The Double Threat: Multiple Brain Abscesses and Pulmonary AVM - A Rare Neuro-Pulmonary Connection Case Report

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ABSTRACT

Background: Brain Abscess is defined as focal area of necrosis caused by a collection of pus, also known as Suppurative Encephalitis. The most common causes of brain abscesses are trauma, contiguous spread such as dental infections, paranasal sinusitis, otitis, mastoiditis, intracranial neurosurgical procedures, or hematogenous spread in cases of an Arteriovenous (AV) shunt, such as an Atrial Septum Defect. Pulmonary Arteriovenous Malformations (PAVMs) are direct abnormal vascular connection between a pulmonary artery and pulmonary vein, this connection bypasses the normal pulmonary capillary bed and results in an intrapulmonary right-to-left shunt. As a consequence, patients with PAVM can have hypoxemia and paradoxical embolization complications, including stroke and brain abscess. Despite, A Pulmonary Arteriovenous Malformation (PAVM) is an uncommon additional cause of AV shunt that may enable brain abscess. We report a case of a patient who was diagnosed with Brain Abscess along with Pulmonary AVM as a presenting manifestation.

Case Presentation: A 28-year-old female presented with complain of fever, occipital Headache, vomiting and left sided weakness along with jerky movements of limbs. She was diagnosed was Brain Abscess in right superior front-parietal and left temporal regions. Craniotomy with evacuation of abscess was done, after few days her oxygen saturation was continuously dropping. Her Routine workup did not reveal any additional pathology apart from the PAVM. After treatment of the cerebral abscess, the PAVM was treated with embolization.

Keywords:

Brain abscess, Pulmonary AVM, Intervention, Neuroradiology.

Introduction

Brain Abscess is a pus-filled pocket within the Brain tissue caused by inflammation and collection of infected material coming from local or remote infectious sources such as mastoiditis, paranasal sinusitis. The infection may also be introduced through intracranial neurosurgical procedures and skull fractures following a head trauma, other than this right to left shunt such as Pulmonary Arteriovenous Malformation (PAVM) is rare and uncommon cause of brain abscess. Pulmonary Arteriovenous Malformations (PAVMs) are abnormal vascular malformations characterized by low resistance and high flow. They commonly connect a pulmonary artery directly to a pulmonary vein, circumventing the normal pulmonary capillary network and leading to an intrapulmonary right-to-left shunt increasing the risk of complications from paradoxical emboli manifesting as transient ischemic attacks, ischemic strokes, or brain abscesses. Almost 40% of cases present with dyspnea and hemoptysis and 60% are asymptomatic. Patients may present with unexplained hypoxemia, dyspnea, orthodeoxia, brain abscess, or cerebral Embolism. we describe a case of multiple brain abscess in which PAVM was an incidental finding. The main purpose of this report is to highlight the added value of HRCT (High-Resolution Computed Tomography) chest in patients with brain abscess of unknown etiology.

Case Report

A 28-year-old female with no known co-morbids came to ER with complain of occipital headache radiating to back of neck and shoulders associated with high grade fever, vomiting, left sided weakness with jerky movement. Her MR was performed which revealed. At least two abnormal signals (Figure 1) identified in brain parenchyma with double wall sign and marked adjacent edema. To further characterize the lesion and to rule out any remote possibility of metastatic deposit MRI brain with contrast advised. Post contrast images showed leptomeningeal enhancement. Lesions showed peripheral rim pattern of enhancement and diagnosis of brain abscesses with meningitis was confirmed. To reduce the significant mass effect due to abscess in right fronto-parietal lobe craniotomy and excisional biopsy/evacuation of abscess was considered and performed. While work up for general anesthesia fitness chest X-ray was performed which showed well defined lobulated opacification in left lower zone extending to the hilum, otherwise no sign of infection noted in lung fields (Figure 2).

