

## Original Article

# Phlebitis-related Peripheral Venous Catheterization and the Associated Risk Factors

S Atay, S Şen, D Çukurlu

Department of Nursing,  
School of Health Sciences,  
Çanakkale Onsekiz Mart  
University, Çanakkale,  
Turkey

ABSTRACT

**Background and Aim:** Development of phlebitis is a painful and common complication in the application of peripheral intravenous catheter (PIC). This is a prospective observational study performed to identify development rate of phlebitis in application of PIC and the factors that affect the development of phlebitis. **Materials and Methods:** The study universe comprises of catheters applied on inpatients in the internal diseases clinic of a state hospital, and the sample comprises of catheters eligible to be included in the study. Five hundred and thirty-two PICs applied on a total of 317 patients were reviewed. The patient identification form, information form for peripheral venous catheter and treatment, and visual infusion phlebitis (VIP) assessment scale were used to collect data. **Results:** 31.8% had phlebitis and a large number of them (79.2%) were Level I phlebitis. There was a significant relationship between having a chronic disease, duration of catheterization and type of fluid used and the development rate of phlebitis. **Conclusion:** The phlebitis in individuals receiving intravenous (IV) treatment was higher than the rate defined by both the centers for disease control and prevention and IV nurses society. It may be recommended to assess phlebitis by VIP assessment scale and to take preventive measures specifically for development of phlebitis.

**KEYWORDS:** Intravenous catheter, phlebitis, risk factors, visual infusion phlebitis assessment scale

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## INTRODUCTION

Peripheral venous catheter (PVC) is a common application that is used for care of millions of patients across the world, for infusion of intravenous (IV) fluid, and other important clinical interventions.<sup>[1,2]</sup> PVC is delivered in roughly one of third inpatients in Scotland.<sup>[3]</sup>

The patients may suffer from complications of local and systemic infection in the use of PVC.<sup>[4]</sup> While the systemic infections are rare, phlebitis, associated with catheter and occlusions are rather observed. Infiltration and phlebitis are common complications of PVC. The centers for disease control and prevention (CDC) have declared that infections developed are associated with 250,000 catheters per year.<sup>[5]</sup> PVC-related phlebitis and infections may develop due to four causes: mechanical, chemical, bacterial, and postinfusion.<sup>[6]</sup>

Phlebitis is the acute inflammation of blood vessel wall that is characterized by edema, pain, and erythema along the vein.<sup>[2]</sup> Phlebitis is graded in Levels I, II, III, and IV.<sup>[7]</sup>

Infiltration and phlebitis are reported to be medical emergencies that result in disability and adversely affect the quality of life.<sup>[8]</sup> These complications prolong care, increase the costs for healthcare, and cause discomfort and increase morbidity in patients. Thus, a variety of studies have been performed to investigate the assessment of vascular access, careful management of catheters, observation and characteristics of phlebitis, to mitigate risks, and to develop strategies and guidelines.<sup>[9-13]</sup> It is very important to daily assess vascular access for early

**Address for correspondence:** Dr. S Atay,


School of Health Sciences, Çanakkale Onsekiz Mart University,  
Çanakkale, Turkey.

E-mail: atayselma@gmail.com

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identification of phlebitis. It will be helpful to report the results and take measures if such assessment is performed by a scale. Many institutions in the country do not use a scale to assess phlebitis. It is important to identify the rate of phlebitis and the risks for facilitating of taking measures. This is a prospective observational study performed to assess the rate and level of phlebitis by a scale and to identify the factors that increase the risk for phlebitis.

## MATERIALS AND METHODS

The universe of study comprises of catheters inserted individuals hospitalized between July and September 2014 at Internal Diseases clinic of a state hospital. The sample comprises of catheters inserted individuals who received intravenous medication such as antibiotics, analgesics and fluid therapy during hospitalization. individuals were over 18 years old and consent. Individuals who received chemotherapy and immunosuppressant medication were not included in the study. The sample includes 532 catheters applied on a total of 317 individuals explain why some had 2 or more times of catheter insertion?

