

Brain Herniations into Arachnoid Granulations (BHAGs) Presenting as PNES: A Rare Presentation

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Abstract

Background: Psychogenic non-epileptic seizures (PNES) are paroxysmal events that share similarities with epileptic seizures but lack epileptic electrical activity. Concurrently, the incidental discovery of arachnoid granulation herniation into dural venous sinuses, typically considered benign, has intrigued researchers, especially when observed in conjunction with paroxysmal events. **Case Report:** We present a case of a 17-year-old male patient with PNES accompanied by an incidental finding of brain herniation into arachnoid granulation (BHAG). **Conclusion:** This case highlights the intriguing association between psychogenic non-epileptic seizures and the incidental discovery of arachnoid granulation herniation into dural venous sinuses and emphasizes the importance of appropriately identifying and managing PNES to optimize patient outcomes, while also considering the fascinating incidental imaging findings.

Keywords: Dissociative Seizures, EEG, Epileptic Seizures, Intracranial Sinuses, Psychogenic Nonepileptic Seizures.

Introduction

Arachnoid granulations are structures filled with cerebrospinal fluid (CSF) that extend into the venous sinuses through openings in the dura mater and allow the drainage of CSF from subarachnoid space into the venous system, size of these granulations varies from a few millimetres to more than 1 cm when called as giant arachnoid granulations [1]. These granulations may grow to fill and dilate the dural sinuses or expand the inner table of the skull, the presence of pre-existing arachnoid granulations facilitates the brain herniation into the dural venous sinus (DVS) or adjacent calvarium which is thought to arise spontaneously or as a result of increased intracranial pressure [2]. Brain herniations into arachnoid granulations (BHAGs) are rare findings of undetermined etiology and significance and are incidentally recognised when patients undergo imaging for some other reason. Battal *et al.* reported that prevalence of BHAGs is 0.32%. The

most common location of BHAGs are the occipital squama and transverse sinus [3,4]. Posterior brain region involving cerebellar hemispheres, occipital lobes herniate more followed by inferior temporal gyrus, occipitotemporal gyrus, parietal cortex and superior frontal gyrus [5,6]. Usually they are asymptomatic but can be symptomatic when large enough to cause sinus occlusion. We report a rare case presenting in epilepsy clinic for refractory seizures and found to have brain herniation into arachnoid granulation on neuroimaging.

Case Report

A 17-year-old male patient presented to us with a history of multiple episodes of abnormal posturing of the body and unresponsiveness for the last 20 days, after a family conflict. These episodes persist for a variable duration of 10 minutes to 2-3 hours, semiology being episodes of abdominal and chest discomfort, hyperventilation followed by variable posturing of both upper limbs, flexion of both lower

limbs at hip and knee joint, tight closure of eyes, and opisthotonos posturing without any urinary and fecal incontinence, tongue bite, the patient didn't suffer injury in any of these episodes, there was no period of confusion or amnesia associated with the event, no history of any automatism, hallucinations, or other type seizures. Family history was not contributory. Birth and developmental history were normal with febrile seizures (3 episodes) before the 3 years of age that subsided without need of any anti-epileptics.

His general and neurological examination was normal. As patient was not responding to two anti-epileptic drugs and with bizarre event semiology, he was subjected to long term video EEG for 3 days which captured five events, when analysed showed clinical events of non-stereotypical episodes of pelvic thrusting, opisthotonos posturing, side-to-side movement of the body, forceful eye closure and bizarre behaviour of act of strangulation during the events. These events increased in presence of family persons. On EEG correlation, there were no ictal epileptiform discharges during the events confirming that the events were psychogenic non-epileptic seizures (PNES). Background rhythm was sinusoidal alpha of 8-9 Hz with preserved reactivity to eye opening and closure. There were no interictal epileptiform discharges noted. Neuroimaging (MRI Brain) showed herniation of the left inferior temporal gyrus into the arachnoid granulations of the left transverse-sigmoid junction, and associated minimal herniation of adjacent CSF spaces along with brain parenchyma. The herniated brain matter showed subtle gliosis at its borders. CT correlation showed smooth scalloping of the inner table of the adjacent left parietal bone, the lumen of the sinus effaced laterally without any intraluminal extension. The clinico-EEG correlate and the imaging findings confirmed the case of psychogenic non-epileptic seizures (PNES) with incidental finding of brain herniation into arachnoid granulation (BHAG). Patient was given counselling by psychiatric

