

Brain abscess of odontogenic origin in a man with interatrial defect

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Abstract. A 65-year-old man with previous surgery for cyanotic congenital heart disease was admitted to our hospital with fever, headache and visual disturbances due to a right occipital brain abscess as shown through CT-scan. A comprehensive workup looking for a source of infection was negative except for an orthopantomogram showing multiple dental caries. A transesophageal echocardiogram (TEE) bubble study revealed the permanence of an atrial septal defect with a moderate right-to-left shunt. The culture of the abscess content showed flora commonly found in the oropharynx that responded to antimicrobial therapy. We hypothesize that the underlying mechanism is a significant bacterial load from dental infections that enters the arterial circulation through the interatrial defect. If a brain abscess is identified without any adjacent source of infection, then a transesophageal echocardiogram is indicated to exclude right to left shunt. If a shunt is found, then hematogenous spread of flora normally found in the oropharynx should be suspected. Surgical evacuation followed by antimicrobial therapy is warranted. Once the infection is eliminated, long term anticoagulation or anatomic closure of the interatrial defect with good oral hygiene could be valid strategies for preventing recurrence. (www.actabiomedica.it)

Key words: brain abscess, patent foramen ovale, paradoxical embolism

Introduction

Brain abscess is a focal suppurated intracerebral infection surrounded by a well-vascularized capsule. It may occur following head trauma and cranio-maxillo-facial surgery or secondary to a contiguous extension from the paranasal sinuses, middle ear, odontogenic sources. It may also be a result of hematogenous septic spread from distant sources (i.e. bacterial endocarditis). In 10-60% of patients with a brain abscess no underlying cause of infection is found. These abscesses are called cryptogenic (1).

Approximately 60% of brain abscesses are multi-microbial and the organisms involved (i.e. Streptococci, Staphylococci, enteric and anaerobic bacteria)

vary with the age of the patient, underlying medical or surgical conditions and type of infection (2).

Predisposing conditions are represented by diabetes, steroid therapy, Congenital hypogammaglobulinaemia, myelodysplasia and organ transplants. Brain abscesses are also complications of cyanotic congenital heart disease in children and teenagers (3,4). In adults brain abscess due to paradoxical embolism is a rare complication of patent foramen ovale (PFO). In this case the probability of brain abscess formation depends on the magnitude of the right-to-left shunt.

The frontal lobe is the most common site from the contiguous sinuses, while hematogenous spreading from distant foci is usually located in the area of the middle cerebral artery.

Clinical presentation commonly includes headache, fever and focal neurological deficit or even confusion and a decreased level of consciousness. Contrast-enhanced CT-scan and MRI are the essential diagnostic tools for accurate diagnosis. Careful culture of abscess content provides the best opportunity to make a microbiological diagnosis.

Treatment options are antimicrobial therapy, surgical excision or stereotactic aspiration. The imaging findings, such as stage of abscess formation, size (diameter less than or more than 2 cm), location (superficial or deep), number (multiple or single) and type (multiloculated or uniloculated), presence of surrounding oedema and midline shift combined with the neurological status of the patient, may guide the therapeutic strategy. Neurological deterioration following mass effect and increased intracranial pressure, enlargement of size in spite of antimicrobial therapy and risk of intraventricular rupture make surgical removal necessary (5).

Mortality rate is 0-24%, with younger patients doing better than older (2).

Case report

A 65-year-old patient with fever, headache and visual disturbances was admitted to our hospital in November 2007. His previous medical history included frequent sinusitis and peptic ulcer. Twenty years before the patient underwent surgery for cyanotic congenital heart disease (no related documents available). A CT scan showed a right occipital abscess (Fig. 1).

He was treated with Vancomycin, Metronidazole and Ceftriaxone, followed by craniotomy and abscess evacuation. After surgery he presented a CVC-related thrombosis of the right jugular and subclavian veins treated with therapeutic-dose of subcutaneous LMWH (Enoxaparin 14000 UI/die). Screening for thrombophilia (prothrombin and activated partial thromboplastin times, protein C and S, antithrombin, factor V Leiden and prothrombin G20210A mutations) was negative.

T, B cell count and immunoglobulin levels were normal; HIV test was negative. The patient was not

diabetic. Ear and nose infections were clinically excluded and a paranasal sinuses CT scan was negative. Evaluation for primary infection source was negative including chest CT-scan and abdomen US. An ophthalmologic examination showed a left side homonymous hemianopsia. An orthopantomogram revealed a generalized periodontal disease and multiple dental caries (Fig 2). No evidence of a contiguous focus of infection was observed on skull CT scan, so we hypothesize an hematogenous source of infection. No valvu-



Figure 1. CT-scan showing a ring-enhancing lesion in the right occipital lobe



Figure 2. Generalized periodontal disease, dental caries.

lar vegetations were found through echocardiogram. A transesophageal echocardiogram bubble study (echocardiography after the injection of agitated saline) revealed the permanence of an atrial septal defect showing a moderate right to left shunt with a mild right atrial and ventricular dilation.

The culture of the abscess content was positive for *Streptococcus Intermedius* (a micro-aerophilic commensal of the mouth). We hypothesized that a significant bacterial load from the periodontal lesion had entered the arterial circulation through the atrial septal defect and reached the brain.

