



SYMPTOMATIC POSTOPERATIVE COMPRESSIVE PNEUMOCEPHALUS AFTER CHOLECYSTECTOMY

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ABSTRACT

A 75-year-old woman with a history of chronic hydrocephalus due to stenosis of the aqueduct of Sylvius was examined at the emergency department for altered mental status. There was placement of a ventriculoperitoneal shunt in 1970 complicated by meningitis, leading to removal of the material and ventriculocisternostomy as definitive treatment in 2004. About one month previously, she had undergone a laparoscopic cholecystectomy complicated by an intra-abdominal collection. Clinical examination at the emergency department revealed a Glasgow score of 8 (E3 V1 M4). In the emergency department the patient presented a tonic-clonic seizure before a cerebral CT scan was performed showing a massive compressive pneumocephalus, then a second seizure. The patient was finally admitted to the neurosurgery department and underwent surgery.

KEYWORDS

Pneumocephalus, cerebral CT scan, cholecystectomy

LEARNING POINTS

- Changes in mental status in a patient with a history of chronic hydrocephalus should alert clinicians to a possible complication.
- This case reflects the delayed diagnosis of a critically ill patient in the emergency department.

INTRODUCTION

Pneumocephalus, also known as pneumatocele or intracranial aerocele, is the presence of air in the intracranial space. Lecat first described the condition in 1741, but the term 'pneumocephalus' was independently coined by Lockett in 1913 and Wolff in 1914^[1]. The most frequently reported causes are secondary to skull base tumours, infections and

otolaryngological or neurosurgical procedures^[2].

It is classified as simple or tension pneumocephalus (PC) and can also be classified as acute – or less than 72 hours old, or delayed – more than 72 hours old. Tension pneumocephalus (TPC) occurs when intracranial air causes intracranial hypertension, generating a mass effect with neurological deterioration. However, conversion from PC to TPC is a rare



event^[3]. We present a case of symptomatic compressive pneumocephalus, which occurred in the operative aftermath of cholecystectomy in a patient with a ventriculoperitoneal shunt.

CASE DESCRIPTION

The patient was a 75-year-old woman with a history of chronic hydrocephalus due to stenosis of the aqueduct of Sylvius, with placement of a ventriculoperitoneal shunt in 1970. This was complicated by meningitis leading to removal of the material, ventriculocisternostomy as definitive treatment in 2004 and a sequelae of partial epilepsy. She was initially admitted to the gastrointestinal surgery department for one month in August 2023 for a laparoscopic cholecystectomy complicated by an intra-abdominal collection. This was subsequently drained by the interventional radiology team and treated with antibiotics. Post-operative follow-up was favourable, and the patient was discharged home in August 2023.

She was seen by the gastrointestinal surgeon one month after discharge. The patient's daughter described a psychomotor slowdown in her mother, accompanied by a drop in hearing acuity. An abdominal and cerebral CT scan was performed, showing no pathological findings. The surgeon then referred her to the ear, nose and throat (ENT) specialist and the referring neurosurgeon.

Fifteen days later, on awakening, the patient's neurological condition deteriorated with the sudden onset of a mutism. The relatives also referred to repeated and unusual falls

during the preceding days. In the emergency department, a clinical examination revealed a Glasgow score of 8 (E3 V1 M4), heart rate was 83 beats per minute, blood pressure was 154/67 mmHg, oxygen saturation 99% on room air and she was febrile (38.2°C). Pupils were symmetric and reactive. A motor deficit of 2/5 on the muscle rating scale was observed without facial paralysis. Cardiopulmonary and gastrointestinal examination was normal.

In this context, a biological workup was performed (Table 1) including blood cultures. COVID-19 and influenza smears were both negative. Blood gases showed no abnormalities (pH 7.45; pO₂ 76 mmHg; pCO₂ 37 mmHg; bicarbonates 26 mmol/l and lactates 0.5 mmol/l).

The patient benefited from the placement of a urinary catheter, and a cerebral CT scan was ordered. While awaiting imaging examination, she presented a generalised tonic-clonic seizure lasting 3 minutes, which resolved on clonazepam. Neurological monitoring was immediately initiated, with hydration and oxygen therapy.

