

Phlebitis prevention protocol; a guide for nursing and allied health care staff

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ABSTRACT

It is very often seen that a client, a health consumer admitted to the hospital, must be Cannulated to get venous access for fluid therapy, parenteral nutrition, administration of drugs, blood and its products, and other diagnostic tests. The insertion of an IV cannula helps us to gain quick access to the circulatory or vascular system and is kept in the vein for quite some time or days till the objectives are achieved. One of the significant complications of cannulation is a risk for Phlebitis. Phlebitis is the inflammation of the vein (tunica intima) and is a common complication associated with the use of peripheral intravenous catheters. It can cause infection or thrombus formation. Symptoms develop in hours to days and resolve over days to weeks. Phlebitis prevention plays a vital role in easing the sufferings of the patients by reducing the chances of getting re-cannulated. Phlebitis must be assessed by the infusion nurses society (INS) proposed scale. JMS: 2023; 26(1):50-56 DOI: <https://doi.org/10.33883/jms.v26i1.1253>

INTRODUCTION

Peripheral venous cannulation has revolutionised the practice of drug administration. It is a common practice in hospitals to allow the infusion of medications, hydration fluids, blood products and nutritional supplements.¹

Along with the benefits, several potential complications are associated with IV cannulations, ranging from minor pain to severe thrombophlebitis and catheter-related infections.^{2,3}

In healthcare practice, infection control plays an important role. For example, hospitals have seen many patients get infected through hospital-acquired infections (UTI, CAI, CLAI, CLABSI, suppurative thrombophlebitis, etc.), possessing a primary threat to healthcare staff.

Most of the patients admitted to the hospital are given some medications intravenously by inserting a catheter. Intravenous catheters cause trauma to the vascular endothelium and inflammation. The inflammation of the tunica intima of a superficial vein causes peripheral catheter-related Phlebitis. The rash is due to irritation of the tunica intima by mechanical, chemical or bacterial sources. If left untreated, it can lead to infection or thrombus

formation.⁴ It has been observed that thrombophlebitis is one of the most frequently associated complications of peripheral vein infusion, occurring in up to a fourth of hospitalised patients receiving intravenous therapy.⁵

Therefore, the nursing staff is responsible for minimising the incidence of Phlebitis while ensuring that patients receive treatment in an appropriate and timely manner. Nursing professionals' knowledge regarding intravenous cannulation is essential. This knowledge will help them in the early recognition of risk factors for the development of Phlebitis, which can reduce the incidence of Phlebitis.⁶

RISK FACTORS OF PHLEBITIS

The primary factors leading to Phlebitis can be broadly divided into;

1. Mechanical causes:

a) **Catheter Size:** choosing an inappropriate cannula diameter can increase the rate of Phlebitis, and the risk increases with increasing diameter.

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b) Catheter Material & Catheter Length: A polyurethane catheter effectively prevents Phlebitis due to its softness, and a 30-50% reduction in phlebitis occurrence is reported compared to polytetrafluoroethylene (Teflon) catheters. Longer catheters have been observed to have a decreased incidence of infiltration, and extravasation, which is especially important when infusing highly irritant (e.g. vesicant) substances.

c) Insertion of cannula near Articulation: The distal areas of the upper extremities are optimal for site selection. Catheters inserted into the lower limbs have a greater risk of Phlebitis. Site selection near areas of flexion may predispose to Phlebitis due to excessive movement causing vessel wall trauma. The basilic or cephalic veins on the posterior (dorsal) non-dominant forearm are the preferred site for catheterisation.

d) Method of Immobilization: The securing of the peripheral intravascular cannula with some other has been observed to increase the risk of Phlebitis, infection, occlusion, infiltration and dislodgement.

e) Dwell time: Incidence of Phlebitis increases when catheters are left in place for > 72 hours, and the incidence of Phlebitis is highest when catheters are left in place for > 96 hours.^{2,7}

2. Chemical causes:

a) Infusion of the medications or fluids with variable pH or osmolality like phenytoin, potassium chloride, antibiotics like levofloxacin, piperacillin-tazobactam, vancomycin etc. There is a significant risk of developing chemical Phlebitis if the pH and osmolality in the medications and solutions differ concerning their blood values.

b) Hypertonic solutions with an osmolality greater than 450mOsm/l and those with a pH of less than 5.0 are associated with the frequent occurrence of Phlebitis.^{2,8}

3. Bacterial causes due to use of contaminated IV solution, tubing, catheter or insertion site and absence of aseptic precautions while cannula insertion and handling like hand rub/hand washing, use of gloves, etc.

