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Case Report

# Vein of Galen aneurysmal malformation associated with brain abscess: A computed tomography case report ☆

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ABSTRACT

Vein of Galen malformation (VGM) is a rare congenital, uncommon intracerebral vascular anomaly rarely complicated with the development of brain abscess as secondary to primary infection or after endovascular treatment. We report a very rare finding of a vein of Galen aneurysm associated with a large brain abscess at the time of diagnosis. A 12-year-old boy with a high-grade fever, severe headache, and recurrent episodes of convulsions came into the radiology department of Kassala Advanced Diagnostic Center. On a Siemens 16-slice scanner, brain non-contrast enhanced computed tomography (NECT) and contrast enhanced CT (CECT) was used to determine the source of the acute headache and convulsions which revealed a right frontal peripherally enhancing cystic lesion measuring 5.7 × 4.7 × 5.3 $cm^2$ surrounded by massive vasogenic edema causing mass effect with midline shift to the left side by 1.5 cm suggestive of brain abscess. There is evidence of another avidly enhancing lesion seen within the third ventricle continuous with a straight sinus surrounded by extensive vascular loops consistent with an aneurysm of the vein of Galen, it was caus-

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ing compression of the cerebral aqueduct with upstream mild hydrocephalus with dilated both lateral ventricles. Late presentation, diagnosis, and treatment also lead to an increase in the morbidities and mortalities of such case conditions. Urgent intervention should be considered for better outcomes.



## Introduction

The brain parenchyma receives 18%-20% of cardiac output and makes up 2% of body weight, and the primary artery supply to the brain is the vertebral and internal carotid arteries. The brain also receives 25% of oxygenated blood from each breath [1,2]. Different venous sinuses drain the venous blood according to the surface and locations in the brain, including superficial and deep groups of veins. Demonstrated as (1) sphenoparietal and cavernous sinuses receive the veinous blood from the sphenoidal group; (2) Superior sagittal sinus receive from the superior sagittal group (3) vein of Galen and inferior sagittal sinus receive falcine group and (4) the tentorial group drain from tentorium cerebelli and its tributaries [2,3]. Deep white matter and the basal ganglia blood are drained via basal and internal cerebral veins which are united to form the vein of Galen (also known as a great vein) that drains to the straight sinus (Fig. 1). It is noteworthy to emphasize that the deep system is rather stable in comparison to the superficial system, making the identification of thrombosis or hemodynamic disease easy [4].

Vein of Galen malformation (VGM) is a rare congenital, uncommon intracerebral vascular anomaly [5] also better named as median prosencephalic arteriovenous fistulas. Representing 1%-2% of all brain vascular anomalies and 30% of all cerebrovascular malformations in pediatric groups [6] 0.5%-5% of cerebral aneurysms [7], the most prevalent cerebral vascular abnormality is identified antenatally which is predominant in male gender [8]. Presented with high-output cardiac failure, and low-flow aneurysms may remain undetected till adulthood.

Different classification systems this malformation started by Litvak et al. [9] according to clinical presentations, Yasargil classification (types I to IV) [10], mural and choroidal type as in Lasjaunias classification [11], and recently classification developed by Mortazavi et al. [12] taking age and heart failure as an important factor [12]. Treatment goals are to prevent new development and to prevent and/or improve the existing symptoms, depending on the age of the patient. In infants, rehabilitation of heart failure is the major goal, whereas in older children the goal is to prevent neurologic problems. The authors believe that; complete obliteration of the Vein of Galen aneurysmal malformation (VGAM) is not the main goal of treatment, particularly when a therapy may cause morbidity and mortality [11].

On the other hand, the presence of brain abscess in children is not frequent and commonly seen between the age of 4-7 years [13] with 15%-30% of unknown causes [13,14], or due to infection originating as contiguous, hematogenous and traumatic or surgical sources [15]. The most common types of microorganisms associated with congenital heart disease are Staphylococcus aureus. aureus, aerobic & microaerophilic streptococci, Haemophilus spp. As seen in 30%-34% of patients with brain abscess [13].

