Source of infection in Hickman catheters

Infection is a principal complication of the use of indwelling, central venous (Hickman) catheters in immunosuppressed patients.^{1,2} There has been disagreement about the pathogenesis of catheter colonisation and sepsis, some workers judging the flora of the skin at the catheter entry site to be the source of infection, and others suggesting contamination of the catheter hub.^{3,4} Liñares *et al* implicated the catheter hub as the most common site of origin of catheter related bacteraemia in patients receiving total parenteral nutrition.⁵ We obtained preliminary data supporting this portal of entry in the course of a prospective study of catheter related bacteraemia in children with leukaemia and other malignant diseases.

Hickman catheters, when not in use for intravenous infusion, were sealed with a male Luer lock hub with a rubber membrane (Vygon) through which injections could be made. When these hubs were removed a quantitative culture technique was used to assess the degree of bacterial colonisation of the inner surfaces.⁵ During the first 20 weeks of the study there were nine catheter related bacteraemias, diagnosed on the basis of quantitative cultures of blood samples drawn through the catheter (after the hub has been removed for culture) and from a peripheral vein. In seven episodes the same organism was isolated from the hub and from blood cultures, in one episode the inner surface of the hub was sterile, and in one episode a different organism from that causing the bacteraemia was isolated (table).

The skin around the catheter entry site was also regularly cultured by a semi-quantitative method,⁶ but the organism causing the catheter related bacteraemia was not isolated.

This finding suggests that catheter infections originate from the hub rather than the

skin entry site. On the other hand, of 89 hubs from 16 patients cultured thus far, including those associated with the catheter related bacteraemias, 14 (16%) had been colonised when there was no evidence of catheter related bacteraemia, but in these cases the degree of colonisation was generally less severe than in those hubs associated with bacteraemia. We are not suggesting that antimicrobial chemotherapy should be given on the basis of the results of hub culture, but our finding suggests that efforts to prevent infection should be directed at the procedures for catheter care and handling.

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References

- 1 Press OW, Ramsey PG, Larson EB, *et al*. Hickman catheter infections in patients with malignancies. *Medicine* 1984;63:189-200.
- 2 Shapiro ED, Wald ER, Nelson KA, *et al*. Broviac catheter-related bacteremia in oncology patients. *Am J Dis Child* 1982;136:679-81.
- 3 Snyderman DR, Gorbea HF, Pober BR, *et al*. Predictive value of surveillance skin cultures in total-parenteral-nutrition-related infection. *Lancet* 1982;i:1385-8.
- 4 Sitges-Serra A, Jaurrieta E, Liñares J, *et al*. Bacteria in total parenteral nutrition catheters: where do they come from? *Lancet* 1983;ii:531.
- 5 Liñares J, Sitges-Serra A, Garau J, *et al*. Pathogenesis of catheter sepsis: a prospective study with quantitative and semiquantitative cultures of catheter hub and segments. *J Clin Microbiol* 1985;21:357-60.
- 6 Bjornson HS, Colley R, Bowey RH, *et al*. Association between microorganism growth at the catheter insertion site and colonisation of the catheter in patients receiving total parenteral nutrition. *Surgery* 1982;92:720-6.

Effect of in vitro sodium citrate anticoagulant on results of arterial blood gas analysis

We report a case in which the mistaken use of sodium citrate as an anticoagulant in a sample of arterial blood intended for blood gas analysis resulted in a severe change in pH and a calculated index of acid base state.

Venous and arterial blood samples from a 59 year old man with sudden onset of dyspnoea were received by the laboratory for urgent biochemical analysis. Results on heparinised venous plasma using a Beckman ASTRA were: urea 6.3 mmol/l, potassium 3.8 mmol/l, sodium 141 mmol/l, and total carbon dioxide 24 mmol/l. Results on arterial whole blood using a Corning 178 automated blood gas analyser were: pH 7.29, carbon dioxide partial pressure 3.4 kPa, oxygen partial pressure 5.3 kPa, calculated bicarbonate 12 mmol/l. The arterial results could be interpreted as reflecting a severe non-respiratory acidosis with respiratory compensation and hypoxia. The discrepancy between total carbon dioxide and calculated bicarbonate, however, alerted the laboratory to the possibility of an error, and enquiry showed that 3.8% sodium citrate (trisodium citrate BP), comprising about 5% of the total volume of the sample, had been used instead of sodium heparin as an anticoagulant for the arterial blood. Using the blood gas analyser the pH of the sodium citrate preparation was found to be 7.29. Sodium citrate has previously been reported to have an acidifying effect on the pH of whole blood in vitro.¹

A heparinised arterial sample from the patient was subsequently analysed and results were: pH 7.47, carbon dioxide partial pressure 3.8 kPa, oxygen partial pressure 6.0 kPa, calculated bicarbonate 21 mmol/l. These results indicate that the patient had a mild respiratory alkalosis with hypoxia.

The artefact caused by sodium citrate is important as it may result in serious misinterpretation of blood gas results, with the consequent risk of starting inappropriate and potentially harmful treatment.

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Reference

- 1 Gambino SR. Heparinized vacuum tubes for determination of plasma pH, plasma CO₂ content and blood oxygen saturation. *J Clin Pathol* 1959;32:285-93.

Table Isolates from catheter hubs

	Catheter related bacteraemia with same organism	No simultaneous catheter related bacteraemia	Catheter related bacteraemia with different organism
Coagulase negative staphylococcus	3	11	1
<i>Staphylococcus aureus</i>	0	1	0
<i>Streptococcus faecalis</i>	1	0	0
<i>Streptococcus sanguis</i>	1	0	0
<i>Klebsiella oxytoca</i>	1	0	0
<i>Escherichia coli</i>	0	1	0
<i>Enterobacter agglomerans</i> + <i>Acinetobacter calcoaceticus</i> var. <i>lwoffi</i>	1	0	0
Coagulase negative staphylococcus + <i>Acinetobacter calcoaceticus</i> var. <i>lwoffi</i>	0	1	0
Total	7*	14	1

*The inner surfaces of the hub associated with one catheter related bacteraemia were sterile.