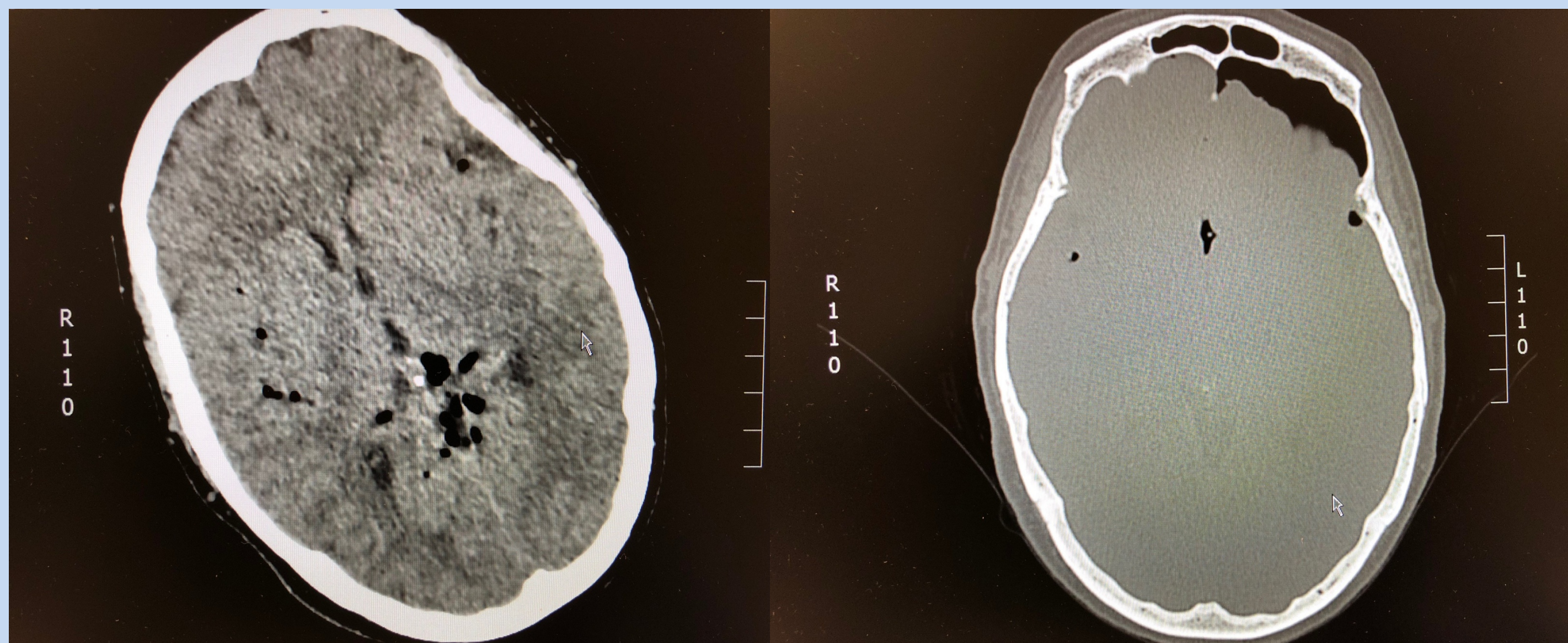


## Background:

Pneumocephalus (PNC) is defined as pathological collection of gas within the cranial cavity accumulating in the epidural, subdural, subarachnoid, intraventricular, or intraparenchymal compartments. The main cause of PNC is head injury, trauma accounts for 74% of all cases followed by intracranial neoplasms, infections, neurosurgery, paranasal sinus surgery, and diagnostic or neurosurgical interventions such as pneumoencephalography or lumbar puncture.



**Non contrast CT head on Day 1**

## Case Description:

67 year old fit and well lady. She presented to A&E having had a cough/cold for approximately 2 weeks. After a prolonged bout of coughing, she developed a sudden onset severe headache associated with vomiting and photophobia.

A CT head showed extensive poles of gas within the CSF spaces with a focus of bony deficit in the posterior aspect of the sphenoid and features suggestive of a process eroding the posterior margin of the sphenoid resulting in a CSF fistula.

She dropped her GCS soon after admission. She recovered her GCS by 3<sup>rd</sup> day. The antiepileptic was stopped after 1 week with no further seizure activity.

CSF showed WBC 2300 (20% neutrophils, 80% polymorphs), 660 RBC, no organisms.

CXR on admission showed right basal consolidation. Haemophilus Influenzae was grown from her blood culture. She was also covered with Pneumovac.

A repeat CT head on 9<sup>th</sup> day of admission showed increase in the extent of pneumocephalus with moderate mass effect. There was no obvious change in the size of the bone defect within the posterior margin of the sphenoid sinus.

She continued to have persistent CSF leak so was managed operatively with endoscopic repair of the sphenoid and discharged home without any neurodeficit.