CT angiography (CTA), magnetic resonance imaging (MRI) brain with contrast, magnetic resonance angiography (MRA), and magnetic resonance venography (MRV) [16] in addition to intrauterine or neonatal ultrasound [17] is readily used to diagnose aneurysms and intracranial brain lesions. NECTwith 100% sensitivity is used to evaluate the ruptured aneurysm and to detect the intracranial hemorrhage [18] while CTA with an advanced machine can detect the small size aneurysm up to 4 mm or smaller in diameter with 100% sensitivity using 16-64 slice scanners [19,20].

## Case presentation

A 12-year-old male admitted to the Emergency Room (ER) at Kassala Teaching Hospital, Sudan complaining of convulsions, headache, and high-grade fever, in addition to treating the convulsions, the primary treatment for headache and fever conditions was administered immediately. A brain CT scan requested to rule out any potential reasons for his headache and convulsions. Siemens Healthineers CT scanner with 130 peak tube voltage (kVp) and an 18.18-second exposure time used for the scanning operation at Kassala Advanced Diagnostic Center. A primary NECT scan reveals a ring ill-defined lesion with a hypodense component in the right brain hemisphere surrounded by a diffuse area of brain edema, in addition to a hyperdense lesion posterior to the third ventricle compressing the lateral ventricles (Fig. 2A).

The patient is then returned to the hospital because the image report will be ready in less than a day. After looking over the CT scans, the radiologist asked to do a contrast phase (CECT), and the report deemed urgent for this patient. The post- and precontrast phases report was immediately created (radiologist call for urgent intervention), leading to the following outcomes: A $5.7 \times 4.7 \times 5.3$ $cm^2$ right frontal peripherally enhancing cystic lesion is present, encircled by a huge vasogenic edema that is creating a mass effect, and a 1.5 cm midline shift to the left, which is suggestive of a brain abscess. There is evidence of another avidly enhancing lesion seen within the third ventricle in continuation with straight sinus surrounded by extensive vascular loops consistent with an aneurysm of the vein of Galen (Fig. 3), it was causing compression of the cerebral aqueduct with upstream mild hydrocephalus with dilation of both lateral ventricles.

Additionally, CT shows that there is no established major arterial territory infarction, no intracerebral or subarachnoid

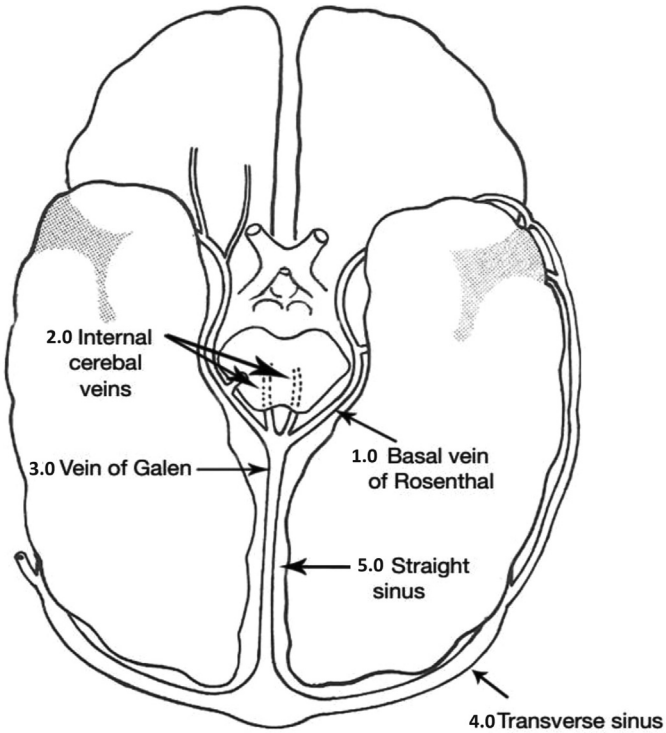


**Fig. 1 – Demonstrates the main course of the vein of Galen (3.0), the inferior view shows the basal veins of Rosenthal (1.0) and internal cerebral veins (2.0) drain to the vein of Galen (3.0) and then to the straight sinus (5.0). As presented by Kılıç and Akakın [3].**

