Title

A Point Prevalence Study of Cancer Nursing Practices for Managing Intravascular Devices in an Australian Tertiary Cancer Center

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ABSTRACT

Purpose: The use of intravascular devices is associated with a number of potential complications. Despite a number of evidence-based clinical guidelines in this area, there continues to be nursing practice discrepancies. This study aims to examine nursing practice in a cancer care setting to identify nursing practice and areas for improvement respective to best available evidence.

Methods: A point prevalence survey was undertaken in a tertiary cancer care centre in Queensland, Australia. On a randomly selected day, two nurses assessed intravascular device related nursing practices and collected data using a standardized survey tool.

Results: 58 inpatients (100%) were assessed. Forty-eight (83%) had a device in situ, comprising 14 Peripheral Intravenous Catheters (29.2%), 14 Peripherally Inserted Central Catheters (29.2%), 14 Hickman catheters (29.2%) and six Port-a-Caths (12.4%). Suboptimal outcomes such as incidences of local site complications, incorrect/inadequate documentation, lack of flushing orders, and unclear/non intact dressings were observed.

Conclusions: This study has highlighted a number of intravascular device related nursing practice discrepancies compared with current hospital policy. Education and other implementation strategies can be applied to improve nursing practice. Following education strategies, it will be valuable to repeat this survey on a regular basis to provide feedback to nursing staff and implement strategies to improve practice. More research is required to provide evidence to clinical practice with regards to intravascular device related consumables, flushing technique and protocols.

Introduction

Intravascular access is critically important in the haemato-oncology setting for the delivery of anticancer treatments, supportive therapies, parenteral nutrition and blood sampling. However, the use of Intravascular Devices (IVD), is associated with a number of potential complications such as catheter-related blood stream infection (CRBSI), extravasation, thrombosis, phlebitis and catheter occlusion (Centers for Disease Control and Prevention, 2011; Ener et al., 2004; Rickard et al., 2010). These complications have a significant impact for patients and healthcare systems. Specifically, CRBSI is associated with increased morbidity, mortality and cost (approximately US \$56 000/episode) (Collignon, 1994; Maki et al., 2006). It is estimated that CRBSI occur in about 0.1 % of Peripheral Intravenous Catheters (PIVCs) or 0.5 per 1000 catheter days (Rickard et al., 2012a), and 5.3 per 1000 catheter days for Central Venous Access Devices (CVADs) (Berenholtz et al., 2004), which contributes to the economic burden of health care associated infections, estimated to cost \$1 billion per annum in Australia (Graves et al., 2009). Catheter thrombotic occlusion is another common IVD complication and has been identified as a risk factor for subsequent CRBSI (Krzywda and Andris, 2005; van Rooden et al., 2005). Catheter occlusion is currently reported to effect up to 50% of IVDs (Krzywda and Andris, 2005), often treated with an injection of anticoagulant or resulting in costly catheter replacement, increased clinical risk and discomfort for the patient (Rickard et al., 2012b).

Identification and prevention of complications related to vascular devices, is increasingly recognised as a nurse sensitive indicator (Chan, 2013; Chan et al., 2012; Webster et al., 2011). Cancer nurses manage IVDs on a daily basis and are therefore in a unique

position to prevent and reduce complications and minimise the associated financial and physiological burden (Chan, 2013). Although there are a number of evidence-based clinical guidelines and high level evidence for informing practice in this area (Cancer Nurses Society of Australia, 2007; Centers for Disease Control and Prevention, 2011; Chan et al., 2012; Harnage, 2012), there continues to be nursing practice discrepancies. Observing adherence to best-available evidence in the local setting can thus inform quality improvement initiatives. It is clear in the literature that undertaking surveillance surveys to identify clinical practice issues and providing feedback is an effective method for reducing hospital acquired infection (Durlach et al., 2012; Goddard et al., 2006; Ritchie et al., 2007; Robertson et al., 2010; Zingg and Pittet, 2009). For example, Goddard and colleagues (Goddard et al., 2006) report improvements over the 12 month period in which they conducted monthly prevalence surveys and provided feedback to staff. This point prevalence survey observed nursing practice in a haemato-oncology setting to identify nursing practice discrepancies and areas for improvement respective to evidence-based guidelines and best available evidence.

