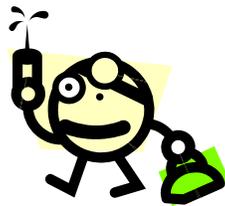


NICU Intravenous Essentials

A self learning module



Speaker/Presenter/Faculty have declared that he/she has nothing to disclose
This self learn packet earns learner 1 CEU

The purpose of this self learning module is to review the fundamental concepts of intravenous (IV) insertions and therapies needed to provide basic IV care for the neonate hospitalized patient.

After successful completion of this module, the learner will be able to:

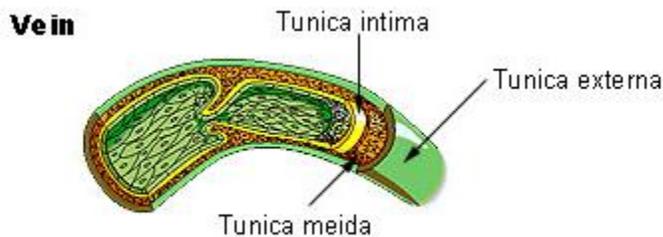
1. Describe the proper technique and documentation criteria for inserting and removing a peripheral IV line or saline lock.
2. Discuss when to change various types of tubing, rotate IV site, and manage pain in the patient
3. Discuss common complication of peripheral IV therapy, their associated signs and symptoms, and basic treatment of the same complications

Introduction

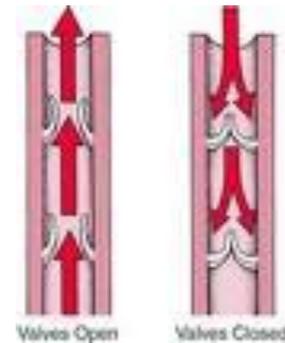
IV therapy is a complex nursing treatment that most neonates in an acute care setting have at one point during their stay in the NICU. Although the technique of actually placing an IV is one that needs to be practiced in order to be proficient, the theory behind IV placement and management is didactic in nature and can be covered in a module such as this one. The importance of correctly identifying veins, dressings, pain control, developmental concerns, and potential complications are all issues that nurses in the NICU face on a daily basis.

Anatomy of a vein

Veins are highly distensible, thin walled vessels. They act as a volume reservoir for the circulatory system. At any given time, the veins carry about 50% of the body's blood volume. The vein is composed of three layers: the tunica intima (internal layer), the tunica media (middle layer), and the tunica externa or tunica adventia (outer layer) (Rodriguez, 2011).