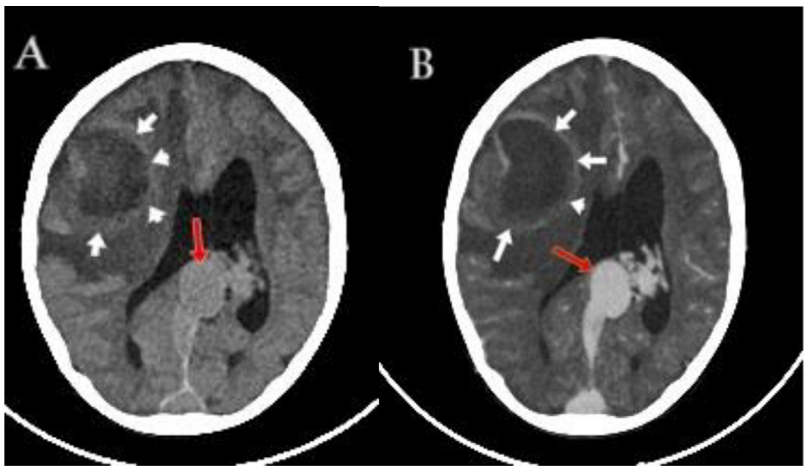


**Fig. 2 – A none contrast Axial CT scan (A) and contrast-enhanced CT as in (B) shows ring enhancing right frontal peripheral cystic brain lesion (white arrows) representing *brain abscess*, surrounded by a wide area of hypodensity (edema), dilated area posterior to the third ventricle representing *aneurysm at the vein of Galen* (red arrow) as connected to straight sinus both are directly drains to the confluence of sinuses.**

hemorrhage, Absence of an extra-axial collection, intact posterior fossa and brain stem, and absence of a localized bone lesion or fracture. It's important to note that this diagnosis was confirmed by 2 consultant radiologists. No further treatment received by the patient because he passed away 2 hours after the scanning procedures.

## Discussion

One of the rare conditions that links the vein of Galen is aneurysmal malformation with the presence of a brain abscess. We have prepared this case report since the patient had

