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Letter to the Editor

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Brain death: Bilateral pneumothorax and pneumoperitoneum after an apnoea test

To the Editor

Brain death is a state of prolonged irreversible cessation of all brain activity, including lower brain stem functions with the complete absence of voluntary movements, responses to stimuli, consciousness, brain stem reflexes, and spontaneous ventilation, in the absence of reversible conditions mimicking this clinical state. The European Directorate for Quality in Medicine guidelines, published in 2016, describe the clinical diagnosis of brain death and recommend performing apnoea test in the end of clinical assessment of brain death [1]. In France, an apnoea test is mandatory to set the absence of spontaneous ventilation [2].

However, several authors have expressed their concern about the safety of this procedure as there are potential complications, such as severe hypotension, excessive hypercapnia, hypoxia, pneumothorax, acidosis, cardiac arrhythmia, and asystole [3–5].

A 54-year-old woman, known to be hypertensive, obese (BMI = 37 kg/m^2), and who had undergone a sleeve gastrectomy a few years before, was admitted in the ICU for coma (Glasgow Cerebral Scale [GCS]: 3) after brutal loss of consciousness while walking in a public area. No cardiac arrest was declared.

The patient was immediately intubated, sedated, and was quickly diagnosed with a massive intra-cerebral haemorrhage, without any surgical solution. Small bilateral pleural effusion was also noticed, with no intra-thoracic or intra-abdominal gas effusion.

In ICU, she remained comatose with no sedation, ventilated with adequate parameters, especially low positive end-expiratory pressure (6 mmHg), low tidal volume (6 mL/kg predicted body weight). Cardio-pulmonary auscultation and abdominal palpation were normal.

Brain death tests began at 2:00 AM, 6 hours after sedation cessation, in the absence of hypothermia. Brainstem reflexes were abolished. An apnoea test was performed, using a 7-french diameter cannula, insufflating 6 L/min oxygen, revealing no spontaneous ventilation. The test was prematurely stopped, after two minutes, because of some ventricular extra-systoles onset without any hypoxemia.

At 2:30 AM, less than 30 minutes after the restart of mechanical ventilation, peak pressure brutally increased, associated with hypotension, desaturation, abolition of respiratory sounds, subcutaneous emphysema, and distended abdomen.

Chest radiography performed in emergency revealed a bilateral tension pneumothorax, subcutaneous emphysema, and a discreet cupola sign (Fig. 1). Bilateral thoracic drains were introduced, improving the patient's situation and restoring normal ventilatory parameters and pressures.

At 8:00 AM, a new CT-scan confirmed brain death, and abdominal views showed massive pneumo-peritoneum, with subcutaneous emphysema. No pulmonary emphysema was noticed on the entry CT-scan and this new one (Fig. 2a and b). The patient, known to have not formulated any opposition about organ donation, was eligible for multi-organ retrieval. Due to the pneumothorax, a pulmonary graft had not been retained.

The mechanism is not always explained, in the sense that no material abnormality, as a probe obstruction, lesion, or malposition, is observed. There are few cases in which pneumothoraxes are due to a mechanical complication, as a direct airway perforation by the oxygen cannula [6], or a probe obstruction, which have been avoided in our case, choosing the right cannula length (few centimetres inserted in a 24 cm-length endotracheal tube). Alternative technique, as using a CPAP-mode or a T-tube assembly, could be studied.

Iatrogenic pneumothorax due to the central catheter is less possible, according to the timing (central venous catheter inserted 6 hours earlier) and the bilateral occurrence. Chest radiography

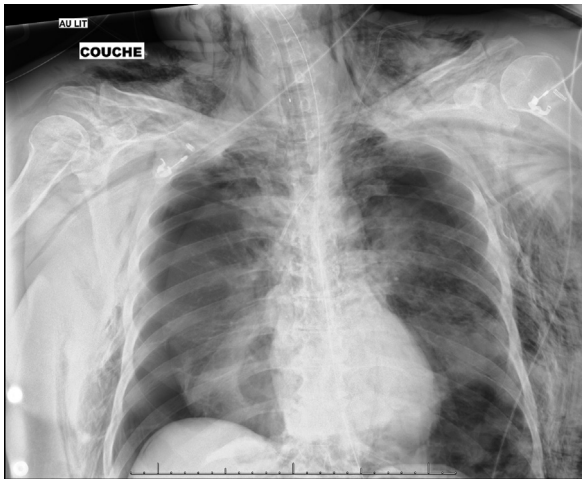

Fig. 1. Chest X-ray diagnostic of a bilateral pneumothorax. Notice air bubble between liver and diaphragm.

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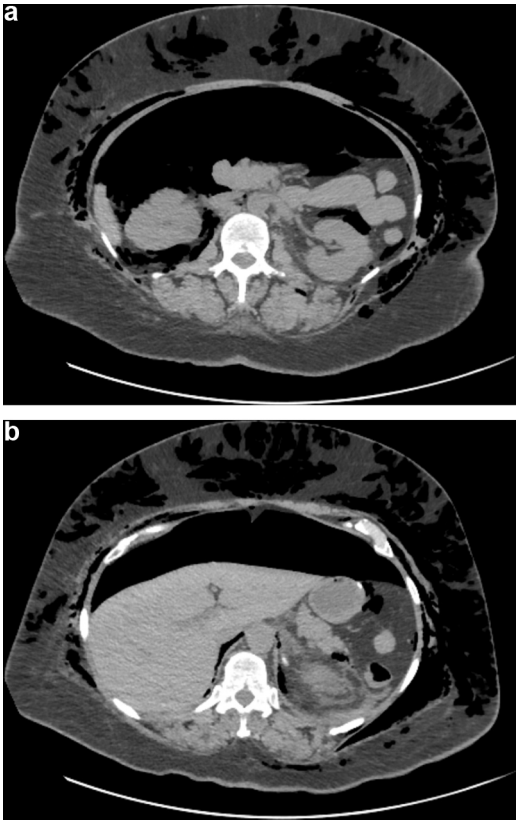

Fig. 2. a and b: abdominal tomography, pneumoperitoneum and subcutaneous emphysema.

control after central catheter insertion showed no sign of pneumothorax.

Some authors mention a "tension pneumothorax" associated with barotraumatism and air-trapping into the pulmonary alveoli [7]. Vivien reports pneumothorax occurring a few seconds after apnoea test beginning. But here, respiratory alarms rang half an hour after procedure cessation Also, barotraumatism was prevented using low positive end-expiratory pressure, low tidal volume and moderate oxygen outflow.

In 90–95% of cases of pneumoperitoneum, perforation throughout the gastrointestinal tract is usually found. In most instances, it represents a serious intra-abdominal complication that requires immediate surgical management. However, the other 5–10% of cases that suggest free air in the peritoneal cavity can be related to gynaecologic, thoracic, abdominal, postoperative, nonsurgical, or idiopathic causes [8,9]. Duarte reports the case of a pneumoperitoneum due to a diaphragmatic defect, which allowed air from a pneumothorax to diffuse through the diaphragmatic hernia into the abdominal cavity [10]. Our patient had undergone a sleeve gastrectomy surgery a few years before, which could possibly create some diaphragm defect.

Pneumothorax is a rare complication related to apnoea test, described, but not well explained, and may be associated with pneumoperitoneum. That situation may sometimes lead to major complications, as cardiac arrest, or in this context to a pulmonary graft loss. But, pneumothorax is very rare and can't be a reason not to perform the apnoea test as it is the only clinical test to confirm necrosis of the lower part of brain stem.

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Disclosure of interest

The authors declare that they have no competing interest.

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