Anatomy of a vein



Valves in Vein

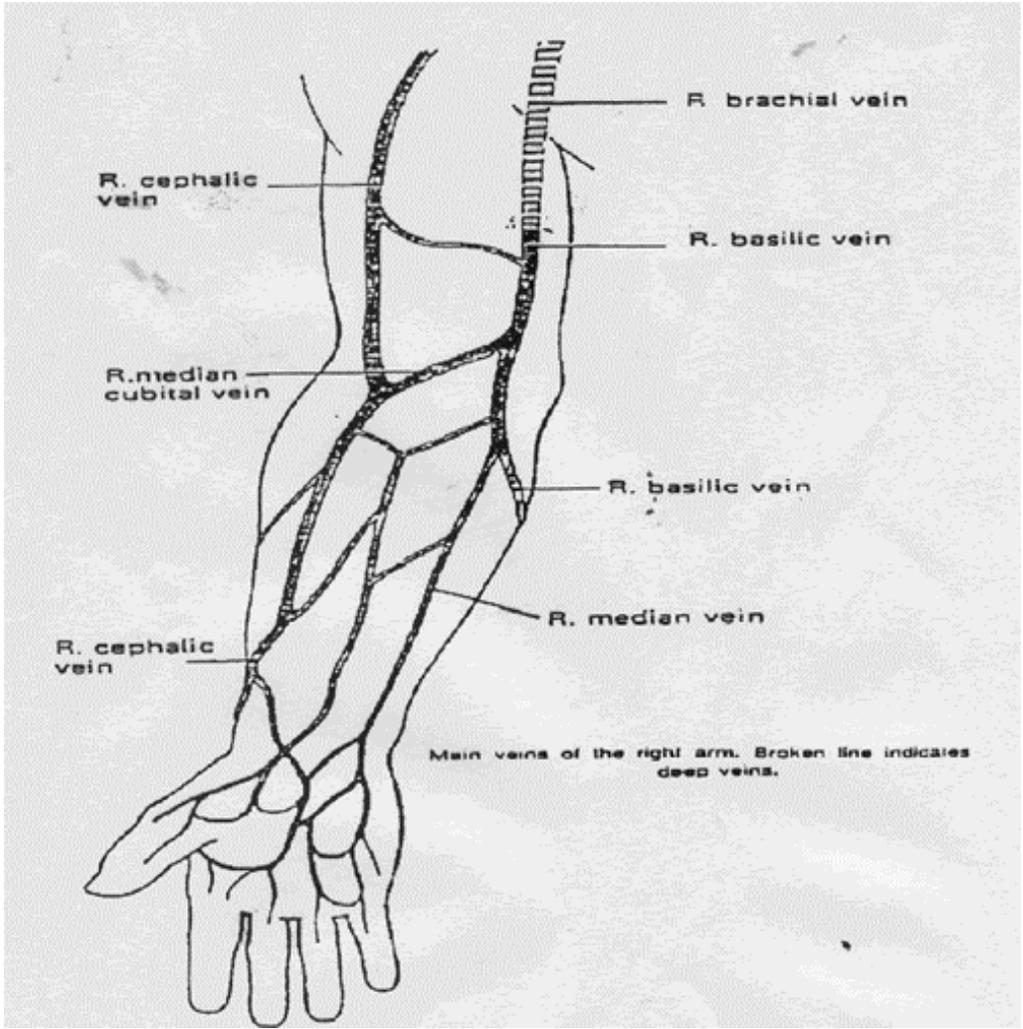
The veins transport blood back to the lungs and heart. Blood leaving the capillaries returns to the heart through the venous system by starting in the venules and progressing to larger and larger veins which eventually lead to the superior and inferior vena cava, which then enter the right atrium and thus begin the journey all over. The veins contain valves that keep blood moving back to the heart. The vein valves also provide “footholds” for the blood as it travels back to the heart to work against gravity. For example, blood traveling from the foot back to the heart has to travel back to the heart against gravity. The venous valves and muscle contractions of the leg prevent backflow of blood and promote upward flow of the blood, allowing blood to be moved “forward” within each space between valves.

The NICU nurse usually performs venipuncture for the purpose of IV access, continuous or intermittent IV infusion of fluids, infusion of medications, or for blood sampling for laboratory testing. Supervised instruction and competency

evaluation in venipuncture for peripheral IV therapy will be documented prior to independent function.

The names and anatomical location of the most commonly accessed veins of the upper and lower extremities in neonates are listed below.