The repeated CT scan showed the partial recovery of the lesion and a slight reduction in the oedema size. After global clinical improvement, oral anticoagulant therapy was started. The patient was discharged with prolonged antimicrobial therapy and then referred to the cardiologist for the correction of the atrial septal defect. Subsequently he cured his cavities and periodontal disease.

After one year we examined the patient. Following treatment by his dentist his oral conditions are good. He presents neurological improvement but mild visual deficit. He is also affected by migraines. MRI shows a right occipital malacic area with gliosis (diameter 4.6 cm). His cardiologist did not recommend atrial septal defect correction because the patient only shows provoked right-to-left shunt. Since the US showed no residual thrombosis, the cardiologist stopped VKAs and started Aspirin 100 mg/d.

Discussion

Here we report a case of a patient with an atrial septal defect who developed a presumably odontogenic brain abscess.

Cerebral abscess and stroke are rare but known complications of the patent foramen ovale. In fact, PFO and atrial septal defect has been suggested as a potential source of paradoxical embolism (6,7,8,9) due to the development of pulmonary hypertension and reversal of left-to-right shunt.

In our patient periodontal disease could be the source of the brain abscess. In fact *Streptococcus Intermedius*, a micro-aerophilic bacterium that usually colonizes the mouth and the upper respiratory tract, was isolated in the culture of the smear test as well as in the abscess contents. This microorganism could be able to by-pass the oxygen rich environment of the lung vascular bed and the action of alveolar macrophages and enter the arterial system through the atrial septal defect. Unfortunately we could not identify the bacterial DNA in order to confirm the diagnosis as suggested in recent reports (10,11).

Few analogous cases in adults in the literature are reported (10,12,13,14) (Tab. 1), the last one by Khouzam et al. in 2006 (15). At present the correct management of these patients is not yet strictly defined. We think that long term antimicrobial therapy and surgical resection or aspiration should be the treatment of choice of cerebral abscess. All patients with a brain abscess caused by flora commonly found

Table 1. Cerebral abscess and atrial septal defect, treatment in previously reported cases

Author	Journal	Treatment
Guy JM et al.	Ann Cardiol Angeiol 1992 ;41(7) :387-9	antibiotic therapy, surgical evacuation and closure of defect
Kawamata T et al.	Neurosurgery 2002 ;50 :674-5	Case 1: aspiration and antibiotic therapy. Case 2: antibiotic therapy
Friedlander RM et al.	NEJM 2003 ;348 :2125-32	antibiotic therapy and surgical evacuation
LaBarbera M et al.	Catheter Cardiovasc Interv 2006 ;68(6) :957-60	antibiotic therapy and closure of defect
Khouzam RN et al.	Heart and lung 2006 ;35(2) :108-111	antibiotic therapy, surgical evacuation and closure of defect
Stathopoulos GT et al.	Journal of Med Care Reports 2007 ;1 :68	antibiotic therapy and surgical evacuation
Abdullah R et al.	Clin Neurol and Neurosurg 2007 ;109 :620-23	antibiotic therapy and closure of defect
Lonnebakken MT et al.	European Journal of Echocard 2008 ;9 :105-06	antibiotic therapy, aspiration and closure of defect

in the oropharynx should be screened for a PFO with a TEE bubble study. Excellent oral hygiene and prophylaxis before dental procedures should be recommended in patients with PFO or atrial septal defect.

No clear guidelines based on randomized trials for the management of patients with PFO or atrial septal defect are available. Both long-term anticoagulation and device closure (16,17) have been proposed in order to prevent recurrent paradoxical embolization. Indication for closure should consider the potential delayed development of aortic valve regurgitation as recent TEE study disclosed (18) even if a recent study performed with cardiac magnetic resonance does not confirm these results.(19) Risk factors for embolic relapse seem to be age > 65 years, the coexistence of atrial septal aneurysm, right-to-left shunt at rest or greater than ten bubbles during TE echocardiography with agitated saline (20).

Our patient showed a CVC-related thrombosis of the right jugular and subclavian veins. Recurrences seem to be increased by thrombophilia and thrombosis. In fact, among patients with pulmonary embolism and a PFO, the migration of a thrombus through the septal defect and hemodynamic changes could promote cerebral embolic events. Moreover some recent reports show the association between inherited hypercoagulable states and paradoxical embolism in patients with PFO. Moreover, a complete blood screening for thrombophilia seems to be indicated after the first event in all patients who show no identifiable cause of cerebral event other than a PFO. (21,22,23).

We suggested atrial defect closure to our patient given the previous embolic event, age, presence of thrombosis, wide right to left shunt and the persistence of periodontitis. The cardiologist did not agree with our decision.

Conclusions

This case report shows the need for clear guidelines about the treatment of patient with atrial septal defect and previous embolic event. The optimal treatment strategy remains controversial. Few data about the efficacy of oral anticoagulation and the duration of therapy required are available. Medical treatment

alone may often offer insufficient protection. On the other hand the efficacy of percutaneous PFO closure in addition or alternative to oral therapy will be shown by future trials, given the risk of recurrent event despite the defect closure. At present failed medical treatment for secondary stroke prevention represents the only FDA accepted indication for PFO closure. Until clear European guidelines are given, we think that the final decision should be based on the clinical history and carefully considering the haemorrhagic and thrombotic balance of the subject (24).

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