

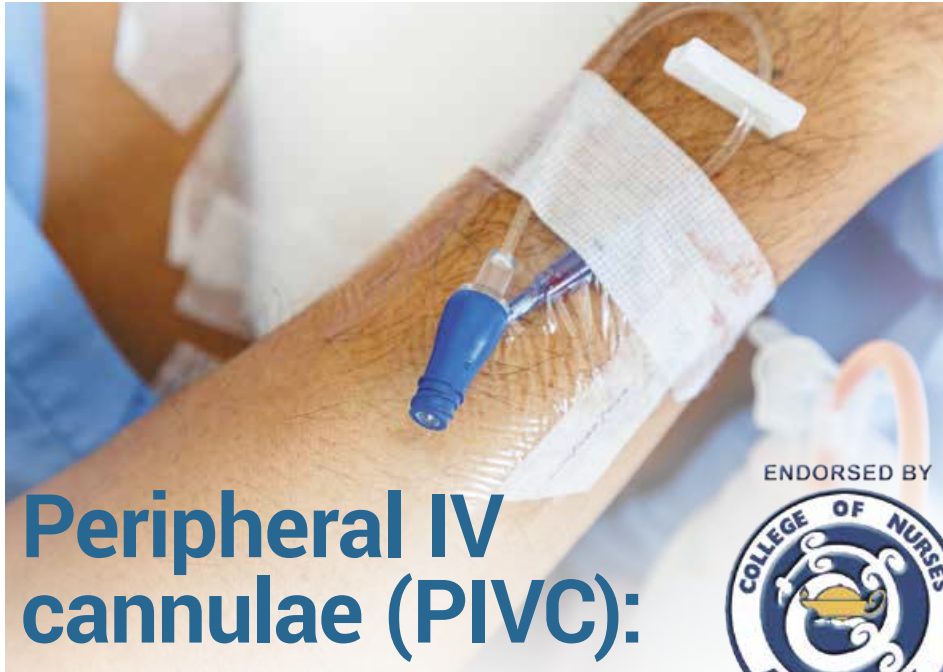
Nursing Review

Professional Development

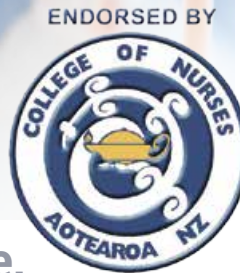


READING, REFLECTION, AND APPLICATION IN REALITY

By Beverley Hopper



Peripheral IV cannulae (PIVC):



Saving a line might just save a life.

It is estimated that over half of all hospital patients have an intravenous catheter inserted. Inserting peripheral intravenous cannulae (PIVC) is now a commonplace procedure; however, more can be done to reduce the risk of complications from these invasive devices. This article highlights the importance of meticulous care, maintenance and documentation of PIVC by nurses.

“Sam” (64) was admitted for elective surgery on his shoulder. He had had a few PIVCs during his admission. Medication from one of these cannulae (in his forearm), had infiltrated the surrounding tissue and the tissue then became necrotic. He required grafts and further surgery. This became infected. The infection went to his shoulder and he required further washouts of his shoulder¹.

Insertion of a PIVC is one of the most common invasive clinical procedures performed in hospitals globally² yet nurses are still not observing, assessing nor documenting the state of these regularly enough to reduce the risk of complications to the patient. PIVCs provide direct access into the venous system. Nurses must ensure that their knowledge and skills are up to date and based on current evidence-based practice to reduce the risk of patients with PIVCs preventing complications³.

Phlebitis

Phlebitis is one of the main complications from PIVC, with research indicating that the

incidence can vary widely from less than 3 per cent up to more than 65 per cent depending on the clinical setting. This broad range suggests poor identification of phlebitis or poor reporting protocols⁴.

Phlebitis is defined as inflammation of the *tunica intima* or inner layer (see Fig. 1) of the vein, characterised by pain, redness and swelling⁵. The area may feel warm with a cord-like appearance of the vein and the patient may feel pain or discomfort when medication is administered.

There are four main types of phlebitis.

