

## A Hospital Based Prospective Observational Assessment of Peripheral Inserted Venous Catheter Related Local Complications

MD. Wahhaj<sup>1</sup>, Anil Kumar<sup>2</sup>, V. S. Prasad<sup>3</sup>

<sup>1</sup>Senior Resident, Upgraded Department of General Surgery, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India

<sup>2</sup>Associate Professor, Upgraded Department of General Surgery, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India

<sup>3</sup>Associate Professor, Upgraded Department of General Surgery, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India

---

Received: 25-11-2022 / Revised: 20-12-2022 / Accepted: 10-01-2023

Corresponding author: Dr. MD.Wahhaj

Conflict of interest: Nil

---

### Abstract

**Aim:** To find the most adequate and safe intravenous peripheral device, our study attempted to estimate the incidence of local complications associated with peripheral catheters.

**Methodology:** This observational study was conducted among indoor patients of Upgraded Department of General Surgery, D.M.C.H, Darbhanga, Bihar admitted during the period of December 2017 to November 2018. Patients of age 5 years and above admitted in surgery department who required intravenous fluid therapy and who were willing to give consent for the study. After the admission into general surgery wards, peripheral intravenous cannula inserted peripherally whichever site better accessible under all aseptic precautions. Cannula site was examined daily for local complications and if any signs of local complications (pain, redness, swelling, thrombophlebitis, and extravasation) was observed, the cannula site was either changed or patient was shifted to oral drugs if not contraindicated and recorded on the evaluation sheet. The clinical and observational data were compiled and analyzed and following observations were obtained.

**Results:** Total 500 study cases, out of which 293 male and 207 female candidates were observed. Complications observed in 34.13% of male patient i.e. 100 male patient, and 65.7% of female patient i.e. 136 females. In our study, complications like swelling and infiltration were observed in 13.26% cases with 18 gauze cannulas, while 12.31% cases with 20 gauze cannulas whereas 15.49% cases observed with 22 gauze cannulas. 36% of cases undergone 3 times cannulation on same vein whereas 34.07% of cases with 2-time cannulation attempt. In our study, 24% of cases undergone 3 times cannulation on same vein whereas 14.81% of cases with 2-time cannulation attempt.

**Conclusion:** A high incidence of complications associated with use of a complete safety catheter was seen. Phlebitis was the predominant complication and duration of catheter permanence was over 72 hours. This long period was considered a risk factor for this complication.

**Keywords:** Cannula, Complications, Catheter, Phlebitis.

---

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

---

## Introduction

Intravenous therapy is widely used in hospital care and is viable because of several technologic devices, including peripheral intravenous catheters. These devices are mainly indicated for administration of medicine, fluids, blood, and nutritional products [1,2]. Peripheral intravenous catheters are the most used invasive device [2], and the technological advances made with this device in the past decades is remarkable.

Peripheral intravenous catheters are a quick, simple and cost-effective method to gain vascular access [3]. Up to 70% of hospitalized patients will receive at least one PVC during their admission [4]. However, these vital devices are prone to complications and failure prior to the completion of treatment; this has been reported to be as high as 67%, making it a common and expensive problem in healthcare [5-7].

Peripheral catheters, despite their wide use, can lead to local and systemic complications. In this study we focus on local complications (i.e., injuries in the area surrounding the catheter insertion site), which are rarely severe and can be observed early by objective assessment. These complications include hematoma, occlusion (Blockage), phlebitis (Irritation or inflammation of the vein wall), thrombophlebitis, infiltration (intravenous fluids moving into surrounding tissue), leakage, and local & systemic infections [2].

Treating the sequelae of peripheral intravenous catheter complications can be time-consuming for health professionals (frequently nurses), and often necessitates peripheral intravenous catheter replacement to continue treatment which results in increased fear and procedural anxiety related to hospitalization [8, 9]. To find the most adequate and safe intravenous peripheral device, our study attempted to estimate the incidence of

local complications associated with peripheral catheters and identify risk factors associated with the development of most common complications.

## Methodology

This observational study was conducted among indoor patients of Upgraded Department of General Surgery, D.M.C.H, Darbhanga, Bihar admitted during the period of December 2017 to November 2018

Inclusion criteria: Patients of age 5 years and above admitted in surgery department who required intravenous fluid therapy and who were willing to give consent for the study.

Exclusion criteria: Patients with local skin infection, central venous catheter, and children below 5 years of age were excluded.

After the admission into general surgery wards, peripheral intravenous cannula inserted peripherally whichever site better accessible under all aseptic precautions as follows: hand hygiene should be maintained with an alcoholic based hand rub before inserting an IV device; personal protective equipment (PPE) like gloves and mask with face shield was put on; better accessible or optimal insertion site was prepared, skin was prepared at insertion site by using an spirit/alcohol/chlorhexidine 2.5% solution based on availability in the wards by performing 30 seconds back and forth scrub and drying with air; intravenous cannula of varying gauzes were inserted, if the insertion fails on particular site 2-3 attempts were made and it was documented on the evaluation performa before choosing the next preferred site.

