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BRIEF COMMUNICATION

Central venous access device practice across haematology and oncology centres in Australia and New Zealand: a cross-sectional survey

Hiu L. A. Yuen [1,2] Robert Weinkove,[3,4,5] Amanda Ullman,[6,7,8] Nicole Marsh,[6,9,10] Claire M. Rickard,[6,9,10,11] Sanjeev Chunilal[1,2] and Zoe McQuilten[1,2]

[1]Monash Haematology, Monash Health, and [2]Monash University, Melbourne, Victoria, [6]School of Nursing, Midwifery and Social Work, The University of Queensland Centre for Clinical Research, [7]Queensland Children's Hospital, [8]Menzies Health Institute Queensland and School of Nursing and Midwifery, Griffith University, [9]Alliance for Vascular Access Teaching and Research (AVATAR) Group, Schools of Nursing and Midwifery, and Pharmacy and Medical Sciences, Griffith University, [10]Nursing and Midwifery Research Centre, Royal Brisbane and Women's Hospital, and [11]Herston Infectious Diseases Institute, Metro North Health, Brisbane, Queensland, Australia, and [3]Cancer Immunotherapy Programme, Malaghan Institute of Medical Research, [4]Te Rerenga Ora Blood & Cancer Centre, Wellington Hospital, and [5]Department of Pathology and Molecular Medicine, University of Otago Wellington, Wellington, New Zealand

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Correspondence
Hiu L. A. Yuen, Monash Haematology, Monash Health, Melbourne, 246 Clayton Road, Clayton, VIC 3168, Australia.
Email: hiulamagnes.yuen@monashhealth.org

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Abstract

Central venous access devices (CVADs) are commonly used in malignancies. We conducted an online, anonymous cross-sectional survey of practice regarding CVAD management in haematology centres among clinicians in Australia and New Zealand. We identified variation in clinical practice regarding CVAD selection, insertion, management and removal. These findings highlight research gaps in CVAD care.

Central venous access devices (CVADs) are essential to the delivery of certain cancer therapies. Globally, approximately one billion CVAD insertions are performed annually.[1] These include peripherally inserted central catheters (PICCs), totally implanted venous devices (TIVDs, also described as 'ports') and Hickman-type tunnelled, cuffed catheters. Advantages of CVADs over peripheral intravenous catheters include reduced extravasation risk, dilution of vesicants and irritants through delivery to larger blood vessels and reduced need for venepuncture to obtain blood tests.[2] However, CVADs are associated with complications, including blockage, accidental removal, infection and thrombosis, and there is a paucity of evidence to guide prevention and management of these issues.

In 2013, the American Society of Clinical Oncology (ASCO) released evidence-based clinical practice guidelines for CVAD care,[3] highlighting multiple areas where evidence was insufficient to inform practice. For example, while heparin locking of CVADs is often employed to prevent CVAD thrombosis, ASCO found insufficient evidence to support this practice. Clinical trials can address the evidence gap: a recent *Lancet*-published randomised controlled trial compared CVADs in a cohort of people with mostly solid organ malignancies, reporting significantly fewer complications (infection, thrombosis and mechanical failure) with TIVDs compared to either PICCs or tunnelled, cuffed catheters.[4] Whether these results apply to people with haematological malignancies, who may be at higher risk of bleeding and thrombotic complications, is unclear.

To inform the need for clinical guidance and identify unmet research questions, we conducted a clinical practice survey, aiming to identify current practices regarding CVAD placement and management (choice of CVAD, locking practices and complication management) in haematology units across Australia and New Zealand.

We conducted an anonymous cross-sectional survey of practice regarding CVAD management in haematology centres among physicians and nurses in

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Australia and New Zealand from March 2021 to August 2021. This study was approved by the Monash University Research Ethics Committee (2021-25842-55727).

Links to the online survey (SurveyMonkey, Palo Alto, CA, USA) were distributed to Australasian Leukaemia and Lymphoma Group (ALLG) members, which represented 48 sites, through email in April 2021. The instructions were to complete one survey per cancer centre. To maintain respondent anonymity, we did not ascertain each respondent's day centre.