Chemical phlebitis is caused by fluid or medication being infused through the cannula. Key factors such as pH and osmolarity (the concentration of a solution) are known to have an effect on the incidence of phlebitis⁶. Blood has a pH of 7.35-7.45. Medications outside this range have the potential to damage the *tunica intima* (Fig. 1), the delicate inner layer of the vein (see Fig. 1), increasing the risk of patients developing phlebitis. This increases the risk

Reading this article and undertaking the learning activity is equivalent to **60 minutes** of professional development.

This learning activity is relevant to the Nursing Council competencies 1.1, 1.4, 2.1, 2.8, 2.9, 4.1, 4.2 and 4.3.

Learning outcomes

Reading and reflecting on this article will enable nurses to:

- » Recognise the signs and symptoms of phlebitis.
- » Summarise the distinguishing features of the four types of phlebitis.
- » Take appropriate action to reduce the risks of phlebitis.
- » Identify the risk factors and potential causes for IV cannula complications.
- » Reflect on improvements that can be made to nursing practice to reduce IV complications.

of further injury to the vein, such as sclerosis, infiltration or thrombosis⁷.

Mechanical phlebitis happens when there is movement of the PIVC within the vein causing inflammation. This can be due to unskilled insertion or with placement of the cannula near a joint or venous valve, poorly secured cannulae, and manipulation of the cannula during administration of medication or fluid⁸. Having an insecure PIVC increases the risk of mechanical and infective phlebitis, with movement of the cannula causing migration of bacteria into the vein⁹.

Infective phlebitis is caused by bacteria entering the vein. Inflammation of the vein may begin as a non-infectious process caused by manipulation of the cannula or irritation from an infusion. Both chemical and mechanical phlebitis can produce inflammatory debris, which may serve as a culture medium for micro-organisms to multiply¹⁰. Once bacteria come into contact with the PIVC, they secrete a glue-like substance that causes the bacteria to stick to the plastic. This slimy protective substance is called biofilm. Antibiotics and white blood cells can't penetrate this layer to kill the bacteria. Flushing and infusions can cause the biofilm to break off and travel into the patient's bloodstream, with the associated risk of bacteraemia¹¹.

Post-infusion phlebitis is an inflammatory response occurring after a PIVC has been removed. While most low-grade phlebitis will resolve when the cannula is removed, phlebitis may occur up to 48 hours later, with some evidence of occurrence up to 96 hours later⁸.

*The Infusion Therapy Standards of Practice*¹² published in 2016 by the Infusion Nurses Society (INS), highly recommends the use of a phlebitis scale that is valid, reliable and clinically

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Septic thrombophlebitis

Septic thrombophlebitis is a rare but serious complication characterised by venous thrombosis and inflammation in the presence of bacteraemia requiring a period of IV antibiotics and a longer hospital admission⁶. Assessment and diagnosis involves removal of the IV cannula; medical intervention includes ultrasound for clear diagnosis, blood cultures and commencement of appropriate antibiotic treatment.

FIG.1 Diagram of a vein showing the three tunica layers

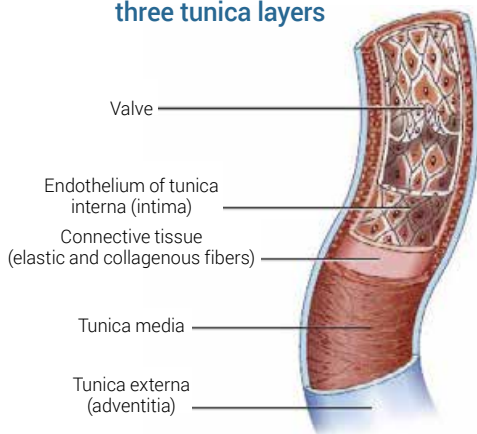


FIG. 2 VISUAL INFUSION PHLEBITIS SCORE (VIP)

