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**Transient ischemic attack induced by pulmonary arteriovenous fistula in a child :  
a case report**

Transient ischemic attack induced by pulmonary arteriovenous fistula

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## Abstract

### BACKGROUND

Cerebral ischemic stroke is attributed to paradoxical cerebral embolism (PCE). Pulmonary arteriovenous fistula (PAVF) is a rare potential cause of cerebral ischemic stroke. Cerebral ischemic stroke induced by PAVF in children is rare.

### CASE SUMMARY

We report a case of right PAVF that presented as transient ischemic attack (TIA) in a 13-year-old boy, who underwent embolization therapy and remained clinical stable for 2 years after treatment.

### CONCLUSION

TIA induced by PAVF in children is rare, lacking typical clinical manifestations, which should not be ignored.

**Key Words:** pulmonary arteriovenous fistula; transient ischemic attack; paradoxical cerebral embolism; children

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**Core Tip:** Pulmonary arteriovenous fistula (PAVF) is a rare potential cause of cerebral ischemic stroke. Children with PAVF have atypical clinical presentations, and even present with cerebral ischemic stroke or TIA as the only clinical symptom. If a PAVF is suspected, we recommend that corresponding examinations should be performed for early detection, then active treatments and follow-up should be offered.

## INTRODUCTION

Cases of cerebral ischemic stroke induced by PAVF were mostly reported in adults, which is attributed to paradoxical cerebral embolism (PCE) [1-5]. Due to the congenital or acquired arteriovenous communications, PCE can be caused by the emboli transferring from venous to artery, or transferring from right heart system to left heart system. PCE is mostly induced by patent foramen ovale (PFO) [6], while PAVF is a rare potential cause. Cerebral ischemic stroke induced by PAVF in children is rare. This study reported a 13-year-old boy with TIA induced by PAVF, in order that enough attentions should be paid to the rare cause of PCE, and the missed diagnosis rate should be reduced.

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## **CASE PRESENTATION**

### ***Chief complaints***

A 13-year-old boy was admitted to our hospital on September 02, 2020 due to a 2-day history of recurrent onset of dizziness.

### ***History of present illness***

The patient presented with recurrent onset of dizziness and bilateral limbs weakness for 2 days. During the attack, he fainted onto the ground for one time, then recovered spontaneously about 5min later, no dyspnea, nausea, vomiting, tinnitus, hearing loss or convulsion.

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### ***History of past illness***

The patient had a free previous medical history.

### ***Personal and family history***

Personal and family history were free.

### ***Physical examination***

Physical examination showed no neurological or cardiorespiratory abnormalities. Vital signs were stable.

### *Laboratory examinations*

The results of laboratory examinations were normal.

### *Imaging examinations*

The subsequent chest x-ray showed a mass shadow in the right upper lung (Figure 1A). The cardiac color ultrasound showed no obvious abnormalities, and no patent foramen ovale (PFO) was seen. The cardiovascular CT angiography (CTA) showed the right upper pulmonary artery (diameter=7.4mm) expanded, its branch vessels thickened and twisted into an abnormal vascular nest, directly refluxed into the right upper pulmonary posterior vein, finally merged into the right upper pulmonary vein (Figure 1B,1C, and1D). Brain magnetic resonance imaging (MRI) and cerebral arteries magnetic resonance angiography (MRA) showed no obvious abnormalities (Figure 1E and 1F). The contrast-enhanced transcranial doppler (c-TCD) revealed a positive result with a large right-to-left shunt (Figure G).

### **FINAL DIAGNOSIS**

The patient was diagnosed with TIA and PAVF. TIA induced by PAVF was considered.

### **TREATMENT**

The patient underwent embolization therapy of PAVF under general anesthesia on the third day of hospitalization. Intraoperative angiography showed a PAVF originated from the right upper pulmonary branch artery (Figure 2A and 2B), which could not be revealed after embolization by a vascular plug (Figure 2C and 2D).