4. Patient-related causes which have been implicated in the development of Phlebitis are the elderly age group, females, those who have poor quality peripheral veins, presence of underlying medical conditions, including cancer, receiving chemotherapy or having

immunodeficiency.¹⁰

PATHOPHYSIOLOGY

Various factors can influence the development of Phlebitis. The inadequate technique while inserting the cannula, characteristics of the selected vein, multiple drugs, incompatibility of medications administered, ineffective filtration, wide bore cannula, length of IV cannulas, material etc.⁹

When a cannula is inserted in the vein, its movement inside the vein causes friction and inflammation, or when the cannula is too wide for the vein, chemical Phlebitis, caused by the drug or fluid infused through the catheter, where factors such as pH and osmolality can significantly impact the incidence of Phlebitis; bacterial, when bacteria penetrate the vein, starting as an inflammatory response to catheter insertion and subsequent colonisation of the site by bacteria; can lead to the development of Phlebitis and eventually may become a cause for systemic sepsis.^{2,9}

SIGNS & SYMPTOMS

The signs and symptoms of Phlebitis include:

The tender area along the superficial veins on the skin.

An extended, thin red area may be seen as the inflammation follows an external vein.

Rigid arm and a tender spot near the Phlebitis site.

The itchy and swollen area near the Phlebitis site.

A low-grade fever may occur.

Redness, fever, pain, swelling and skin breakdown

PREVENTION OF PHLEBITIS AND NURSE'S RESPONSIBILITY

The various measures recommended for the prevention of Phlebitis based upon identification of risk factors of Phlebitis are given in general recommendations followed by specific recommendations related to various aspects of cannulation as

1. General Recommendations:

a) The nursing professionals should choose an appropriate intravascular Device (IVD)-considering catheter type, number of lumens, length, type of therapy, site of insertion, risk of complications including infection, and patient factors.¹¹

b) Only competent nursing staff (or training staff

supervised by competent staff) should insert IVDs to minimise infection and other complications.

- c) The professional nurse must explain the procedure and its need to the patient (if possible) or parent/guardian.
- d) Nursing professionals should set up all sterile fields immediately before the IV procedure.
- e) Nursing professionals should maintain accurate documentation and record-keeping to ensure patient safety, allow for audits, and track infection outbreaks.
- f) Nursing professionals should educate patients on symptoms of Phlebitis or infection and encourage them to alert nursing staff on duty or treating clinicians to any changes or concerns or for recanalisation.

2. Specific Recommendations related to risk factors:

2.1 Hand hygiene:

- a) The nursing professionals must perform hand hygiene with an antiseptic-containing soap solution or use an alcohol-based waterless cleanser, before and after palpating catheter insertion sites, before and after accessing, repairing, or dressing an intravascular cannula
- b) The nursing staff should use gloves, but at the same time, gloves should never replace the need for hand hygiene.
- c) The nurse practitioner should take the opportunity to educate the patients and attendants about the importance of hand wash or hand hygiene with alcohol-based hand rub.

2.2 Cannula site selection:

- a) The nurse must consider factors such as pre-existing catheters, anatomic deformity, site restrictions (e.g. mastectomy, arterio-venous [AV] fistula or graft), the relative risk of mechanical complications and the risk of infection before cannula site selection.¹²
- b) The distal areas of the upper extremities are optimal for site selection.
- c) The nursing professionals must ensure that subsequent catheterisation should be made proximal to the previously catheterised site.
- d) Nursing staff should avoid cannulation of lower limbs as it poses a greater risk of thrombophlebitis and thrombosis than the upper limbs unless indicated or recommended.
- e) The nursing professionals must ensure that cannulas

inserted in a lower extremity site should be replaced with an upper extremity site as soon as possible in case of patients have no such indication.

2.3 Veins of Cannulation:

- a) The nurse practitioner should select veins of the non-dominant forearm over veins of the dominant arm.
- b) The nursing professionals should prefer basilic or cephalic veins on the posterior (dorsal) forearm for cannulation. The metacarpal veins on the dorsum of the hand are the easiest to visualise. Still, they are more liable to block, difficult to stabilise, and prone to infusate or medication-induced vessel damage.
- c) The nursing staff should use forearm veins as it has been observed that cannulating these veins significantly lowers the risk of Phlebitis than the dorsal veins of the hand.
- d) The movement areas like joints should be avoided as this may predispose to Phlebitis (due to excessive movement causing vessel wall trauma). However, this may not always be possible in an emergency (e.g. resuscitation) when the Antecubital fossa is recommended due to the need for a larger vessel.

2.4 Cannula types and materials:

- a) nursing professionals should always prefer polyurethane catheters over tetrafluoroethylene-hexafluoropropylene (Teflon) or silicone cannulas in the hospital supply.
- b) nursing professionals should avoid using steel needles due to the risk of extravasation and needle stick injury.