### Data collection

Demographic questions (age, gender and medical diagnosis of patients) developed in accordance with literature, quesitons for Peripheral Venous Catheter & Treatment (e.g., catheter number, anatomic site of catheterization, frequency of insertion into the site, antibiotics and liquids used, duration of catheterization in the vein) and the Visual Infusion Phlebitis Assessment Scale developed by Schultz and Gallant were used to collect data.<sup>[14]</sup> The VIP assessment scale includes observation of catheter for potential risks when performing treatment with PVC and/or signs of phlebitis seen at any stages of development of phlebitis and grading steps.<sup>[14]</sup> The VIP assessment scale is graded in 5 stages.

#### Level I

Sign of phlebitis is pain; no symptoms of redness or edema appear; and recommendation is to observe catheter.

#### Level II

Early signs of phlebitis are seen. There is a redness smaller than 2.5 cm around catheter and pain manifesting by palpation (0–3). It is recommended to remove the catheter and insert a new catheter.

#### Level III

The medium stage of phlebitis. At this level, there is a redness around the IV site that is 2.5 cm or <2.5 cm and smaller than 5 cm, pain on or around the IV site manifesting by palpation (4–10) and symptoms of

swelling around it. It is recommended to remove catheter, insert a new catheter, report to the physician and consider treatment.

#### Level IV

The advanced stage of phlebitis or the start of thrombophlebitis. At this level, there is a redness of 5 cm or over on the IV site, pain on or around the IV site manifesting by palpation (4–10), swelling. It is recommended to remove catheter, insert a new catheter, report to the physician and consider treatment.

#### Level V

The advanced stage of thrombophlebitis. At this level, symptoms of level IV phlebitis and symptoms of purulent drainage are observed. It is recommended to remove catheter, insert a new catheter, report to the physician and consider treatment.

PVCs were observed by researchers at each shift in accordance with the phlebitis assessment scale. In addition, each IV intervention to patients was individually observed.

### Ethical considerations

Ethical compliance of the study was approved by the Ethics Committee of Medical Faculty, Çanakkale On Sekiz Mart University with decision No. 2014–12 on 25.06.2014. In addition, a written permission was obtained from the institution where the study was performed. The study objective was explained to the patients for data collection and those who agreed to participate and met inclusion criteria provided the filled informed consent form.

### Data assessment

The study data were assessed on the computer using statistical package SPSS software (version 21.0, IBM, Chicago, IL, USA). Chi-square test was used to assess the effect of factors; durations of catheter, type of fluid, having a cronic disease.

## RESULTS

Out of the 317 individuals/patients studied, 50.8% were female, 67.5% were primary school graduate, 64.4% had at least one chronic disease (such as hypertension, heart disease, diabetes), and the mean age was  $65.6 \pm 16.9$  years. Catheter size No. 20 was used in 46.6% of PVCs observed for the study, and 35.5% were inserted through the dorsal surface of the hand, and 33.3% were inserted through the forearm antecubital surface. IV fluid specify was injected into 87.8% of IV accesses and 66.7% of them were isotonic fluid; also, antibiotics were injected into 51.9% of IV accesses and 85.5% of them were single antibiotic. Phlebitis developed in 31.8% of vascular accesses was observed for the study.

**Table 1: Levels of phlebitis (n=169)**

Levels of phlebitis	n (%)
Level I phlebitis	134 (79.2)
Level II phlebitis	26 (15.3)
Level III phlebitis	4 (2.3)
Level IV phlebitis	5 (2.9)

**Table 2: Duration of peripheral intravenous catheter in the vein and rate of incidence for phlebitis**

Stay time of catheter in the vein	Phlebitis observed, n (%)	Phlebitis not observed, n (%)	Total, n (%)
0-24 h	9 (1.7)	104 (19.5)	113 (21.2)
25-48 h	50 (9.4)	139 (26.1)	189 (35.5)
49-72 h	78 (14.7)	99 (18.6)	177 (33.3)
73 h or over	32 (6.0)	21 (3.9)	53 (10.0)
$\chi^2$ , SD, P	64.3, 3, <0.05		

