Intravascular device utilisation, management, documentation and complications: a point prevalence survey.

Objective: To examine utilisation, management, documentation and complications for intravascular devices in cardiac, medical and surgical inpatients.

Methods: A point prevalence survey was undertaken in a large tertiary hospital in Queensland. Descriptive statistics were used to analyse data.

Results: Of the 327 patients assessed, 192 (58.7%) had one or more devices in situ. Of the 220 devices, 190 (86.4%) were peripheral venous catheters, 25 (11.4%) peripherally inserted central catheters and 5 (2.3%) central venous catheters**.** Sixty-two of 220 devices (28.2%) were in situ without a clear purpose, while 54 (24.7%) had one or more complications such as redness, pain, tracking, oedema or oozing. There was no documentation on the daily patient care record to indicate that a site assessment had occurred within the last eight hours for 25% of devices in situ.

Conclusions: The study identified a number of problems and highlighted areas for improvement in management and documentation for intravascular devices. Ongoing education, promoting good clinical practice and reauditing can be applied to improve the management of devices.

What is known about the topic?

Intravascular devices are associated with healthcare associated infections including rare but serious bloodstream infections Measures for reducing healthcare associated infection related to devices include surveillance with feedback.

What does this paper add?

This paper complements other surveillance data undertaken in similar sized institutions with similar patients. Ongoing surveillance and education is required to maintain best clinical practice and management of devises.

What are the implications for practitioners?

Healthcare associated infections are a serious problem and have negative outcomes for both patients and organisations. Intravascular devices may be associated with bloodstream infections so prudent clinical care and management of devices is important. All devices should be assessed at least daily for their continued need and removed promptly if no longer required.

Introduction

Intravascular devices (IVDs) are required by patients for the administration of fluids and or drugs whilst in hospital. Devices such as central venous catheter's (CVCs), Peripherally Inserted Central Catheters (PICCs) and peripheral venous catheters (PVCs) all pose potentially serious infection risks to hospitalised patients. While CVCs and PICCs pose a greater infection risk[1] the insertion of a PVC is the most common invasive medical procedure[1, 2] with between 30-80 % of people admitted to hospital receiving a PVC during their stay[3]. Thus PVCs are also a significant risk factor in acquiring a healthcare associated infection (HAI)[4-7]. It is estimated that bloodstream infections occur in about 5.3 per 1000 catheter days for Central Venous Access Devices [8] and 0.1 % of PVC or 0.5 per 1000 catheter days[2], which may seem insignificant, however this contributes to the economic burden of HAI, which is estimated to potentially cost $1 billion per annum in Australia[9].

PVC related complications are often associated with insertion technique or reactions to the catheter or infusate. However, other key risk factors, including delayed removal of the device when no longer in use and the administration of medications like potassium chloride and some antibiotics have been identified[3]. Point prevalence surveys undertaken in New Zealand and the United Kingdom identified a number of additional areas for improvement, chiefly documentation on dating when the device was inserted, purpose of the PVC and assessment of the site[10-12].

Using surveillance surveys to identify clinical practice issues and providing feedback is an effective method for reducing healthcare associated infection[3, 5, 11, 13]. For example, improvements were seen by Goddard and colleagues[10] over the 12 month

period in which they conducted monthly prevalence surveys and provided feedback to staff.

In September 2011, Australian health ministers endorsed the National Safety and Quality Health Service Standards[14]. Following a grace introduction period, implementation of the ten standards, including standard three, "preventing and controlling healthcare associated infections", became mandatory for all public and private hospitals from 1 January 2013. In response, the Royal Brisbane and Women's Hospital Executive Director of Nursing Services formed four nursing research councils to address clinical practice areas, which fall under the standards. The Intravenous Access Research Council identified clinical practice and management of intravascular devices as a clinical area in which the quality of patient care and patient outcomes could be potentially improved.

As an initial step, a point prevalence survey was undertaken to examine utilisation, management, documentation and complications for intravascular devices in cardiac, medical and surgical inpatients.

