

# Post-traumatic temporal bone pneumatocele presenting after aggressive Valsalva

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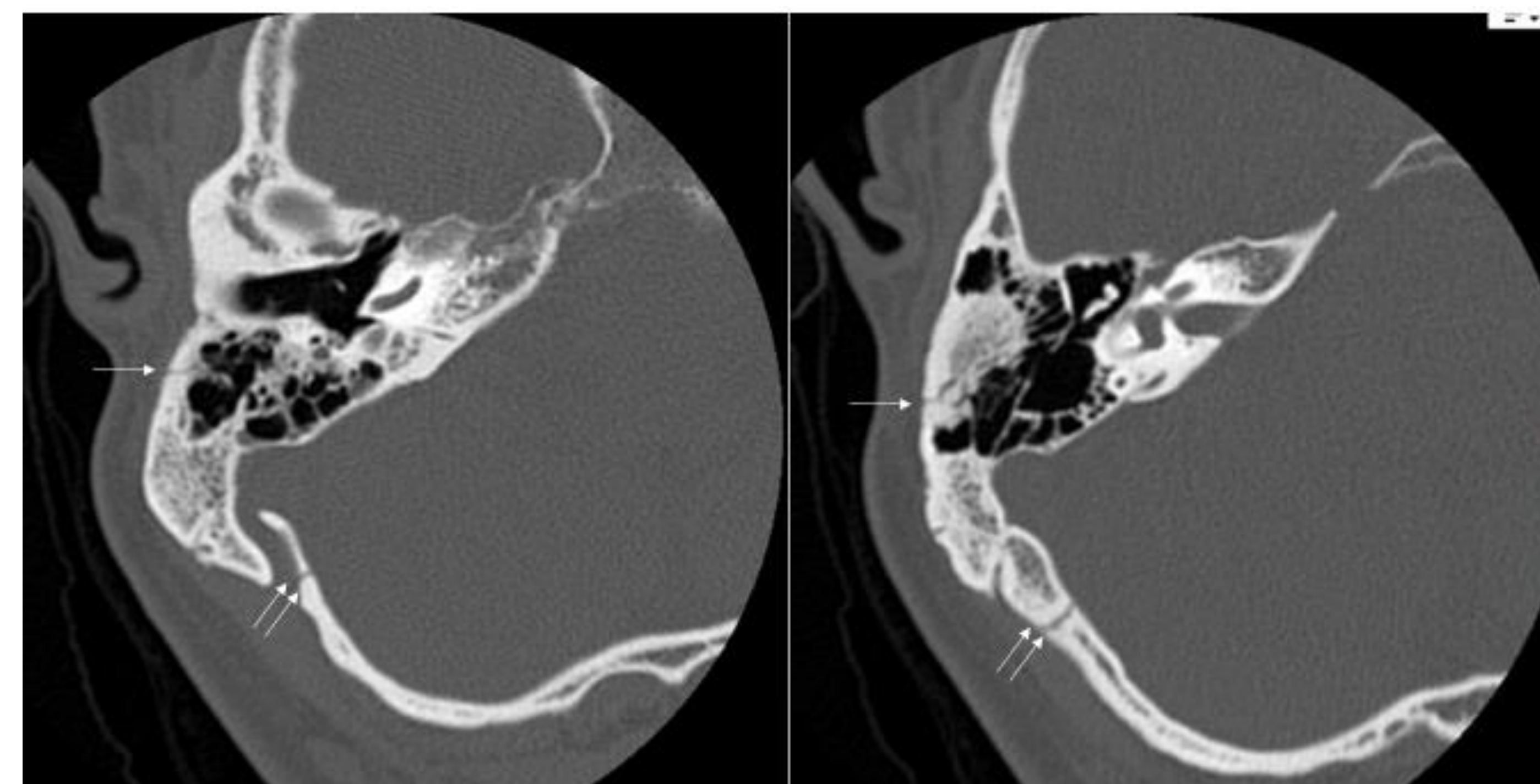
## Introduction

- Cranial pneumatization is normally restricted to the paranasal sinuses and the petrous and mastoid parts of the temporal bone.
- A pneumocele is a rare condition described as an abnormally enlarged intraosseous collection of air, with diffuse thinning of the surrounding bony walls.
- When the air collection extends into the surrounding soft tissue, it is termed a pneumatocele. When the air extends intracranially, it can be termed pneumocephalus.
- Pneumatoceles more commonly present in the paranasal sinuses, but at least 17 cases of mastoid sinus origin have been reported.
- The mastoid part of the temporal bone is normally air-filled, and its antrum is in communication with the middle ear space.
- Eleven of the 17 cases referenced above reported an association between hyperpneumatization and increased middle ear pressure or frequent Valsalva maneuvers.
- However, no cases of pneumatization at the site of a prior mastoid bone fracture have been reported.