Patients and methods

Design

A point prevalence survey was undertaken in two inpatient units at a tertiary cancer care centre in Queensland, Australia. All current inpatients were invited to participate in the study and all agreed to participate. Verbal consent was obtained at the time of data collection. The study was approved by Human Research and Ethics Committee at the Royal Brisbane and Women's Hospital.

Instrument

The original survey instrument was designed and trialled by New et al (New et al., 2013). The original survey tool consisted of 25 assessment questions, including the type, number and purpose of devices in situ, visibility of site, presence and condition of dressings and/or other securement devices, insertion site location, where and by whom the catheter was inserted and evidence of any complications. Documentation on the daily patient care record or medication chart related to the IVD location, site assessment, 'insertion' or 're-site' dates, infusate and any intravenous medications were also noted. This original tool was modified to suit the context of IVDs in the cancer care setting. Additional items were added to capture patient diagnosis, current anti-cancer therapy, reason for admission, dominant arm site placement, the patient's opinion as to whether their CVAD was inserted "too late", and inspection of previous IVD sites (less than one month old). Items irrelevant to the cancer setting were removed. The tool was piloted by two advanced practice cancer nurses and further amended.

Procedure

At 0700 hours on a Monday morning in November 2012, two teams of data collectors undertook the survey. The study date is not specified to allow anonymity of participants. Each team included one advanced practice nurse and one clinical nurse who regularly manage IVDs in their daily practice. Each data collector was sent the survey tool prior to survey day, to allow familiarization with the content. On survey day, and before data collection commenced, a brief training session was held to clarify the process, to allow any questions to be answered and to ensure consistency of approach to patient assessment during the survey. The teams assessed each patient

together, collecting data using the standardized survey tool. The survey was conducted between 0700 and 1300 hours. This time slot was chosen to maximise access to patients before procedures or discharges occurred. If there were disagreement during the patient assessment or data collection process, the two data collectors discussed to reach consensus. If consensus was not reached, a data collector from the other team was to serve as an arbiter, however this was not required.

Data Analysis

Frequency counts were used to analyze data. Results are presented as numbers and proportions. Predictive Analytics Software (SPSS Inc v19) was used to analyse the data.

Results

Participant Characteristics

Of the 58 inpatients that were eligible, 100% were assessed for the presence of an IVD. Thirty-nine patients (67%) had a hematological malignancy and 19 patients a solid tumor. Hemato-oncologic reasons for patient admission included hematopoietic stem cell transplantation (21%), anti-cancer therapy (21%), symptom management (31%), radiation therapy (12%) or other reasons (15%). Participant demographic, clinical and IVD characteristics are summarized in Table 1.

Presence, use and placement of intravascular devices

Of the 58 inpatients, 48 (83%) had a device in situ, comprising 14 PIVCs (29.2%), 14 Peripherally Inserted Central Catheters (PICCs) (29.2%), 14 Hickman catheters (29.2%) and six Port-a-Caths (12.4%); with a total of 78 lumens. Forty-six devices

(96%) were currently in use for fluid, supportive therapies or medication administration. The remaining two devices were Port-a-Caths that were de-accessed and not in use however both devices were in-place for required treatment in the near future.

Side of insertion was assessed for all IVDs (left vs right for all IVDs; and dominant arm vs non-dominant arm for PICCs only) (see Table 2). The majority of PICCs were placed in the patients' non-dominant arm (78.6%). All PICCs were inserted at a site proximal to the antecubital fossa in the upper basilic or upper cephalic veins. PIVC placement was mostly sited in the cephalic vein, and the metacarpal and dorsal veins. Hickman catheters and port-a-caths were observed for placement location, with the majority sited in the right side of the chest (83%).

Table 1.