Methods

Design: The survey was undertaken at a large tertiary teaching hospital in Brisbane, Queensland. Inpatients that were able to be approached were verbally invited to participate in the study and 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 (reference number HREC/12/QRBW/173).

Instrument: The survey was designed by the chief investigator and a research nurse who specialises in conducting IVD trials. The survey was reviewed by the Intravenous Access Research Council and then trialled by two survey teams, on two separate occasions, prior to survey day. After each review, assessment items were modified and reordered to improve clarity and ease of use.

The survey consisted of 25 assessment items relating to devices and documentation. Assessment items included the type, number and purpose of devices in situ; presence and condition of dressings and/or other securements; visibility of insertion site; site location and by whom the catheter was inserted; evidence of complications and documentation on the daily patient care record and medication chart. Documents were examined for notation of device location; site assessment; 'insertion' or 're-site' dates; infusate; and intravenous medications.

Procedure: The survey was conducted on the 23rd August 2012, between 6.30 am and 11.00 am. This time was chosen to make sure that as many patients were assessed as possible before procedures or discharges occurred. Earlier, at 6 am, the chief investigator downloaded a census list of all inpatients in the cardiac, medical and surgical wards from the hospital's inpatient database. Cancer care wards were excluded from the initial survey, due to the specialised nature of the oncology environment. Additionally emergency departments were also excluded due to the high turnover of patients, as were the maternity wards, because catheters are usually of short duration.

Eighteen clinical and non-clinical nurses volunteered as surveyors. The survey was distributed to each surveyor prior to the day to allow familiarisation with the content. On the morning, before data collection commenced, a brief training session was held to clarify the process, to allocate wards, and to allow any questions to be answered. The non-clinical nurses, unfamiliar with dressing and cannula types, were teamed with a clinical nurse to enhance accuracy of the data collection. The teams assessed each patient together, collecting data using the standardised survey.

Analysis: Frequency counts were the only statistics used to analyse data. Results are presented as numbers and proportions. The analyses accounted for any denominator variation. Predictive Analytics Software (SPSS Inc v19) was used to analyse the data.

Results

Of the 359 inpatients who were potentially eligible, 327 (91.1%) were assessed for the presence of an IVD. Thirty-two patients (8.9%) were not assessed, either because they declined (0.3%), were missed (0.8%), were absent from their bed (7.5%) or because a request was made not to assess the patient (0.3%). Of the patients assessed, 192 of 327 (58.7%) had one or more devices in situ. The 220 devices assessed, consisted of 190 (86.4%) PVCs, 25 (11.4%) PICCs and 5 (2.3%) CVCs.

Purpose

One hundred and thirty-seven of 220 devices (62.3%) were currently in use (i.e. for fluid or medication administration). Twenty-one of 220 devices (9.5%) had a PRN medication order (e.g. antiemetic); however no medication or flush had been administered in the previous 12 hours. A further 62 of 220 devices (28.2%) were in

situ without a clear purpose. That is, there were no orders for fluids, medications or tests. Of the 27 of 192 patients (14%) who had more than one device in situ, 22 (81.5%) had two PVCs. For the majority (81.8%) of the patients with two devices in situ, only one device was in use.

Visibility, dressings and securement

The insertion site was not visible for 68 of 218 devices (31.2%) where this data was collected. At least seven different primary dressing types (e.g. polyurethane transparent, IV 3000, IV tegaderm, advanced transparent with bordered edge) were being used to secure PVCs and PICCs and four different types of dressings for CVCs. For 183 of 210 devices (83.2%) the primary dressing was taped in place with either Micropore and/or Hyperfix. Tubigrip was used extensively for covering and securing the PVC area.

The dressing securing a device at the insertion site should meet three criteria: clean, dry and intact. Of the 203 devices in which data was collected on all three of the criteria, 51 device dressings (25.1%) did not meet any of the criteria. That is, the dressings were assessed as not clean, not dry and not intact.