SD=Standard deviation

**Table 3: Type of fluid used and rate of incidence for phlebitis**

Type of fluid used	Phlebitis observed, n (%)	Phlebitis not observed, n (%)	Total, n (%)
Isotonic	108 (23.1)	247 (52.9)	355 (76.0)
Hypertonic	31 (6.6)	34 (7.3)	65 (13.9)
Blood and blood products	21 (4.5)	26 (5.6)	47 (10.1)
$\chi^2$ , SD, P	9.79, 2, <0.05		

SD=Standard deviation

**Table 4: Having a chronic disease and rate of incidence for phlebitis**

Chronic disease	Phlebitis observed, n (%)	Phlebitis not observed, n (%)	Total, n (%)
Yes	122 (23.0)	216 (40.7)	338 (63.7)
No	47 (8.9)	146 (27.5)	193 (36.3)
$\chi^2$ , SD, P	7.80, 1, <0.05		

SD=Standard deviation

Level I phlebitis was observed in 79.2% of the cases while 20.5% were Level II phlebitis and above [Table 1].

There were statistically significant differences between groups ( $\chi^2 = 64.3$ , Sd = 3,  $P < 0.05$ ) in comparison to the duration of peripheral IV catheter (PIC) in the vein with the rate of incidence for phlebitis [Table 2].

There were statistically significant differences between groups ( $\chi^2 = 9.79$ , sd = 2,  $P < 0.05$ ) in comparison of type of fluid administrated through PIC with the rate of incidence for phlebitis [Table 3].

There were statistically significant differences between the groups ( $\chi^2 = 7.80$ , sd = 1,  $P < 0.05$ ) in comparison of having a chronic disease with the rate of incidence for phlebitis [Table 4].

## DISCUSSION

In this study, phlebitis developed in 31.8% of vascular accesses was higher than that reported by Nassaji-Zavareh and Ghorbani who reported the development rate of phlebitis to be 26%.<sup>[12]</sup> Higher values (36.5%) were obtained in the studies by Karadağ and Görgülü,<sup>[10]</sup> 67.2% by Karadeniz *et al.*,<sup>[11]</sup> and 54.5% by Uslusoy and Mete.<sup>[13]</sup> The incidence for phlebitis was 11.09% in the prospective observational study by SalgueiroOliveira *et al.*<sup>[15]</sup> and 15.4% in the study by Cicolini *et al.*<sup>[4]</sup>

The findings in our study were higher than the rate (5%) suggested by both (CDC)<sup>[16]</sup> and IV nurses society (INS).<sup>[17]</sup>

Level I phlebitis is the most common grade in this study, and it is similar to the findings by Cicolini *et al.* who reported that 94.4% of the rate of phlebitis were Level I in their study.<sup>[4]</sup> Washington and Barrett found that 9.5% of level of phlebitis was higher than 2.<sup>[18]</sup> Gallant and Schultz indicated that 5.7% of phlebitis in their study had a VIP scale score that was equal to or higher than 2.<sup>[14]</sup>

There were statistically significant differences between groups in comparison of stay time of PIC in the vein with the rate of incidence for phlebitis. There are studies that demonstrate increased risk for phlebitis and thrombophlebitis when the stay time of catheter in the vein is prolonged,<sup>[10,19,20]</sup> and there are also studies reporting that prolonged duration of catheterization in the vein did not affect the rate of phlebitis.<sup>[21-23]</sup> A number of observational studies suggest that the risk for phlebitis is increased with duration of catheterization.<sup>[2-4]</sup> Maki and Ringer indicated that the rate of phlebitis was gradually increased after day 2,<sup>[19]</sup> Lundgren *et al.* and Karadağ and Görgülü found that rate of phlebitis was increased after the first 24 h.<sup>[10,20]</sup> Based on those studies, it was recommended to replace the catheter in 48 or 72 h at the latest.<sup>[19,20]</sup> Currently, the US CDC states that replacement of catheter every 72–96 h in adults reduces the risk for phlebitis and infection.<sup>[24]</sup> Cornely *et al.* indicated that the duration of catheterization did not cause any increase on risk of phlebitis in their prospective descriptive study.<sup>[22]</sup> Catney *et al.* found that there was no difference in whether the duration of catheterization was 72 or 144 and suggested that duration of catheterization could be over 72 h.<sup>[23]</sup> Gallant and Schultz identified that catheter number and duration of catheterization over 96 h were not important in the development of phlebitis.<sup>[14]</sup>