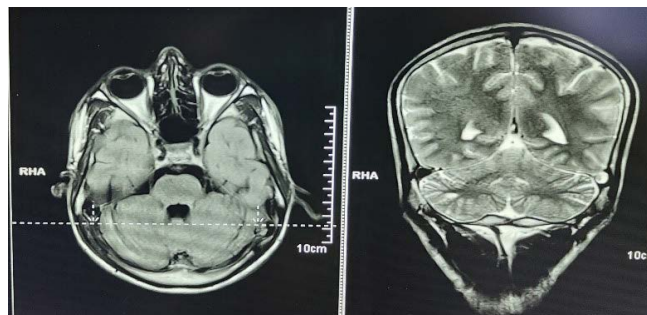


Fig.1,2: *Herniation of the left inferior temporal gyrus into the arachnoid granulation appears hyperintense on flair and T2 at left transverse-sigmoid junction.*

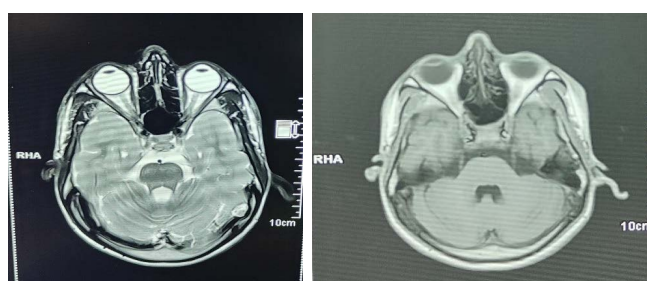


Fig.3,4: *Herniated brain matter is showing subtle gliosis at its borders and inner table smooth scalloping of left parietal bone. The lumen of the venous sinus is effaced laterally without any intraluminal extension.*

unit and anti-epileptics were slowly tapered and withdrawn. Patient has markedly improved after counselling.

Discussion

Arachnoid granulations (AG) were first described by Antonio Pacchioni in 1705. These are arachnoid extension into sinuses. Arachnoid granulations can enlarge with age or in response to an increase in cerebrospinal fluid pressure and they can be found anywhere in the dural venous sinuses and are macroscopically visible. Most of BHAGs are asymptomatic incidental findings as occurred in our case, but a part of them can potentially be linked to particular symptoms probably due to eloquent brain tissue found in the herniation. Their etiology is not completely understood and many theories are associated with it. Symptoms can occur as a result of venous hypertension secondary to partial

sinus occlusion [7]. Increased intracranial pressure causes brain parenchyma to herniate into arachnoid granulations or it sometimes herniate spontaneously or as a result of increased intracranial pressure, also confirmed by Battal *et al.* [8].

Benign intracranial venous hypertension is another clinical phenotype reported with giant arachnoid granulation and daily acetazolamide in 750 mg dosage reduces the symptoms effectively [9]. AG are most reliably seen in FLAIR with totally different CSF intensity (not attenuated) in 100% cases. Flair hyperintensity of CSF could be due to pulsation artifacts from the adjacent sinus. The closest differentials are thrombosis of dural sinuses and neoplasia which can be differentiated by their unique characteristics of involving more extensively and contrast enhancement and diffusion restriction feature, shape respectively. Brain parenchyma herniations into the calvarium are recently described rare controversial entity and encountered more frequently in posterior inferior parts of the intracranial cavity. Brain herniations into AG are most commonly located in the occipital squama, followed by transverse sinus, lateral lacuna of the superior sagittal sinus, and straight sinus. Cerebellar tissue is the most frequent found in these herniations but cerebral tissue can also herniate. Brain parenchyma herniations affect more women than men [5]. Complicated AG result from strangulation of herniated tissue as a result of narrow neck which causes infarction of the herniated parenchyma which can result in brain dysfunction and seizures. Our patient though had apparent seizure like events which were confirmed to be PNES on video EEG and it was mere incidental association of BAGH and PNES. The rarity and unique presentation bring this case for highlight.

Conclusion

This case is presented for its rarity and unique association of BAGH with PNES. It's potential relation with above mentioned symptoms in some of the patients makes them an important entity

to be identified. It is important to recognize both arachnoid granulations and BHAGs correctly and avoid confusing them with normal filling defects of dural sinuses such as septae or fat, or with pathological conditions including sinus thrombosis, malignancy or encephalocele. The author tried to bring this less recognised entity and describe the facts related to it.

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