We collected demographic data on respondents in terms of location (metropolitan vs rural), type of practice (public vs private) and years of practice.

We focussed on three CVADs: PICCs, TIVDs and Hickman-type tunnelled, cuffed catheters. Our survey results were based on hospital policies if available. We provided treatment scenarios where respondents were asked to indicate CVAD preference. For each CVAD, we asked a set of questions in triplicate on locking practices and indications for removal to allow comparison between CVADs.

Research topics were provided for respondents to choose three they felt were most important. Each research topic chosen by a respondent was assigned one point, and results were tallied to calculate a percentage of respondents.

For questions related to catheter-related thrombosis, we defined superficial thrombosis as involvement of the cephalic or basilic veins, whereas deep thrombosis involved the axillary, subclavian, brachial, radial or ulnar veins.

The authors drafted the survey formulating key questions based on a review of the literature, followed by discussion within the writing group. This was piloted by five clinicians and modified based on feedback sought from the ALLG supportive care working party, assessing relevance, scope and ease of administration (Appendix S1).

Where similar responses to the repeated series of questions for each CVAD were elicited, we combined the responses to give a percentage range and provide results listed in order of PICCs, TIVDs and Hickman-type tunnelled, cuffed catheters.

We received 40 responses with equal representation from nursing and medical staff, most of whom (95%, 38/40) reported more than 5 years of clinical practice. Our respondents represented most states across Australia and New Zealand (Table 1), with more respondents reporting working in the public health system (55%, 22/40) and metropolitan cities (73%, 29/40). Median response rate to questions was 97% (range 92–100%).

Preferences based on cancer and treatment type for CVAD selection are presented in Table 2. Notably, few respondents reported use of TIVDs, which were primarily employed for transfusion support/phlebotomy (19% reported use for this indication).

Table 1 Characteristics of respondents

	N (%)
Geographic location	
New Zealand	4 (11)
New South Wales	12 (32)
Victoria	7 (18)
Queensland	7 (18)
South Australia	0
Tasmania	2 (5)
Northern Territory	0
Australian Capital Territory	3 (8)
Western Australia	3 (8)

Responses regarding policies for locking CVADs were similar for all three CVAD types (Table 2). Normal saline was most frequently reported as a locking solution for PICCs (61%, 23/38). In comparison, for TIVDs or tunnelled catheters, the usage of normal saline and heparin alone was similar (37 and 40% respectively). When heparin was used, reported concentrations varied between 10 and 5000 units/mL with volumes of 2.5–5 mL. Where normal saline was used, the volume varied from 10 to 20 mL, with most respondents reporting the use of 20 mL for TIVD (59%, 17/29) and 10 mL for PICCs (69%, 18/26).

Most respondents reported a hospital-wide policy on CVAD removal. Similar indications for removal were noted for all CVAD types and in neutropenic and non-neutropenic patients. More than half of respondents reported using the following indications for CVAD removal: positive blood cultures with specific organisms (e.g. *Staphylococci*); infection with clinical deterioration despite broad-spectrum antibiotics; blockage of all CVAD lumens; CVAD-related deep vein thrombosis irrespective of line function (Table 2). Fewer respondents reported CVAD removal would be indicated in CVAD-related superficial vein thrombosis.

Fewer than half of respondents reported attempting catheter salvage in the event of catheter-related infection (29%, 42% and 42% for PICCs, TIVDs and tunnelled lines respectively). Reported catheter salvage methods for PICCs, TIVDs and tunnelled lines comprised culture-specific antibiotic locks (50%, 36%, and 36% respectively), empiric antibiotic locks (20%, 36% and 36% respectively) and ethanol (30%, 29% and 29% respectively).

These research areas were prioritised by respondents, in order from most to least important: indications for line placement (63%, 25/40), management of line infection (63%, 25/40), catheter thrombosis management (45%, 18/40), indications for line removal (38%, 15/40), selection of line type (38%, 15/40) and management of line occlusion (23%, 9/40).