There were no statistically significant differences between groups in comparison of the type of fluid administrated through PIC with the rate of incidence for phlebitis. The hypertonic solution was reported to damage vascular endothelium and cause phlebitis because it is a chemical substance and its osmolarity is higher than the



osmolarity of blood.<sup>[19,20]</sup> There are studies indicating that type infusion fluid is important in the development of phlebitis, particularly that use of hyperosmolar solutions, antibiotics, and fluid with KCl increases the risk for phlebitis.<sup>[13,23]</sup>

There may be a relation between the chemical phlebitis and density of fluid, the number and dosage of medication, and the pH of medications. Hypotonic fluids draw fluids into the vascular endothelium, leading to swelling and bursting of cells. This can also induce fluids to migrate from the cardiovascular space, resulting in cardiovascular collapse. Particularly, 5% dextrose that is in the bag is isotonic, but following infusion and metabolizing of dextrose, it becomes hypotonic in the body. Hypertonic fluids draw fluids from the endothelium, which causes the cells to shrink and make them weak to infiltrations and phlebitis, leading to the need for PIV restart; INS recommends to centrally infuse fluids with high osmolarity.

There were statistically significant differences between the groups in comparison of lack of chronic disease with the rate of incidence for phlebitis. Nassaji-Zavareh and Ghorbani detected a relationship between the development rate of phlebitis and the diabetes mellitus.<sup>[12]</sup>

Based on the study results, phlebitis was observed in 31.8% individuals receiving peripheral IV therapy, and a large number of them (79.2%) were identified to be Level I phlebitis. In addition, while no relationship was found between the development of phlebitis and the age, site of IV catheter, catheter number, and use of antibiotics, there was a significant relationship between the presence of chronic disease, duration of catheterization and type of fluid used and the development of phlebitis.

As a result, the rate of incidence for phlebitis in individuals receiving peripheral IV treatment was higher than the rate defined by both CDC and INS. It may be recommended to assess the phlebitis by an appropriate scale and take preventive measures for development of phlebitis.

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### Conflicts of interest

There are no conflicts of interest.

