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## Reasons for Removal of Emergency Department–Inserted Peripheral Intravenous Cannulae in Admitted Patients: A Retrospective Medical Chart Audit in Australia

It has been reported that the peripheral intravenous cannula (PIVC) is the first choice of vascular access device for patient treatment in the emergency department (ED).[1] The number of PIVC insertions in our Australian ED is more than 35,000 per year. Concern arises when ED-inserted PIVCs are used exclusively for blood sampling because this may lead to unused PIVCs being left in situ after patients are transferred to the ward, increasing risk of infection. The rate of unused or *idle* PIVCs inserted in the ED has been reported at 45%-50%.[2,3] PIVC insertions in the ED have been identified as a cause for phlebitis and bacteremia, leading to their premature failure.[4] Analysis of 5 years of prospective data from 2 hospitals in Australia found a high incidence of catheter-related *Staphylococcus aureus* bloodstream infections with 39.6% of such infections associated with PIVCs inserted in the ED.[5] As a result, routine PIVC replacement should be considered after 24 hours for PIVCs inserted under emergent conditions[6] and after 96 hours for those inserted under nonemergent conditions.[5] These worrying statistics prompted the design of the current study that was performed to investigate how and why PIVCs are used in the ED, and during the subsequent hospital admission, as well as the documented rationale for removal of ED-inserted PIVCs by ward staff. To our knowledge, there is no prior study investigating this phenomenon.

We planned a retrospective audit of 370 medical charts of patients who had been admitted from the ED with a PIVC from December 1, 2013, through January 31, 2014, during a previous quality improvement initiative.[7] Our large tertiary ED in Western Australia provides a 24-hour emergency service for adult patients. At the time of our study our census suggested approximately 64,000 patients presented to the ED with an approximate 50% admission rate (35% to inpatient stay and the remaining 15% to short-stay assessment unit).

Items included in the audit were age, gender, patient size, type of intravenous therapy given (fluids, antibiotics, and/or analgesia) or bloods taken through the cannula, Peripheral Vein Assessment Score (PVAS, the current peripheral cannula daily assessment tool at our hospital) for each day, dwell time of the PIVC, the rationale for removal (infiltration, phlebitis, occlusion, accidental removal, no longer needed, routine replacement, not documented), evidence of the type and number of other vascular access devices inserted, length of hospital stay, and whether the PIVC was used for intravenous/medication therapy in ED or in the hospital (unused/idle PIVC).

This study was approved as a quality improvement initiative and deemed to be of low risk by the human research ethics department at Sir Charles Gairdner Hospital (no. 158).

Data were analyzed using descriptive statistics. Outcomes of key interest to this study were dwell time, documented complications, unused cannulae, and rationale for removal. Data analyses were conducted in SAS, version 9.3 (SAS Institute).

We analyzed medical charts of 131 patients. For demographic characteristics, see Table 1. Documentation of the PVAS was missing for 19% on day 1, for 23% on day 2, for 26% on day 3, for 27% on day 4, and for 48% overall (ie, at least any of the 4 days). The unused or idle PIVC prevalence was 16%. In total, 51% of PIVCs had an undocumented rationale for the ED-inserted cannula's removal, yet 37% of patients were subjected to a subsequent PIVC insertion. No infections were identified. We suspended our medical chart audit early because of the futility in obtaining data, in favor of a future prospective observational study.

Our results clearly identified that the rationale for removal of the most common medical invasive device used in hospitals was poorly documented in the patient's medical record—in our case, more than half were not documented. This implies that the level of PIVC failure may be underreported and thus underestimated. In more than one-third of the patients whose cannulae were removed, subsequent cannulae were inserted, suggesting that the initial cannulae failed or were removed owing to concern over the potential infection risk of ED-inserted PIVCs. Both are concerning regarding patient outcomes as well as the potential legal liability of nondocumentation of removal for an invasive medical device.

