Central Venous Dialysis Catheter Care: An Australian Survey

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Abstract

Aim: To explore the current central venous dialysis catheter (CVDC) nursing care practices in Australia. **Method**: A survey of dialysis units in Australia. **Results**: 66% return rate (48/73) Internal jugular is the main insertion site (75%) and the majority are tunneled (85%). Insertion was performed most commonly by radiologists (34%) followed by intensivists (24%) with one center reporting insertion by nursing staff. CVDCs were most commonly inserted in radiology (54%), followed by theatre (33%). Dressings were attended weekly (55%) or on dialysis days (45%). Chlorhexidine was the antiseptic solution of choice (54%) followed by povidine-iodine (37%). In 21% of centres Mupirocin was routinely applied in addition to the antiseptic solution. Transparent dressings were overwhelmingly favoured however most centres recommended alternatives related to patient need. 21% of units reported enrolled nurses undertaking dressings. All units reported the use of sterile gloves and sterile dressing packs. 10% reported different routine care for tunneled and non-tunneled. 40% of the units collected data on infection rates per catheter days. General opinion (39%) was identified as the reason to base CVDC protocols while descriptive studies (25%), RCTs (23%) and guidelines (18%) were also reported. **Conclusion**: There are significant variations in the Australian nursing practice related to the care of CVDCs. Although there is still practice based on general opinion there is evidence that changes in practice in the past 8 years may be associated with knowledge derived from research.

Key Words
haemodialysis, central venous dialysis catheter, nursing, infection

Introduction

In Australia 10% of all patients requiring haemodialysis dialyse via central venous dialysis catheters (CVDCs). In addition, 58% of all haemodialysis patients dialyze via a CVDC on their first dialysis treatment (ANZDATA, 2005). In Australia, patients with a CVDC at the commencement of dialysis have a two to threefold increase in the risk of death compared with the arterio-venous fistula (Polkinghorne, McDonald, Atkins, & Kerr, 2004) and the most prominent and serious complication with CVDCs is infection (Schwab & Beathard, 1999).

CVDC infection can be classified as exit site infection, tunneled infection and catheter-related bacteraemia (Schwab & Beathard, 1999). Nursing staff play an essential role to prevent these infectious complications. Following the insertion of the CVDC it is the nurse who practices connection/disconnection procedures and insertion site dressing procedures. A survey of Australian haemodialysis access practices, undertaken in by Bolch (1998), confirmed that variations in care exist among dialysis centres in Australia. This was consistent with US nursing literature (Thomas-Hawkins, 1996). The authors were concerned with the variation of practice and the potential that units were not using the latest evidence in practice. Thus, the aim of this study was to identify current CVDC nursing care practices in Australia in 2005 and identify the basis for nursing related decisions in CVDC care.

Methods

An initial test pilot survey was sent to 8 random haemodialysis units in Australia. Feedback from this pilot survey was used to design the final questionnaire.

Sample

The survey was sent to all Australian tertiary haemodialysis units and all haemodialysis units not affiliated with a tertiary unit. The units were sourced from

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the Kidney Health Australia Database of Australian Dialysis Units at March, 2005 (Kidney Health Australia, 2005). The survey, including an introductory letter, was mailed to Nurse Managers (also known as Clinical Nurse Managers, Nurse Unit Managers and Clinical Nurse Consultants). Pre-stamped and addressed return envelopes were provided and the returned surveys were opened by a third party to assure anonymity of data. There were no questions included that would identify the responding units, therefore responses could not be linked to a particular unit. Participants were informed that completing the survey would serve as their consent to participate in the survey.

There were limitations to the sampling in this study. Firstly, the questionnaires were addressed to the Nurse Manager of each dialysis unit. Thus, the authors have made the assumption that the Nurse Manager was in the best position to accurately report the current practice of the dialysis unit. Anonymity assurance was a feature of this survey. We believed that this would increase the accuracy and "truth" of the responses. However, the downside to this was that the reduced potential to clarify unclear responses, exploring responses further and extract further information from the units. The authors acknowledge that to protect anonymity there was limited questioning on the characteristics of the unit. Details relating to unit size, location, patient age, patient numbers, staff characteristics etc. would have potentially identified the unit and decreased anonymity. In addition the issue of anonymity reduced the potential response rate and did not allow for follow up and reminder correspondence.