Demographic, clinical and IVD characteristics of participants (n=58)

Chacteristics		
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		<i>Mean (SD)</i>
Age		57.2 (13.2)
		<i>N (%)</i>
Gender	Male	26 (44.8)
	Female	32 (55.2)
Type of cancer	AML	16 (27.6)
	Lymphoma	14 (24.1)
	Multiple Myeloma	4 (5.2)
	MDS	3 (6.9)
	CLL	2 (3.4)
	Melanoma	1 (1.7)
	Breast	5 (8.6)
	Lung	2 (3.4)
	Gynaecological	2 (3.4)
	Pancreatic	1 (1.7)
	Head and Neck	3 (5.2)
	Mesothelioma	1 (1.7)
	GBM	1 (1.7)
	Anal	1 (1.7)
	Pineal Germinoma	1 (1.7)
	Unknown primary	1 (1.7)
Reason for admission	BMT	12 (20.7)
	Anti-cancer therapy	12 (20.7)
	Radiation Therapy	6 (10.3)
	Infection	3 (5.2)
	Symptom management	18 (31.0)
	Other	7 (12)
Type of IVD	Nil	10 (17.2)
	PIVC	14 (24.1)
	PICC	14 (24.1)
	Port-a-Cath	6 (10.3)
	Hickman catheter	14 (24.1)
Total number of lumens		78 (100)

Table 2.
Side of Insertion of the 48 IVDs

<i>Type of IVD</i>	<i>Left side</i>	<i>Right side</i>
PIVC	8	6
PICC	10	4
Port-a-Cath	1	5
Hickman catheter	2	10
Total	21	25

Visibility, dressings and securement

The insertion site was not visible for 29 devices (61.7%). Twenty-seven of these insertion sites were not visible because of placement of a chlorhexidine-impregnated sponge dressing (CHIS) over the insertion site, however this practice demonstrated 96.4% compliance with hospital policy. The insertion sites of the remaining two devices were not visible due to the use of additional securement on one and the dressing lifting on the other device.

Forty-seven of the 48 IVDs had a dressing insitu. The one Hickman catheter that was not dressed complied with our hospital policy, as the device had been insitu for greater than three weeks in a non-neutropenic patient. Nine different primary dressing types and securement materials (including Tegaderm 1626w, IV 3000®, IV Tegaderm™, advanced transparent with bordered edge, foam square, Statlock®, sutures) were used to secure the IVDs. Of the 47 devices that were dressed, the primary dressing for 36 devices (76.6%) was secured with one or more additional dressings. Micropore™ and Tubigrip® were the most commonly used products for

this purpose. Dressings were assessed as being not clean in five cases (8.6%), not dry in four cases (6.9%) and not intact in 10 cases (17.2%).

Local complications

Of the 48 devices assessed by surveyors, 34 (70.8%) were rated as being free from complications, while 14 (29.2%) had one or more local complications such as redness, edema or oozing. These complications occurred in seven PIVCs (50%) and five PICCs (35.7%), one Hickman catheter exit site (7.1%), and one Port-a-Cath access site (7.1%).

Participants were asked if they had a previous IVD which had been removed within the past month. Sixteen participants reported a total of 21 previous IVDs. Inspection of the old IVD sites by the data collectors revealed nine sites (42.9%) as having one or more complications such as edema, oozing, pain and redness.

Documentation

Of the 48 devices, documentation of site assessment on the daily patient care record was absent for seven (14.6%) devices. Of these seven devices, the surveyors identified two with complications. Of those signed by nursing staff as being free of complication, a further 10 devices were identified as having a complication. For 14 PIVCs, there were five (35.7%) instances in which the site location of the device was not accurately documented. For example, the daily patient care record stated left arm when the device was in the right arm.

In one inpatient unit, CVAD management activities such as when the dressing is due to be changed, were documented on a white board outside the patient's room rather than on the daily patient care record.

Insertion and re-site dates

The daily patient care record allows for the recording of insertion and re-site dates for PIVCs only, not for CVADs. Of the 14 PIVCs assessed, 100% had a documented insertion date and 13 (92.9%) had a documented re-site date.

Flushing and locking/clamping

The survey assessed the presence of a 0.9% sodium chloride flush prescribed by a medical officer for flushing of lumens not in use. This may have been a written order or a purpose designed sticker attached to the medication chart. Of the 78 lumens, 26 lumens were not being used, making them eligible for routine flushes. But in only one instance 10ml sodium chloride flushes were prescribed.

Local practice is that lumens in use have a 3-way tap in situ, however 11 (21.2%) did not. Nine (34.6%) of the lumens not in use were not locked (clamped off or turned off to the closed position). However all catheter lumens maintained a closed system with the use of a bung or infusion set.

