Rare disease

An unusual case of pneumocephalus

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The authors present an unusual cause of pneumocephalus in a previously fit and well female octogenarian who presented with acute onset altered level of consciousness and generalised weakness. Radiological imaging demonstrated widespread cerebritis with pneumocephalus and gas within the superior sagittal sinus. Blood culture grew *Clostridium septicum*, a virulent but rare organism that can infect normal tissues. The close association between *C septicum* and both haematological and bowel malignancies must be considered if this organism is cultured.

BACKGROUND

This condition is very rare.

No previous cases of *Clostridium septicum* related pneumocephalus in the past 35 years at the admitting institution (Lister Hospital, Stevenage).

C septicum infection can result in fatality rapidly; therefore, correct diagnosis and treatment is required urgently.

C septicum infections are associated with both bowel and haematological malignancies.

CASE PRESENTATION

Our patient was a normally fit and healthy lady who lived alone and was independent in activities of daily living. She suffered from hypertension, stable angina and non-insulin dependant type II diabetes mellitus.

She presented to the emergency department having been found with an altered level of consciousness and generalised weakness by her son. History from the relatives revealed that she had been suffering from diarrhoea and vomiting for 3 days.

On arrival to the emergency department, her Glasgow Coma Scale was 9 (E4, M4, V1). Clinical examination demonstrated marked neck stiffness, limb weakness and equivocal plantar response. She was in atrial fibrillation but otherwise had a normal cardiovascular and abdominal examination. On arrival in the emergency department, her blood pressure was 177/76 mm Hg, pulse 87, apyrexial with respiratory rate of 20 and saturating at 95% on 15 l of oxygen. Her blood glucose was 12 mmol/l.

INVESTIGATIONS

Blood tests revealed a normocytic anaemia (haemoglobin 9.5 g/dl, mean cell volume 90 fl), raised white cell count of 38.5 ($\times 10^9/l$) with neutrophil count of 27.6 ($\times 10^9/l$). She was thrombocytopenic with platelet count of 49 ($\times 10^9/l$), raised fibrinogen (13 g/l, normal 2–4 g/l) and normal international normalised ratio. The C reactive

protein was 464 mg/l. Liver function tests, electrolytes and albumin were normal but her renal function tests showed urea 21.2 mmol/l and creatinine 179 mmol/l. Recent blood tests conducted 1 month earlier were all normal except for the anaemia. Blood, stool and urine samples were sent for microscopy, culture and sensitivity. A chest radiograph performed in the department was normal.

Figure 1 A large pocket of air can be seen in the right frontal lobe in a parafalcine position. There is a small amount of surrounding oedema but no mass effect.

Figure 2 Several smaller pockets of intraparenchymal air were seen throughout the rest of the brain. No fractures were seen.

Figure 3 Air was also seen in the sagittal sinus.

Figures 4 Demonstrate no significant contrast enhancement of the surrounding tissue.

Approximately 1 h after arrival in the emergency department, a CT head scan was performed.

DIFFERENTIAL DIAGNOSIS

Brain abscess secondary to *Escherichia coli*, *Enterobacter cloacae* and *Klebsiella aerogenes* (figures 1–5).

TREATMENT

She was started on intravenous cefotaxime and metronidazole.

OUTCOME AND FOLLOW-UP

Shortly after the CT scan, the patient went into cardiorespiratory arrest and died. *C. septicum* was grown from the blood samples 48 h later.

DISCUSSION

Our patient presented with generalised weakness and altered consciousness and was found to have pneumocephalus and positive blood cultures. The most common causes for intracranial gas are trauma and surgical intervention. Infection by gas-forming organisms is a rare cause,^{1 2} and further infrequent causes include congenital defects, neoplastic erosion of the skull base, barotrauma and radiotherapy to the base of the skull. In a review of 295 cases, the causes for pneumocephalus were found to be secondary to trauma in 73%, tumours in 12.9%, surgical intervention in 8.8% and unknown in 0.6%.³

Details of the several previous causes are given below:

Reference	Presentation	Management	Outcome
Roeltgen <i>et al</i> ⁴	Adult patient presented with cerebritis He had previously undergone colectomy 11 years ago for colonic adenocarcinoma, and there was evidence of metastatic adenocarcinoma of the liver	Managed with intravenous antibiotics	Died within 24 h of admission
Gorse <i>et al</i> ⁵	Adult patient admitted with cerebritis Colonic carcinoma was diagnosed at autopsy	Managed with intravenous antibiotics	Died within 24 h of admission
Riccio and Oberkircher ⁶	16-month-old febrile patient admitted with 3-day history of blood-streaked watery diarrhoea	Fluid resuscitation was required before haemodialysis could be started	Died approximately 48 h after hospital admission
Marangou <i>et al</i> ⁷	Adult patient presented with cerebritis Diagnosis of colonic neoplasm was made during admission	Neurosurgical debridement and drainage of necrotic tissue and antibiotic therapy	Died 16 days after admission
Randall <i>et al</i> ⁸	4-year-old male patient admitted with bloody diarrhoea and abdominal pain Diagnosed with haemolytic uraemic syndrome (HUS) and 2 days after admission suffered a generalised seizure and never regained consciousness	Treatment as appropriate for HUS	Ventilator therapy was withdrawn 5 h after generalised seizure
Dirks <i>et al</i> ⁹	Adult patient admitted with loss of consciousness. Found to have surgical emphysema and multiple bullae over the nates and vulva	Admitted to ITU	Patient dies 8 h after admission to hospital

Figure 5 Demonstrate no ring enhancement.

C. septicum is an anaerobic, gas producing, gram positive, spore-forming bacillus. It is more aerotolerant than other members of the clostridia family and is, hence, hardier and able to infect normal tissues. It appears to have a fulminant course and is usually associated with malignancy.² The organism can produce an exotoxin that is able to hydrolyse cell membranes and cause tissue necrosis by inducing occlusive microvascular thrombosis.¹⁰ The ability of *C. septicum* to infect normal tissue and its aggressive nature

can produce startling changes in the clinical condition of patients.

C. septicum has been found in 10–63% of normal appendices,¹¹ and it is believed that the terminal ileum and caecum may provide the most favourable environment in the human gastrointestinal tract for colonisation.¹⁰ It is believed that when the bowel mucosal barrier is compromised through colitis, neutropaenia or perforating colon cancers, a portal exists for entry of the organism into the blood stream and seeding at distant sites.¹² This is the proposed theory behind the association of *C. septicum* infection and gastrointestinal malignancy.

Infections with *C. septicum* are rare and comprise only 1.3% of all clostridial infections.¹³ It is an important pathogen not only because of its strong association with malignancy but also because of its high mortality. The mortality for infection with *C. septicum* can be as high as 70%,² and in one study that looked at all clostridial infections, the mortality was found to be 56% from *C. septicum* compared to 26% from other strains.¹⁴ Other bacterial organisms that can cause pneumocephalus include *E. coli*, *E. cloacae* and *K. aerogenes*.¹⁵

The mainstay of treatment is with intravenous antibiotics, principally penicillins. Patients with *C. septicum* infection should also undergo investigation to exclude malignancy, primarily gastrointestinal or haematological in origin.

Our case serves as a reminder of this rare but grave disease and again emphasises the rapidness with which patients can deteriorate.

Learning points

- ▶ *C. septicum* is rapidly fatal if not treated with appropriate antibiotics – penicillins.
- ▶ It is associated with both bowel and haematological malignancies.
- ▶ The organism can survive in well-oxygenated tissues.

Competing interests None.

Patient consent Not obtained.

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