Data Collection Instrument

The questionnaire consisted of 18 major questions. Nine sub-questions were added to explore several aspects further. A funnel approach was adopted commencing with broad questions followed by more specific questions. Closed or forced questions were used as many of the choices were already known as a result of the pilot study and suitable pre-determined response codes had been developed (Bowling, 1997). In addition, the survey included open or follow-up questions for clarification and further detail (Minichiello, Sullivan, Greenwood, & Axford, 1999).

Issues related to face validity or "the extent to which the research tool measures what it is supposed to measure" (Clifford, 1997, p. 35) were addressed through feedback from the pilot study. Results from the pilot study were presented to the participating units who considered the instrument was measuring clinically significant areas in relation to CVDC nursing care.

Following the pilot study the questionnaire was designed to address several aspects relating to CVDC care. The questions addressed the following domains:

- CVDC insertion characteristics
- CVDC nursing care practice
- CVDC infection rate recording
- Basis for procedure and protocol decision making

Information relating to CVDC insertion characteristics were sought. This information consisted of Insertion method, type of catheter (tunneled or non-tunneled), which member of staff was responsible for the insertion and in what part of the hospital the insertions were undertaken.

Information about the nursing policies and procedures relating to frequency, personnel, solutions used, dressing material used, intravenous medication usage, where the dressing was performed, and antibiotic prophylaxis information were sought. Infection rate information was sought in addition to information relating to what basis (RCTs, general opinion etc.) the units based their policies and procedures on.

Data Analysis

The data was manually coded and verified by a second independent researcher. Question response frequencies were calculated. In addition, narrative comments were recorded to assist further analysis of the data.

Ethics

Ethics approval for this survey was received from the originating health service organisation. The health service is a community based hospital with a focus towards primary health care. No financial incentives were provided and no coercion was undertaken. Respondents all participated voluntarily. The research was not financially supported, sponsored or influenced by any external party.

Limitations

No statistical analysis was performed on the data. This was deemed as appropriate by the authors as the survey responses were to provide a descriptive overview of current CVDC practices and encourage debate and discussion relating to best practice CVDC care in Australia.

The length of the questionnaire has varying effects on response rates. Thus, further information on CVDC care including connection procedures, percentage of CVDCs, infection rate measurement details and unit characteristics was not included as there was a limit on how many questions the respondents would reply to. As Sarantakos suggests "one should include as many questions as necessary and as few as possible" (1998, p. 228).

Results

Of the 73 questionnaires mailed to Clinical Nurse Managers 48 were returned completed and 2 were returned to sender. This represents a response rate

of 66% (48/73). This represented 33 tertiary hospitals (69%), 15 satellite units (31%) and 4 home training units (8%). Some units considered themselves both tertiary hospitals and home dialysis units. The results are summarised in Tables 1 to 4.

The majority of units performed CVDC dressings weekly (55%) while 45% of units performed them each dialysis. Units noted that it was dependent on the dressing whether occlusive or non-occlusive, that the dressing may be changed daily if the patient was an inpatient or that it was "changed if soiled". One unit reported that the dressings were performed on dialysis days for the first month and then twice weekly.

The antiseptics solutions applied to the insertion site were chlorhexidine (54%) followed by povidine-iodine (37%). A small amount of units used chlorhexidine and alcohol mix (10%) while 1 unit reported the use of chlorhexidine followed by the application of MedihoneyTM to the insertion site and another was trialing this. One unit reported the use of triclosan 1% in normal saline followed by mupirocin. One unit reported the use of hydrogen peroxide. Twenty one percent applied mupirocin following the antiseptic. Those applying Mupirocin either used chlorhexidine, povidine-iodine or triclosan. Several units reported that they had recently introduced a chlorhexidine gluconate impregnated dressing called the Biopatch™. One unit reported the use of mupirocin for the first month only whilst another unit specified the use of mupirocin for the first two weeks until the tunnel has "healed". Ten percent of units reported the use of prophylactic antibiotics. The favoured prophylaxis was mupirocin applied to the nasal passages particularly if patients were positive for staphylococcus aureus. Further details of Mupirocin use were not obtained.

Discussion

CVDC Insertion Practices

Although CVDC insertion practices were not the primary aim of this survey the researchers felt that this information was of interest to Australian nurses. The finding that 75% of respondents reported the internal jugular vein (IJV) as the main site for insertion and that femoral sites being used for temporary use only are consistent with CARI Guideline 16 (CARI, 2000). This is a significant increase from 21% IJV reported in 1998 (Bolch).