2.5 Cannula Size:

- a) The nursing professionals should consider the patient's age, the condition of veins, the degree of cardiovascular stability, and Medical or surgical interventions required before cannulation.
- b) The nursing professionals should cannulate the patient as per the prescribed therapy, preferably with a short and small cannula.
- c) The nurse should also consider the size of the target vein when selecting cannula size;
- d) The nursing staff should use large bore cannulas for rapid infusions or resuscitation. However, high flow rates are only achieved if the catheter is inserted into a significant (low resistance) vein.

- e) The nursing professionals should consider a peripheral intravascular central line or central venous catheter for patients with cardiovascular instability, intended extensive surgery, or those requiring long-term intravenous therapy after discussing the same with consulting physician or surgeon.

2.6 Skin Preparation for Cannulation:

Skin is to be prepared before cannulating a patient, and the following steps are ensured before it.

- a) The nursing staff must remove hair at the insertion site before antiseptic application using clippers to improve dressing adherence.
- b) The nursing professionals should clean the skin with soap and water (if the site is soiled and found necessary) before applying the antiseptic solution and inserting the catheter.
- c) The nursing staff should use alcohol-containing skin preparatory agents like chlorhexidine or povidone-iodine if no contraindication exists to prepare the skin for this invasive procedure.
- d) The nurse should have a solution containing 2% chlorhexidine gluconate (CHG) in $\geq 70\%$ (ethyl or isopropyl) alcohol (alcoholic chlorhexidine) as is recommended for the preparation of the insertion site.
- e) The nursing Practitioner should wait to let the solution containing povidone-iodine 10% in 70% ethyl alcohol (ethanol) dry before inserting the cannula.
- f) The nurse should avoid the use of alcohol-based sanitisers if contraindicated (e.g. for allergy, sensitivity, or skin condition)
- g) The nursing professionals should apply the solution meticulously to an area of skin approximately 10cm x 10cm in a circular motion beginning in the centre of the proposed site and moving outward for at least 30 seconds.
- h) The nurse should ensure the insertion site is not touched or palpated after applying antiseptic unless the aseptic technique is maintained.

2.7 Catheter fixation:

- a) The nursing professionals should stabilise the cannula with a transparent dressing (Tegaderm) and sterile adhesive tape or sterile adhesive/wound closure strips to prevent catheter dislodgement.

- b) The nurse should use a short extension set attached to the catheter can reduce complications associated with catheter movement.

2.8 Peripheral IV Cannula reassessment:

- a) The nursing staff should inspect the insertion site visually every hour with continuous infusions and at least every eight hours if there is no infusion. Frequent assessments are necessary when using high-risk solutions and medications like chemotherapy, blood transfusions, electrolytes etc.
- b) The nurse must document the review of the cannula in the patient record during each shift.
- c) The nursing staff should encourage the patients to report any discomfort, such as pain, burning, swelling or bleeding.
- d) The nurse should ensure that the cannula is assessed in each shift and remove those cannulas promptly that are no longer needed.

2.9 Catheter duration and re-insertion:

It is recommended that facilities locally determine through their Infection Control Committee which of the following two options they will adopt. A single possibility should be selected for the entire facility and implemented by the nursing officials in their respective wards.

Option 1:

- a) Replace cannula every 72-96 hours unless extenuating circumstance criteria are met.
- b) Cannula should be removed when they are no longer required.
- c) If it can be forecast that a cannula would be in situ for more than 96 hours, an alternative device should be considered, such as a peripherally inserted central catheter (PICC).
- d) If the cannula is in situ for 72-96 hours and is necessary for an extended period, it should be removed and resited at this time.
- e) In extenuating circumstances, a cannula may be left in situ after 96 hours if all of the following criteria are fulfilled:
 - ☞ The patient has abysmal peripheral access
 - ☞ No one else can cannulate the patient
 - ☞ The patient still requires peripheral access

- ☞ The cannula is patent
- ☞ There is no sign or symptom of Phlebitis.
- f) Cannula should be removed at the first sign of Phlebitis (warmth, tenderness, erythema, palpable venous cord).
- g) Catheters inserted in emergencies, when adherence to asepsis cannot be ensured, should be replaced within 24 hours or sooner if the patient's condition is stabilised.
- h) Replace all fluid administration tubing and connectors when the cannula is replaced.