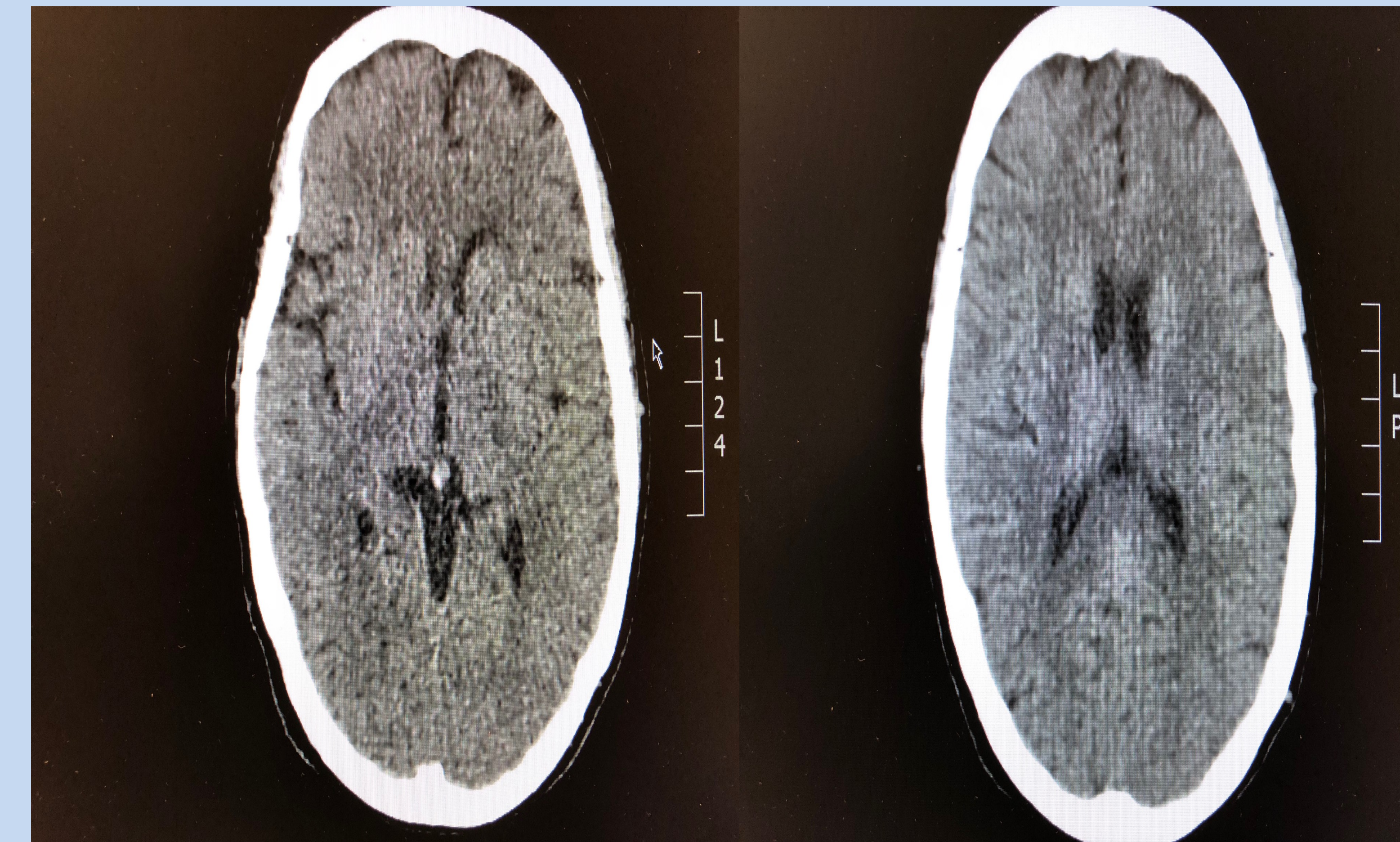
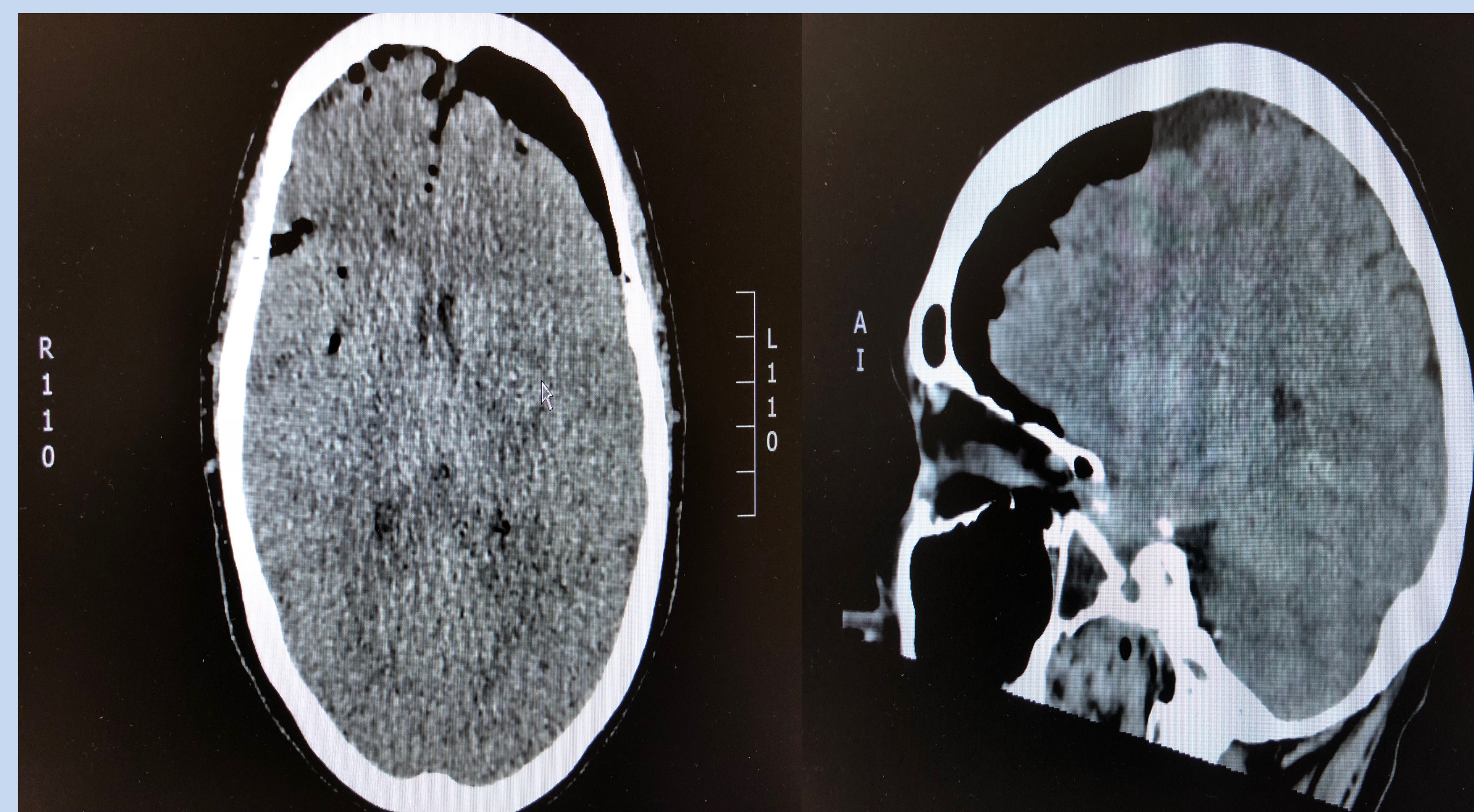
## Discussion:

