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RESEARCH ARTICLE

SPONTANEOUS INTRAPARENCHYMAL PNEUMOCEPHALUS

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ABSTRACT

Pneumocephalus is defined as an intracranial gas collection. Most of the cases are secondary to trauma or are iatrogenic. Spontaneous, intraparenchymal non-traumatic pneumocephalus are extremely rare. In this article, we report a rare case of a 79-year-old female who presented in the emergency department with history of severe headache and nausea after a severe bout of cough .She had prior history of stroke 4 years back but no old history of any trauma or intracranial surgery. She was then advised MRI brain, which revealed a large gliotic area in the right occipital lobe with a large area of intraparenchymal pneumocephalus in left temporal lobe. *Limited CT brain imaging confirmed no evidence of fracture.* Due to the absence of history of prior trauma or surgery, the appearances noted on the CT scan were reported to be secondary due to sinus or middle ear disease. Patient was then advised HRCT temporal bone.

INTRODUCTION

Most of the cases of pneumocephalus are secondary to trauma or are iatrogenic. Non-traumatic pneumocephalus are extremely rare. Common causes for it being adjacent air sinus infection, barotrauma, valsalva maneuver, post-radiation necrosis and various neoplasms. As spontaneous intraparenchymal pneumocephalus is exteremely rare conditionthus its underlying etiology should always be diagnosed at the earliest for further management. A 79-year-old female presented to our hospital emergency department with history of sudden onset of severe headache associated with nausea after a severe bout of cough. Headache was progressively worsening more on the left side . Past history revealed that patient had prior history of stroke 4 years back. Patient did not have any old history of trauma/ intracranial sinus surgery or any known sinus infection. Patient was then advised MRI brain which revealed a large gliotic area in the right occipital lobe with large area of pneumocephalus in left temporal lobe.

Limited CT imaging confirmed no evidence of fracture however minimal fluid densities were noted in the left mastoid air cells.

Due to the absence of history of prior trauma or surgery, the appearances noted on the CT scan were reported to be secondary to sinus/mastoid or middle ear disease. Patient was then advised HRCT temporal bone. Immediately after our diagnoisis, left temporal craniotomy was performed for decompression and to seal the temporal bone and dura defects. After the operation, the patient gradually improved, and postoperative course was uneventful. The follow-up examination 1 month later revealed absence of pneumocephalus on CT and MRI.

DISCUSSION

Spontaneous pneumocephalus caused by a primary defect at the temporal bone level without association with pathological conditions is very rare. Very few cases have been published with purely intraparenchymal involvement. The term "spontaneous" is used when air accumulates intracranially, without any underlying cause liketumour, infection, inflammation, surgery or trauma. The first report of a pneumocephalus was described in 1741 by Lecat. In 1884, Chiari first reported pneumocephalus on autopsy of a patient The initial evidence of intracranial air was performed by Luckett in 1913. Pneumocephalus can be divided by location.It can be

- Extra-Axial (epidural, subdural or subarachnoid)
- Intra-Axial (parenchymal, intraventricular or intravascular)

Thus for intraparenchyma pneumocephalus to occur, there should either be an extra cranial positive pressure source, or a persistent negative intracranial pressure gradient.