### REFERENCES

- White SA. Peripheral intravenous therapy-related phlebitis rates in an adult population. *J Intraven Nurs* 2001;24:19-24.
- McCallum L, Higgins D. Care of peripheral venous cannula sites. *Nurs Times* 2012;108:12, 14-5.
- Reilly J, Stewart S, Allardice G, Noone A, Robertson C, Walker A, *et al.* NHS Scotland National HAI Prevalence Survey. Final Report 2007. Health Protection Scotland; 2007. p. 5. Available from: <http://www.hps.scot.nhs.uk/resourcedocument.aspx?id=512>. [Last accessed on 2017 May 12].
- Cicolini G, Manzoli L, Simonetti V, Flacco ME, Comparcini D, Capasso L, *et al.* Phlebitis risk varies by peripheral venous catheter site and increases after 96 hours: A large multi-centre prospective study. *J Adv Nurs* 2014;70:2539-49.
- O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, *et al.* Guidelines for the prevention of intravascular catheter-related infections. *Am J Infect Control* 2011;39:S1-34.
- Phillips L. Parenteral fluids. In: Alexander M, Corrigan A, Gorski L, Hankins J, Perucca R, editors. *Infusion Nursing: An Evidence-Based Approach*. 3<sup>rd</sup> ed. St. Louis, MO: Saunders/Elsevier; 2010. p. 233, 474.
- Infusion Nurses Society. *Infusion Therapy Standards of Practice*. *J Infus Nurs* 2016;39(suppl 1): 103-104. Available from: <https://tr.scribd.com/document/354457205/Infusion-Therapy-Standards-of-Practice-INS-2016>. [Last accessed on 2017 Jul 10].
- Doellman D, Hadaway L, Bowe-Geddes LA, Franklin M, LeDonne J, Papke-O'Donnell L, *et al.* Infiltration and extravasation: Update on prevention and management. *J Infus Nurs* 2009;32:203-11.
- Curran ET, Coia JE, Gilmour H, McNamee S, Hood J. Multi-centre research surveillance project to reduce infections/phlebitis associated with peripheral vascular catheters. *J Hosp Infect* 2000;46:194-202.
- Karadağ A, Görgülü S. Devising an intravenous fluid therapy protocol and compliance of nurses with the protocol. *J Intraven Nurs* 2000;23:232-8.
- Karadeniz G, Kutlu N, Tatlisumak E, Ozbakkaloğlu B. Nurses' knowledge regarding patients with intravenous catheters and phlebitis interventions. *J Vasc Nurs* 2003;21:44-7.
- Nassaji-Zavareh M, Ghorbani R. Peripheral intravenous catheter-related phlebitis and related risk factors. *Singapore Med J* 2007;48:733-6.
- Uslusoy E, Mete S. Predisposing factors to phlebitis in patients with peripheral intravenous catheters: A descriptive study. *J Am Acad Nurse Pract* 2008;20:172-80.
- Gallant P, Schultz AA. Evaluation of a visual infusion phlebitis scale for determining appropriate discontinuation of peripheral intravenous catheters. *J Infus Nurs* 2006;29:338-45.
- Salgueiro-Oliveira A, Parreira P. Incidence of phlebitis in patients with peripheral intravenous catheters: The influence of some risk factors. *Aust J Adv Nurs* 2013;30:32-9. Available from: <http://www.ajan.com.au/Vol30/Issue2/4Salgueiro-Oliveira.pdf>. [Last accessed on 2017 May 10].
- Guidelines for the Prevention of Intravascular Catheter-Related Infections. Atlanta, GA: Centers for Disease Control and Prevention; 2011. p. 45. Available from: <http://www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf>. [Last accessed on 2011 Jul 28].
- Infusion Nurses Society. *Infusion nursing standards of practice*. *Infus Nurs* 2011;34 Suppl 1:1-110. Available from: <https://www.engage.ahima.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=2238ee0a-c2df-4d1a-f69f2ce41856>. [Last accessed on 2017 May 10].
- Washington GT, Barrett R. Peripheral phlebitis: A point-prevalence study. *J Infus Nurs* 2012;35:252-8.
- Maki DG, Ringer M. Risk factors for infusion-related phlebitis with small peripheral venous catheters. A randomized controlled trial. *Ann Intern Med* 1991;114:845-54.
- Lundgren A, Wahren LK, Ek AC. Peripheral intravenous lines: Time *in situ* related to complications. *J Intraven Nurs*

- 1996;19:229-38.
21. Homer LD, Holmes KR. Risks associated with 72- and 96-hour peripheral intravenous catheter dwell times. *J Intraven Nurs* 1998;21:301-5.
  22. Cornely OA, Bethe U, Pauls R, Waldschmidt D. Peripheral teflon catheters: Factors determining incidence of phlebitis and duration of cannulation. *Infect Control Hosp Epidemiol* 2002;23:249-53.
  23. Catney MR, Hillis S, Wakefield B, Simpson L, Domino L, Keller S, *et al.* Relationship between peripheral intravenous catheter Dwell time and the development of phlebitis and infiltration. *J Infus Nurs* 2001;24:332-41.
  24. O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, *et al.* Summary of recommendations: Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis* 2011;52:1087-99.