Chiari was the first to describe PNC in 1884

Two hypotheses have been reported to describe the pathophysiologic basis of pneumocephalus in the absence of craniofacial skull base fracture; they are known as the "ball valve" and "inverted bottle" mechanisms.

- In the ball valve mechanism, it is postulated that air enters through a fracture or foramens of the skull base bone adjacent to an air-containing space. The only requirement, then, is a force to push air into the intracranial space. Once this has occurred, the air remains trapped and a seal is created by the arachnoid membrane, cerebral cortex, or ventricle.
- The second theory, the inverted bottle mechanism, hypothesizes that as CSF flows out of the skull, negative pressure is created within the intracranial space. This negative pressure will not allow the efflux of more CSF until air enters to take its place and equilibrates the pressure differential.

## Non contrast CT head on Day 9



**Complete resolution after endoscopic repair**

## Conclusion & perspectives :

Pneumocephalus of nontraumatic, spontaneous origin is rare. According to the available literature, most cases of spontaneous pneumocephalus result from nose blowing, sneezing or valsalva maneuver. In patients with Pneumosinus dilatans, pneumocephalus can occur spontaneously. If there are no signs of infection or symptoms of dural defect, we believe that observation and serial imaging would be an alternative treatment option. Surgical treatment for pneumocephalus is indicated when the defect does not heal satisfactorily, allowing recurrence with continued or recurrent cerebrospinal fluid rhinorrhea or otorrhea associated with pneumocephalus or signs of increased intracranial pressure due to intracranial air accumulation. Subarachnoid air can cause significant irritation; so as little as 2 mL of subarachnoid air has been reported to cause headache. Tension pneumocephalus usually manifests as deterioration of consciousness, restlessness, generalized convulsion, or focal. Tension pneumocephalus is a rare entity, but it should be considered in patients with severe headache at the ED, especially those with concomitant rhinorrhea.