

Peripheral intravenous (IV) device management

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Introduction

Peripheral intravenous catheters (PIVCs) are the most commonly used intravenous devices in hospitalised paediatric patients. They are primarily used for therapeutic purposes such as administration of medications, fluids, and blood products.



Illustration by The Royal Children's Hospital, Melbourne

Aim

The aim of this guideline is to provide an outline of the ongoing maintenance and management of the PIVC for patients in hospital, outpatient, and home healthcare settings. For information related to insertion of PIVC, please refer to intravenous access guideline (https://www.rch.org.au/clinicalguide/guideline_index/Intravenous_access_Peripheral/) (https://www.rch.org.au/clinicalguide/guideline_index/Intravenous_access_Peripheral/). Nurses who are deemed competent in IV insertion could continue to insert PIVC in consultation with NUM/CSN's. For information regarding extravasation injuries please see the [Peripheral extravasation injuries initial management and washout procedure CPG](https://www.rch.org.au/clinicalguide/guideline_index/Peripheral_extravasation_injuries_initial_management_and_washout_procedure/) (https://www.rch.org.au/clinicalguide/guideline_index/Peripheral_extravasation_injuries_initial_management_and_washout_procedure/).

Definition of terms

- A **peripheral intravenous catheter (PIVC)** is a thin plastic tube inserted into a vein using a needle. PIVCs allow for the administration of medications, fluids and/or blood products.
- **Aseptic technique** – aims to prevent pathogenic microorganisms in sufficient quantity to cause infection, from being introduced to susceptible sites by hands, surfaces and equipment. Therefore, unlike sterile techniques, aseptic techniques are possible and can be achieved in typical hospital and community settings. It is a set of practices designed to reduce contamination and protect the patient from infection during invasive procedures such as PIVC insertion and maintenance. Maintaining asepsis is crucial for preventing microorganisms from entering the patient
- **Decontaminate hands** – Effective hand hygiene is an essential component of Aseptic Technique. Hand hygiene is performed to protect the patient from organisms which may enter their key sites or key parts during a procedure.
- **Extravasation** refers to the leaking of a fluid or medication into extravascular tissue from a peripheral intravenous (IV) cannula or central venous access device (CVAD) with potential to cause short or long term tissue damage.
- **Key Parts** are parts of the device/s that must remain aseptic throughout the clinical procedures. Examples of key parts include, the catheter hub, needleless connector, syringe hub and needle.
- **Double checking** - refers to the practice of two clinicians (appropriately endorsed Enrolled nurses (EN), Registered Nurses (RN), Doctors or Pharmacists) independently checking the medications.
- **Key Parts are** the equipment or solutions that must remain aseptic throughout the clinical procedures by ensuring that key parts only have contact with other aseptic key parts and sites to protect the patient from contamination or infection e.g. wound dressing, syringe hub, needle etc. These parts of the device/s that must remain aseptic throughout the clinical procedures. Examples of key parts include, the catheter hub, needleless connector, syringe hub and needle.
- **Key Sites** the area on the patient such as a wound or intravenous (IV) insertion site that must be protected from microorganisms. Another example is any catheter insertion site.
- **Infusion Pump** refers to infusions pumps like large volume pumps (LVPs)/volumetric pumps (e.g. Plum 360™), Syringe drivers (e.g. Alaris GH+™), Patient Controlled Analgesia/PCA pumps (Alaris PCAM™) etc.
- **Phlebitis** is a sign of vessel damage. The cause can be chemical (due to the osmolarity of the solution), mechanical (from trauma at insertion or movement) or infective (microorganisms contaminating the device). Signs include swelling, redness, heat, induration, purulence, a palpable venous cord (hard vein) and pain related to local inflammation of the vein at or near the insertion site.
- **Scrub the hub** refers to scrub access point vigorously with 2% chlorhexidine and 70% alcohol swab for 15 seconds and allow for it to completely air dry.

Assessment

Patient and IV site assessments should be done on a regular basis.

PIVC assessment includes:

- **Assessment of PIVC insertion site:** Peripheral IV line site assessment should involve visualising, palpating and comparing the site with the opposite limb/other side of the body. This includes catheter position, patency/occlusion, signs of phlebitis (erythema, tenderness, swelling, pain etc.) pressure injuries, and for signs of extravasation injuries. Paediatric patients are considered a vulnerable patient population therefore, the PIVC insertion site should be checked hourly when continuous infusions or medications are running. If Extravasation is suspected please see the Peripheral extravasation injuries initial management and washout procedure CPG. For assessment and management of pressure injuries please see Pressure injury prevention and management nursing guideline.
- **Assessment of PIVC dressing and splints:** check securement of the PIVC dressing and securement devices and ensure they remain clean, dry, and intact. Ensure the splint tapes are not too tight or restrictive and that the insertion site remains visible for assessment
- **Assessment of IV lines, equipment and IV fluid infusions:**
 - If the patient is receiving continuous IV fluid infusion- observations of the IV site, type of fluid and volume infused, and accurate rate of infusion should be observed hourly and documented in the fluid balance flowsheet.
 - If the patient no longer requires IV access for infusions, remove the cannula at the earliest to avoid complications.
 - If the patient (inpatient setting) is having intermittent infusion, eight hourly assessments are a minimum. Unstable patients who have signs and symptoms of complications are to be assessed more frequently.
- For Wallaby (Hospital-in-the-Home) patients, the nurse will assess the PIVC with each visit.
- Caregiver and patient education will be provided on the signs of injuries and the process of contacting the nurse.

Management

Administration of intravenous fluid, drug infusions or blood products

a) Continuous infusion of IV fluids

Assessment and documentation of findings are to be completed hourly to determine effective delivery of prescribed medications and fluid.

- Each bag of fluid is independently double checked, and a signed patient label is put on the bag.
- Check the solution is the prescribed one, the rate of infusion, and the amount infused is noted.
- Document the infused volume: Hourly on fluid balance flowsheet (it is advised to clear the infusion pump hourly)
- Check the infusion site for any signs of complications and document the assessment findings hourly in fluid balance flowsheet
- Review the cumulative volume infused and fluid output as required based on patient's clinical condition

Infusion Pump Pressure

Pressure limit defaults for intravascular infusion pumps are programmed by Biomedical Engineering, based on the manufacturer's recommendations.

Upper limit infusion pump pressure can be manually increased with clinical discretion to accommodate:

- Increased viscosity of the fluid being administered
- High rate of the fluid being administered
- Reduced diameter of the intravascular catheter
- Increased length of the intravascular catheter
- Increased level of patient activity

If pump pressure exceeds the recommended limits, check the patency of the PIVC.

Special consideration: Patients admitted to the Neonatal Unit should have line pressure documented within the Peripheral IV Cannula Lines, Drains, and Airway (LDA) tab.

b) Administration of bolus/loading doses:

Administering drugs:

Drugs administered via PIVC may be

- diluted into a bag of IV fluids
- added to the burette of an infusion set
- prepared for administration via a volumetric infusion pump
- in a syringe for use in a syringe driver
- administered directly as a bolus or push

The most appropriate method should be selected depending on volume of diluent required, patient condition, fluid balance and intended rate of delivery.

- **Drugs administered via:**
 - **Burette of an infusion set:** to dilute the drug in a smaller volume via burette giving system, hang the bag of infusion fluid and gradually open the roller clamp to allow appropriate amount of diluent into the burette. Inject the prescribed drug into the burette via the additive port.
 - **Line B (of the Plum 360™ pump):** Certain medications can be infused as a secondary infusion through a syringe or infusion bag via line B.
 - **Syringe driver:** is recommended for children weighing less than 10kg. Draw up required volume of diluent in appropriate size syringe and then pull back the syringe plunger to enable you to inject the drug into the syringe using principles of aseptic technique.
 - **Infusion bag:** Scrub the hub prior to access of additive port before injecting prepared drug into infusion fluid bag. Without contaminating the key part (spike) using a non-touch technique insert the spike of the administration set into the septum of the infusion bag.
- Attach a completed drug label detailing the drug, dose, diluent, volume of diluent, date, time and signature of the nurse and the staff who double checked.
- Access PIVC only after scrubbing the hub.
- For intermittent infusions, IV lines which are disconnected are to be discarded between infusions.
- Ensure the cannula is flushed with normal saline once the giving set is disconnected from the cannula.
- For Opioid infusion bolus refer to the specific guidelines: [Children's Pain Management Service \(CPMS\)](http://www.rch.org.au/anaes/pain_management/Childrens_Pain_Management_Service_CPMS) (http://www.rch.org.au/anaes/pain_management/Childrens_Pain_Management_Service_CPMS) (opioid infusion guideline)

Flushing of PIVC's

- If the cannula is to be accessed intermittently for the administration of medications or fluids, the cannula should be flushed prior to infusion or at least once a shift.
- Sterile 0.9% sodium chloride for injection should be used to flush a catheter. This must be prescribed as a medication.
- The optimal volume used for intermittent injections or infusions is unclear. The literature suggests the volume of flush should equal at least twice the volume of the catheter and add on devices and a minimum of 2mL normal saline flush is recommended.
- Use 10mL syringe for flushing to avoid excessive pressure and catheter rupture. Syringes with an internal diameter smaller than that of a 10mL syringe can produce higher pressure in the lumen and rupture the catheter. If resistance is felt during flushing and force is applied this may result in an infiltration or extravasation injury
- Use aseptic non touch techniques including cleaning the access port (scrub the hub) vigorously for at least 15 seconds and allowing to dry prior to accessing the system.