## Radiographic Imaging



**Figure 1.** Computed tomography images nine years after trauma. A significant defect is seen in the right temporal bone. Continuity with mastoid air cells is visible in the coronal slice (arrow). Subcutaneous and epidural air pockets are also visible.



**Figure 2.** Computed tomography images after initial trauma. Otic sparing fractures identified in the mastoid (single arrow). A widened occipitotemporal suture was also apparent (double arrows). No hyperpneumatization of temporal bone was identified.

## Case Presentation

- We report a case of a 38-year-old male who presented with a temporal bone pneumatocele nine years after a severe motor vehicle collision that resulted in a temporal bone fracture.
- He initially complained of a soft, palpable mass in the right retroauricular region.
- The patient stated that he was an “aggressive nose blower,” and upon blowing his nose he reported a sensation of fullness in his right ear and scalp.
- Upon palpation of the mass, tympanic membrane motility was observed by otoscopy and right ear fullness was reported by the patient. No neurologic deficits were present.
- Computed tomography (CT) of the temporal bone showed complete loss of bone in the retroauricular region, with a pneumatocele in the epidural space extraneous to the right transverse venous sinus (Figure 1). These findings were not present in the CT scan at the time of the accident (Figure 2).
- Before definitive repair, we first performed a eustachian tube augmentation with septal cartilage and acellular dermis for luminal narrowing of the right eustachian tube.
- Subsequently a right retrosigmoid craniotomy with extradural repair with abdominal fat graft and hydroxyapatite cement cranioplasty was performed, similar to our cranioplasty after translabyrinthine vestibular schwannoma excision. The postoperative period was uneventful.

## Discussion

- We believe that both **trauma** and **frequent Valsalva** maneuvers had a role to play in the formation of this patient’s cranial defect.
- A study by Sakikawa et al. showed that **nose blowing results in a mean increase in middle ear pressure** of 252 mmH<sub>2</sub>O.
- Abbati et al. states that a spontaneous pneumocephalus can occur if there is:
  - (1) a communication of air between the mastoid sinus and the intracranial compartment
  - (2) a gradient of pressure between the middle ear and the intracranial space to allow for air to enter the cranium.
- Eleven of those 17 cases of mastoid hyperpneumatization reported an association with Valsalva or elevated middle ear pressure.
- Of all the literature reviewed, our case is unique regarding:
  - (1) the degree of **erosion of the external and internal cortical lining** of the calvarial bone, and
  - (2) the long term **post-traumatic** presentation.
- These characteristics have led us to believe that **the fracture played a distinct role** in the development of the full thickness skull defect.
- Interestingly, **nose blowing after facial trauma has been known to cause complications** such as subcutaneous emphysema and rarely, pneumomediastinum.
  - Maxillofacial surgeons who treat these fractures recommend that patients must be told to refrain from nose blowing during recovery.
- In many cases of cranial hyperpneumatization, the reversal of pneumatization has been achieved by non-invasive measures such as instructing the patient to cease any form of Valsalva maneuver, or performing a myringotomy.
- While such an approach offers good results without major surgery, careful consideration should be taken to ensure that the hyperpneumatization is not predisposing the patient to complications such as meningitis or fracture of the thinned cortical bone with minor trauma.
- A full thickness cranial defect as in our case puts the patient at risk of serious injury with head trauma due to the absence of a region of the protective calvarium.

## Conclusions

- In conclusion, we report a case of a temporal bone pneumatocele with full thickness erosion of the skull bones associated with aggressive nose blowing.
- This condition presented nine years after traumatic fracture of the temporal bone.
- We propose that the fracture, in combination with elevated mastoid sinus pressure from aggressive nose blowing, lead to escape and trapping of pressurized air in the epidural and subcutaneous spaces, which resulted in bone erosion.