

Caution during endotracheal suctioning in case of skull base fractures!

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Abstract. – OBJECTIVE: Cerebral exteriorization through the cribriform plate during routine endotracheal suctioning (ETS) in a coughing patient without sedation with multiple complex skull base fracture; this case has never been reported in the literature.

CLINICAL PRESENTATION: We report the case of a polytrauma patient admitted in our ICU with severe traumatic brain injury (TBI) and multiple complex skull base fractures. After 48 hours of neurocritical care and stable neuromonitoring parameters, sedation was stopped for neurological assessment. During this period and while routine ETS was being performed, brain herniation with exteriorization through the nose occurred with a concomitant ICP elevation.

CONCLUSIONS: ETS can induce the coughing reflex and provoke a rise in ICP. It is a simple routine procedure that should be performed with great precautions in order to avoid iatrogenic complications, particularly in patients with skull base fractures, such as brain herniation as described in our patient.

Key Words:

Brain herniation, Skull base fracture, Endotracheal suctioning, ICU, Polytrauma.

Case Report

We present the case of a patient in his 70's with previous medical history of ischemic heart disease and hypertension. He was admitted for a severe traumatic brain injury (TBI), with Glasgow Coma Scale (GCS) 3 on admission. A total body computerized tomography scanner (CT-scan) showed a posttraumatic diffuse subarachnoid haemorrhage, a minimal left occipital subdural hematoma and multiple complex skull base and facial fractures, involving the frontal, sphenoidal and ethmoidal sinus provoking secondary pneumocephalus. No signs of intracranial hyperten-

sion or brain herniation were present (Figure 1). The CT-scan also showed an aspiration pneumonia, and polytrauma injuries.

Conservative treatment was decided for the craniofacial fractures and indication for multimodal neuromonitoring was retained given the initial GCS and the patient was taken to the operating room for the insertion of an intracranial pressure monitoring probe (ICP), brain tissue oxygenation pressure (PtiO₂) and cerebral microdialysis. ICP was inferior to 15 mmHg throughout the monitoring.

48-hour follow-up cerebral CT-scan showed no changes in the hemorrhagic lesions. Given the favourable evolution with correct neuromonitoring parameters and stable CT-scan, the analgo-sedation with midazolam and sufentanil was stopped in order to obtain a neurological assessment.

In the meantime, the aspiration pneumonia was treated with piperacilin/tazobactam and clindamycin. Endotracheal suctioning (ETS) was routinely performed several times per day given the bronchial secretions. In our ICU setting, this procedure is performed with a 12-French catheter, a negative pressure not exceeding 150 mmHg, and a duration of less than 60 seconds.

During the period of sedation withdrawal, the patient presented with an episode of brain tissue exteriorization through the nose while coughing during routine ETS (single pass) (Figure 2). The coughing reflex induced an acute ICP elevation of 40 mmHg at the moment of brain herniation through the nose (Figure 3). The histopathological analysis of the tissue confirmed the cerebral nature.

A magnetic resonance imaging (MRI) subsequently performed confirmed the basi-frontal brain herniation through the right cribriform plate into the nasal cavity (Figure 2).

