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CASE DESCRIPTION

Brain abscess, a rare and life-threatening complication of untreated TOF.

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Introduction

Brain abscess (BA) is defined as a focal infection within the brain parenchyma, which starts as a localized area of cerebritis, and is subsequently converted into a collection of pus within a well-vascularised capsule [1]. Its incidence is estimated between 0.4 and 0.9 per 100,000 people per year [2]. One of the rare causes of a BA is a congenital cardiac malformation. Tetralogy of Fallot (TOF) comprises a quadrant of pathology with pulmonary vessel lumen calibre to be narrowed, causing an increase in back pressure contributing to right ventricular hypertrophy, aorta arising from right and left ventricle, and a septal defect between the two ventricles [3]. It is the most common type of cyanotic congenital heart disease (CHD) and has an incidence of 0.34 per 1000 live births [4]. Brain abscess is a relatively unusual but potentially life-threatening infection of brain parenchyma, which can occur in around 5%-18.7% of the population with CHD [5]. The delay in the diagnosis and management of brain abscess in cyanotic congenital heart disease patients leaves the underlying condition unaddressed for a while sufficient to complicate the disease process. Mortality in untreated patients in India/Pakistan ranges from 27.5%–71% [6]. This value is based on the mortality rates in developing countries with limited medical/surgical resources.

Patient description

A 16-year-old girl presented to the Pakistan Institute of Medical Sciences Islamabad, Emergency Department with complaints of headache, fever, intermittent nausea, and vomiting for 3 weeks, she had a history of untreated TOF. CT head showed a ring-enhancing lesion (Figure 1), she was diagnosed with a brain abscess and admitted to the medicine service. The patient survived.

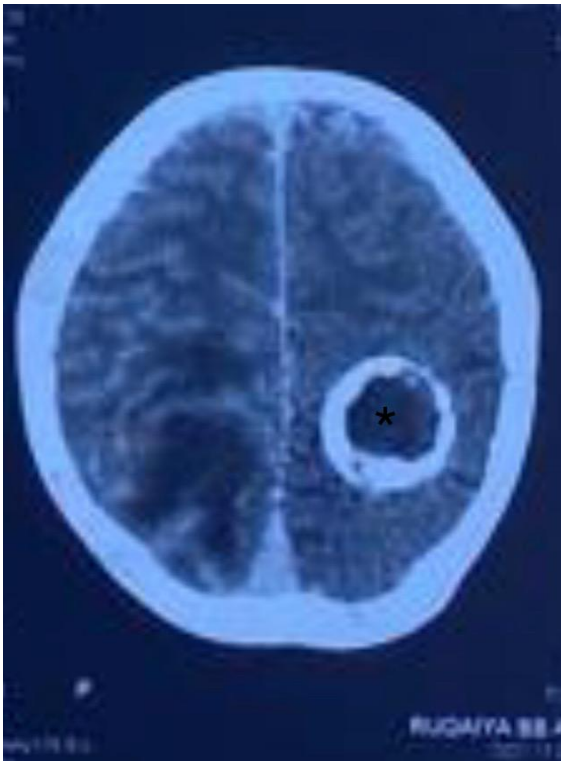

Figure 1. CT scan shows a hyper-dense ring-enhancing lesion in the left parieto-occipital region marked with an asterisk. Author of the photo: Muhammad Shehzad Khan Wazir.

Discussion with conclusion

Tetralogy of Fallot (TOF) is one of the most common cyanotic congenital heart diseases [6] with cerebral brain abscess being a rare but potentially fatal complication. If left untreated, TOF can lead to a variety of complications, all of which share the same pathophysiology.

Patients with TOF have low oxygen saturation, leading to ischemic areas in the brain. Due to the right-to-left shunting of blood, the microorganisms enter the cerebral circulation, bypassing filtration by the lungs and settling in the ischemic areas of the brain. These patients typically present with fever and headache (from compensatory polycythemia and vasodilation due to low oxygen saturation) with seizures being a rare occurrence [5]. Secondary polycythemia, delayed and restricted growth, infective endocarditis, and brain abscess are all complications of TOF [6] with cerebral abscess being the most common non-cardiac cause of morbidity and mortality in these patients [5].