IV. site appears healthy	0	No sign of phlebitis » Observe cannula
One of the following is evident » Slight pain near IV site » Slight redness near IV site	1	Possible first signs of phlebitis » Observe cannula
Two of the following are evident » Pain near IV site » Erythema » Swelling	2	Early stage of phlebitis » Resite cannula
All of the following are evident » Pain near along the path of the cannula » Erythema » Induration	3	Medium stage of phlebitis » Resite cannula » Consider treatment
All of the following are evident and extensive » Pain along the path of the cannula » Erythema » Induration » Palpable venous cord	4	Advanced stage of phlebitis or start of thrombophlebitis » Resite cannula » Consider treatment
All of the following are evident and extensive » Pain along the path of the cannula » Erythema » Induration » Palpable venous cord » Pyrexia	5	Advanced stage of thrombophlebitis » Initiate treatment » Resite cannula

Developed by Andrew Jackson. Consultant Nurse IV Therapy. Rotherham General Hospital. NHS. UK

feasible; for example, the Jackson VIP Scale (Fig. 2). Intravenous Nursing New Zealand¹³, supports the use of the Infusion Therapy Standards of Practice to promote a consistent approach to catheter management when monitoring phlebitis. Interestingly, a systematic literature review published in 2014¹⁴ identified more than 70 different phlebitis assessment scales in use worldwide. Nurses still need to be aware of the treatment required for the different types of phlebitis.

Management of phlebitis

Nurses should determine the possible aetiology of the phlebitis as noted below; apply a warm compress; elevate the limb; provide pain relief as needed; consider other pharmacologic interventions, such as anti-inflammatory agents; and use a visual scale, like the Jackson VIP Scale (Fig. 2), to consider whether removal (resiting) of the cannula is necessary^{10,11}. For example, if two of the following three are evident: pain near the IV site, erythema or swelling, no matter what the aetiology of the phlebitis, the PIVC must be removed and resited.

Chemical phlebitis: evaluate the infusion therapy and need for different IV access (e.g. central venous access device), different medication, or a slower rate of infusion; determine if removal of the PIVC is needed. Provide interventions as above^{10,11}.

Mechanical phlebitis: stabilise the IV cannula, apply heat, elevate the limb, and monitor closely. If signs and symptoms persist after 48 hours, consider removing PIVC as per Jackson VIP Scale (Fig. 2)^{10,11}.

Infective phlebitis: if suspected, (pain, erythema, swelling), remove the PIVC. Follow local policy regarding microbiology culture to identify the organism and incident reporting. Medical assessment will be required for the

initiation of any antibiotic treatment. Monitor for signs of systemic infection^{10,11}.

Post-infusion phlebitis: if this appears to be a bacterial source, ensure that medical review is initiated, monitor for signs of systemic infection; if nonbacterial, apply warm compress, elevate limb, provide analgesics as needed, and consider other pharmacologic interventions, such as anti-inflammatory agents or corticosteroids as necessary^{10,11}.

Reducing the risks of phlebitis

Having a skilled practitioner or IV team inserting IV cannulae is proven to reduce many complications of PIVC¹⁵. IV teams are not always practical for all settings, but having skilled, trained IV practitioners who regularly update their skills and knowledge is a necessity for improving clinical quality and reducing risk. It has been demonstrated that skilled cannulators have a significantly higher first-time insertion rate, which is associated with a lower incidence of phlebitis and failure¹⁶.

Chemical phlebitis

» patients at risk may need to be referred for a central venous access device, such as a peripherally inserted central catheter (PICC) depending on the pH and tonicity of the medications to be administered⁷.

Mechanical phlebitis

- » Prevent movement by carefully securing the cannula with a sterile, occlusive, transparent semipermeable polyurethane dressing⁹.
- » Ensure the cannula hub is not directly accessed close to the insertion site⁹.
- » Keep dressing dry and redress if the dressing loses its integrity.
- » Select the smallest practical cannula for the largest possible vein.
- » Avoid placing PIVCs near to joints i.e. ante-cubital fossa, to reduce irritation of the vessel wall by the tip of the cannula during movement⁹.