However, surgery was performed as lifesaving procedure by taking high risk consent on urgent basis. CT was performed (Figure 3). After 2 days of hospital course, she was discharged under antibiotic cover and pain killers. After few days she again presented to ER with complain of restlessness and difficulty in breathing. Her oxygen saturation was continuously dropping, ABG's were done which showed hypoxia. D-dimer was raised,

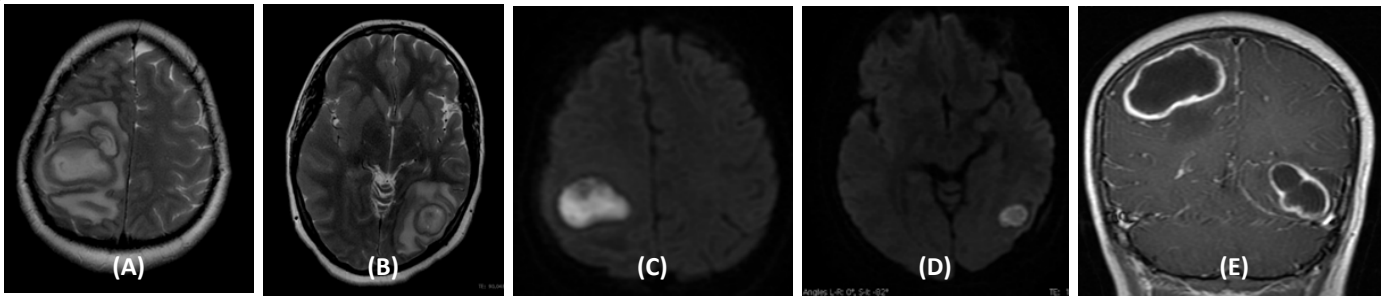

Figure 1: (A) and **(B):** Show atleast two abnormal signal intensity areas in brain parechyma with double wall sign and marked adjacent edema; **(C)** and **(D):** Show restricted diffusion; and **(E):** Show peripheral postcontrast enhancement with meningeal enhancement.

Figure 2: Well defeind lobulated opacification in left lower zone extending to the hilum. otherwise no sign of infection noted in lung fields.

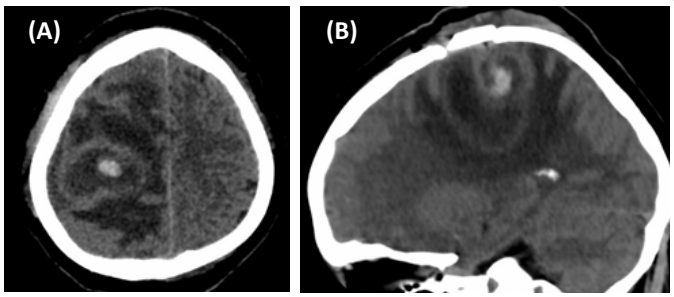

Figure 3: A,B show residual abcesses and right fronto-parietal lobe craniotomy.

Pulmonology team was taken onboard keeping in view of pulmonary embolism. CT Pulmonary Angiogram (Figure 4) was done which showed two AVMs with single segmental artery to each one as feeders from left lower lobe pulmonary artery branch. One in left lateral basal segment consisted of large aneurysmal dilated vessels and other small one in medial basal segment consists of abnormal vessels. Venous drainage was into the pulmonary veins. This resulted in arteriovenous shunting of blood that possibly led to development of brain abscesses and also resulted in dyspnea. For further management endovascular embolization of pulmonary AVM was offered and the patient was referred to Vascular Interventional Radiology team. AVM Embolization (Figure 5) was done under General Anesthesia. Ultrasound guidance sheath was passed through left common femoral vein.