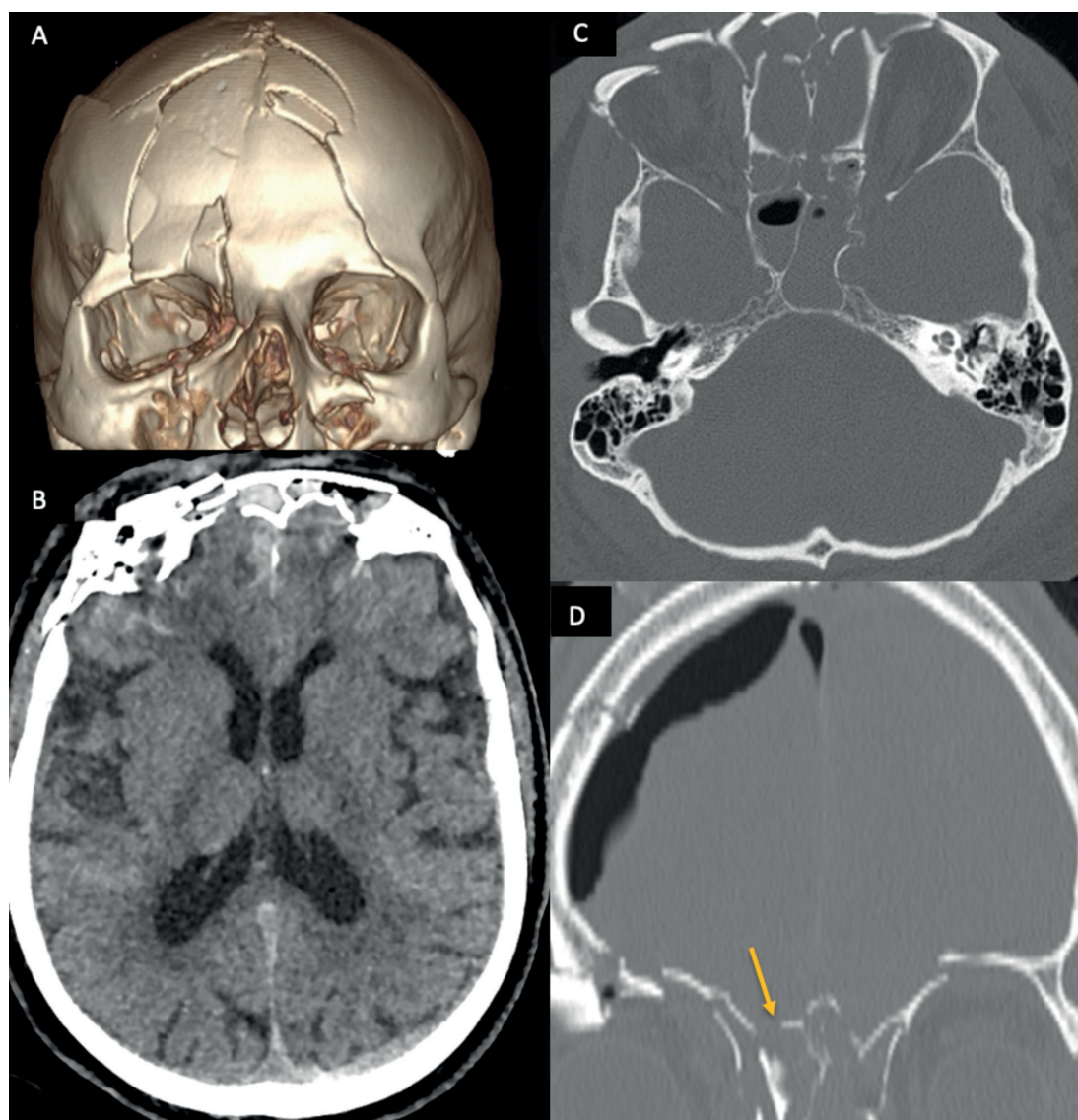


Figure 1. Cerebral CT-scan at patient's admission. **A**, 3D reconstruction of craniofacial fractures. **B**, Axial view of the frontal sinus fractures with posttraumatic subarachnoid haemorrhage and minimal acute parieto-occipital subdural hematoma. **C**, Axial view of the skull base fractures within the anterior ethmoidal and sphenoidal sinus. **D**, Coronal view showing fractures involving the frontal bone, roof of the orbit and cribriform plate (*arrow*). Intracranial pneumocephalus is also noted.

Given the dramatic injuries and after a multi-disciplinary discussion between the radiologists, neurosurgeons, neurologists and intensivists, hospice care was decided, and the patient died one week after his admission.

Discussion

We present a case of a rare complication that, to our knowledge, has never been described in the literature.

Brain herniation has been described previously¹ in patients that presented permanent elevated ICP and with CSF rhinorrhea. In our case, ICP was overall controlled, and no previous CSF rhinorrhea was reported, making cerebral herniation unexpected.

ETS can potentially be painful and induce the coughing reflex, both being translated in an ICP increase². In our patient, given the known complex skull base fractures and the possible effects of ETS, this complication could be considered as iatrogenic, as ETS was being performed without appropriate sedation.