CARI recommends that CVDC insertion should be performed by, or under the supervision of experienced personnel, in sterile conditions and under direct vision, either surgical or ultrasound-guided. Our findings confirm that these recommendations are being followed in Australian haemodialysis units. Of note in our results is the reported insertion of CVDCs by a nurse. We believe that this is the first report in the literature of an Australian nurse inserting CVDCs.

CVDC Nursing Care Practices

The past 8 years have seen an increase in dialysis centre's preference for tunneled over non-tunneled catheters. The reported increase has been from 25% (Bolch, 1998) to our reported 85% in 2005. However, with the few exceptions the increase in tunneled catheter use has seen little change in the nursing practices of these catheters. Although, several centres report different practices only 10 % of units reported different routine care for tunneled and non-tunneled catheters. Several centres reported that non-tunneled catheter insertion sites were dressed and inspected more frequently than tunneled catheters. One centre reported that after two weeks no dressings were applied to tunneled insertion sites and several centres reported that patients can shower after 6 weeks of insertion of tunneled catheter. Several centres reported the use of gauze 3 months following insertion for tunneled catheters. Unfortunately no further information on outcomes related to these various practices was reported. With the increase in tunneled catheters used for haemodialysis in Australia this is a very exciting area for further nursing research.

Table 1. CVDC Insertion Characteristics. (* More than one response accepted)

Insertion Site	Internal jugular 75% (36)	Subclavian 23%(11)	No Response 2% (1)			
Tunneling Practice	Tunneled 85% (41)	Non-Tunneled 13% (6)	Equal 2% (1)			
Medications inserted	Yes 30% (14)	No 70% (34)				
CVDC Inserters*	Radiologist 34% (24)	Intensivist 24% (17)	Renal Registrar 21% (15)	Surgeon 15% (11)	Nephrologist 6% (4)	Nurse 2% (1)
Place of Insertion*	Radiology 54% (26)	Theatre 33% (16)	ICU 18% (9)	Ward Tx Rm 10% (5)	Dialysis Rm 8% (4)	

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Table 2. CVDC Nursing Practice (* More than one response accepted)

Frequency*	Weekly 56% (27)		Dialysis Days 46% (21)		Other 23% (11)	
Antiseptic Solution*	Chlorhex 54% (26)	Pov/Iodine 37% (18)	Chlor/Alc 10% (5)	Mupirocin 21% (10)	Medihoney 4% (2)	Triclosan 2% (1)
Dressing Type*	OpSite 50% (24)	Tegaderm 31% (15)	Not Stated 19% (9)		Other 21% (10)	
Who *	Registered Nurses 100% (48)		Enrolled Nurses 21% (10)		Other 8 (17%)	RN Only 79% (38)
When	Pre-Dialysis 65% (31)		Post Dialysis 19% (19)		Intradialytically/Anytime 16% (8)	
Where	Dialysis Room 94% (45)		Ward Tx Room 4% (2)		Other 2% (1)	
What*	Sterile Packs 100% (48)		Sterile Gloves 100% (48)	Mask 11% (5)	Gown 0% (0)	Sterile Drape 35 (17)
Do you have different practices for Tunnelled and Non-tunnelled CVDCs?			Yes 11% (5)		No 89% (43)	
Cover Patient's Face*	No Mask 98% (47)		Sterile Drape 8% (4)		Turn Away 7% (3)	Mask 2% (1)