Discussion

Although it is clear that IVDs not in use should be removed promptly (Centers for Disease Control and Prevention, 2011), a recent IVD point prevalence survey conducted by our team in medical, surgical and cardiac care wards, revealed that

28.2% of IVDs were in situ without a clear purpose (New et al., 2013). In contrast, we found that in our cancer care units, 100% of IVDs were in situ with a clear purpose.

Another encouraging finding was the compliance rate (96.4%) of the use of the CHIS dressing at the catheter entry site for PICCs and exit site for Hickman catheters. This practice was introduced two years ago following an implementation research project (a systematic review and meta-analysis involving 5925 patients favoring the CHIS dressing use on the reduction of CRBSI)(Chan et al., 2012). We are encouraged that the high compliance rate has been sustained at 24 months after the implementation of our research evidence into practice project. Although the CHIS dressing use is supported by best-available evidence, a shortfall is that the entry/exit site of catheters is not visible, restricting visual assessment of the site. However it is possible that assessment of the site can be undertaken using other methods such as by palpation through an intact dressing on a regular basis(Centers for Disease Control and Prevention, 2011). Additionally the Centers for Disease Control and Prevention recommends monitoring the catheter sites when changing the dressing, suggesting that the visual inspection of a catheter insertion site once a week might be sufficient (Centers for Disease Control and Prevention, 2011). To the best of our knowledge, there is a lack of research informing the most optimal frequency for visual assessment of catheter entry/exit sites that are not visible due to a dressing. Further research is required to establish the optimal frequency for visual assessment of the entry/exit site.

At our facility, patients having a PICC inserted are asked if they have a preference for side of insertion. We had anecdotally noted that the majority of people opt for

insertion in their non-dominant side. The survey findings support this as the majority of PICCs were placed in the patients' non-dominant left arm. Placement preference for Port-a-Caths and Hickman catheters is not offered. The majority of these devices were placed in the right side of the chest and this site preference may be because of the perceived ease of access to the vasculature and a desire to reduce insertion complications (Mansfield et al., 1994; Unal et al., 2003). However, a recent observational study of 727 patients reported that Hickman catheters and PICCs inserted into the right side of the patient resulted in an increased risk of Catheter Associated Blood Stream Infection (CABSI) (Mollee et al., 2011). The authors speculated that the increase in CABSI could be attributed to the predominance of right-handedness in the population which may result in greater movement and subsequent bacterial contamination on that side (Mollee et al., 2011). Given the uncertainty of the evidence, our facility is a recruiting site for a large randomized controlled trial to determine incidence of CRBSI in patients with CVADs inserted in dominant versus non-dominant side.

We have identified a number of nursing practice areas requiring attention. These include the use and management of dressings, documentation, and flushing. Firstly, the results of our study indicate an inconsistency in the type of IVD primary or secondary dressing being used, irrespective of the type of IVD insitu, a result consistent with findings in the hospital wide survey (New et al., 2013). This might be due to the insufficient evidence to support the superiority of a particular dressing (Webster et al., 2011). Our study also found that despite the use of additional securement, 10 IVD dressings were still not intact. Successful securement can enable catheter stabilization, which is recognized as an important factor in decreasing

phlebitis risk, catheter migration, dislodgement and preventing CRBSI (Centers for Disease Control and Prevention, 2011). Further to the number of dressings assessed as not intact, an unacceptable percentage was noted not to be clean or dry. Appropriate nursing management of dressings is required to minimize the risk of catheter related complications (Gabriel, 2010). These findings indicate a need for future research to investigate the cost-effectiveness of securement materials for IVDs and nursing management to inform best practice in this area.

Secondly, there was an overall complication rate of 27.1% at the IVD insertion site. It is important to note that these complications were identified by the surveyors, but not by clinical nursing staff. Further, there was no evidence of site inspection in the current or previous shift (2300hrs to time of assessment on the next day by surveyors) in 14.6% of cases. According to local policy, nursing staff have the responsibility to inspect and record IVD site inspection and note any complications by recording any variance on the daily patient care record. Additionally, skin inspection at previous IVD sites revealed a high complication rate, including one or more signs of phlebitis such as edema, oozing, pain and redness in nine sites. Currently, there is nowhere on the daily patient care record to document site inspection of previous IVD sites.