Infective phlebitis

As above (mechanical phlebitis), plus:

- » Strict hand hygiene.
- » Clipping excess hair from the preferred insertion site.
- » Ensure strict aseptic non-touch technique during insertion of the cannula.
- » Perform skin antisepsis with >0.5 per cent Chlorhexidine/70 per cent alcohol¹², cleansing the skin with friction for 30 seconds and allow the solution to dry naturally. If a Chlorhexidine/alcohol solution is contraindicated, consider using povidone-iodine or 70 per cent alcohol wipes.
- » No repalpating of the preferred site after cleansing.
- » Use appropriate sterile IV dressing.
- » 'Scrub the hub' of the needleless connector every time the cannula is accessed with single use disinfecting agent e.g. 70 per cent alcohol wipes or >0.5 per cent Chlorhexidine/70 per cent alcohol wipe, for at least 15 seconds¹².
- » Check the integrity of the PIVC dressing.
- » Carefully remove the dressing that has lost its integrity and replace with new sterile dressing, taking care not to manipulate the sited cannula.
- » Only use flush solutions from a single use system. Minimum of 10mL pre- and post-IV medication or according to local medication policy¹¹.

Post-infusion phlebitis

A recent Australian study¹⁷ noted that the main predictor of post-infusion phlebitis was cannulae inserted under emergency situations, reinforcing the following recommendations:

- » Replace all PIVC inserted under emergency conditions as soon as feasibly possible, i.e. within 24 to 48 hours¹².
- » Observe the insertion site for at least 48 hours after removal of the cannula.
- » Educate the patient or family on discharge about signs and symptoms of phlebitis¹⁷.

Peripheral IV cannulae (PIVC): Saving a line might just save a life.

Reducing the risk of other PIVC complications

Nurses also need to be cognisant of other complications leading to PIVC failure.

A quarter of PIVCs fail through accidental dislodgement or occlusion. Infiltration and extravasation (see Definitions box), haematoma formation or thrombophlebitis and septic thrombophlebitis may then occur¹⁸. It has been suggested that the use of visualisation devices (infrared or ultrasound) can increase the success of first-attempt insertion and decrease trauma to the patient¹⁹.

Definitions

Infiltration: the inadvertent leakage of non-vesicant solution into surrounding tissue.

Extravasation: the inadvertent leakage of a vesicant solution into surrounding tissue¹³.

Vesicant: medications that can cause blistering on infusion – generally not suitable for infusion via a peripheral IV cannula^{13,18}.

Good PIVC management

Early identification and intervention are critical to prevent serious adverse events, such as extensive tissue injury or nerve injury leading to compartment syndrome requiring surgical intervention²⁰.

If a patient reports any burning or stinging at or around the insertion site or anywhere along the venous pathway:

- » stop infusion immediately
- » disconnect the IV tubing from the PIVC
- » attempt aspiration of the residual medication from the cannula
- » remove the cannula
- » notify the medical team or senior nurse as further intervention may be required depending on the factors related to the injury¹³.

Elevation of the affected limb for up to 48 hours may help with reabsorption of the infiltrate. Local thermal treatment depends on the pharmacological agent infused and expert advice should be sought as to whether heat or cold is appropriate²⁰.

If an extravasation injury does occur, ensure that the appropriate documentation is completed using an approved extravasation scale and following local policy for reporting¹³.

REFERENCES

1. Personal anecdote of Beverley Hopper.
2. AHLQVIST M, BERGLUND B, NORDSTROM G, KLANG B ET AL. (2010). A new reliable tool (PVC assess) for assessment of peripheral venous catheters. *Journal of Evaluation in Clinical Practice* 16 (6), 1108-15.
3. NURSING COUNCIL OF NEW ZEALAND (2007). Competencies for Registered Nurses. Retrieved September 2016 from www.nursingcouncil.org.nz/Publications/Standards-and-guidelines-for-nurses.
4. OLIVEIRA A & PARREIRA P (2010). Nursing interventions and peripheral venous catheter-related phlebitis. Systematic literature review. *Referência: Scientific Journal of the Health Sciences Research Unit: Nursing* 3(2), 137-47.
5. DOUGHERTY L (2008). Peripheral Cannulation. *Nursing Standard* 22 (52), 49-56.
6. HIGGINSON R (2011). Phlebitis: treatment, care and prevention. *Nursing Times* 107 (36), 18-21.
7. KOKOTIS K (2015). Preventing chemical phlebitis. *Nursing* 28 (11), 41-7.
8. MACKLIN D (2003). Phlebitis: A painful complication of peripheral IV catheterization that may be prevented. *The American Journal of Nursing* 103(2), 55-60.
9. HIGGINSON R (2015). IV cannula securement: protecting the patient from infection *British Journal of Nursing* (8)24, S23-S28.
10. MALACH T, JERASSY Z, RUDENSKY B, SCHESINGER Y ET AL. (2006). Prospective surveillance of phlebitis associated with peripheral intravenous catheters. *American Journal of Infection Control* 34 (5), 308-12.

