

## Rare disease

# Nosocomial meningitis caused by gas producing *Klebsiella pneumoniae*

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## Summary

A 40-year-old woman presented with dyspnoea and lowered level of consciousness. Three months before presentation she had undergone craniotomy for an episode of acute subdural hematoma caused by a severe neurotrauma. Her temperature was 37.3°C, she had no focal neurological deficits or neck stiffness, and the score on the Glasgow Coma Scale was 9 (E2M5V2). Cranial CT showed obstruction hydrocephalus with hypodensities consistent with airbubbles in the lateral ventricles, but no air in the proximity of the skull defect resulting from the craniotomy. External ventricular drainage was performed and cerebrospinal fluid (CSF) examination showed 126 327 leucocytes per  $\mu\text{L}$ , a protein level of 26.28 g/L and a glucose level of  $<0.1$  mmol/L. CSF culture grew *Klebsiella pneumoniae*, a gas producing bacterium. Despite antibiotic treatment with meropenem, ceftriaxone and intraventricular gentamicin and supportive therapy, our patient deteriorated and died 3 weeks after admission. The family did not give consent for autopsy.

## BACKGROUND

Intraventricular air on cranial imaging is rarely seen, unless directly after ventriculostomy. The cause of intracranial air production was unclear in this patient until *Klebsiella pneumoniae* was cultured from the cerebrospinal fluid (CSF). Spontaneous intracranial air limited to the ventricles is uncommon as in most patients with intracranial air the cause lies in skull defects.

## CASE PRESENTATION

A 40-year-old woman presented with dyspnoea and lowered level of consciousness. Three months before presentation she had undergone craniotomy for an episode of acute subdural hematoma after a severe neurotrauma. Her temperature was 37.3°C, she had no focal neurological deficits or neck stiffness, and the score on the Glasgow Coma Scale was 9 (E2M5V2).

## INVESTIGATIONS

Cranial CT showed obstruction hydrocephalus with hypodensities consistent with airbubbles in the lateral ventricles (figure 1), but no air in the proximity of the skull defect resulting from the craniotomy. External ventricular drainage was performed and CSF examination showed 126 327 leucocytes per  $\mu\text{L}$ , a protein level of 26.28 g/L and a glucose level of  $<0.1$  mmol/L. CSF culture grew *K pneumoniae*, a gas producing bacterium.

## TREATMENT

On admission, the patient was empirically treated with co-amoxycylav 1200 mg intravenously every 6 h and ciprofloxacin 400 mg intravenously every 12 h. Following the external ventricular drainage the day after admission the antimicrobial treatment was changed to meropenem 1 gram intravenously every 6 h. On day 5 of admission, the antimicrobial susceptibility patterns of the cultured

*K pneumoniae* were definite, and therapy was changed to ceftriaxone 2 gram intravenously every 12 h. As the patient did not improve, additional treatment with 6 mg intraventricular gentamicin per day was started on day 8 of admission for a total of 6 days. Because of a clinical deterioration all antimicrobial therapy was discontinued 14 days after admission.

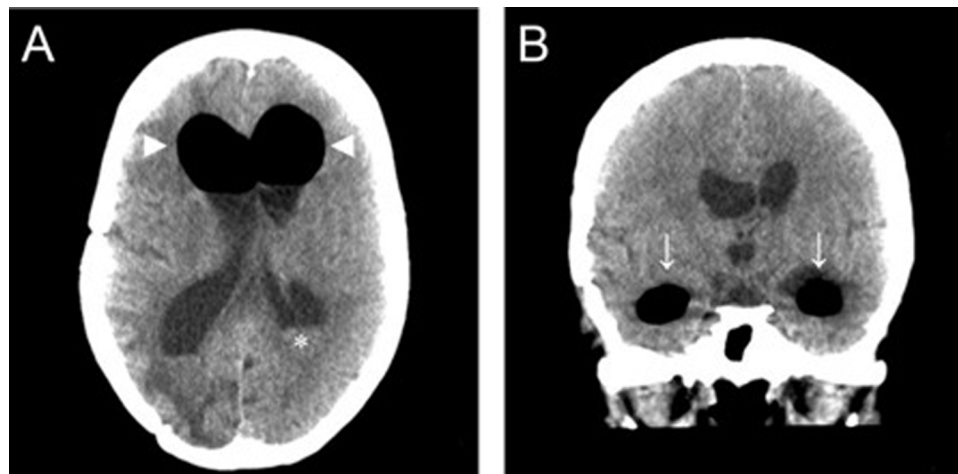
## OUTCOME AND FOLLOW-UP

Despite antibiotic treatment and supportive therapy our patient deteriorated and died 3 weeks after admission. The family did not give consent for autopsy.

## DISCUSSION

*K pneumoniae* is a rare cause of bacterial meningitis in Europe and the United States but is relatively common in Taiwan and Korea.<sup>1 2</sup> The bacterium is able to produce gas by fermenting glucose under anaerobic conditions. Few cases of gas forming central nervous system infections due to *K pneumoniae* have been published.<sup>3</sup> In a case-series of 55 patients with meningitis due to *K pneumoniae* pneumocephalus was not described.<sup>2</sup> Most cases of pneumocephalus in bacterial meningitis result from bony defects due to mastoiditis, sinusitis or skull fractures.<sup>1 4</sup> In our patient a large quantity of intraventricular air was shown on the cranial CT with no direct relation with the craniotomy defect. The intracranial gas was limited to the lateral ventricles, suggesting local gas production. Physicians should be aware of bacterial meningitis by gas producing bacteria in patients with intracranial air in whom no obvious cause for pneumocephalus can be established.

Nosocomial meningitis after neurosurgical procedure mostly occurs within the first 2 weeks after the operation. One third of cases however occur after this time frame, and some cases have been reported to occur years after neurosurgery.<sup>1</sup> In the literature most cases of nosocomial



**Figure 1** Cranial CT showing intraventricular air in the frontal horns of the lateral ventricles (arrowheads) (A) and temporal horns of the lateral ventricles (arrows) (B), with a hyperdense sediment in the occipital horns of the lateral ventricles, consistent with pus (asterisk) (A).

*K pneumoniae* meningitis were found after craniotomy while community-acquired meningitis cases have been described almost exclusively in severely immunocompromised patients.<sup>2</sup> In our patient it is likely the meningitis was related to the craniotomy.

Although our patient received adequate antimicrobial and supportive therapy she continued to deteriorate and eventually died. Previous reports on *Klebsiella* meningitis show that more than half of the patients with *K pneumoniae* meningitis die despite adequate therapy.<sup>2</sup> High dose intravenous antibiotic therapy, CSF drainage when hydrocephalus is present and intraventricular antimicrobial therapy when intraventricular access is available is currently the advised treatment.<sup>1 2</sup>

**Competing interests** None.

**Patient consent** Not obtained.

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## Learning points

- ▶ *K pneumoniae* meningitis is an uncommon cause of nosocomial meningitis.
- ▶ Nosocomial bacterial meningitis can present several months after neurosurgical operations.
- ▶ Nosocomial bacterial meningitis caused by *K pneumoniae* can present with intracranial gas on cranial imaging.
- ▶ Physicians should be aware of bacterial meningitis by gas producing bacteria in patients with intracranial air in whom no obvious cause for pneumocephalus can be established.

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