Although the recorded number of idle PIVCs from the ED was lower (16%) than recent figures (50%),[2] it still amounts to unnecessary use of a medical device. Whilst this may hint that some ED clinicians have no definitive rationale for inserting a PIVC, it is of concern that patients are exposed to avoidable potential risks of hospital-acquired PIVC infection, in addition to the trauma and discomfort of an insertion. It is possible that a portion of the idle PIVCs may have been appropriate due to potential patient clinical deterioration. We found it difficult to confirm this using the medical chart review method. The importance of good quality documentation for medical chart audits for providing confidence in results has been argued when the medical record review methodology is used.[8]

Our hospital uses a locally developed PVAS that isolates failure to an infection/phlebitis problem alone. This may lead to

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TABLE 1. Demographic and Clinical Characteristics of 131 Patients in Retrospective Medical Chart Audit

| Variable | Value |
|---|---|
| Gender (missing n = 2) | |
| Male | 69 (53%) |
| Female | 62 (47%) |
| Age, mean (SD), y | 61.1 (22.9) |
| Length of stay, mean (SD), days | 5.6 (7.8) |
| Patient size (missing n = 8) | |
| Emaciated | 3 (2%) |
| Underweight | 22 (17%) |
| Normal weight | 68 (52%) |
| Overweight | 21 (16%) |
| Obese | 9 (7%) |
| Hospitalization category | |
| Medical[a] | 60 (46%) |
| Surgical | 17 (13%) |
| Orthopedics | 12 (9%) |
| ED presentation | 25 (19%) |
| Neurology | 10 (8%) |
| Urology | 7 (5%) |
| Comorbidities[b] (missing n = 4) | |
| Obesity | 8 (6%) |
| Respiratory | 10 (8%) |
| Hypertension | 56 (43%) |
| Diabetes mellitus | 22 (17%) |
| Atrial fibrillation | 19 (15%) |
| Dwell time (missing n = 2) | |
| <1 day | 53 (40%) |
| 1-2 days | 19 (15%) |
| 2-3 days | 23 (18%) |
| 3-4 days | 8 (6%) |
| >4 days | 5 (4%) |
| Unknown | 21 (16%) |
| Removal rationale (missing n = 3) | |
| Accidental | 7 (5%) |
| No longer needed | 49 (37%) |
| Replacement 72 hrs | 1 (1%) |
| Infiltration | 4 (3%) |
| Not documented | 65 (50%) |
| Other | 2 (2%) |
| Subsequent device (missing n = 3) | |
| Yes | 47 (36%) |
| No | 81 (62%) |

NOTE. ED, emergency department.
[a]Includes admitted medical assessment patients and hematology/oncology patients.
[b]Comorbidities are separate categories and not mutually exclusive, hence do not add up to 100%.

reporting failure of the PIVC exclusively for phlebitis and perhaps dissuade documentation of any other rationale for device removal, such as infiltration, occlusion, and securement device failure, or accidental dislodgement. We identified no PIVCs removed owing to a PVAS score of 2 or greater (which recommends removal), which makes us consider that some other rationale for failure has occurred—for example, dislodgement. Additionally, ward nurses, the primary carers for PIVCs, were inconsistent in documenting a PVAS score daily in 48% of patients. It is unknown whether clinically acceptable and functioning PIVCs are removed at our hospital in favor of routine replacement. This is of further concern given that our policy states 72-96 hours, whilst research indicates the subsequent PIVC is more likely to experience complications and device failure.[9]

The major limitation of this study is the lack of an accurate rationale documented for the removal of PIVCs inserted in the ED. Our results suggest suboptimal adherence with Australian recommendations to document the use and management of invasive devices so they can be monitored as a reportable national health standard.[10] This finding represents an opportunity for process improvement at a local and national level.

This retrospective medical chart audit has led us to conduct a prospective observational clinical study to identify the insertion success and dwell time of ED-placed PIVCs with ward follow-up observations. This is registered with ANZCTR Clinical Trial Registry (identifier ACTRN12615000588594).

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