- Flush the PIVC using a pulsatile flushing technique (push pause motion).
- Flush catheters:
 - Immediately after placement
 - Prior to and after fluid infusion (as an empty fluid container lacks infusion pressure and will allow blood reflux into the catheter lumen from normal venous pressure) or injection.
 - Prior to and after blood drawing.

Change of PIVC dressing and securement of cannula:

- Dressings to PIVC sites are the first line of defence against infection and dislodgements. The dressing must be kept secure, clean dry and intact.
- Indications for dressing change include when it becomes insecure or if there is blood or fluid leakage under the dressing.
- Determine the need for an assistant considering patient age, developmental level and family participation prior to the procedure.
- If patient is allergic to transparent film dressings, use sterile film dressing to be used and changed daily.
- Carefully remove the old dressing, always holding the cannula in place. Loosen the edge of the dressing/tape and remove 'low and slow' in the direction of hair growth, keeping it close to the skin surface while pulling it back over itself, and supporting the newly exposed skin with your other hand.
- Take the opportunity to thoroughly inspect the site of entry of the cannula for any sign of infection.
- Skin preparation use 2% chlorhexidine and 70% alcohol swab or solution for dressings.
- Cleanse the area around the catheter insertion site including under the hub using a pattern which will ensure entire area is covered.
- Allow skin preparation to air dry prior to applying any dressing, this allows the disinfectant to work.
- Consider placing a small piece of sterile cotton wool ball or gauze underneath the hub of the cannula to reduce pressure.
- If desired, place sterile tape over the hub of the device before placing the transparent dressing.
- Cover the cannula insertion site with sterile transparent semipermeable, occlusive dressing (e.g. Tegaderm™, IV 3000™) placed using an aseptic non touch technique over the catheter. This will allow continuous observation of the site and to help stabilise and secure the catheter.
- IV board / splints are recommended to secure PIVC placed in or adjacent to areas of flexion. This will adequately immobilize the joint and minimise the risk of venous damage resulting from flexion.
 - When using Splints, ensure these are positioned and strapped with the limb and digits in a neutral position to prevent injury from restricting blood or nerve supply and to prevent pressure sores.
 - Inspect the splint at least daily and change if soiled by blood or fluid leakage.
- Cover with non-compression tubular bandage. Ensure there is a clear window where the cannula enters the skin- insertion site, so the site can be regularly viewed.
- In Summary, when dressing a peripheral IV cannula ensure:
 - it is secure
 - the site is visible
 - the child can't injure themselves, or be injured by the connections
 - the child can't remove or dislodge the cannula
 - tapes are not too tight or restrictive.
- Refer to *Intravenous access-Peripheral guideline* for steps involved in accessing and securing the cannula http://www.rch.org.au/clinicalguide/guidelineindex/Intravenous_access_Peripheral/ (http://www.rch.org.au/clinicalguide/guideline_index/Intravenous_access_Peripheral/)
- Documentation shall contain information on the insertion site, gauge of the needle and date and time of insertion has been documented in the EMR- LDA properties.

Change of Extension sets

- Extension sets are to be changed when the access device is changed or immediately upon suspected contamination or when any break in integrity.
- Extension sets are to be primed and attached to the cannula at the time of IV insertion using an aseptic non touch technique
- When exiting the flushing of extension set you must use a positive pressure clamping technique.
- When not in use, extension sets must be clamped

IV Fluid Considerations via Peripheral IV line

Which Fluids and how much fluids to use

Refer to the *Intravenous Fluids Clinical Practice Guideline: Intravenous Fluids* (http://www.rch.org.au/clinicalguide/guideline_index/Intravenous_Fluids/)

- Administering fluids containing glucose concentration greater than 12.5% will require central venous line access due to the risk of vascular endothelial damage.

Labeling infusions:

- Label the fluid bag/syringe with date, time, patient name and signature of two checking staff.
- Label IV line if multiple lines are running: label close to the fluid bag or syringe or below the drip chamber.
- If additives are added to infusion, please label the bag or syringe driver with additives added.
- Approved label can be generated by the EMR.

