Haemodialysis with a dialysate sodium of 170 mmol/l

During calibration of a haemodialysis machine, an incorrect touch screen entry during the ‘span adjustment’ of the conductivity calibration procedure led to a machine reading 14.0 mS/cm when the actual conductivity was 17 mS/cm. This should have been picked up during the following step (confirmation of the conductivity indication), but it was not and the machine went on to automatically record the pump speeds across the newly calibrated conductivity curve. The effectively disabled the protective system that alarms if the pump has to run more than 10% faster or slower than expected to achieve the set conductivity.

The problem was identified after approximately 21 sessions when the machine was moved from an area where highly dependent and hospitalised patients were treated to one used by stable patients. When staff realised that at least three patients had complained of unusual symptoms while dialysing at the same station, the machine was taken out of service. A dialysate sample was taken and the lab reported a sodium level of 174 mmol/l, more than 30 mmol/l higher than the prescribed 137 mmol/l.

A review of the nursing kardex for the patients treated with the miscalibrated machine showed that patients reported thirst (often very severe), head and neck aches, flu-like symptoms including fever and trembling, nausea and general discomfort. Several patients became agitated or angry and insisted on being taken off early. Post dialysis systolic blood pressure was up to 70 mmHg higher than usual. The patients who were able to access fluids freely brought their sodium levels back into the normal range before the next dialysis by drinking up to 4.5 litres more than usual (depending on the size of the patient and their residual renal function). This led to interdialytic weight gains of up to 8 kg.

All patients affected were sent a letter explaining the incident. A root cause analysis was carried out, during which the miscalibration was found to have occurred out-of-hours when the machine was in the workshop for a software upgrade that did not require a conductivity calibration. It was not possible to identify the person responsible as the same ‘PIN’ is used by all staff who access the technical screens.

An additional functional check (a ‘mini-dialysis) is now carried out after all services, or repairs that require recalibration. However, this would not have prevented the above incident as there was no reason for the calibration. The company have been asked to review the calibration procedure, particularly the possibility of skipping the confirmation step and the lack of a limit, or at least a warning message, on the amount by which the expected pump speed can be automatically adjusted.

Action:
1. Renal units using haemodialysis dialysis machines should be aware of the possibility of miscalibration.
2. Comments are welcomed to whether a similar calibration error has occurred, or is possible with other makes of haemodialysis machines.

Please submit comments, solutions, and personal experience to:

Dr. Paul Rylance, Renal Unit, New Cross Hospital, Wolverhampton, WV10 0QP
or email to: Paul.Rylance@rwh-tr.nhs.uk