Option 2:

- a) Replacement of a cannula when clinically indicated
- b) Clinically indicated replacement of cannula, with daily and random cannula site assessment, has been shown in some studies to lower healthcare expenditures without posing any additional risk of complication, including phlebitis or catheter-related bloodstream infection.¹³
- c) A recent study observed the highest incidence of Phlebitis within the first 48 hours of insertion, which decreased for catheters remaining in place 49-96 hours, and was lowest between 97-120 hours.^{15,16}
- d) It has also been observed that the first cannula is the least likely to fail, with subsequent resites failing more often due to occlusion and Phlebitis.
- e) Remove the cannula at the first sign of Phlebitis and when no longer required.
- f) Cannula inserted in emergencies, when adherence to asepsis cannot be ensured, should be replaced by a clinician within 24 hours or sooner if the patient's condition is stabilised.
- g) Replace all fluid administration tubing and connectors when the cannula is replaced.¹⁴

NURSING INTERVENTIONS IN CANNULATION

Intravenous cannulation is when a small plastic tube (a cannula) is inserted into a peripheral vein. The subsequent venous access can administer fluids, medication and nutrition. The technique of cannulation can be performed in four steps; explanation and consent, preparation, procedure and aftercare.

Explanation and consent:

- a) The nursing staff must identify the correct patients undergoing intravenous cannulation.

- b) The nursing professional should confirm the credentials like MRD Number, Patient ID, surname, forename and date of birth as applicable.
- c) The nursing professionals must explain the procedure to the patient or attendant and obtain verbal/informed consent from the patient or legal heir before commencing the procedure.
- d) The nursing staff should ask about the relevant history of any blood clotting disorders or medications that affect blood clotting (e.g. warfarin).
- e) The nursing staff should ask about needle phobia and the preferred location of the cannula if the patient's anatomy and disease condition permit.

Preparation:

- a) The nursing staff should decontaminate their hands and clean their trolley and plastic tray for intravenous cannulation.
- b) The nursing professional must check the expiry dates on the Intravenous cannula and other equipment/materials for cannulation.
- c) The clinical nurse must ensure that the patient is lying down throughout the procedure and should continually observe the patient.
- d) The clinical nurse should select an appropriate cannula based on the patient's purpose, duration of use, need and age.
- e) The nursing professional should select a smaller cannula suitable for cannulation.
- f) The nursing staff should inspect the cannula before insertion to ensure the needle is fully inserted into the plastic cannula and that the needle tip is not damaged.
- g) The nursing staff should ensure that the patient is comfortable and the arm is supported.
- h) The nursing staff must obtain assistance from another staff member or assistant if necessary, e.g. if the patient is nervous or in pediatric patients.
- i) The nursing staff should apply a tourniquet after selecting a suitable vein and continue the procedure.

Procedure:

Pre-procedure steps:

- a) The nursing staff should put on their gloves and apron.

b) The nurse should clean the puncture site with a chlorhexidine or alcohol-based wipe (in a cross-hatch formation) and allow it to dry.

c) The nurse should apply the tourniquet and not palpate the cleaned skin.

Intra-procedure steps:

a) The nurse should place traction on the skin below the intended puncture site.

b) The clinical nurse should insert the cannula with the bevel up at an angle of 30 degrees into the puncture site.

c) After puncturing the skin, the nurse should advance the cannula and observe a flashback of blood in the bushing of the cannula.

d) The nurse should gently remove the stylet of the needle backwards, keeping it still inside the cannula so that the needle will not puncture the vein at the second site.

e) The nurse should hold the cannula wings whilst advancing the cannula forward, over the needle and entirely into the vein.

f) The nurse should release the tourniquet and dispose of the needle into the sharps bin after destroying it in the needle destroyer.

g) The nurse should connect the bioreactor to the cannula.

h) The clinical nurse should secure the cannula with the sterile semi-occlusive or transparent dressing. Ensure not to cover the puncture site with the tape when securing it down, as this can cover up any possible phlebitis developing.

Post-procedure steps:

a) The nurse should flush the bioreactor and cannula with 5 ml of normal saline. If no resistance should be felt, it confirms the safe insertion of an intravenous cannula.

b) The nurse must wait and check for any signs of extravasation around the cannula site and should remove the cannula if evident or suspected.

c) The nursing professional should discard all waste into the correct disposal bins and ensure the patient is comfortable.

d) The nurse should remove their gloves and sanitise their hands.

Aftercare:

a) The nursing staff should instruct the patient to inform

the nursing staff if the cannula site becomes painful, red, hot, or swollen or if the area around the cannula feels wet or the dressing is coming loose.

b) Acknowledge the patient's patience and leave the patient's bedside.

c) The nurse must ensure that the correct cannula insertion documentation is filled out completely and placed in the patient's records.

CONCLUSION

In clinical practice, we see that in most cases, cannulation procedures are being done by nursing professionals or anaesthesia residents for the overall benefit of the patient. Still, all healthcare workers must be vigilant to check for any sign of Phlebitis in the patient. The same should be brought to the notice of the concerned nursing professional for further assessment and intervention as required so that Phlebitis can be prevented or appropriate remedial action can be taken. At the same time, each hospital in developing countries should have its Infection control committees that assess intravenous lines for Phlebitis by having infusion or intravenous line nurses as members.

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