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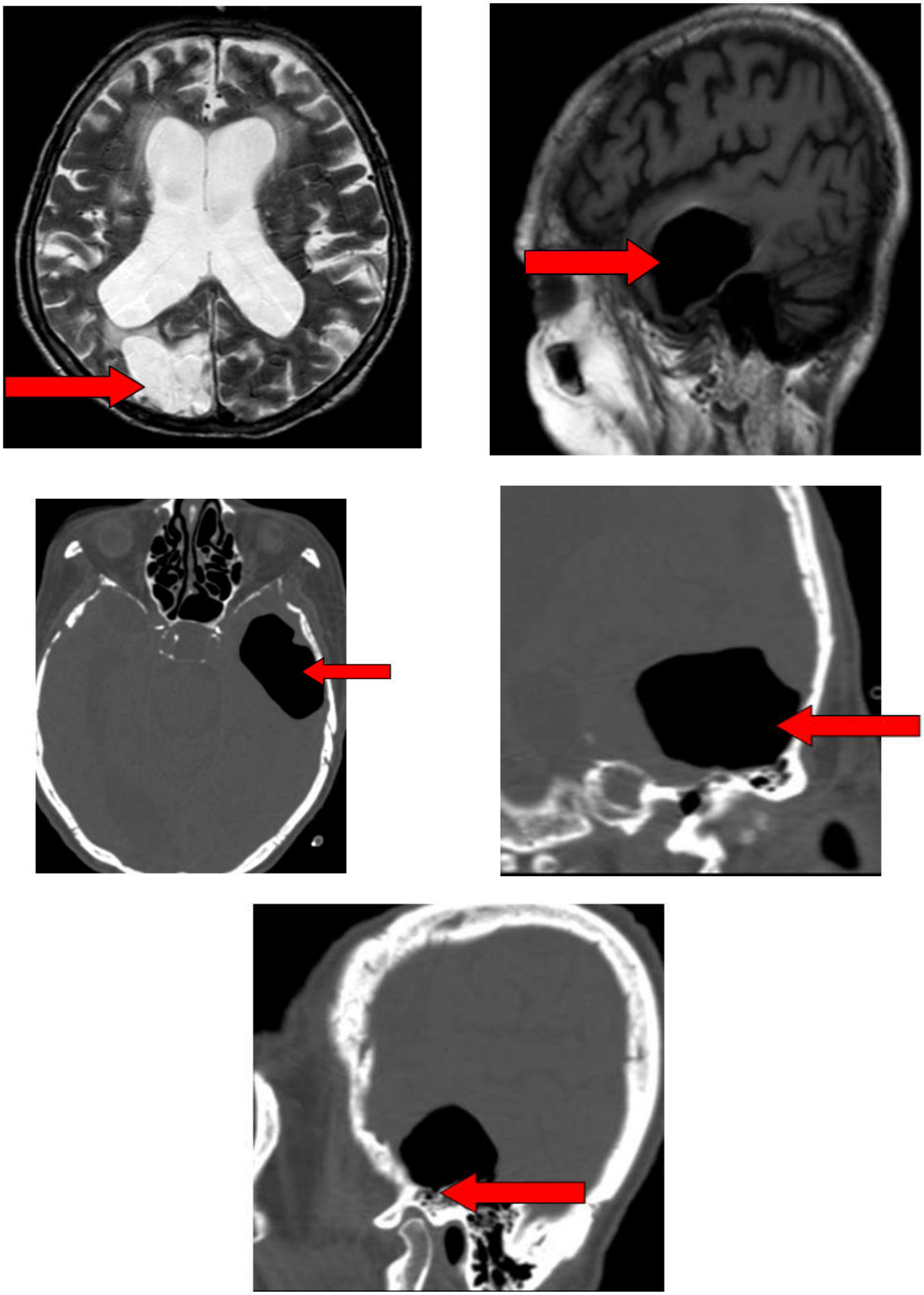

There are two possible mechanisms for it to occur. The first possibility is known as the “inverted soda bottle” or “siphon effect” and it is seen in the cases of low intracranial pressure by dural leak or shunt placement, where the CSF is replaced by air. In the absence of these factors, low or negative intracranial pressure occurs due to an excessive loss of CSF either through settling into the distend able spinal subarachnoid space or by simple drainage via normal pathways. However, in the presence of a fistulous connection across the dura to an aerated sinus, air may enter the intracranial space in response to the negative pressure gradient. If the brain substance was tightly adherent to the dura at the fistula site, the air could bypass the extra cerebral spaces and penetrate the brain directly in the path of least resistance. In the second possibility, the mechanism by which the air is trapped is known as "ball valve" described by Dandy. In this case, in order to produce a spontaneous pneumocephalus, two pathological conditions must coexist. First, a defect in the temporal bone needs to be present to allow communication of air from the mastoid cells to the intracranial compartment. Second, there should be a gradient of pressure between the middle ear and the intracranial space to allow the air to enter the cranium. Valsalva's maneuvers or changes in ambient pressure result in the passage of high pressure air through the fistula. This increases intracranial pressure which leads to the dura and/or brain to quickly

obliterate the fistula, allowing the air collected to become trapped. There is paucity of cases in literature, reporting intraparenchymal pneumocephalus due to nontraumatic or spontaneous causes. This case re-emphasized the importance of consideration of the diagnosis in a patient with unexplained sudden onset headache without any significant neurological deficit.

It can be managed either surgically or conservatively, depending on etiology as well as severity of the condition. The surgical management is priorty when there is recurrent CSF rhinorrhea and/or otorrhea, or high Intracranial pressure as a result of air accumulation, neoplasm, gas-producing infection, Symptoms of pneumocephalus are related to the amount of air in the cranial cavity. Although small amounts are usually asymptomatic, larger amounts can have neurologically catastrophic outcomes. Thus it is always essential that any precipitating factors are eliminated immediately and adequate investigations are carried out to rule out infectious causes of the underlying pathology. We opt for conservative management if neither infection nor dural defect could be detected. Surgery should be taken into account in order to relieve intracranial pressure and fistulotomy in recurrent or infected cases.

Conclusion

Spontaneous intraparenchyma pneumocephalus is a very rare entity. There is usually a defect in the temporal bone which allows communication between the middle ear and the brain parenchyma. It should be suspected in patients with sudden onset of otological symptoms and other non-specific neurological manifestations. Surgery is indicated to repair bone and dural defects.

It is aimed at relieving intracranial pressure and repair the fistula at the temporal bone roof and the dura. MRI T2 W axial image showing a large gliotic area in the right occipital lobe. Axial T1W image of the brain showing pneumocephalus. Limited CT imaging confirmed pneumocephalus however no evidence of fracture was noted with minimal fluid densities noted in the left mastoid air cells. HRCT temporal bone showing a small defect in left mastoid cavity leading to spontaneous pneumocephalus.

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