### **OUTCOME AND FOLLOW-UP**

At 10 mo postoperative follow-up, CT scan showed the position of the vascular plug was stable (Figure 3A), and the PAVF shrink obviously (Figure 3B). At 1 year and 2 year postoperative follow-up, the patient remains clinical stable, no any symptom of dizziness, limbs weakness or fainting.

## **DISCUSSION**

The presence of right-to-left shunt (RLS), which can result in paradoxical brain embolism, is an important etiology of ischemic stroke especially in young adults. PFO and PAVF are the most important causes of RLS. Currently, transcranial Doppler ultrasound has been reported to be a noninvasive and useful method for detecting RLS. The golden standard for detecting RLS is contrast-enhanced transesophageal echocardiography (TEE). It is recommended that these examinations be carried out immediately after the onset of the stroke [7]. PAVF is one of the important causes of RLS. Previous report showed that the prevalence of PAVF was 0.026% [8]. TIA occur as the clinical manifestation of PAVF is up to 20% of cases [1]. At present, it is believed that the risk factors for cerebral ischemic stroke in patients with PAVF are: (1) feeding artery diameter > 3 mm; (2) existence of multiple PAVMs [9]. Whether patients with PAVF present with clinical manifestations depends on the right-to-left shunt quantity. There are intrapulmonary and extrapulmonary manifestations in patients with pulmonary arteriovenous fistula. The intrapulmonary manifestations are as follows: dyspnea after the activity, dizziness, easy to fatigue, and so forth [10-12]. Physical examination reveal cyanosis, clubbing fingers or toes, and chest continuous murmur, *etc.* Some patients may only present with abnormal arterial blood gas analysis. The extrapulmonary manifestations are as follows: migraine, TIA, ischemic stroke, brain abscess, epilepsy, and so forth [10-12].

Espejo-Herrero et al [1] reported a patient with TIA presenting with a short-term (30 min) right limb paralysis, and subsequent pulmonary arteriography showing a PAVF. Pulmonary DSA is the gold standard for the diagnosis of PAVF, which can observe the fistula size, feeding artery, draining vein and other conditions [10]. However,

DSA is an invasive examination. As a non-invasive examination, CTA can not only show the lesions (even the mild lesions) and the responsible blood vessels of PAVFs, but also accurately judge the peripheral and complex PAVFs, which is more suitable for the diagnosis of PAVF [10]. At present, c-TCD has been widely used for right-to-left shunt screening, which can dynamically observe the emboli entering into the intracranial arteries and the changes of cerebral blood flow in real time [13]. In our report of this case, c-TCD revealed a positive result with a big right-to-left shunt, which was in line with the diagnosis of PAVF.

Most of the PAVFs will gradually enlarge and rarely shrink spontaneously, which may cause serious complications. The mortality rate of untreated patients with PAVF was as high as 50%, which can be reduced to 3% after treatment. At present, it is advocated that active treatments should be adopted for patients with symptomatic or asymptomatic PAVFs, if their lesions diameter exceed 3mm. The PAVF treatments mainly include surgery and interventional embolization, which can improve the symptoms of hypoxia and prevent the occurrence of central nervous system complications [10,11]. Todo et al [14] reported a patient with recurrent ischemic stroke induced by PAVF with a feeding artery diameter of 1.80 mm, who was successfully prevented from the recurrence of embolic events after embolization treatment. In our report, this case was treated with interventional embolization of PAVF in our hospital, and there was no recurrent seizure of TIA symptoms for 2 years, which further confirmed that the recurrent TIA symptoms were associated with PAVF.

## **CONCLUSION**

Although pulmonary arteriovenous fistula is a rare cause of abnormal embolism, it should not be ignored. Most patients with PAVF have atypical clinical presentations, and even present with cerebral ischemic stroke or TIA as the only clinical symptom. Therefore, to the patients with cryptogenic stroke, especially the children with cryptogenic stroke, the corresponding examinations should be performed to judge

whether they may suffer from PAVF, then active treatments and follow-up should be offered.



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