Sterile dressing was kept to ensure the fixity to the skin and to prevent retrograde infection by using adhesive bandage; the PIV lines were assessed on a daily basis – PIV was replaced if the site was no longer

working or the signs of pain, redness, phlebitis, swelling, extravasating and other local complications; and ports, hub, needle-less connectors and stopcocks were disinfected before connecting or injecting. Cannula site was examined daily for local complications and if any signs of local complications (pain, redness, swelling, thrombophlebitis, and extravasation) was observed, the cannula site was either changed or patient was shifted to oral drugs if not contraindicated and recorded on the evaluation sheet. The clinical and observational data were compiled and analyzed and following observations were obtained.

#### Results:

Total 500 study cases, out of which 293 male and 207 female candidates were

observed. Complications observed in 34.13% of male patient i.e. 100 male patient, and 65.7% of female patient i.e. 136 females. In our study, complications like swelling and infiltration were observed in 13.26% cases with 18 gauze cannulas, while 12.31% cases with 20 gauze cannulas whereas 15.49% cases observed with 22 gauze cannulas. Complications like swelling, infiltration/extravasation increases as the gauze of cannula increase. Complications like thrombophlebitis, pain, redness was observed in 26.53% cases with 18 gauze cannulas while 32.31% cases with 20 gauze cannulas whereas 41.55% cases observed with 22 gauze cannulas. Local complications like thrombophlebitis, redness and pain significantly increased as the gauze of the vein flow increases.

**Table 1: Comparison of gauze of cannula versus complications.**

Gauze	No. of patients	Complication (swelling/infiltration)	Complication (thrombophlebitis/pain/redness)
18	98	13 (13.26%)	26 (26.53%)
20	260	32 (12.31%)	84 (32.31%)
22	142	22 (15.49%)	59 (41.55%)

38.09% of complication like thrombophlebitis, redness and pain were observed in intravenous catheter placed at hand whereas 32.07% of complications were observed in intravenous catheter placed at forearm. 14.76% of complication

like swelling and infiltration were observed in intravenous catheter placed at hand and 12.07% of complications were observed in intravenous catheter placed at forearm.

**Table 2: Comparison between site of PVC and complications.**

Site of PVC	No. of patients	Complication (swelling/infiltration)	Complication (thrombophlebitis/pain/redness)
Hand	210	31 (14.76%)	80 (38.09%)
Forearm	290	35 (12.07%)	93 (32.07%)

36% of cases undergone 3 times cannulation on same vein whereas 34.07% of cases with 2-time cannulation attempt. In our study, 24% of cases undergone 3 times cannulation on same vein whereas 14.81% of cases with 2-time cannulation attempt.

No of cannulation attempt on same vein (times)	No. of patients	Complication (swelling/infiltration)	Complication (thrombophlebitis/pain/redness)
1	340	41 (12.06%)	105 (30.88%)
2	135	20 (14.81%)	46 (34.07%)
3	25	6 (24%)	9 (36%)

## Discussion

The complete safety catheter appears to be an innovation for intravenous therapy, considering the benefits pointed out in the research. These include the high rate of successful placement with the first puncture attempt; longer permanence until appearance of local complications; low incidence of local infection due to components of the closed system; and protection offered to the professional against accidental exposure to biological and hazardous waste. In addition, our results can be used to help prevent local complications because of the use of peripheral intravenous catheter by the nursing team once they are responsible for choosing the technology to be used, as well as catheter insertion and maintenance until removal.

In the present study, complications observed in 34.13% of male patient i.e. 100 male patient, and 65.7% of female patient i.e. 136 females. In the present study, most of the complete safety catheters used in our analysis were 20 gauge (52%) and were inserted in the forearm region to administer sedatives or analgesics. Another study in the literature also reported the prevalent use of 20-gauge catheters (53%); in that study, however, punctures were mainly made at the dorsum of the hand (47%) [10]. Another study found more frequent use of catheter to administer antibiotic drugs (68.9%) [11].

In the present study, 38.09% of complication like thrombophlebitis, redness and pain were observed in intravenous catheter placed at hand whereas 32.07% of complications were observed in intravenous catheter placed at forearm. 14.76% of complication like swelling and infiltration were observed in intravenous catheter placed at hand and 12.07% of complications were observed in intravenous catheter placed at forearm. Insertion site, specifically at the point of flexion of joint (wrist joint and antecubital fossa) compared to insertion in the forearm

was significantly associated with all causes of failure infiltration/occlusion, thrombophlebitis and catheter dislodgement [12].