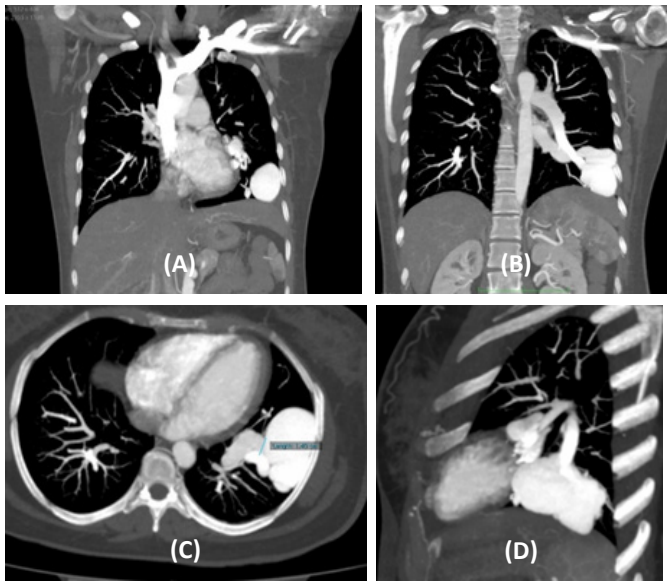

Figure 4: A-D show two AVMs with single segmental artery to each one as feeders from left lower lobe pulmonary artery branch.

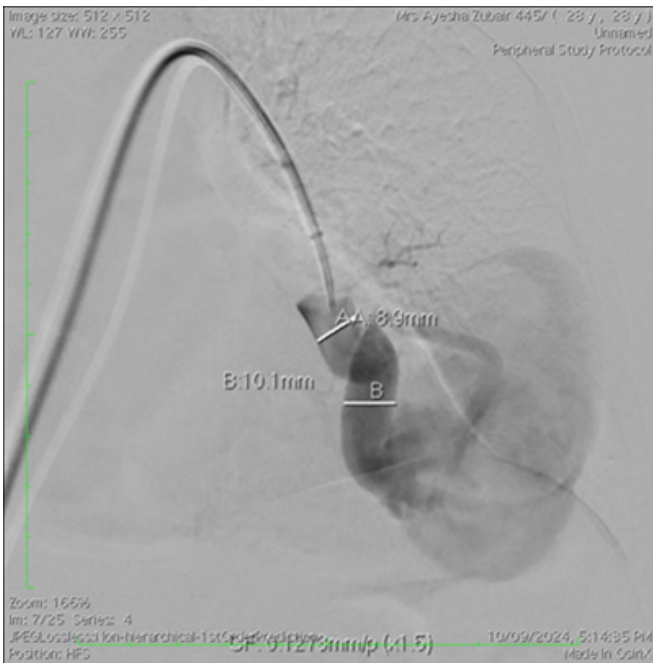

Figure 5: Pre-embolization shows feeding artery to the aneurysm and AVM in lateral basal segment.

A catheter with the help of Eoftuire was taken into the lower lobe branch of left pulmonary artery which was supplying the

Figure 6: Pre-embolization show no AVM.

AVM. A 6F destination sheath was advanced into the arterial limb of AVM. An Amplatz plug was placed in arterial limb of AVM to block it. Post deployment run showed complete occlusion of artery. Another smaller AVM was seen arising from another branch of left lower lobe pulmonary artery. The smaller AVM and its Post feeding vessel were embolised with coils. Post Embolisation (Figure 6) run showed no contrast blush in second aneurysm. After the procedure patient was maintaining Oxygen Saturation on 5 liters of oxygen and other vitals were stable. Patient was given high dose Antibiotic cover and pain killers and was discharged after a week. She was advised follow-up in neurosurgery department and infectious department.

Discussion

A brain abscess is a localized infection in the brain caused by various microorganisms, including bacteria, mycobacteria, protozoa, helminths, and fungi [1,2] and can spread through hematogenous and metastatic route and is most common in immunocompromised patients [1-4]. Although it appears in only 20% of cases, the typical symptoms include headache, fever, and specific neurological deficits [1] most of the patients present with clinical signs that depend on the location or mass effect of the lesion: headache, nausea, emesis, fever, alteration in consciousness, seizures, and motor weakness are the most common symptoms [3]. Brain abscess is also known as suppurative encephalitis which is surgically curable [2,3]. About 15 to 30% of brain abscesses are thought to come from cryptogenic sources [1,5] potentially related to heart problems. However, due to the strong blood-brain barrier and the abundant blood flow in the brain, the chance of these abscesses developing from pulmonary arteriovenous malformations (AVM) is around 5% [2,5]. Cranial imaging plays a vital role in diagnosing brain abscesses. It typically involves a CT scan with IV contrast enhancement and an MRI [1,3,4]. The imaging characteristics of a brain abscess vary based on the stage at which the imaging is performed and the origin of the infection [4]. Furthermore, MRI protocols help in differentiating brain abscess from necrotic and cystic lesions [1,4].