Fifty minutes later, almost 6 hours after her arrival at the emergency department, the patient underwent a brain scan (Fig. 1) and was diagnosed with massive compressive pneumocephalus, without osteo-meningeal breach, accompanied by increased hydrocephalus. The radiologist then hypothesised a role for the ventriculoperitoneal shunt in the origin of this pneumocephalus^[4].

An abdominopelvic CT scan was performed at the same time, showing an abscessed pre-rectal collection leading to the initiation of treatment with tazocillin and metronidazole.

Investigation	Value	Investigation	Value
Urea	3.7 mmol/l	Ethanol	< 0.03 g/l
Creatinine	38.1 µmol/l	Leucocytes	12.71 g/l
Glomerular filtration rate	100 ml/min/1.73 m ²	Haemoglobin	11.2 g/dl
Sodium	135 mmol/l	Haematocrit	34.6%
Potassium	3.66 mmol/l	Mean corpuscular volume	90.6 fl
Calcium	2.27 mmol/l	Platelets	338 g/l
Corrected calcium	2.43 mmol/l	Neutrophils	8.36 g/l
Phosphorus	0.87 mmol/l	Eosinophils	0.01 g/l
Magnesium	0.74 mmol/l	Basophils	0.06 g/l
Albumin	29 g/l	Lymphocytes	2.3 g/l
C reactive protein	56.7 mg/l	Monocytes	1.97 g/l
Total bilirubin	7.5 µmol/l	Prothrombin time	72%
Direct bilirubin	2.3 µmol/l	International normalised ratio	1.5
GOT (glutamic-oxaloacetic transaminase)	10 U/l		
GPT (glutamic pyruvic transaminase)	7 U/l		
Phosphatase alkaline	87 U/l		
Lipase	15 U/l		
Creatine phosphokinase (CPK)	37 U/l		
Brain natriuretic peptide (BNP)	73 pg/ml		

Table 1. Initial blood investigations at the emergency department



Figure 1. Cerebral CT scan showing pneumocephalus.

While awaiting neurosurgeons concerning immediate management, the patient presented with a second generalised tonic-clonic seizure lasting 2 minutes, which resolved spontaneously.

Finally, the patient was admitted to the neurosurgery department and underwent surgery to have the internal shunt removed and an external shunt inserted, in the context of chronic hydrocephalus. This was decompensated by probable dysfunction of the ventriculoperitoneal shunt, complicated by meningitis in the context of an infectiously complicated surgical procedure.

DISCUSSION

The presence of air within the cranium is not physiological. According to Markham, the most common aetiologies of pneumocephalus are trauma (74%), followed by infection (9%) and neurosurgery (4%). However, in the last thirty years, no case of pneumocephalus secondary to cholecystectomy has been described in the literature to our knowledge; the last report was made in 1988^[4]. The large volume of intracranial gas probably explains the severity of this case, with its multiple episodes of generalised tonic-clonic seizures and altered state of consciousness.

However, several aspects of this case are still unclear. The first question concerns the quality of the ventriculoperitoneal shunt installed in the 1970s^[5]. Clearly, material constituents continue to evolve over the years, and it is not impossible that the patient's shunt may have malfunctioned without any real connection with the cholecystectomy, even if the clinical course of neurological deterioration coincides with the post-surgical aftermath^[6].

The second question is the quality of the cholecystectomy procedure. The post-operative course showed the appearance of a medium-abundance intraperitoneal fluid effusion, with a pelvic fluid and gas component. It is therefore not impossible that the shunt may also have become infected, gradually leading to pneumocephalus. Perhaps the bile should have been drained first, before performing the procedure.

The third question concerns the time taken to treat this patient in the emergency department. It is hard to understand how this patient (Glasgow 8), with the onset of generalised tonic-clonic seizures, admitted to the emergency

department in the morning, could not have been taken care of and had her scan only after several hours of waiting. It should be imperative to rapidly manage critical situations that could be life threatening.

CONCLUSION

Symptomatic compressive pneumocephalus is an exceptional complication of gastrointestinal surgery associated with the presence of a ventriculoperitoneal shunt.

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