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Table 2 Responses to selected questions

Question	PICC, *N* (%)	TIVD, *N* (%)	Tunnelled catheter, *N* (%)	Both tunnelled catheter and PICC, *N* (%)	Peripheral venous catheter
Which type of central venous catheter is selected for the following scenarios?					
Autograft	13 (41)	0	19 (59)	0	0
Full intensity allograft	3 (16)	0	16 (84)	0	0
Acute myeloid leukaemia intensive induction	20 (57)	0	11 (31)	4 (11)	0
Acute lymphoid leukaemia intensive induction	21 (58)	0	11 (31)	4 (11)	0
Single-day chemotherapy (e.g. R-CHOP)	11 (27)	2 (5)	0	0	28 (68)
Multi-day chemotherapy (e.g. DA-EPOCH and BEACOPP)	32 (73)	4 (9)	4 (9)	0	4 (9)
Transfusion support/phlebotomy	14 (29)	9 (19)	0	0	24 (51)
Does your hospital or unit have a policy on the practice of locking and/or flushing?					
Yes, a hospital-wide policy	27 (75)	24 (80)	26 (74)	–	–
Yes, a haemato-oncology-specific policy	6 (17)	2 (7)	3 (9)	–	–
Yes, both hospital-wide and haemato-oncology-specific policy	3 (8)	4 (13)	6 (17)	–	–
No	0	0	0	–	–
What does your unit usually use to lock?					
Heparin	5 (14)	12 (36)	14 (40)	–	–
Normal saline	23 (62)	12 (36)	3 (37)	–	–
Both heparin and normal saline	9 (22)	6 (18)	5 (14)	–	–
Does your hospital or unit have a policy on venous catheter removal?					
Yes, a hospital-wide policy	22 (67)	19 (63)	20 (63)	–	–
Yes, a haematolo-oncology-specific policy	3 (9)	3 (10)	3 (9)	–	–
Yes, both hospital-wide and haematolo-oncology-specific policy	5 (15)	2 (7)	6 (19)	–	–
No	3 (9)	6 (20)	3 (9)	–	–
In which of the situations is venous catheter removal indicated in your unit? (Multiple answers allowed)					
Diagnosis of a central venous catheter-associated superficial thrombosis (e.g. cephalic and basilic) irrespective of line function	10 (26)	7 (24)	7 (19)	–	–
Diagnosis of a central venous catheter-associated deep vein thrombosis, (e.g. axillary, subclavian, brachial, radial and ulnar) irrespective of line function	21 (55)	16 (55)	19 (53)	–	–
Unable to aspirate or administer fluids through a single lumen (though more than one lumen available)	4 (11)	1(3)	1 (3)	–	–
Unable to aspirate or administer fluids through all available lumens	24 (63)	17 (59)	23 (64)	–	–
Unable to aspirate despite instillation of thrombolytic agent	26 (68)	18 (62)	25 (69)	–	–
What are the criteria for 'suspected' line infection that would lead to device removal in patients or those at high risk for infections?					
Neutropenic patients					
Positive blood cultures with specific organism(s), for example, *Staphylococci*	33 (83)	28 (88)	28 (76)		
Lack of response or deterioration despite broad-spectrum antibiotics	31 (78)	23 (72)	29 (78)		
Febrile without localising source	15 (38)	12 (38)	13 (35)		
Local erythema at insertion site without fever	3 (8)	6 (19)	2 (5)		
Local erythema advancing >2 cm from insertion site without fever	18 (45)	15 (47)	16 (43)		
Non-neutropenic patients					
Positive blood cultures with specific organism(s), for example, *Staphylococci*	30 (77)	28 (88)	28 (76)		
Lack of response or deterioration despite broad-spectrum antibiotics	31 (79)	23 (72)	29 (78)		
Febrile without localising source	14 (36)	12 (38)	13 (35)		
Local erythema at insertion site without fever	2 (5)	6 (19)	2 (5)		
Local erythema advancing >2 cm from insertion site without fever	13 (33)	15 (47)	16 (43)		

BEACOPP, bleomycin, etoposide, doxorubicin, cyclophosphamide, vincristine, procarbazine, prednisolone; DA-EPOCH, dose adjusted rituximab, etoposide, prednisolone, vincristine, cyclophosphamide, doxorubicin; PICC, peripherally inserted central catheter; R-CHOP, rituximab, cyclophosphamide, doxorubicin, vincristine, prednisolone; TIVD, totally implanted venous device.