Insertion site and inserted by whom

Of the 200 devices for which insertion site data were collected, 73 devices (36.5%) were inserted in the forearm, 59 (29.5%) in the wrist or hand, and 32 (16%) in the cubital fossa. The remaining devices were inserted in the upper arm or clavicle area.

Forty-nine of 220 devices (22.3%) were inserted by a doctor, 45 (20.5%) by the intravenous service, 22 (10%) by trained ward nurses and for the remaining 104 devices (47%) it was not known who inserted the device.

Insertion and re-site dates

The documenting of insertion and re-site dates on the daily patient care record is limited to PVCs. There is no space on the form for recording this information for PICCs and CVCs. Of the PVCs assessed for insertion date documentation, there was no insertion date recorded for 79 of 186 devices (42.5%). Of the PVCs assessed for re-site date, there was no re-site date documented for 84 of 179 devices (46.9%).

Flushing and Locking

Of the 216 devices for which there were data, only three (1.4%) patients, who should have had a flush ordered, had one. Of the three flushes ordered, only one was signed as having been administered. Of the devices that had a clamp or 3-way tap in situ, 41 of 167 (24.6%) were not locked (clamped off or turned off to the closed position).

Complications

Documentation relating to complications was available for 219 devices. Of these, 165 (75.3%) were rated as being free from complications, while 54 of 219 (24.7%) had one or more complications such as redness, pain, tracking, oedema or oozing. Complications occurred in 47 of 189 PVCs (24.9%) and 7 of 25 PICCs (28%). No complications were seen in CVCs.

Surveyors were able to extract information about site assessment for 208 devices. There was no documentation on the patient's daily care record to indicate that a site assessment had occurred within the last eight hours for 52 of 208 devices (25.0%). Seventeen of the 52 devices (32.7%), had complications identified by the surveyors. A further six devices were identified by the surveyors as having complications, which had been signed off by a nurse as being free of signs of inflammation or infiltration. Of 185 PVCs where documentation was available, there were 68 (36.8%) instances in which the site location of the device was not accurately documented. For example, the care record stated left arm when the device was in the right arm.

Discussion

The primary purpose of the current study was to examine utilisation, management, documentation and complications for intravascular devices in cardiac, medical and surgical inpatients. Our data demonstrate that the presence of devices in situ for no clear purpose is high (28.2%). This is consistent with other studies reporting rates of 'no longer required' PVCs in situ of 38% [(15)]. Ritchie et al. (2007) conducted a repeat audit of IVD practices four years after the previous audit. They reported a much lower percentage (7%) of PVCs in situ without a reason; however indicated that ongoing education and follow-up audits for the purpose of quality control are required. Documentation on the patient daily care record was poor in terms of site assessment; insertion date, re-site date, and location of the device, which was inaccurately recorded in 37% of cases. Failure to document such information suggests that nurses may not be looking at the device before care records are updated and signed. This seems to be particularly true where the documented location was incorrect and where complications were not recorded. This would suggest that existing clinical education

needs to be reviewed to address a number of areas related to care of devices and documentation.

Of concern was the data related to flushing and locking. Both flushing and locking of devices are important to prevent clot formation inside the catheter. If these processes are not carried out, cannula patency may be lost, and removal and resiting of the device may be necessary[16].

One quarter of all dressings were assessed as not being clean, dry and intact. Maintaining a secure and dry environment is important to reduce the risk of site infection[17]. Therefore it is important to observe the dressing frequently and to change it if it becomes soiled, if there is any ooze or is no longer intact. In addition, semi-permeable transparent dressings should be sufficiently occlusive and secure to remove the need for additional dressings[17]. However our survey showed that additional dressings were applied to over 83% of devices to ensure they remained in situ. It appears that in practice simple occlusive dressings are inadequate for securing devices. Consequently makeshift designs using multiple dressings are utilised for this purpose, adding considerably to the cost of IVD care.