Correct PIVC placement and observation

Key factors to a successful infusion include ensuring correct placement and stabilisation of the cannula (with the patient reporting no pain or burning), and no swelling around the insertion site. The recommended guides should be carefully adhered to during infusion of any medication or fluid to reduce the risk of tissue injury and loss of the PIVC. The cannula insertion site should also be assessed and observed at least every four hours²⁰.

Placement of PIVCs is recommended in forearm veins as opposed to the hand, wrist or ante-cubital fossa as the forearm sites are less prone to occlusion, accidental dislodgment and phlebitis²¹. Nurses are well placed to advocate for their patient to have a central venous access device (CVAD) placed for the administration of vesicant medications¹⁸.

Flushing protocols and administration of IV medications

There is very little research and a high degree of practice variation in the maintenance of PIVC, including the role of flushing to prevent complications. It is highly recommended that nurses refer to the manufacturer's guidelines and local organisational policy for the recommended preparation and speed of infusion in order to prevent vein injury²¹. For example: *1.2g Amoxicillin plus Clavulanic Acid (Augmentin). Administration notes: Inject slowly over three to four minutes*²².

Good documentation

Documentation is essential for accountability, as well as the maintenance of a high standard of professional practice; however, it is often

overlooked, especially when the workload is high²¹.

The use of a pre-printed care plan can be useful. An example used in one New Zealand hospital includes documentation of:

- » Patient information and consent
- » date and time of insertion
- » name and signature of cannulator
- » location, type and gauge of cannula
- » indication for use.

Ongoing care documentation should include:

- » cannula checked & cannula required
- » needleless access device insitu
- » dressing intact & dated
- » cannula flushed (flush solution)
- » VIP score & indication for use
- » cannula removed – including date, time and reason^{12,13,21}.

Conclusion

Early recognition of IV complications through regular assessment and observation enables appropriate and timely intervention, minimising disruption to the patient's treatment, improving patient outcomes, as well as reducing healthcare costs involved in extra treatment and procedural requirements and increased bed days from unnecessary complications.

The following quote reinforces the intent of this article:

"Penetration of a patient's natural protective skin barrier with a foreign body that directly connects the outside world to the bloodstream for a prolonged period of time is not to be taken lightly. Insertion of an IV catheter is an invasive procedure that introduces multiple risks and potential morbidities, and even mortalities, and should be given the respect that it deserves."²³

Recommended Resources

AVATAR is an Australian-based teaching and research group aimed at "making vascular access complications history": www.avatargroup.org.au

Intravenous Nursing New Zealand (IVNNZ Inc.) is an affiliated international member of the Infusion Nurses Society (INS) and is dedicated to Best Practice Recommendations and Standards of Practice for Infusion Therapy: www.ivnnz.co.nz

Infusion Nurses Society (2016). Infusion Therapy Standards of Practice *Journal of Infusion Nursing* 39 (1S).

About the author:

- » Beverley Hopper RN MHP (Nursing), PG Cert (Orthopaedics), BHSc (Nursing) is the Clinical Nurse Specialist (Outpatient IV Antibiotics) at Waitemata District Health Board.

This article was peer reviewed by:

- » Catharine O'Hara RN MN, Clinical Nurse Specialist (Lead) Intravenous and Related Therapy at MidCentral District Health Board's Department of Anaesthesia and ICU
- » Rachael Haldane RN BN PGDip HSc, Clinical Nurse Specialist, Infusion Services, Nurse Maude, Christchurch.