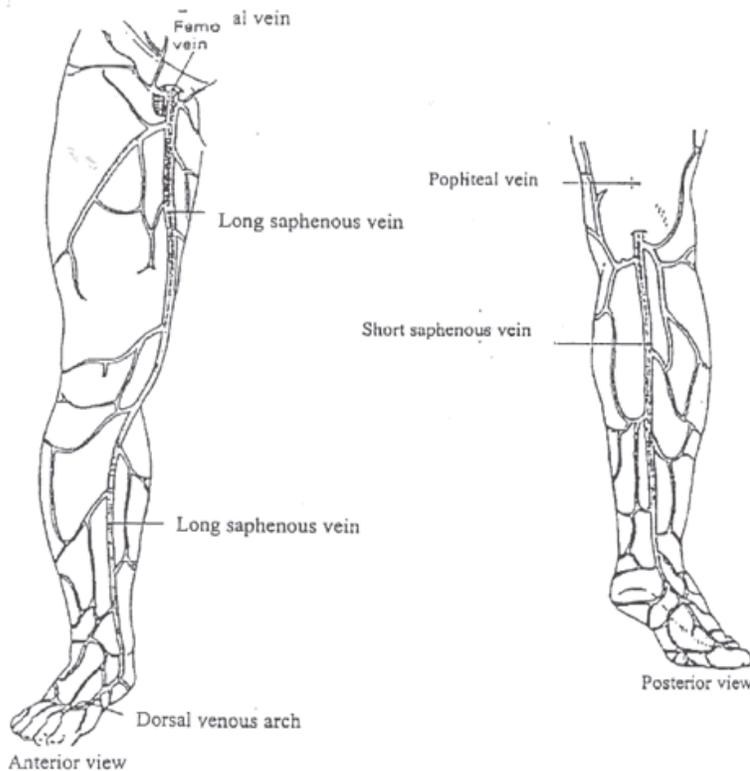
Name of Vein	Anatomical Description
Basilic Vein	The largest arm vein of the upper extremity. It runs along the medial (ulnar) aspect of the arm from wrist to shoulder. It begins at the dorsum of the hand, crosses the elbow, and drains into the brachial vein
Cephalic Vein	This vein runs along the lateral (radial) aspect of the arm also from the wrist to shoulder and empties into the axillary vein. Although the basilica vein is larger, the cephalic vein is more superficial and easier to access.
Median Vein	Forms a Y just below the elbow and drains into both the basilic and cephalic veins
Median Antecubital Vein	Oblique coursing vein at the elbow that joins the basilic and cephalic veins.
Brachial Vein	These veins are the deep veins of the upper arm, usually paired and smaller than the superficial veins. They travel in the upper arm parallel to (on either side) the brachial artery and join with the basilica vein to form the axillary vein.