Table 1.Changing IV bags and lines

Task	Minimum frequency of changes	Aseptic technique method (based on risk assessment)
Fluid bag/syringe with additive	Every 24 hours	Standard aseptic technique
Fluid bag/syringe with no additive	Every seven days	Standard aseptic technique
Giving set with lipid or blood products	Every 24 hours	Standard aseptic technique
Giving set (with no TPN)	Every seven days	Standard aseptic technique
Giving set with TPN and in-line filter	With every new bag of nutrient	Standard aseptic technique
Giving set with in-line filter and no TPN	Every 96 hours	Standard aseptic technique
Needleless connectors, extension sets or three-way taps	Every seven days	Surgical aseptic technique

NOTE:

- All components are to be changed earlier if the integrity of the dressing is compromised or if there is any visible debris in any of the add on devices or needleless connectors.
- The outside tubing of the Primary PLUM™ giving sets are NOT sterile and are not to be placed on a surgical aseptic field.
- Administration sets that have been disconnected (either accidentally or planned) are no longer sterile and are to be discarded and replaced.

Removal of PIVCs

There is no evidence for routine replacement of PIVC unless clinically indicated. PIVC's should be maintained with regular assessment and documentation of complications.

The possible reasons for removal of PIVC's include a number of complications which range from infiltration, extravasation, phlebitis, occlusion, dislodgement and migration. Once the child's treatment is over, the PIVC should be removed to avoid any additional complications.

- Perform hand hygiene
- Prepare patient and caregiver
- Perform hand hygiene and apply non-sterile gloves, carefully remove the adhesive dressing, holding the cannula in place at all times
- Hold a piece of sterile gauze or cotton wool over the exit site but do not apply pressure
- Slowly withdraw the cannula, maintaining a neutral angle with the child's skin
- Cover site with dressing e.g. pressure dot, cotton wool and tape or Band-Aid™
- Advise the child and family that the cotton wool and tape or Band-Aid should remain in situ for up to 24 hours
- Remove gloves, perform hand hygiene
- Dispose of waste according to clinical practice, perform hand hygiene
- Document date and reason for removal. Ensure the device is also removed from the LDA in EMR.

Management of complications

There are a range of complications that could occur with the presence of a PIVC in situ. Some of these complications can be prevented by the correct use of aseptic technique for insertion and maintenance as well as assessing the device as indicated.

Common complications are:

Infection:

- Skin-based bacteria may enter through insertion site
- Local cellulitis or systemic bacteraemia are possible.

Phlebitis: Vein irritation

- Due to the presence of the catheter/fluids or medication
- Chronically ill patients requiring multiple and recurrent IV access.
- Extravasation injury: delivery of fluids or medications into surrounding tissue
 - If extravasation is suspected please refer to see the Peripheral extravasation injuries initial management and washout procedure CPG.
 - Extravasation should be documented in the LDA section of EMR
 - Please complete a VHIMS as appropriate

RCH specific information

For assistance with difficult intravenous access

0730 - 1730 (Mon – Fri): Anaesthetics ASCOM 52000

After hours / public holidays: PICU ASCOM 52327

Companion Documents

1. http://www.rch.org.au/clinicalguide/guideline_index/Intravenous_access_Peripheral/ (http://www.rch.org.au/clinicalguide/guideline_index/Intravenous_access_Peripheral/)
2. http://www.rch.org.au/policy/policies/Central_Venous_Access_Device_Management/ (http://www.rch.org.au/policy/policies/Central_Venous_Access_Device_Management/)
3. http://www.rch.org.au/policy/policies/Medication_Management/ (http://www.rch.org.au/policy/policies/Medication_Management/)
4. http://www.rch.org.au/policy/policies/Procedural_Pain_Management/ (http://www.rch.org.au/policy/policies/Procedural_Pain_Management/)
5. (http://www.rch.org.au/rchcpghospital_clinical_guideline_index/Neonatal_Extravasation/)https://www.rch.org.au/clinicalguide/guideline_index/Peripheral_extravasation_injuries_Initial_management/ (https://www.rch.org.au/clinicalguide/guideline_index/Peripheral_extravasation_injuries_Initial_management_and_washout_procedure/)
6. http://www.rch.org.au/policy/policies/Blood_Product_Transfusion/ (http://www.rch.org.au/policy/policies/Blood_Product_Transfusion/)
7. http://www.rch.org.au/rchcpghospital_clinical_guideline_index/Pressure_Injury_Prevention_and_Management/ (http://www.rch.org.au/rchcpghospital_clinical_guideline_index/Pressure_Injury_Prevention_and_Management/)
8. http://www.rch.org.au/policy/policies/Aseptic_Technique/ (http://www.rch.org.au/policy/policies/Aseptic_Technique/)

References

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Evidence Table

The evidence table can be found here. (www.rch.org.au/uploadedFiles/Main/Content/rchcpghospital_clinical_guideline_index/Hierarchy_of_Evidence_PIVC_2022.pdf)

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