This is likely due to joint motion loosening the catheter dressing or causing catheter movement in the vein, peripheral vein flow kinking or mechanical occlusion. Peripheral intravenous catheter movement can cause the catheter tip to pierce the vessel wall leading to infiltration, inflammation, thrombus formation, occlusion, and/or complete dislodgement Helm et al and Hadaway [12, 13]. These results are similar to studies reporting higher peripheral intravenous catheter failure rates when catheters were placed over joints Cicolini et al and doRego Furtado [14, 15]. Peripheral intravenous catheter insertion in the forearm reduces failure and complications as there are no joint to cross over and better securement of dressing than at joints.

Another study with 76 adult patients using peripherally inserted catheter showed results similar to our study findings, their identified higher occurrence of phlebitis in those who used 18- and 20-gauge catheter size in the upper left limb and forearm. However, their study identified more complications in catheter with permanence equal or lower than 72 hours, a similar result identified by the other study mentioned above [16,17].

## Conclusion

A high incidence of complications associated with use of a complete safety catheter was seen. Phlebitis was the predominant complication and duration of catheter permanence was over 72 hours. This long period was considered a risk factor for this complication.

## References

1. Silva GA, Priebe S, Dias FN. Benefits of establishing an intravenous team and the standardization of peripheral

- intravenous catheters. *J Infus Nurs.* 2010; 33(3):156-60.
2. Infusion Nurses Society. Infusion nursing standards of practice. *J Infus Nurs.* 2011;34(1S).
  3. Dougherty L. Peripheral cannulation. Nursing standard (Royal College of Nursing (Great Britain)). 1987. 2008; 22 :49-56.
  4. Zingg W, Pittet D. Peripheral venous catheters: an under-evaluated problem. *Int J Antimicrob Agents.* 2009; 34(4): S38-42.
  5. Chico-Padrón RM, Carrión-García L, Delle-Vedove Rosales L, González-Vargas CS, Marrero-Perera M, Medina-Chico S, Rodríguez-Díaz MP, Alonso-Díaz M, Jiménez-Sosa A. Comparative safety and costs of transparent versus gauze wound dressings in intravenous catheterization. *J Nurs Care Qual.* 2011 ;26(4):371-6.
  6. Marsh N, Webster J, Flynn J, Mihala G, Hewer B, Fraser J, Rickard CM. Securement methods for peripheral venous catheters to prevent failure: a randomised controlled pilot trial. *J Vasc Access.* 2015;16(3):237-44.
  7. Enes SM, Opitz SP, Faro AR, Pedreira Mde L. Phlebitis associated with peripheral intravenous catheters in adults admitted to hospital in the Western Brazilian Amazon. *Rev Esc Enferm USP.* 2016;50(2):263-71.
  8. Alexandrou E, Ray-Barruel G, Carr PJ, Frost SA, Inwood S, Higgins N, Lin F, Alberto L, Mermel L, Rickard CM; OMG Study Group. Use of Short Peripheral Intravenous Catheters: Characteristics, Management, and Outcomes Worldwide. *J Hosp Med.* 2016;13(5).
  9. Kleidon TM, Cattanach P, Mihala G, Ullman AJ. Implementation of a paediatric peripheral intravenous catheter care bundle: A quality improvement initiative. *J Paediatr Child Health.* 2016;55(10):1214-23.
  10. Göransson KE, Johansson E. Prehospital peripheral venous catheters: a prospective study of patient complications. *J Vasc Access.* 2012; 13(1):16-21.
  11. Wallis MC, McGrail M, Webster J, Marsh N, Gowardman J, Playford EG, et al. Risk factors for peripheral intravenous catheter failure: a multivariate analysis of data from a randomized controlled trial. *Infect Control.* 2014; 35(1):63-8.
  12. Helm RE, Klausner JD, Klemperer JD, Flint LM, Huang E. Accepted but unacceptable: peripheral IV catheter failure. *J Infus Nurs.* 2015;38(3):189-203.
  13. Hadaway L. Infiltration and extravasation. *Am J Nurs.* 2007;107 (8):64-72.
  14. Cicolini G, Bonghi AP, Di Labio L, Di Mascio R. Position of peripheral venous cannulae and the incidence of thrombophlebitis: an observational study. *J Adv Nurs.* 2009;65(6):1268-73.
  15. Carr PJ, Rippey JC, Cooke ML, Bharat C, Murray K, Higgins NS, Foale A, Rickard CM. Development of a clinical prediction rule to improve peripheral
  16. Magerote NP, Lima MHM, Silva JB, Correia MDL, Secoli SR. Associação entre flebite e retirada de cateteres intravenosos periféricos. *Texto Contexto Enferm.* 2011; 20(3):486-92.
  17. Chakdoufi S., Moumen A., & Guerboub A. Dyslipidemia and Diabetic Retinopathy in Moroccan Type 2 Diabetics Patients: A Cross-Sectional Study. *Journal of Medical Research and Health Sciences,* 2023; 6(3): 2471–2479.