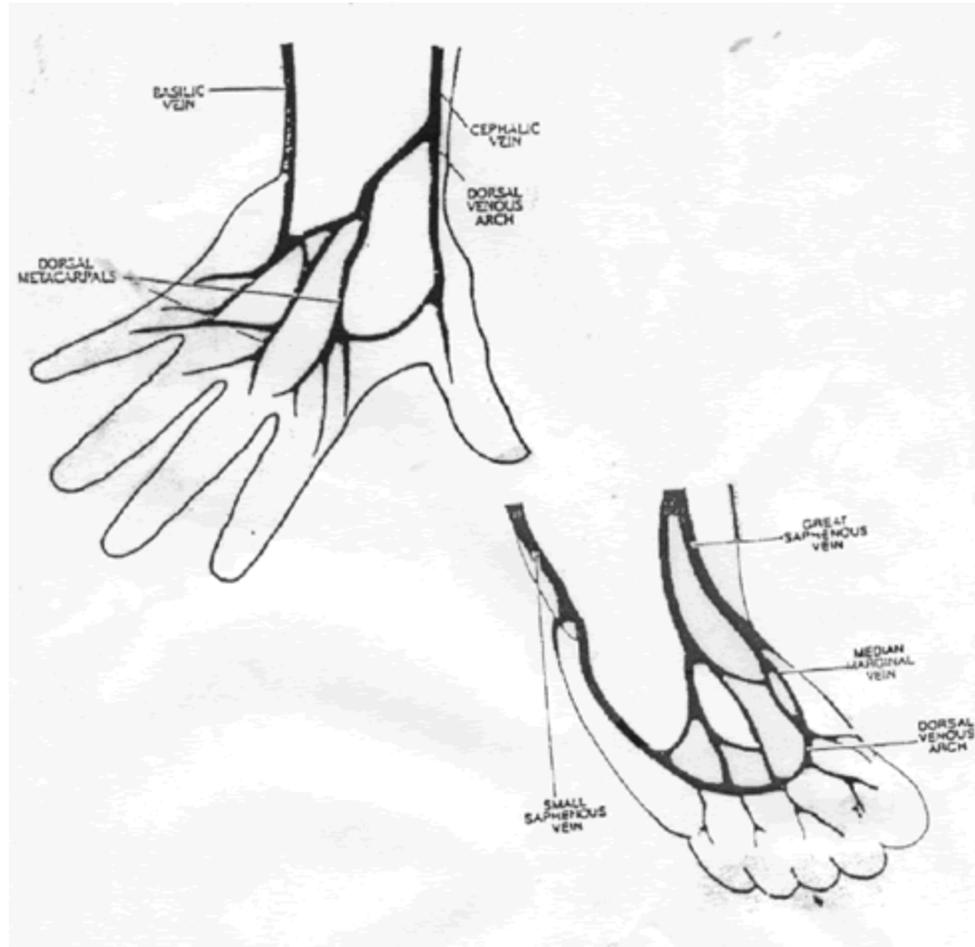
Veins of the arm

Name of Vein	Anatomical Description of Vein
Long Saphenous Vein	The longest vein in the body, originates at the ankle as a continuation of the medial marginal vein of the foot and ends at the femoral vein within the femoral triangle. At the ankle, it crosses 1 cm anterior to the medial malleolus and continues up the anteromedial aspect of the lower leg. It continues its superficial course and lies on the posteromedial aspect at the level of the knee. In the thigh, the greater saphenous vein courses anterolaterally through the fossa ovalis, where it joins the femoral vein approximately 4 cm below the inguinal ligament.
Short saphenous vein	Superficial vein of leg, does not directly anastomose with the greater saphenous vein. It begins at the lateral aspect of the ankle and runs up the posterolateral lower leg to join the popliteal vein in the popliteal fossa.
Popliteal vein	The popliteal vein begins as the anterior tibial vein joins the tibial/peroneal trunk in the upper calf. There are a number of veins which join the popliteal, including the sural veins and the lesser saphenous vein.

Veins of the leg



Veins of the hands and feet



Name of Vein	Anatomical location of vein
Dorsal metacarpal veins of hand	The radial part of the net-work is joined by the dorsal digital vein from the radial side of the index finger and by the dorsal digital veins of the thumb, and is prolonged upward as the cephalic vein. The ulnar part of the network receives the dorsal digital vein of the ulnar side of the little finger and is continued upward as the basilic vein.
Metatarsal veins of foot	Dorsal digital veins, unite to form four metatarsal veins; these run backward in the metatarsal spaces, communicate, by means of perforating veins, with the veins on the dorsum of the foot, and unite to form the deep plantar venous arch which lies alongside the plantar arterial arch. From the deep plantar venous arch the medial and lateral plantar veins run backward close to the corresponding arteries and, after communicating with the great and small saphenous veins

Insertion of a Peripheral IV Line or Saline Lock

The first step in initiating peripheral IV access is to ensure physician order for doing so, whether to initiate IV fluids or to administer medications or blood products. Determining whether to perform venipuncture for drawing larger volumes of blood for laboratory tests will need to be done on a case by case assessment and determined by the RN.

Considerations to make prior to initiating therapy:

- ✓ Your choice of cannula or angiocath should be the smallest gauge that will accommodate the prescribed therapy. This will allow for sufficient blood flow around the cannula and cause the least disruption to tissue.
- ✓ Only one device should be used per attempt
- ✓ Stylets shall never be reinserted into cannula when attempting IV access



First, WASH HANDS!!!

Then, gather equipment

You will need the following:

- ✓ Alcohol swab
- ✓ Gloves
- ✓ Tourniquet
- ✓ 22g butterfly or angiocath
- ✓ T connector
- ✓ Anti reflux valve
- ✓ Sterile 2x2 gauze
- ✓ Transparent dressing tape
- ✓ 1" transparent non-allergenic tape
- ✓ Flush solution for saline lock (0.9% sodium chloride, 20mL vial, preservative free)
- ✓ Flush syringes (3-5mL size)
- ✓ IV solution with primed tubing as per protocol
- ✓ Arm board
- ✓ SWEETEASE FOR PAIN! (For the baby, not the nurse)

Next:

- ✓ Prepare all equipment as needed for task
- ✓ If preparing for venipuncture blood draw, select appropriate site, assemble butterfly and syringe, open alcohol and cleanse site, open pressure dressing (gauze and tape).