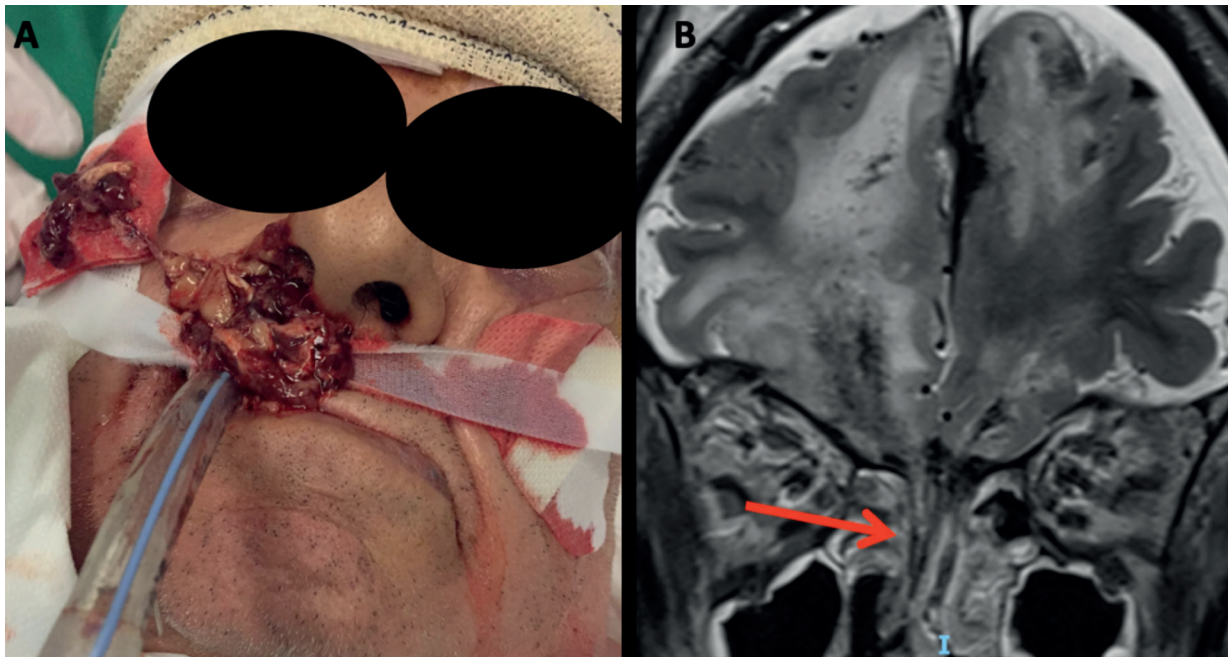


Figure 2. A, Brain tissue exteriorised through the nose of the patient after he coughed. B, Correlation of the clinical brain herniation through the nose with radiological signs of herniation through the nasal cavity.

Even though he had a Richmond Agitation-Sedation Scale (RASS) of -5, the endotracheal suction induced the cough.

From our standpoint, the brain herniation through the cribriform plate was due to multiple

factors: the skull base fractures, the abrupt ICP increase from 17 to 40 mmHg measured during the coughing episode (Figure 3) and elevation of the partial pressure of carbon dioxide (due to a short disconnection from the ventilator during

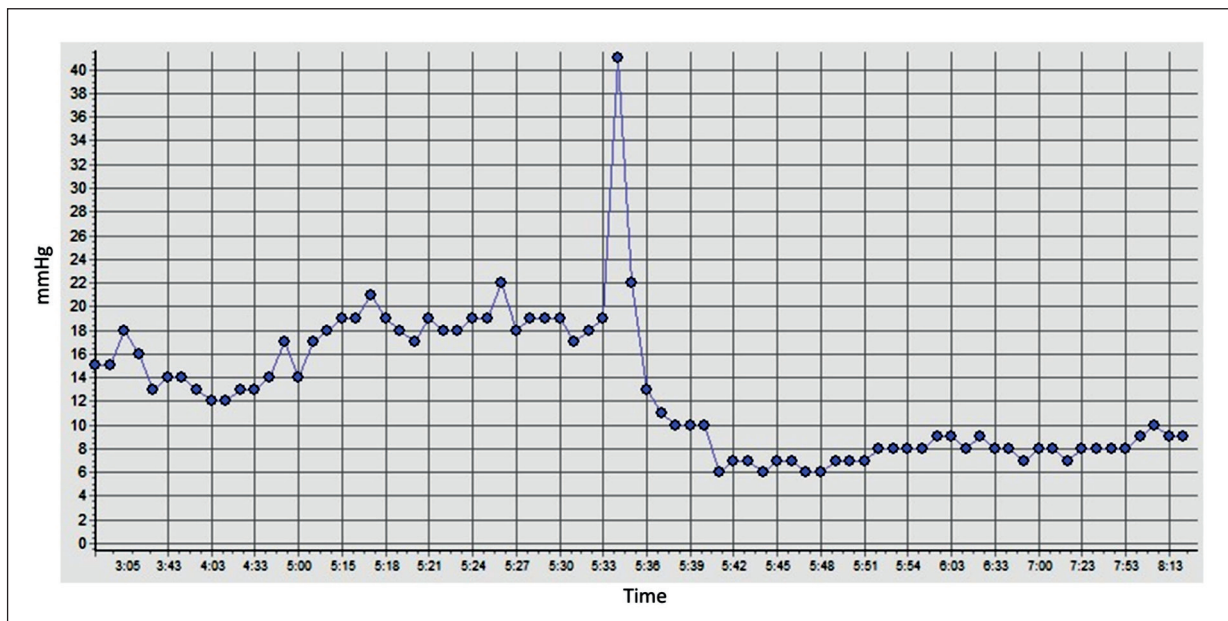


Figure 3. Intracranial pressure curve. The increase of intracranial pressure from 17 to 40 mmHg measured during the cough episode just after endotracheal suctioning.

suctioning) leading to cerebral vasodilation and thus contributing to the raised ICP³.

Some authors suggest preventive strategies such as limiting suction duration to 10 seconds, hyperventilating with caution, and keeping negative suction pressure under 120 mmHg⁴. Furthermore, analgo-sedation is crucial in the management of raised ICP and should be considered as one of the earliest treatment modalities in such cases².

Conclusions

To sum up, we reckon that ETS should be performed with great caution in order to avoid catastrophic complications such a brain herniation through the nose in patients with predisposing skull base fractures. Internal ICU protocols should be created and adapted for ETS procedures in every single patient.

Conflict of Interest

The Authors declare that they have no conflict of interests.

Competing Interests

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