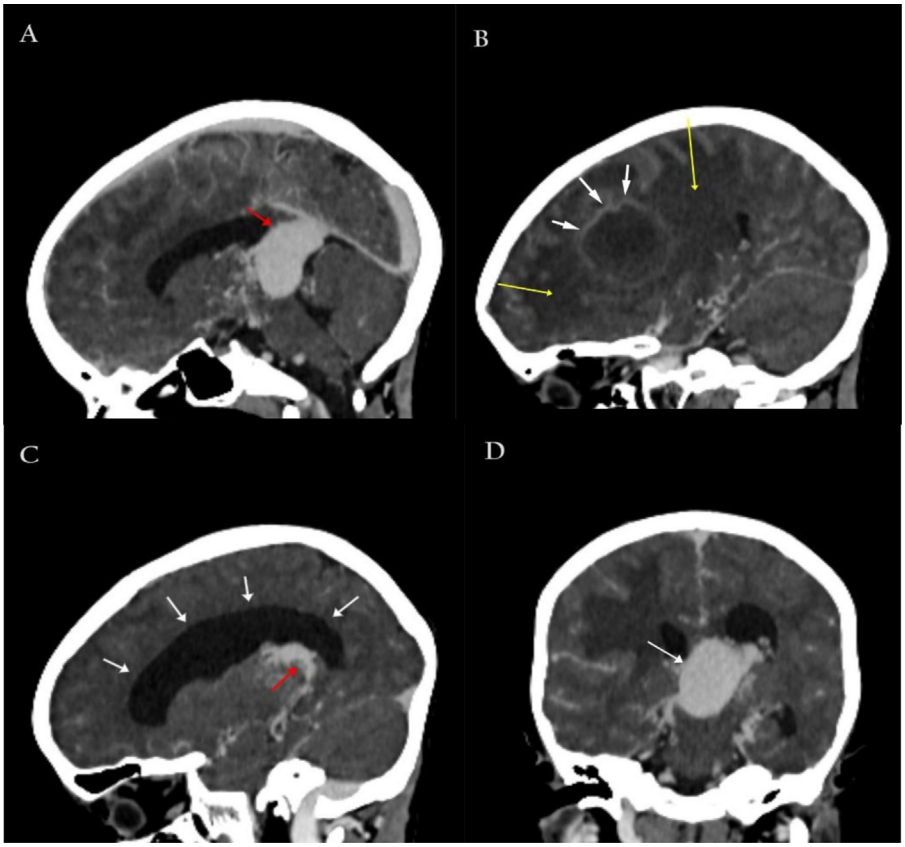


**Fig. 3 – A reconstructed sagittal section for contrast-enhanced CT demonstrates the size and shape of the *aneurysm in the vein of Galen* and its relation to the straight sinus (A), ring-enhancing lesion (white arrows) with its surrounded edema (yellow arrow) (B), dilated lateral ventricles and extensive vascular loops (red arrow) (C), VGAM with its vascular loops as in coronal section (D).**

a variety of unusual illnesses noticed in their older age, including the development of an enormous brain abscess and aneurysmal malformation of the Galen vein. Late presentation and diagnosis of such condition, in addition to the primary pathological issues, resulted in the patient's death before receiving the final report. The presence of an aneurysm in the area of deep brain structure leads to the compression of a variety of vital structures in addition to increasing the risk of rupture [21]. In our presented case as in (Figs. 1 and 2) different complications had been identified from CT images as compression of a cerebral aqueduct also anteriorly compressing the third ventricle and the lateral ventricles as well leading to development of hydrocephalus, the presence of huge abscess in the right hemisphere with diffuse brain edema compromising the function of the right brain tissue.

Different authors reported that aneurysms with brain abscesses are very rare, as Farran and Antony [22] describe the successful treatment of a 60-year-old patient's intracranial aneurysm in the internal carotid artery and cerebral abscess caused by Nocardia infections. Chen et al., [23] report only one brain abscess out of 700 aneurysmal patients after embolization of a left middle cerebral artery aneurysm, However, the illnesses linked to endovascular embolization make this case typical. As a rare consequence following therapeutic neuroendovascular treatments, a different author observed that the co-incidence of infection with embolization of the intracranial aneurysm treatment technique may result in a parenchymal abscess due to external infection [23–26]. Another type of aneurysm reported due to infections from different sources called microbial aneurysms (MAs) due to infective endocarditis, meningitis, or other type of infections [16,27] and reported cases in immunocompromised patients as in the human immunodeficiency virus—HIV-1 in children [27].

## Conclusion

Based on a thorough review of numerous publications, there are no documented instances of a large brain abscess linked to a vein of Galen aneurysm. According to the case report, a massive vein of Galen aneurysm with a complex abscess combined with cerebral aqueduct blockage causes mild hydrocephalus, which raises intracranial pressure and compresses the brain's structure, ultimately ending the patient's life. It is also crucial to note that: to identify urgent situations that require immediate reporting, the CT department should undertake patient procedures with an experienced radiographer and a resident radiologist in attendance.

## Patient consent

The patient's parent signed a written informed consent that authorizes the research team to report the necessary information before data collection.

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