Further, documentation on the daily patient care record was poor in terms of site assessment, insertion date, re-site date and location of the device. Where IVD data was recorded on the daily patient care record, 43.8% had inaccurate data. Specifically, 35.7% of PIVC site locations were inaccurately documented. Failure to document such information suggests that nurses may not be looking at the device before the daily patient care records are updated and signed. The frequency for CVAD dressing

and administration set change is weekly. The due date for each patient is recorded on a white board outside the patient's room for one unit, and on the daily patient care record for the other unit. Whilst the use of the whiteboard provides a means for clinical handover, this information was often not recorded on the daily patient care record as evidence of management of IVDs.

Thirdly, the survey revealed that a routine 5-10ml sodium chloride flush was only prescribed for one patient (3.8%). According to the literature, flushing should occur before and after administration of medications, following blood drawn from a CVAD and following disconnection of an administration set (Intravenous Nursing New Zealand, 2012). There is a lack of evidence surrounding correct flush volume and technique, however regular intravenous flushing of lumens is identified as an important factor in minimizing intraluminal occlusion (Harnage, 2007). In addition, adherence to correct locking technique is important to prevent blood reflux into the catheter (Btaiche et al., 2011). Nine (11.4%) of the lumens that were not in use were not locked (clamped off or turned off to the closed position), increasing the risk of blood reflux into the end of the catheter and subsequent intra-luminal occlusion. As catheter thrombotic occlusion has been identified as a risk factor for CRBSI (Krzywda and Andris, 2005; van Rooden et al., 2005), routine flushing of catheters and correct locking techniques can contribute to prevention of catheter related thrombosis and subsequent CRBSI (Harnage, 2007).

We acknowledge that there are several limitations in this study. Firstly, this point prevalence study was undertaken on a single given day randomly selected by the

research team. Without longitudinal data, we cannot ascertain whether the results are true over a prolonged period. This study, however, did identify some patterns of practice that warrant improvement and further attention/investigations. Secondly, this study had a relatively small sample size of 58 patients. However, this sample represented 100% of the inpatients in our cancer care center. Although this data might not be directly transferable to other cancer care centers, the results can form a basis for a benchmarking exercise including comparisons with future results in our cancer care center and other similar cancer care centers. Thirdly, we could not ascertain more comprehensive data of complications associated with previous IVD sites. In this study, we relied on patient reported data to determine any IVDs that were removed over the last month. We could not be certain if patient recall was absolutely accurate, nor could we correlate the time since removal and the complications at these previous IVD sites.

This point prevalence survey has highlighted a number of IVD nursing practice discrepancies with current hospital policy. Education and other implementation strategies can be applied to improve nursing practice. In addition to highlighting mal-aligned nursing practices, the survey demonstrated that more research is required to provide evidence to inform standardized protocols of ideal IVD consumables such as primary dressings and securement materials. Additionally, more research is required to provide evidence in regards to IVD flushing technique and protocols.

Following education strategies, it will be valuable to repeat this survey on a regular basis to provide feedback to nurse managers and clinicians, and implement strategies to improve practice with regard to IVDs. In addition, an improvement initiative was subsequently undertaken to amend the daily patient care record to facilitate higher compliance and clearer documentation for IVD management. Given that one of the issues identified was the lack of dressing integrity, the research team is currently undertaking pilot testing of four different dressing and securement regimens using a randomized controlled trial design. The research instrument specifically adapted in this study can be further tested in other cancer care centers. The core components of the instrument should form the basis of the survey with additional questions suitable to the context of the cancer care center. Such efforts will enable future benchmarking activities or multi-center research studies.

Conclusion

This survey of IVD practices was undertaken to provide quality assurance information to ascertain the degree to which the national safety and quality health service standards are being met. Results identified a number of areas for improvement and provided useful information for the development of IVD related education and research. In light of the results, we suggest that ongoing surveillance of IVD practices with prospective data collection, timely feedback to healthcare practitioners and effective documentation will hold promise in improving a number of IVD related complications.

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