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Short report

Ethanol versus heparin locks for the prevention of central venous catheter-associated bloodstream infections: a randomized trial in adult haematology patients with Hickman devices

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SUMMARY

The effectiveness of ethanol locks for prevention of central venous catheter (CVC)-associated bloodstream infection (CLABSI) in adult haematology patients has not been thoroughly evaluated. This study aimed to compare prospectively heparinized saline with 70% ethanol locks using 2 h dwell time in patients with tunnelled CVCs. In saline ($N = 43$) and ethanol ($N = 42$) groups, CLABSI rates were 6.0 [95% confidence interval (CI): 3.4–9.8] and 4.1 (95% CI: 1.9–7.7) per 1000 CVC days, respectively ($P = 0.42$). In the ethanol group, two exit-site infections and one tunnel/pocket infection were observed. Reduction in device-associated infection was not achieved with prophylactic 70% ethanol locks in patients with haematological malignancy and tunnelled CVCs.

Introduction

Central venous catheters (CVCs) are required for management of patients with haematological malignancy and for bone marrow transplantation (BMT).[1,2] If complicated by bloodstream infection, poorer outcomes are observed, including mortality and increased healthcare costs. Although CVC care bundles have been widely implemented to reduce the burden of infection, additional preventive methods may be needed in populations requiring long-term catheterization.[3–5]

Few studies have evaluated the role of ethanol locks for prevention of CVC-associated infection in adult haematology patients. One randomized study demonstrated a reduction in

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Table I
Characteristics of study population

	Heparinized saline ($N = 43$)	70% ethanol ($N = 42$)	*P*-value
Male sex	24	28	0.38
Median (range) age (years)	48.1 (17–66)	47.0 (18–70)	0.76
Underlying disease			
Acute lymphoblastic leukaemia	7	3	0.32
Acute myeloid leukaemia	16	11	0.51
Chronic lymphocytic leukaemia	2	0	0.49
Chronic myeloid leukaemia	0	1	1.00
Non-Hodgkin lymphoma	5	12	0.18
Hodgkin lymphoma	1	1	1.00
Myeloma	2	9	0.06
Other	10	5	0.28
CVC insertion for SCT/BMT	32	31	0.19
Median (range) duration of catheterization (days)	34 (3–196)	27 (0–191)	0.56

CVC, central venous catheter; SCT, stem cell transplantation; BMT, bone marrow transplantation.

device-related bloodstream infections classified according to a surveillance definition.[6] However, the validity of this definition in haematology patients has been questioned, and this definition has subsequently been updated.[7,8]

The objective of this study was to evaluate prospectively the effectiveness of 70% ethanol compared to heparin locks for prevention of CVC-associated infections in a randomized trial of adult haematology/BMT patients with tunnelled CVCs.

Methods

Study design and patient population

The study was performed between September 2009 and January 2011 at the Royal Melbourne Hospital, a tertiary healthcare facility with a clinical haematology and BMT unit. Patients with haematological malignancy or planned BMT were eligible for enrolment at time of insertion of a dual lumen, non-antibiotic-impregnated, tunnelled, cuffed, intravascular catheter (Hickman catheter) into subclavian or internal jugular veins, where the intended period of catheterization was $\geq$30 days.

Standardized insertion processes were followed, including barrier precautions described by Pronovost *et al.*[3] and administration of prophylactic intravenous vancomycin 60 min prior. Maintenance practices included weekly dressing changes and aseptic non-touch technique for CVC access.

Patients were randomized before insertion to receive either heparinized saline or ethanol locks (1:1 ratio). The primary study endpoint was device-related bloodstream infection, defined according to accepted surveillance and clinical criteria. Secondary endpoints included exit-site infection, tunnel/pocket infection, and CVC occlusion related to thrombosis. Patients were monitored for duration of catheterization, until a device-related bloodstream infection occurred, or planned study end-date. Adverse outcomes were recorded.

A 50–70% reduction in the incidence of device-related bloodstream infection was assumed to be clinically relevant. To enable >80% likelihood of demonstrating a 60% reduction ($P < 0.05$), 76 patients were required for randomization to each study arm.

Intervention

After flushing CVC lumens with 10 mL normal saline, 2 mL of 70% ethanol or heparinized saline (50 units in 5 mL) were instilled into each lumen of the CVC daily for inpatients and left *in situ* for 2 h. A 5–10 mL aliquot was then aspirated from each lumen before locking under positive pressure with 10 mL normal saline. Patients receiving continuous chemotherapy or narcotic infusion via one lumen received lock solution into the single available lumen on that day with alternating lumens on the next day. Self-caring outpatients were educated to administer ethanol lock or heparinized saline solution three times weekly, with 2 h dwell time.

Definitions

Consistent with National Healthcare Safety Network surveillance criteria, central-line-associated bloodstream infection (CLABSI) was defined as a bloodstream infection with no other identified primary focus of infection.[8] For a recognized pathogen, at least one positive blood culture was required to confirm diagnosis. For a common commensal, at least two positive blood cultures drawn on separate occasions were required.

According to Infectious Diseases Society of America recommendations, catheter-related bloodstream infection (CRBSI) was defined as a positive blood culture with a recognized pathogen or common commensal, with confirmation of infection by isolation of the same organism following culture of catheter tip, or a differential time to positivity for centrally and peripherally drawn blood cultures of $\geq$2 h.[5] This clinical definition was applied to exclude other possible causes of bacteraemia in neutropenic patients (e.g. gut source) and because of debate concerning the validity of surveillance definitions in this population.[7] Confirmatory tests were performed at discretion of the treating clinician.

Ethics review

The study was approved by the human research ethics committee at the study centre. Authorization of ethanol for