CASE REPORT

Crystals seen on CSF microscopy in a case of suspected subarachnoid haemorrhage

Daniel Weiland,¹ Ian Hanning,² Moussa Mouhamadou,³ Debbie Wearmouth¹¹Department of Medical Microbiology, Hull Royal Infirmary, Hull, East Riding of Yorkshire, UK²Department of Clinical Biochemistry, Hull Royal Infirmary, Hull, East Riding of Yorkshire, UK³Department of Neurology, Hull Royal Infirmary, Hull, East Riding of Yorkshire, UK**Correspondence to**
Dr Daniel Weiland,
dweiland@nhs.net

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SUMMARY

Although crystals are rarely identified on cerebrospinal fluid (CSF) microscopy, their presence can be of significant diagnostic value. We report a case of oxalate crystals seen on CSF microscopy of a 43-year-old woman. The patient presented with headaches, nausea and vomiting. CT of the head showed a small focus of hyper-density, suspicious of haemorrhage, in the right side of the pontine cistern. CSF cell count was within the normal range. Although no organisms were seen on microscopy, copious oxalate crystals were seen. The same crystals were seen on microscopy of CSF collected in a fluoride oxalate container used for glucose analysis. A follow-up contrast-enhanced CT angiogram did not demonstrate any abnormalities. It transpired that excess CSF had been collected into a fluoride oxalate container. This had subsequently been decanted into a plain container for microbiological analysis. Correct specimen collection should be emphasised when teaching lumbar puncture technique.

BACKGROUND

Crystals are rarely identified on cerebrospinal fluid (CSF) microscopy. The presence of yellow rhomboid bilirubin crystals within macrophages can help establish the diagnosis of subarachnoid haemorrhage, some weeks earlier.¹ In contrast, the presence of oxalate crystals may suggest severe ethylene glycol poisoning² or primary hyperoxaluria type 1.³ Ethylene glycol is metabolised by alcohol dehydrogenase to form glycolic and oxalic acids. Ethylene glycol poisoning is associated with an increased osmolar gap and increased anion gap metabolic acidosis.³ Different crystals may also be seen on CSF microscopy as a result of specimen dehydration,⁴ macrophage degeneration⁵ or craniopharyngioma.⁶ We report a case of oxalate crystals seen on CSF microscopy of a 43-year-old woman.

CASE PRESENTATION

In June 2014, the patient presented with headaches of such severity that she was woken in her sleep. Her headache was associated with nausea and vomiting but no other symptoms of meningism.

Her medical history was complex, including bladder reconstruction and left nephrectomy for congenital malformation in childhood. Multiple follow-up procedures were performed and a permanent sacral nerve neuromodulator was eventually implanted. The patient also had a hysterectomy and unilateral oophorectomy, and was diagnosed with type 2 diabetes in 2011. More recently, she suffered from recurrent pyelonephritis of her

remaining kidney, but her renal function had remained within normal limits. She was a non-smoker, denied any alcohol intake and was of average build for her age.

INVESTIGATIONS

On admission, CT of the head showed no definite evidence of acute intracranial haemorrhage. There was a small focus of hyper-density, suspicious of haemorrhage, in the right side of the pontine cistern. The brain otherwise appeared normal.

To help rule out subarachnoid haemorrhage, a lumbar puncture was performed following the CT scan. Cell count showed no white cells and only one red cell per cubic mm. CSF glucose was 3.7 mmol/L and CSF total protein was 0.60 g/L. Bilirubin was not increased. A small amount of oxyhaemoglobin was detected, probably due to slight blood contamination at the lumbar puncture. Although no organisms were seen on microscopy, copious crystals were seen. These were identified as oxalate crystals on the basis of their microscopic appearance (figure 1).

Given this unusual result, further clinical information was sought and the clinical biochemistry department kindly provided their specimens for comparison. The same crystals were seen on microscopy of CSF collected in a fluoride oxalate

Figure 1 Photomicrograph of unspun cerebrospinal fluid in the cell counting chamber, taken at 400× high-dry magnification. Copious crystals can be seen in the background. The arrow points to an oxalate crystal; these typically appear as squares with an X in the middle, or having an envelope shape.

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Table 1 Results of electrolyte analysis for contemporaneously collected CSF specimens, which were received in different container types depending on the type of investigation being requested

Container type	Investigation type	Sodium (mmol/L)	Potassium (mmol/L)
Fluoride oxalate	Glucose	688	87
Plain	Microbiology	168	16.6
Plain	Xanthochromia	152	3.1

CSF, cerebrospinal fluid.

tube used for glucose analysis, but not in the light-protect plain container used for analysis of xanthochromia. Fluoride oxalate tubes contain sodium fluoride and potassium oxalate. As a result, sodium concentrations are approximately 30 times higher, and potassium concentrations are approximately 4 times higher, than in normal CSF. In this case, electrolyte analysis of all CSF specimens revealed abnormally high sodium and, particularly, high potassium concentrations, in the microbiology specimen (table 1).

OUTCOME AND FOLLOW-UP

Follow-up contrast-enhanced CT angiogram, to rule out vascular abnormalities in light of the earlier CT of the head, did not demonstrate any evidence of intracranial aneurysm, dissection or arteriovenous malformations. The dural venous sinuses also appeared patent. A single blood culture set collected on admission was culture-negative at 5 days' incubation.

The finding of oxalate crystals on CSF microscopy prompted further questioning. There was no current or a history of toxin ingestion, suicide attempts, or renal calculi. On further questioning of the doctors who performed the lumbar puncture, it was determined that excess CSF had been collected into the fluoride oxalate container type, which had subsequently been decanted into the plain container type intended for microbiological analysis. The patient was discharged 3 days following admission, after subarachnoid haemorrhage was ruled out and symptoms had fully resolved.

DISCUSSION

Correct specimen collection should be emphasised when teaching lumbar puncture technique. CSF will drip without the need to aspirate.⁷ The first specimen should be collected in a fluoride EDTA container for glucose and protein analysis. The last, least blood-stained specimen should be sent, protected from light, for bilirubin analysis.⁸ Larger volumes of CSF may be required for investigations including cytology or mycobacterial culture.⁹ Rapid transport of all specimens is critical. Decanting CSF between specimen containers must be avoided.

In this case, the oxalate crystals seen on CSF microscopy were the direct result of poor specimen collection technique. Although crystals are rarely identified on CSF microscopy, their presence can be clinically significant.¹

Learning points

- ▶ Correct specimen collection should be emphasised when teaching lumbar puncture technique.
- ▶ This case demonstrates the importance of correct specimen collection technique when performing diagnostic lumbar puncture.
- ▶ Although crystals are rarely identified on cerebrospinal fluid (CSF) microscopy, their presence can be clinically significant.
- ▶ The presence of oxalate crystals may suggest severe ethylene glycol poisoning or primary hyperoxaluria type 1.
- ▶ Oxalate crystals may also be seen on CSF microscopy as the result of poor specimen collection technique.

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