The treatment plan for brain abscess includes 1) Medical, 2) Aspiration and 3) Surgical excision. The modern-day therapy involves combined medical and surgical approach [3,4]. However, if brain abscess left untreated, the most common complication is Herniation and less commonly due to Intraventricular rupture of brain abscess with fulminant meningitis [2]. When diagnosing a brain abscess, it's important to conduct a thorough workup in order to identify the source of the infection. This typically includes echocardiography to check for atrial septal defects and endocarditis, a chest X-ray to look for lung infections, and an evaluation of the teeth, ears, nose, and throat. Transthoracic Echocardiography (TTE) is suggested as the first step in screening for cardiac issues [1,6,7]. If the TTE results are normal, unclear, or if no other cause is found, a Transesophageal Echocardiogram (TEE) should be done due to its higher sensitivity. In about 20% of cases, even after extensive investigation, the source of the infection remains unknown. In such situations, screening for Pulmonary Arteriovenous Malformations (PAVM) may be beneficial [1,3,6,7,]. PAVM occurs in approximately 1 in every 2,600 individuals [1]. Most PAVMs are inherited, with 80% to 95% of cases found in patients with HHT (Hereditary hemorrhagic telangiectasia) [1-3,6-8]. Acquired causes of PAVM are uncommon and can include chest surgery, trauma, actinomycosis, schistosomiasis, Hepatopulmonary Syndrome (HPS) related to hepatic cirrhosis, and metastatic carcinoma [1,2,5,7] , but in our case there was no any symptoms of HHT, however, Brain abscess affects between 7.8% and 9% of patients with PAVM [1] and it is estimated that 6% of patients with PAVM will develop a brain abscess, typically occurring between the third and fifth decades of life [2]. Most of the PAVM are common in left lower lung fields [1,2,5-7,9]. Clinical Features vary depending on the size, number, flow and degree of right to left shunt in PAVM [1,2,6,7]. Most of them are asymptomatic but become symptomatic in presence of significant intra pulmonary shunt developing features like Dyspnea, orthodeoxia, platypnea with decreasing oxygen saturation [7]. If thin walled PAVM ruptures patient may present with Hemothorax or Hemoptysis [1].

In our case decreasing oxygen saturation with cyanosis were classical features pointing towards PAVM. Imaging is required for the diagnosis of PAVM. Transthoracic Contrast Echocardiography (TTCE) or Bubble Echocardiography is the most sensitive and safe screening test [1,6,7,9] with a sensitivity of 100% and a specificity ranging from 67% to 91% [6]. CT has become the gold standard imaging test to establish the presence of PAVM in patients with positive intrapulmonary shunt [1,6,7). Best treatment option is Embolisation which is safe, less invasive, effective and the standard technique in the treatment of PAVM because it is effective in reducing the danger of paradoxical embolism and other risks related to PAVM [1,6,7,9]. Recurrence of pulmonary AV malformation following successful treatment occurs in approximately 25% of patients, primarily due to recanalization or reperfusion through pulmonary and bronchial arteries [5]. After embolization, a contrast-enhanced chest CT should be performed at 6 months, and then every 3

to 5 years thereafter, to monitor for complications such as failed embolization, reperfusion of the aneurysmal sac, or the potential growth of new PAVMs [1,2,5,6,9]. Surgical parenchymal resection is recommended for patients with centrally located or large Pulmonary Arteriovenous Malformations (PAVMs) or those at a high risk of embolization failure [1,6,7]. However, it is important to establish the diagnosis of PAVM in patients with Brain Abscess as occlusion of malformation can reduce the chance of recurrence of brain abscess [1,6-9].

Conclusion

This case demonstrates that PAVM can result in brain abscesses, and in cases of cryptogenic abscesses in particular, PAVM prevention measures are necessary. Recurrences of brain abscesses may be lessened with a PAVM treatment. For any patient with a cryptogenic brain abscess with a strong clinical right-to-left shunt, we recommend a contrast-enhanced chest CT scan.

Conflict of Interest

The authors declare no conflict of interest.

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