11. RYDER M (2005). Catheter related infections: It's all about the bio-film. *Topics in Advanced Practice Nursing eJournal* 5 (3).
12. INFUSION THERAPY STANDARDS OF PRACTICE (2016). Retrieved September 2016 from www.anzctr.org.au/AnzctrAttachments/369954-INSper cent20Standardsper cent20for per cent20Practice%202016.pdf.
13. INTRAVENOUS NURSING NEW ZEALAND. (2012). Retrieved September 2016 from www.ivnnz.co.nz/files/file/7672/IVNNZ_Inc_Provisional_Infusion_Therapy_Standards_of_Practice_March_2012.pdf
14. RAY-BARRUEL G, POLIT D, MURFIELD J & RICKARD C (2014). Infusion phlebitis assessment measures: a systematic review. *Journal of Evaluation in Clinical Practice* 20 (2), 191-202.
15. WALLIS M, MCGRAIL M, WEBSTER J, MARSH N ET AL (2014). Risk factors for peripheral intravenous catheter failure: a multivariate analysis of data from a randomised control trial. *Infection Control and Hospital Epidemiology* 35 (1), 63-8.
16. DA SILVA G, PRIEBE S, DIAS F (2010). Benefits of establishing an intravenous team and the standardisation of peripheral intravenous catheters. *Journal of Infection Nursing* 33 (3), 156-60.
17. WEBSTER J, MCGRAIL M, MARSH N, WALLIS M ET AL (2015). Post-infusion phlebitis: incidence and risk factors. *Nursing Research and Practice*, 2015.
18. SIMONOV M, PITTIRUTI M, RICKARD C, CHOPRA V (2015). Navigating venous access: A guide for hospitalists. *Journal of Hospital Medicine* 10 (7), 471-8.
19. SALGUIRO-OLIVEIRA A, PARREIRA P, VEIGA P (2012). Incidence of phlebitis in patients with peripheral intravenous catheters: the influence of some risk factors. *Australian Journal of Advanced Nursing* 30 (2), 32-9.
20. DOELLMAN D, HADAWAY L, BOWE-GEDDES L, FRANKLIN M, ET AL. (2009). Infiltration and extravasation: Update on prevention and management. *Journal of Infusion Nursing* 32 (4), 203-11.
21. BROOKS N (2016). Intravenous cannula site management. *Nursing Standard* 30, 53-62.
22. New Zealand Hospital Pharmacists Association (2015). Notes on injectable drugs (7th ed.) Wellington, New Zealand.
23. HELM R, KLAUSNER J, KLEMPERER J, FLINT L, ET AL (2015). Accepted but unacceptable: Peripheral IV catheter failure. *Journal of Infusion Nursing* 38 (3), 189-203.

Professional Development

RRR READING, REFLECTION, AND APPLICATION IN REALITY

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NursingReview

Reading the article and completion of this *Peripheral IV Cannulae (PIVC): Saving a line might just save a life* learning activity is equivalent to **60 minutes** of professional development.

This learning activity is relevant to the NZNC competencies 1.1, 1.4, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 3.1, 3.2, 3.3, 4.1, and 4.3.

Please discuss all your answers with your peer/s.

Learning outcomes

Reading and reflecting on this article will enable nurses to:

- » Recognise the signs and symptoms of phlebitis.
- » Summarise the distinguishing features of the four types of phlebitis.
- » Take appropriate action to reduce the risks of phlebitis.
- » Identify the risk factors and potential causes for IV cannula complications.
- » Reflect on improvements that can be made to nursing practice to reduce IV complications.

A READING

- 1 Read your organisational policy on IV cannulation, care and maintenance. Is it reflective of current evidence-based guidelines?

B REFLECTION

- 1 Reflect on how to increase awareness of the human and financial cost of PIVC complications and failure.
- 2 Reflect on your own practice of caring for a patient who has an IV cannula. What was the reason for the IV cannula insertion? Was the time and date of insertion documented?

C Applying in REALITY

- 1 Review the documentation practices in your workplace and discuss with a peer how this could be improved.
- 2 Identify which Phlebitis Scoring Tool your workplace uses. Discuss the advantages of using a Phlebitis Scoring Tool with a peer.
- 3 What are some changes that you could implement to improve patient outcomes in your workplace with regard to PIVC care and maintenance?

Verification by a colleague of your completion of this activity

Colleague name

Designation

Date

Nursing council ID

Work address

Contact #

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