TOF and its complications are most common in developing countries with poor sanitation and limited access to basic medical facilities [6]. In Pakistan, most deliveries in rural areas occur at home with the assistance of community midwives; as a result, babies rarely undergo screening, and babies with TOF go unnoticed [4]. There aren't enough studies on the Pakistani population to show the true prevalence of TOF, and any studies that are done are biased because the data is limited to a specific population and doesn't represent all of Pakistan's socioeconomic and ethnic communities [3]. According to Mohammad *et al*., TOF is one of the most common congenital heart lesions in the Pakistani population, with a prevalence of 11.2% [7]. TOF is the most common

surgically managed paediatric cardiac condition, with a male predominance, according to data from a study conducted by Pathan *et al*. [8]

In rural setups screening for cardiac defects can be conducted. The technique carried out in neonatal intensive care units in tertiary care hospitals for such purpose is that receiving the born child either via a caesarean section or standard vaginal delivery, the infant undergoes a complete neonatal examination in which one of the components is to screen for cardiac defects. This is conducted via the usage of a simple, adult pulse oximeter; by attaching it to the periphery of all four limbs, both upper and lower. Firstly, meeting the prerequisites; the infant is kept warm before conducting this exam as cold peripheries cause erroneous readings. Then, measuring the oxygen saturation through the pulse oximeter in all the limbs and checking if the oxygen level is less than 90% on room air which points towards an anomaly either in the respiratory or cardiac circuit. In order to differentiate this, oxygen is provided via a high flow route, nasally and by mouth, and if there is still persistence of low oxygen saturation in any of the limbs then there is a likelihood of cardiac pathology, i.e. congenital cardiac defects. This evaluation can be conducted in the rural set-ups in basic health units or rural health centres where there is the availability of equipment, pulse oximeters, and skilled personnel, general practitioners or nurses. The protocol needs to be derived by the paediatricians in order to use it as a screening modality. A simple proposal could be labelling the cut-off of oxygen saturation to be at or less than 90% on any of the four limbs. This can be conducted on the first visit of the infant brought by their parents to the basic health units or rural health centres for the acquisition of free vaccination through the extended program for immunization. This is a cost-effective model with low skill-set requirements. Any deficiency in oxygen saturation can lead the basic health provider to move towards a referral of such a case to the nearby tertiary care hospital. Also, counselling the parents on the importance of implementing such a referral. Paediatricians here can then conduct a thorough examination. And, based on their assessment can then order a diagnostic test which is the echocardiogram. This will markedly decrease undiagnosed cases in our part of the world that end up in lethal complications (Appreciation: Dr Faiza Malik, Resident Paediatrician Year 4, at Pakistan Air Force Hospital, Islamabad - neonatal examination conducted at Neonatal Intensive Care Units, Pakistan Air Force Hospital, Islamabad).

The purpose of this case report is to emphasize the importance of early detection and treatment of cardiac malformations and their complications. The prognosis is determined by the stage at which the condition or complication was diagnosed, which is difficult in developing countries. BAs with cardiac malformations have a higher mortality rate than all the other BAs, ranging from 27.5% to 71%. [9].

The Ministry of Health has not proposed any model to overcome this issue. This idea can be proposed and sent to the Ministry of Health. A panel of paediatricians based on a joint consensus can formulate clear criteria based on this framework that can be implemented in the basic health units and rural health centres.

To summarize, early diagnosis is critical for reducing morbidity and mortality in patients with cardiac malformations in developing nations, and to achieve this further research is needed to understand the incidence and prevalence of TOF and its related complications.

References

[1] Arif A, Zehra S, Qamarunnisa S, Patel N, Azhar A. CFC1 gene mutation in tetralogy of Fallot and dextro-transposition of great arteries in Pakistani population. *FASEB Journal* 2014; 28:S1.
[2] Khokhar RA, Gowa MA, Bangash SK, Tahir A. The Spectrum of Pediatric Cardiac Procedures and Their Outcomes: A Six-month Report from the Largest Cardiac Facility in Sindh, Pakistan. *Cureus* 2019; 11:e5339.
[3] Aziz K. Incidence of Heart Disease in Children at the National Institute of Cardiovascular Diseases. *JPMA* 1984; 34:10.
[4] Rizvi SFH, Mustafa G, Kundi A, Khan MA. Prevalence Of Congenital Heart Disease In Rural Communities Of Pakistan. *J Ayub Med Coll Abbottabad* 2015; 27:124-7.
[5] Kanneganti V, Thakar S, Aryan S, Kini P, Mohan D, Hegde, AS. Clinical and Laboratory Markers of Brain Abscess in Tetralogy of Fallot ('BA-TOF' Score): Results of a Case–Control Study and Implications for Community Surveillance. *J Neurosci Rural Pract* 2021; 12:302-7.
[6] Lakhani M, Memon RS, Khanb F. Brain abscess: A rare complication in a child with tetralogy of Fallot. *IDCases* 2020; 22:e00954.
[7] Mohammad N, Shaikh S, Memon S, Dasd H. Spectrum of heart disease in children under 5 years of age at Liaquat University Hospital, Hyderabad, Pakistan. *Indian Heart J* 2014; 66:145-9.
[8] Pathan IH, Bangash SK, Khawaja AM. Spectrum of heart defects in children presenting for pediatric cardiac surgery. *Pakistan Heart J* 2016; 49:1.
[9] Pandian JD, Moosa NV, Cherian PJ, Radhakrishnan K, Brainstem abscess complicating tetralogy of Fallot successfully treated with antibiotics alone. *Neurology India* 2000; 48:272-5.

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