

## CASE REPORT

# The case of the floating gel

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In patients with chronic renal failure, blood samples for laboratory analysis are often taken via dialysis catheters. This report describes a case of gross spurious hypernatraemia in a blood sample collected from a patient undergoing haemodialysis. After centrifugation of the blood sample in question, the separator gel formed the topmost layer, with the serum in the middle and the clot at the bottom. Subsequent analysis of the serum showed severe hypernatraemia (serum sodium, 744 mmol/litre). It was established that the blood sample had been taken from the patient's dialysis catheter into which 3 ml of Citra-Lock™ (46.7% trisodium citrate) had been instilled previously as a "catheter locking" solution. The hypernatraemia seen in this case was recognised immediately as an artefact, but it was found that even minimal contamination of blood samples with Citra-Lock may significantly affect sodium concentrations. This contamination may be missed, with potentially adverse consequences for patient management.

We report a case of gross spurious hypernatraemia in a blood sample collected from a 79 year old woman undergoing haemodialysis for chronic renal failure. The blood sample in question was submitted predialysis for renal and bone profiles. It had been collected into a BD Vacutainer® SST™ tube containing a serum separator gel (Becton Dickinson, Cowley, UK), and arrived in the laboratory without undue delay.

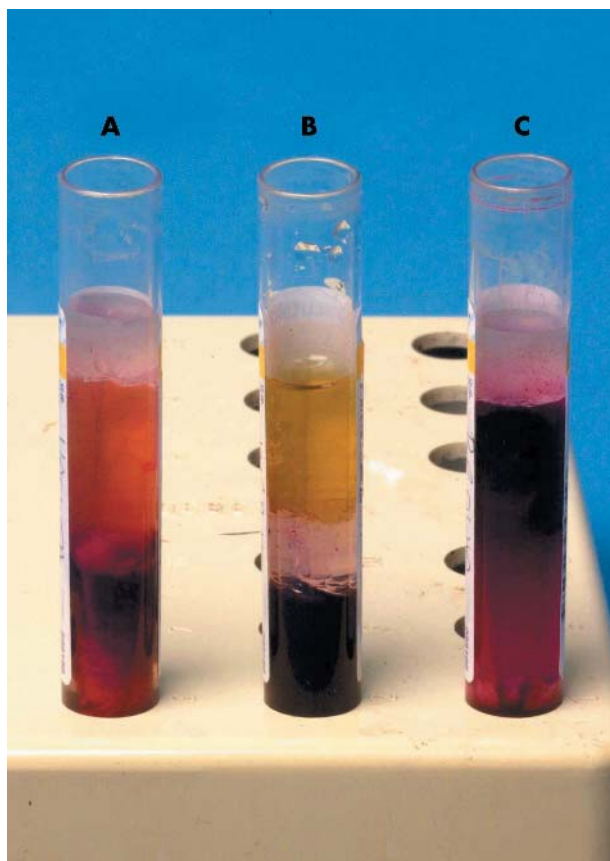
"Normally, serum forms the top layer and is separated from the clot (and cells) at the bottom of the tube by the gel"

The tube was centrifuged at 1200 ×g for 10 minutes to separate the constituents of blood according to their relative density. Normally, serum forms the top layer and is separated from the clot (and cells) at the bottom of the tube by the gel (fig 1B). However, here, a very unusual phenomenon was observed. The separator gel formed the topmost layer, with the serum in the middle and the clot at the bottom (fig 1A). This suggested that the relative density of the serum was unusually high. The serum was aspirated by a pipette. The gross appearance of the sample showed mild haemolysis but no apparent lipaemia or icterus. Biochemical analyses were performed on an automated laboratory analyser (Roche Diagnostics, Lewes, East Sussex, UK).

The following results (reference intervals) were obtained and confirmed by reanalysis: sodium, 744 mmol/litre (135–145); potassium, 4.7 mmol/litre (3.5–5.0); chloride, 71 mmol/litre (96–108); albumin, 29 g/litre (36–50); calcium, 1.12 mmol/litre (2.10–2.55). Therefore, a source of sample contamination was sought. It was established that the blood sample had been taken from the patient's dialysis catheter. Previously, 3 ml of 46.7% wt/vol trisodium citrate

(Citra-Lock™, Dirinco Inc, the Netherlands) had been inserted into the catheter. Citra-Lock solution has a sodium concentration of 4800 mmol/litre (approximately 35 times that of human serum).

To determine more fully the effect of contamination with Citra-Lock, we sequentially added 10 µl quantities of Citra-Lock to 1 ml aliquots of a normal serum sample and measured the sodium concentration. For every 10 µl of Citra-Lock added, the sodium concentration increased by approximately 20 mmol/litre. Finally, 0.5 ml Citra-Lock was added to another blood sample collected into a BD Vacutainer® SST™ tube. After centrifugation, the relative density of the serum had become even greater than the clot, resulting in the arrangement of gel, clot (cells), and serum shown in fig 1C.



**Figure 1** Vacutainer tubes containing blood samples and serum separator gel after centrifugation. (A) The sample reported here, where the separator gel formed the topmost layer, with the serum in the middle and the clot at the bottom. (B) Normal blood sample, with serum forming the top layer and being separated from the clot (and cells) at the bottom of the tube by the gel. (C) Blood sample plus 0.5 ml Citra-Lock solution in which the relative density of the serum had become even greater than the clot, resulting in the arrangement of gel, clot (cells), and serum.

## DISCUSSION

Because of the difficulties often encountered in venesecting patients with chronic renal failure, it is not uncommon for medical and nursing staff to take blood samples from dialysis catheters. Although citrate anticoagulation has long been used as an alternative to heparinisation during intermittent haemodialysis,<sup>1</sup> Citra-Lock is a relatively recent development. It is essentially a "catheter locking" solution for use in the dialysis catheter between dialysis sessions (the high citrate concentration is supposed to reduce infection and thrombosis in the catheters). After dialysis, the catheter is flushed with saline and Citra-Lock is instilled into both lumens. Before the catheter is re-attached to the dialysis machine at the next session, the Citra-Lock in the catheter should be aspirated and discarded.

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The hypernatraemia seen in this patient was sufficiently striking that it was recognised immediately as an artefact, but we have shown that contamination of blood samples with very small amounts of Citra-Lock results in erroneous sodium concentrations. This may go unrecognised, with serious implications for patient treatment, for two reasons. First, although contamination is well recognised as a cause of artefactual laboratory results,<sup>2</sup> serious artefactual hypernatraemia is uncommon. Second, the tonicity of Citra-Lock is such that considerable contamination is possible from the residue even if it has been aspirated from the catheter and discarded, as outlined above. Thus, contamination may be considered—and missed.

## Take home messages

- We describe a case of gross spurious hypernatraemia in a blood sample collected from the dialysis catheter of a patient undergoing haemodialysis as a result of contamination with Citra-Lock, which had been instilled previously as a "catheter locking" solution
- We determined that even minimal contamination of blood samples with Citra-Lock may significantly affect sodium concentrations
- This is important because this contamination may be missed, with potentially adverse consequences for patient management

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## REFERENCES

- 1 von Brecht JH, Flanigan MJ, Freeman RM, *et al.* Regional anticoagulation: hemodialysis with hypertonic trisodium citrate. *Am J Kidney Dis* 1986;**8**:196–201.
- 2 Gaw A, Murphy MJ, Cowan RA, *et al.* *Clinical biochemistry: an illustrated colour text*, 3rd ed. Edinburgh: Churchill Livingstone, 2004.