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# Nursing care as a predictor of phlebitis related to insertion of a peripheral venous cannula in emergency departments: findings from a prospective study

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## SUMMARY

**Background:** To date, few studies have investigated the occurrence of phlebitis related to insertion of a peripheral venous cannula (PVC) in an emergency department (ED).

**Aim:** To describe the natural history of ED-inserted PVC site use; the occurrence and severity of PVC-related phlebitis; and associations with patient, PVC and nursing care factors.

**Methods:** A prospective study was undertaken of 1262 patients treated as urgent cases in EDs who remained in a medical unit for at least 24 h. The first PVC inserted was observed daily until its removal; phlebitis was measured using the Visual Infusion Phlebitis Scale. Data on patient, PVC, nursing care and organizational variables were collected, and a time-to-event analysis was performed.

**Findings:** The prevalence of PVC-related phlebitis was 31%. The cumulative incidence (78/391) was almost 20% three days after insertion, and reached >50% (231/391) five days after insertion. Being in a specialized hospital [hazard ratio (HR) 0.583, 95% confidence interval (CI) 0.366–0.928] and receiving more nursing care (HR 0.988, 95% CI 0.983–0.993) were protective against PVC-related phlebitis at all time points. Missed nursing care

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increased the incidence of PVC-related phlebitis by approximately 4% (HR 1.038, 95% CI 1.001–1.077).

**Conclusions:** Missed nursing care and expertise of the nurses caring for the patient after PVC insertion affected the incidence of phlebitis; receiving more nursing care and being in a specialized hospital were associated with lower risk of PVC-related phlebitis. These are modifiable risk factors of phlebitis, suggesting areas for intervention at both hospital and unit level.

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## Introduction

Peripheral venous cannulae (PVC) are commonly used by nurses to provide medications or infusions.<sup>1</sup> The use of PVC among hospital inpatients increased significantly from 11% in 1992 to 33% in 2002.<sup>2</sup> More recently, 30–80% of patients were reported to have had at least one PVC inserted during their hospital stay.<sup>3</sup> With the increased use of PVC, concerns have arisen regarding the incidence of PVC-related phlebitis, which can result in discomfort, pain and increased morbidity, mortality and healthcare costs.<sup>4–6</sup>

PVC-related phlebitis is inflammation of the tunica intima of a superficial vein caused by the presence and use of a PVC. It can be diagnosed clinically on the basis of at least two of the following signs: pain; erythema; swelling; induration; or a palpable venous cord near the site of the PVC.<sup>1</sup> The incidence of PVC-related phlebitis has been documented to occur in 10.9–25% of cases,<sup>4–7</sup> with great variability in the literature due to lack of agreement on a definition of PVC-related phlebitis; the use of different measurement tools;<sup>8</sup> and the inclusion of various clinical contexts, populations<sup>7</sup> and sample sizes (from 38 to 1498).<sup>4</sup>

Factors related to patients and to the PVC itself influence the occurrence of phlebitis. Some studies<sup>6,9</sup> found that patients aged  $\geq 65$  years were more likely to develop phlebitis, but other studies did not.<sup>5</sup> Some studies<sup>6</sup> found that phlebitis was more common in women, other studies<sup>9</sup> found it was more common in men, and others<sup>5</sup> did not find any association between sex and the incidence of phlebitis. Neutropenia, immunosuppression, circulatory impairments and malnutrition have been shown to increase the risk of phlebitis.<sup>5,9</sup> At the PVC level, cannula material and size,<sup>5,6</sup> insertion site and placement technique,<sup>4,5,10</sup> duration of site use<sup>4,5,10,11</sup> and type of infusion solution<sup>6,12</sup> have been identified as factors influencing the occurrence of phlebitis.

More recently, the relationship between nursing care and the incidence of PVC-related phlebitis has attracted the attention of researchers. The risk of PVC-related phlebitis has been reported to be lower when patients are cared for by experienced nurses,<sup>13</sup> and when nurses follow evidence-based guidelines.<sup>13</sup> Registered nurses' (RNs) perceptions of working under suboptimal conditions affecting daily PVC management have also been associated with increased risk of phlebitis.<sup>9,14</sup> Nevertheless, ensuring compliance with the available guidelines<sup>15</sup> and offering the care required by each patient is not often possible due to high workloads in the wards (e.g. an increase in the number of patients that a nurse is required to care for), communication failures within the healthcare team, and shortages of resources at the bedside (e.g. appropriate

dressing materials).<sup>16</sup> However, the abovementioned factors determining missed nursing care (defined as unfinished, delayed or omitted nursing tasks<sup>16</sup>) have not been studied to date in relation to their association with PVC-related phlebitis. In addition, the amount of nursing care given to patients on a daily basis, the proportion of care offered by graduate nurses educated to university level, and the skills mix of the nursing staff have been largely associated with negative clinical outcomes,<sup>17</sup> but no studies to date have explored their role in predicting PVC-related phlebitis.

Moreover, only a few studies<sup>1,18</sup> have investigated the occurrence of phlebitis in PVC inserted in emergency departments (EDs), despite the fact that a large proportion are positioned in this context.<sup>19</sup> Although PVC insertion should be performed under aseptic conditions in all contexts, the urgent need to cannulate a vein in critically ill patients, the overcrowded ED setting or other concerns can conflict with strict compliance with asepsis guidelines.<sup>20</sup> Therefore, PVC inserted in EDs that remain *in situ* in patients subsequently admitted to a ward can incur a higher risk of phlebitis due to the initial substandard conditions of insertion, if nursing care offered at the ward level is substandard.

This study aimed to develop knowledge on the natural history of PVC inserted in EDs and then managed in medical wards; assess the prevalence, cumulative incidence and severity of PVC-related phlebitis; and determine patient, PVC and nursing care predictors.

## Methods

### Study design and setting

A prospective explanatory pragmatic study was undertaken over a seven-month period (2012–2013) in 12 medical units located in 12 hospitals in northern Italy.

### Participants

Urgent cases who received PVC in EDs and were subsequently admitted to a medical unit for at least 24 h, who were willing to participate in the study, were included. In all patients included, the first PVC inserted in the ED was considered. This PVC was observed and followed until it was removed for clinical reasons (such as phlebitis), or because, based on the RN's clinical judgement, it was no longer needed (completion of the treatment or patient discharge).<sup>10</sup>

Patients who did not wish to participate in the study, and those admitted to the ward as scheduled cases or transferred from other hospitals were excluded. Other secondary PVC

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