A further concern was the overall complication rate of 24.7% and the number of complications identified by the survey teams and not by the nurse caring for the device. While it is acknowledge that some assessments by the nursing staff may have occurred on the previous shift, our procedure states that at the commencement of each shift, and before and after a cannula is accessed; staff must visually check the cannula site for signs of complications (i.e. infiltration, phlebitis, infection). As the survey was

conducted up to 4.5 hours after the commencement of the shift, it would be expected that the majority of devices should have been assessed by a nurse prior to the survey teams' assessment of devices. However the complication rate observed in both PVCs and PICCs are similar to complication rates reported in other institutions[11, 15] and cancer care wards at the RBWH[18] .

The limitation of our study is that the data was collected on a single day over a short time period, thus providing a single snapshot of device utilisation, documentation and management. However this provided baseline data against which future audits can be measured.

Recommendations

Our hospital policy states that PVCs should be reviewed daily and removed promptly when no longer needed. While PVC related bloodstream infections are low compared to central venous access devices, the presence of PVCs put the patient at risk of local and systemic infectious complications. Such complications can impact negatively on patient outcomes and increase hospital and healthcare costs. Thus it is important, if the device is no longer in use that it is removed promptly to prevent healthcare associated infections. It was recommended that the hospital policy and managing intravascular devices, including the timely removal of no longer needed devices, be a feature of the rotating monthly education and awareness programs that are run throughout the hospital. Additionally repeat audits will need to be conducted to monitor change over time.

In regards to flushing to maintain patency of devices, some inconsistencies were found when the hospital policy was examined. The policy stated that devices with no lines attached should be flushed with 5mls of 0.9% sodium chloride 8th hourly. The policy also specifies that there is a 'standing order' for the administration of 0.9% sodium chloride flushes; however the standing order was unable to be located on the internal hospital web-site or in hard copy. To complicate matters further, the pre-printed stickers, which are placed on the patient medication chart, order 4th hourly 0.9% sodium chloride flushes, not 8th hourly. It was also identified that sections of the patient daily care record needed revising. The current record form does not provide space for recording the time when a device was last flushed and if the device continues to be patent. Therefore it is unclear from the records if and when a device was last flushed. These system errors are easily rectified and will provide greater clarity for managing patients with an IVD.

As a result of this survey, the hospitals' Intravenous Working Party is reviewing the type of securement dressings that are available in the hospital. In addition, a randomised controlled trial of four different securement methods is currently being conducted. When outcomes of this trial are known, recommendations regarding the appropriate dressing type for securing devices will be made.

To enhance clinical practice and management of devices, a care bundle and education will be introduced as part of the currently established 'iCare' education program.

Previously it has been demonstrated that if a patient is not aware of the reason for which they have a device, then the device was significantly more likely to be left in

situ after it was no longer required[15]. In the light of this information and given the high percentage of devices found in situ without a clear purpose, a recommendation has been put forward to the Consumers Research Council for a patient information sheet to be developed on IVDs for patients to receive at or around the time they have a device inserted. This information sheet should highlight the indications for device insertion, features of complications, expected duration of device placement and the ways in which the patient can play a role in preventing device-related infection.

The results of this survey provided useful information in identifying a number of areas for improvement including (i) the daily care plan record to be revised to improve documentation and for user-friendliness and; (ii) the vascular access devices service to develop guidelines and a decision-making tree, which will assist clinicians on decision making post assessment of the device and site. Additionally as surveillance is important to hospital infection control ongoing prospective data collection, timely feedback to healthcare practitioners and documentation of the effectiveness of any interventions has been recommended. This will reinforce to clinicians the importance of ongoing surveillance and research to optimise patient outcomes.

Conclusion

The study identified a number of problems with intravenous device management at the study site. Specifically, failure to remove redundant devices, uncertainty around flushing practices, visibility of the insertion site, inadequacy of the simple polyurethane dressing to secure devices, and poor documentation of the device

insertion date and insertion site assessment. Identifying these problems has provided useful information for recommendations for education and awareness programs.

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