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Discussion

This cross-sectional survey highlights considerable variability in CVAD management in haematology centres in Australia and New Zealand, reflecting the need for further research and clinical guidance in this area.

Our study is limited by the relatively small number of responses, and we cannot confirm each were from different sites. Further, our respondents were self-selected ALLG members who likely had pre-existing interests in CVADs, and therefore our results may not reflect widespread practice. However, our respondents were representative of most states across Australia and New Zealand and were thorough in their survey completion. Further, the authors are not aware of any other similar surveys conducted among haematology units. Previous research primarily focussed on solid malignancies, where similar variability in CVAD practice has been demonstrated.[5]

Our survey highlights several areas for future research, such as indications for CVAD insertion. The Michigan Appropriateness Guide for Intravenous Catheters was formulated based on expert consensus and attempts to address CVAD indications for situations including use of vesicant chemotherapies.[6] For vesicant chemotherapy, PICC and tunnelled, cuffed catheter insertion was deemed indicated regardless of anticipated duration, while TIVDs were deemed appropriate where required for more than 6 months. On the other hand, for peripherally compatible infusions, such as transfusion support, TIVDs were deemed appropriate if required for more than 31 days. This recommendation is discordant with our survey findings suggesting low TIVD usage among haematology patients. We this could relate to perceived risks of severe thrombocytopenia (impacting TIVD placement, removal or access), accessibility or a need for multiple lumens to facilitate concurrent chemotherapy, transfusion and fluid support in some haemato-oncology patients.

The variability demonstrated in CVAD locking solutions highlights another area of research need. If normal saline were found to be non-inferior to heparin as a locking solution, avoidance of heparin could obviate associated risks of allergy, bleeding and heparin-induced thrombocytopenia. Clinical research may have already impacted CVAD locking solutions, as shown by the absence of taurolidine in our survey responses, likely reflecting the negative studies on taurolidine to date.[7]

Infection is a feared complication of CVADs, jeopardising future venous access and increasing the risk of hospital mortality.[8] Treatment involves either CVAD removal or CVAD salvage entailing line retention with empiric antibiotic treatment.[3] Severe neutropenia and other forms of immunocompromise are frequent among haematology patients, who are at higher risk of infection than patients with solid organ malignancies.[9] Our respondents had a strong preference for line removal in the case of positive blood cultures with a specific organism or lack of response to broad spectrum antibiotics. It is possible this also influenced CVAD choice favouring PICC or tunnelled catheters over TIVDs based on ease of removal.

Most respondents felt line removal was indicated for the complication of deep vein thrombosis despite the CVAD retaining function. This practice is contrary to recommendations, not specific to haematology, made by the American College of Chest Physicians Guidelines in 2008 based on weak and low-grade evidence.[10] The enthusiasm of respondents to remove CVADs in the event of catheter-related thrombosis might reflect the high rate of severe thrombocytopenia among some haemato-oncology patients, which could prohibit adequate anticoagulation. This is aligned with ASCO recommendations that CVADs be removed if anticoagulation was contraindicated or if there was no improvement with anticoagulation.[3]

In conclusion, this survey of real-world practice in CVADs in haematology centres in Australasia highlights major variation in nearly all aspects of CVAD management. Respondents highlighted unmet clinical research questions including indications for line placement and management of suspected line infection and line thrombosis. This survey will inform future research directions to inform optimal and safe use of CVADs in haematology.

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Supporting Information

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Appendix S1. Supporting Information

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