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Original Contributions

APPROPRIATENESS AND COMPLICATIONS OF PERIPHERAL VENOUS CATHETERS PLACED IN AN EMERGENCY DEPARTMENT

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☐ **Abstract—Background: The insertion of peripheral venous catheters (PVCs) is the invasive procedure most frequently performed in hospitals, and it could be associated with complications. The appropriateness of PVC placement, however, has not been carefully analyzed. Objectives: We conducted a study to assess the rate of PVC placement in our Emergency Department (ED), their use, their immediate or potential usefulness, and their complications. Methods: In this descriptive prospective study, we recorded every PVC placed in our ED during 1 week and assessed its appropriateness in terms of its use and potential usefulness. We then followed the patients transferred to medical wards to determine the duration of PVC maintenance and any complications. Results: PVCs (n = 210) were placed for 34% (n = 207) of the 605 patients admitted to the ED during the study period. Of these PVCs, 27% (n = 52) were not used and 43% (n = 91) were considered ineffective. Follow-up covered 92 patients with PVCs transferred to medical wards. We recorded seven episodes of phlebitis (8%) and no infections, local or systemic. The mean duration of PVS maintenance in the medical wards was 40 h from insertion. Of the PVCs with complications, 43% were ineffective. The mean duration of maintenance of the PVCs that led to complications was 80 h, compared with 35 h for those without complications ($p < 0.02$). Conclusion: In accordance with the literature, half of the PVCs inserted in our ED were ineffective; half the PVCs causing complications were avoidable.**

☐ **Keywords—peripheral venous catheter; emergency; phlebitis**

INTRODUCTION

The placement of peripheral venous catheters (PVCs) is the invasive procedure most frequently performed in hospitals, especially in emergency departments (EDs). Insertion of a PVC is a time-consuming procedure and often a source of discomfort for the patient. It can also cause various complications. The incidence of episodes of phlebitis induced by PVCs varies among studies from 6.8% to 21.7% (1–3). Local infections occur in 2.3–6.9% of cases (1,4). Systemic infections are much less frequent but lead to morbidity and mortality (5–7).

Guidelines for the techniques of inserting and changing PVCs have been issued to reduce the onset of these complications (8). The formation of dedicated teams specialized in the insertion of PVCs has also been assessed (3). Another line of prevention of PVC complications is to limit the indications for their use. Studies examining this issue have shown that 25–50% of PVCs placed are not used at all (4,9–11).

There is, nonetheless, a difference between the use of a PVC and its appropriateness. Even if not used, a PVC can be considered essential for the management of patients at high risk of complications. Inversely, a PVC is sometimes used to administer medication for which oral alternatives are available. We thus sought to assess not the use but the appropriateness of PVCs placed in EDs.

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MATERIALS AND METHODS

This descriptive prospective study took place in the ED of the North Réunion university hospital center (35,000 visits annually). This is a medium-sized French ED with standard activity. Nearly 30% of the patients are minor trauma patients, 50% of the medical patients are discharged, and < 10% of the patients need intensive care. The Level I trauma center is close to the ED, and the intensive care unit, stroke center, and intensive cardiac care unit are also on site.

This study was conducted in accordance with the ethical principles stated in the Declaration of Helsinki, Good Clinical Practice, and relevant French regulations regarding ethics and data protection.

We included all patients seen in the Department during the week of July 21–27, 2014. The study does not include patients who had a PVC placed in prehospital care or those who left the Department without being examined.

We recorded all PVCs inserted during the study period and collected information about these patients and their management. The appropriateness of PVC placement was assessed according to predefined criteria. These criteria took into account the planned and actual use of the PVC and the patient's clinical presentation. We considered the criteria used in previous studies for the usefulness of PVC but we also search any appropriate oral alternative for each treatment prescribed (10,11).

A PVC was thus considered appropriate if it enabled the administration of blood products, radiological contrast products, fluid resuscitation, rehydration, or osmotic diuresis. It was judged appropriate for the prescription of an intravenous drug treatment when there was no oral alternative to the treatment or when the patient was nauseated or vomiting or needed to remain on not-by-mouth status (e.g., pending potential surgery). Finally, a PVC was considered appropriate in patients who were clinically unstable (French Classification Clinique des Malades aux Urgences [CCMU] classification ≥ 4) (12).

We followed up all patients transferred to our hospital's medical wards. An investigator went to each department daily to verify and record the time to PVC removal and the onset of any complications. Follow-up ended once the PVC inserted in the ED was removed or when the patient was transferred to a surgical, psychiatric, or intensive care unit. The complications sought were phlebitis, local infection, or a bloodstream infection associated with the PVC. We used the criteria described by Bregenzer et al. to define phlebitis, and those of the French Haute Autorité de Santé (National Authority for Health) and the Société Française d'Hygiène Hospitalière (French Society of Hospital Hygiene) for local and systemic infections (1). Local infections were characterized by at least one clinical sign of infection at the insertion site (erythema, induration, collection, or pus) associated with a positive local microbiological sampling. Systemic infections associated general signs of infection and a positive microbiological sampling (catheter, insertion point, or a positive blood culture without any other etiology recognized).

Quantitative variables were compared with Student's *t* test, and qualitative variables with the chi-squared test or Fisher's exact test, as appropriate.

RESULTS

PVCs were inserted for 207 (34%) of the 605 patients seen in our ED during the study period (Figure 1). Three (0.5%) had two PVCs placed. Nurses placed 99% of the catheters, and physicians 1%.

The reasons for admission most likely to result in PVC insertion were gastrointestinal and neurological disorders (Table 1).

Of the 605 patients included, 185 (31%) were hospitalized: 142 (77%) of the latter had a PVC inserted. In addition, PVCs had been inserted for 65 of the 420 (16%) patients sent home from the ED and were removed prior to discharge.

The principal criterion for appropriate PVC placement was intravenous drug administration, especially in the absence of an oral alternative (Table 2).

We considered 91 PVCs (43%) to be ineffective according to the criteria described above. Among them, 52 (57%) were ineffective because they were not used and had been placed in patients judged stable. For the other 39 (43%), an oral alternative was available for the treatment administered intravenously—analgesia in 77% of the cases (Table 3).

There was no significant difference between the proportion of ineffective PVCs prescribed by senior physicians and those prescribed by interns ($p = 0.2$). Finally, 42% of the patients with an ineffective PVC returned home from the ED without any in-hospital transfer.

Blood samples were taken from 195 (94%) of those who had a PVC placed. This proportion was identical regardless of the appropriateness of the PVC. Inversely, among all the patients who had blood samples taken, 80% had a PVC inserted.

In all, 95 of the 207 patients perfused (46%) were transferred to the hospital's medical department; 43 (45%) had had an ineffective PVC placed. Three of them had two PVCs. We therefore followed up 98 PVCs in the Medical Department. Of these 98 catheters, 92 were followed up through their removal. Six catheters were lost to follow-up due to secondary transfer to the intensive care unit or for surgery.