Australian clinical practice guidelines (CARI) are restricted by the lack of reported strong evidence. They list practice tips for central line catheter care but this is in the absence of Level 1 evidence. The guidelines recommend the catheter should be covered by a dressing however the optimum dressing and frequency of change are undefined. In addition, the catheter should be inspected for signs of infection and dressing performed at each dialysis treatment. A meta analysis of a number of small studies suggested that there was no evidence of any difference in the incidence of infection between gauze and tape dressings and transparent polyurethane dressings for central venous catheters (Gillies et al., 2003). Conclusions by the authors indicated that the type of dressing could therefore be based on patient preference. There was no distinction made between tunneled or non-tunneled catheters in any of the included studies and so the application of this meta analysis may need to be used with caution when applying it specifically to tunneled haemodialysis catheters. In Gillies' meta analysis of the six included studies only 2 compared Opsite IV3000 TM with gauze and tape, with two comparing Opsite TM with Opsite IV 3000 TM and one with gauze and tape and Tegaderm TM and one with Tegaderm TM and Opsite TM (Gillies et al., 2003). In addition transparent dressings such as Opsite IV3000 TM that increase the rate of evaporation of fluid from the site compared with other transparent dressings may decrease risk of infection. (Gillies et al., 2003) Therefore, the type of transparent dressing used may influence infection outcomes. It could therefore be argued that the type of catheter dressing will be influenced by patient cohort and dressing type should be based on unit infection rates, need for catheter security and patient tolerance to dressing material. This is reflected in the current use of transparent dressings of Opsite IV3000 TM and Tegaderm TM in Australia. Our results found the antiseptic solution of choice applied to the insertion site was chlorhexidine (54%) followed by povidine-iodine (37%). The authors wish to acknowledge that the strength of chlorhexidine solution was not considered in the survey. This can be viewed as a weakness in this study.

There has been an increase in the use of chlorhexidine and a decrease in the use of povidine-iodine in the past 8 years when compared to a previous survey (Bolch, 1998). The issue of alcohol degrading the catheters was a concern and the emergence of non-alcohol based chlorhexidine has possibly contributed to its increased use. A systematic review of chlorhexidine gluconate vs. povidine-iodine relating to catheter related bloodstream infection outcome favoured chlorhexidine gluconate (Chaiyakunapruk, Veenstra, Lipsky, & Saint, 2002). However, to relate this review to tunneled haemodialysis catheters requires caution. Reports of catheter degradation have resulted in some catheter manufacturers warning against the use glycol ointments over catheter sites due to the potential for catheter degradation (Bolch, 1998; KDOQI, 2000).

There is clear evidence based on randomised controlled trials (RCTs) that the use of mupirocin at the catheter exit sit does reduce the risk of catheter related infections (CARI, 2000). KDOQI recommends the use of mupirocin ointment after catheter placement and at the end of each dialysis session (KDOQI, 2000). Twenty one percent of units applied mupirocin following cleaning of the site. Several units reported that they had recently introduced a chlorhexidine gluconate impregnated dressing (Biopatch™). Several well-designed RCTs have demonstrated the effectiveness of mupirocin on catheter colonisation, exit site infection and bacteraemia in haemodialysis patients. One study concluded thrice weekly use of mupirocin in this catheter type resulted in a marked reduction in line related sepsis and improved catheter survival (D Johnson et al., 2002). Further work by this Australian group has suggested the potential for MedihoneyTM for the prevention of catheter related infections (Johnson et al., 2005). Although the authors acknowledge that this study was not adequately powered to assess therapeutic equivalence they concluded that the application of standardized antibacterial honey thrice weekly was safe, cheap, and effective and resulted in comparable rates of catheter-associated

infection to mupirocin. The application of MedihoneyTM is an exciting option in our current environment of antibiotic resistance and an area for further research.

Although not specifically addressed in CARI guidelines KDOQI recommend the patient and staff wear a mask or face shield for the dialysis staff for all catheter dressing changes. Although all units reported the use of sterile gloves and sterile dressing packs to perform the CVDC dressing, only 10% reported the use of surgical masks by nurses and only 2% (one unit) reported patients wearing a mask during the dressing. Several units reported that patients are asked to turn their heads away during the dressing procedure. This is an area that the authors feel requires more research given the increased use of tunneled CVDCs.

The United States KDOQI guidelines (KDOQI, 2000) recommend dressing changes and catheter manipulation be performed by trained dialysis staff (evidence/opinion). Our findings show 79% of units reported that only Registered Nurses (RNs) perform CVDC dressings. 2 (2/48) units added that only "Renal Trained" RNs performed dressings. However, the definition of "renal trained" was not required and not specified and could be variously defined as external, tertiary renal/nephrology qualifications or local in-house training/education courses.

It was not within the scope of this survey to report the clinically significant results of interventions, policies and procedures related to CVDC care. However, the authors felt it important to report policies that may be significant to clinicians. These included the use of antibiotic catheter locks, luer access connection systems, weekly blood cultures and the use of "sandwich" dressings.

CVDC Infection Rate Recording

Although the treatment of exit site infection, tunnel infection and catheter related bacteraemia may vary the prevention of all three is related to the nursing care provided. Thus, it was encouraging to report that 40% of units reported collecting infection rate data (given that 31% of surveyed centres described themselves as satellite units). These centres specifically reported collecting and analyzing central line infection rates by 100 or 1000 catheter days.

