythemia, poor host immunity and bypass of lung phagocytes [12]. However the risk factors for stroke include polycythemia, anemia, prolonged hypotension and dehydration [10, 13, 14]. Children with tetralogy of fallot are susceptible to two types of strokes i.e. arterial and venous. Venous thrombosis is more common than arterial thrombosis. CT scan brain is the first line investigation to detect these neurological complications

especially in emergency [15]. In developed countries these neurological manifestations like brain abscess and stroke are very rare and their main focus has been shifted to neurological complications of cardiac surgery in the very young children as result of cardiopulmonary bypass and total hypothermic circulatory arrest. However in developing countries many of congenital heart diseases including tetralogy of fallot remain uncorrected and these neurological complications are frequently encountered [10]. The main reason behind it is the delay in surgery resulting in chronic hypoxia leading to secondary polycythemia which is responsible for these neurological complications. More recently, the Toronto group encountered that optimal age for elective primary repair of tetralogy of fallot patients should be 3 to 11 months [16]. In one study by Hirsh et al it was reported that primary repair of tetralogy of fallot if done in neonatal age will lead to no neurological complications [17]. Gender distribution observed in my study showed male predominance which was also demonstrated by Aebi et al [18] and Carpenter et al [19]. In our study we collected 75 unoperated cases of tetralogy of fallot up to the age of 15 years presented with neurological manifestation in a period of 12 months. This is a large number of patients collected from single hospital because The Children's Hospital and Institute of Child Health, Lahore is a tertiary care hospital with facilities of pediatric cardiology, pediatric neurology and pediatric neurosurgery and patients being referred from all over country. Another important reason for this large number of unoperated patients of tetralogy of fallot with neurological complications is that chronic hypoxia (due to delay in surgery) is main etiological factor behind these neurological complications. This fact was also supported by Mulder et al who suggested by earlier repair of these children we can reduce duration of hypoxia in them [20]. In our study 48 out of 75 patients (64%) were found to have brain abscess and 24 out of 75 patients (32%) were found to have cerebrovascular accident (stroke) (Table-1). This is contrary to Bernstein D who suggested that brain abscess is less common than cerebrovascular accidents in children with tetralogy of fallot and extremely rare today [1]. However our findings are comparable with another study of unoperated cases of tetralogy of fallot where incidence of brain abscesses in more than cerebrovascular accident [2]. In this study 14 cases out of 75 (18.6%) were >2 year, 7 cases out of 75 (9.3%) were between >2 to 5 years, 18 cases out of 75 (24%) were between >5year to 10 years and 36 cases out of 75 (48%) were > 10 year of age. So it showed that the risk of neurological complications increase with increasing age in unoperated case of TOF. In children > 2 year of age, 3 out of 14 cases were found to have brain abscess and 13 cases were found to have cerebrovascular accident, showing CVA is more common than brain abscess in this age group. However in children >10 year of age 30 cases out of 36 cases were found to have brain abscess and 6 cases were of cerebrovascular accident revealing brain abscess is more common in this age group. (Table-2) So, in our study brain abscess in more common in children above 2 year of age and cerebrovascular accident more common in children less than 2 year of age. This age distribution was also observed by Bernstein D [1]. In this study the frequency of brain abscess increases with increasing age (Table-2). However cerebrovascular accident is common in two age groups i.e. less than 2 years (54%) and more than 10 year (25%). The reason for increased number of brain abscess than cerebrovascular accident in our study seems to be due to delay in their surgery in developing country like Pakistan, malnutrition leading to impaired host immunity, and very late presentation of unoperated tetralogy of fallot as most of cases are above 10 years of age. The early diagnosis of brain abscess is very important because prompt management can decrease mortality and morbidity in them [5, 6]. It was reported that advent of CT scan brain resulted in fourfold decrease in mortality of patients of tetralogy of fallot with brain abscess [7, 8]. In developing country like Pakistan where CT facility is not available everywhere it is judicial to start intravenous antibiotic for every patient of tetralogy of fallot presented with neurological manifestation until it is get ruled out by CT brain with contrast because prompt treatment of brain abscess can reduce fatal outcomes and improve prognosis in these children.

Figure-I



CONCLUSION

Brain abscess and cerebrovascular accidents are common neurological complications in unoperated children of Tetralogy of Fallot which are responsible for mortality and morbidity in them. Frequency of brain abscess is found to be more than cerebrovascular accidents in these patients. So we should have a high index of

suspicion of these neurological complications especially of brain abscess in every unoperated patient of Tetralogy of Fallot presented with neurological manifestation. Early detection of cerebrovascular accident prevents further such episodes, and prompt diagnosis and treatment of brain abscess lead to better outcome.