CARI recommend that in the absence of clear evidence relating to the nursing care of haemodialysis CVDC infection rates should be recorded and audited (CARI, 2000). Although there are no mandated reporting mechanisms for recording of haemodialysis central line infection rates in Australian dialysis units the major Australian accreditation body, the Australian Council on Healthcare Standards (ACHS) introduced haemodialysis associated blood stream infection clinical indicators in 2004 as part of their infection control indicators. These indicators are stratified by access type and include haemodialysis centrally inserted non-cuffed and cuffed dialysis line associated blood stream infection rate (Australian Council on Healthcare Standards, 2004). The denominator used may be expressed per 100 patient months or 1000 catheter days. 1000 catheter days has been utilized predominantly due to the relatively short length of time a CVDC is in place compared to a native access. KDOQI guidelines recommend target tunneled cuffed catheter systemic infection rates less than 10% at 3 months and less than 50% at 1 year. Irrespective of how units choose to express infection rates it is important that surveillance techniques are established and implemented to validate unit outcomes and provide a system for continuous quality improvement.

Basis For Procedure and Protocol Decision Making

Nurses frequently lament the lack of evidence to support nursing practice. CVDC care is no exception. Although there are limited studies to base practice on it was encouraging that units reported clinical decision making based on RCTs (23%) and guidelines (18%). Two examples of these have been reported in this study. Firstly, the increase use of chlorhexidine over povidine-iodine as the antiseptic solution of choice. This trend may have been associated with the literature summarized in a meta-analysis that supports the use of chlorhexidine (Chaiyakunapruk, Veenstra, Lipsky, & Saint, 2002). Secondly, the increase in infection rate data collection from 20% to 40% may have an association with the recommendations of CARI and KDOQI guidelines. From the units (n=14) who reported changing their protocol as a result of infection rates only 2 units specified the change. These were changes from a sandwich to a flat dressing design and from Opsite 3000TM to

Table 3. Infection Rates

Do you collect CVDC infection rate data?	Yes	No	No response
	40% (19)	38% (18)	22% (11)
What measurements do you use?	1000 Catheter days	100 Catheter days	
	52% (10/19)	48% (9/19)	

SysLoc

Annotation of SysLoc Wing Sheath

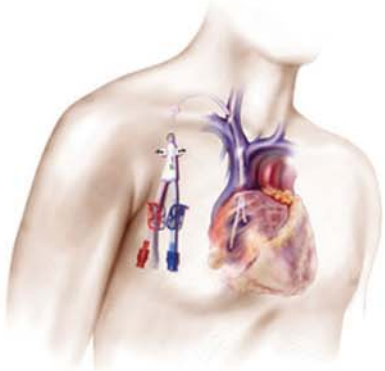

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Table 4. Basis for Protocol Decision Making

General Opinion	39% (19)
Descriptive Studies	25% (12)
Randomised Controlled Trials	23% (11)
Guidelines	18% (9)

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Although RCTs and guidelines have been utilized units still reported general opinion and descriptive studies as their basis for decision making. In addition, units reported that clinical protocols being based upon infection control units, intensive care policies, oncology practices, statewide consensus, manufacturer's guidelines, a previous nationwide survey and several commented that their protocols were based on a combination of these sources. The wide variety of sources for decision making strengthens the argument for more research in the area of CVDC care.

Conclusions

There are variations in the Australian nursing practice related to the care of CVDCs. Although there is still practice based on general opinion our study has shown evidence that changes in practice in the past 8 years may be associated with knowledge derived from research. However, significant diversity of current practice and limited numbers of published studies identify the need for RCTs of interventions in CVDC care. These are particularly required given the increase in tunneled catheters in Australia in the past 8 years. In addition, although there has been an increase in CVDC infection monitoring, the development of monitoring systems should be implemented further to observe the clinical outcomes and benefits of implementing CVDC practices.

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Table 5. Comparisons of Australian Surveys 1998 and 2005

	Bolch (1998)	Bennett et al (2005)
% Tunneled cuffed catheter	25%	85%
% Subclavian vein access	64%	23%
% Chlorhexidine (without alcohol) on insertion site	12%	54%
% Povidine-iodine on insertion site	72%	37%
% Collect infection rates	20%	40%