REFERRENCES

1. Bermstein D. Congenital heart disease. In: Kleigman MR, Behrman ER, Janson BH, Stanton FB. Nelson textbook of pediatrics. 18th ed. New Delhi: Elsevier; 2008. p. 1906-11.
2. Sadiq A, Shymkrishnan GK, Theodore S, Gopalkarishnan S, Tharakan MJ, Karunkaran J. Long term functional assessment after correction of tetralogy of fallot in adulthood. Ann Thorac Surg 2007;83:1790-5.
3. Engelfreit P, Boersma E, Oechslin E, Tijssen J, Gatzoulis AM, Thilen U, et al. The spectrum of adult congenital heart disease in Europe: morbidity and mortality in a 5 year follow up period. Eur Heart J 2005;26:2325-33.
4. Saliha MA, Al-Jarallah AS, Abdel-Gader AG, Al-Jarallah AA, Al-Saadi MM, Kentab AY, et al. Cardiac diseases a risk factor for stroke in Saudi children. Saudi Med J 2006;27:S61-8.
5. Mehnaz A, Syed UM, Saleem SA, Khalid NS. Clinical features and outcome of cerebral abscesses in congenital heart disease. J Ayub Med Coll Abbottabad 2006;18:21-4.
6. Kanamori S, Kusano N, Shinzato T, Saito A. The role of the capsule of the Streptococcus milleri group in its pathogenicity. J Infect Chemother 2004;10:105-9.
7. Benardini GL. Diagnosis and management of brain abscess and subdural empyema. Curr Neurol Neurosci Rep 2004;4:448-56.
8. Morthy, Rajshaker VB. Isolated ring enhancing lesion of brain abscess in patient with cyanotic heart disease: role of stereotactic intervention. Neurol India 2008;51:400-4.
9. Shinebourne AE, Babu-Narayan VS, Carvalho SJ. Tetraloy of fallot: from fetus to adult. Heart 2006 September;92(9):1353-1359.
10. Kumar K. Neurological complications of congenital heart disease. Indian J Pedaitr 2000 March:67 (3suppl):S 15-9.
11. Bhatnagar S, Naware S, Kuber R, Thind SS. Pediatric stroke: Neurological sequel in uncorrected tetralogy of fallot. Ann Med Health Sci Res 2013 November; 3 (suppl1:S27-S30.
12. Raha A, Ganjoo P, Singh A, Tandon SM, Singh D. Surgery for brain abscess in children with cyanotic heart diseases: An anesthetic challenge. J Pediatr Neurosci 2012 Jan-Apr; 7(1):23-26.
13. Carvalho KS, Garg BP. Arterial strokes in children. Neurol clin 2002;20:1079-100.
14. Rose SS, Shah AA, Hoover DR, Saidi P. Cyanotic congenital heart disease (CCHD) with symptomatic erythrocytosis. J Gen Intern Med 2007;22:1775-7.
15. Dai AL. Paediatric cerebral venous thrombosis. J Pak Med Assoc 2006;56:531-5.
16. Van Arsdell GS, Maharaj GS, Tom J. What is the optimal age for repair of tetralogy of fallot ? Circulation 2000.102lll123-lll129.lll129.
17. Hirsch JC, Mosca RS, Bore EL. Complete repair of tetralogy of fallot in neonate: results in modern era. Ann surg 2000. 232508-514.514.
18. Aebi C, Kaufmann F, Schaad UB. Brain abscess in childhood: Long term experiences. Eur J Pediatr 1991;150:282-6.
19. Carpenter J, Stapleton S, Holliman R. Retrospective analysis of 49 cases of brain abscess and review of the literature. Eur J Clin Microbiol Infect Dis 2007; 26:1-11.
20. Mulder TJ, Pyles LA, Stolfi A. A multicenter analysis of the choice of initial surgical procedure in tetralogy of fallot. Pediatr Cardiol 2002;23:580-6.

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Author's contribution:

Sommayya Aftab: Study concept and design,data collection, data analysis, manuscript writing, manuscript review

Amir Usman: Study concept and design, protocol writing, data analysis, manuscript writing, manuscript review

Tipu Sultan: Study concept and design, data collection, data analysis, manuscript writing, manuscript review