- ✓ If preparing for angiocath insertion for IV fluid, medication, or blood infusion, select appropriate site, assemble T connector, anti-reflux valve, flush with 0.9% normal saline, assemble transparent dressing and cut transparent 1" tapes as needed to anchor and secure device.

Next:

- ✓ Administer Sweetease as per unit policy
- ✓ Position the patients limb
- ✓ Dependent positions increase capillary refill and may increase the likelihood you will be successful in inserting the IV
- ✓ For cold skin, warm it by rubbing or stroking the skin or applying a warm pack for 5-10 minutes as needed.

Apply the tourniquet a few inches above the site to dilate the vein

Check for distal pulse (if no pulse, remove tourniquet and reapply as not to occlude the arterial blood flow)

Lightly palpate the vein with your index finger, while gently stretching the skin to keep entry site taut

- ✓ If the vein feels hard or "rope-like", select another site!
- ✓ If the vein is easily palpable, but not sufficiently dilated you may try these steps to promote engorgement of the vessel:
 - Lightly tap the skin over the vein
 - Place vein in a more dependent position
 - Warm the vessel

Next, select your insertion site!

Use the smallest catheter possible for need

Save antecubital and upper arm veins for future PICC insertion sites, if possible

Use most distal sites first!

Assess patient's condition, vein condition, vein size and location to insure ideal and safe access.

Next, prepare your site!

Wash your hands again, put on gloves

Cleanse the site with alcohol by applying in a circular motion, outward from the insertion site to approx. 2" to 4" with friction

Administer Sweetease as per protocol

Hold skin taut to stabilize vein

Grasp needle or catheter bevel up

- ✓ If using a butterfly set, grasp by both wings between thumb and forefinger of dominant hand
- ✓ If using angiocath, remove the cover, grasp the plastic hub with dominant hand, examine tip. Use opposite hand to keep vein stabilized by holding skin taut below insertion site

Lightly palpate the vein (vein should be engorged, round, firm, and resilient)(Intravenous Nurses Society, 2000).

Venipuncture Itself!!

Confirm the integrity of the product and insert the device always as per manufacturer's guidelines

Insert the device. Different nurses may use different approaches-both are acceptable! You will use the approach that works best for you and gives you the greatest chance of success with the least trauma for the patient!!

- ✓ For the direct approach: enter the skin directly over the vein at a 30-40° angle
- ✓ For the indirect approach: enter the skin slightly adjacent to the vein and direct the device into the side of the vein wall at a 30-40° angle

Advance the device slowly and steadily until you meet resistance

- ✓ Don't penetrate the vein!!
- ✓ Lower the needle to a 15-20° angle, THEN slowly pierce the vein
- ✓ You may feel a "pop" or a sensation of release when the needle enters the vein

Observe flashback!!

- ✓ This ensures the catheter is in the vein
- ✓ If using a butterfly, advance needle slowly and be mindful not to insert all the way!! You may insert all the way through the vein if too aggressive!!
- ✓ If you fail to see flashback, pull the catheter back slightly. If you still fail to see flashback, remove the catheter and try again with a new IV needle
- ✓ If successful, tilt the needle very slightly upward to advance needle without penetrating the lower wall of the vein

Advance the catheter device so that the needle is held stationary by the hub

Withdraw the needle while holding the catheter at the hub so it does not move, if inserting an indwelling angiocath

- ✓ As you withdraw, press lightly on the catheter to prevent bleeding

Advance catheter tip or hub until it is fully inserted or you meet resistance

Release tourniquet

Remove stylet

Attach saline lock

Check for placement of cannula in vein either by infusing IV fluids or flushing with a small amount of saline with soft pressure. If device is resistant to flushing or you note a "wheal" develop under skin, remove catheter immediately

After two unsuccessful attempts to insert an angiocath or venipuncture, consult with another RN or MD to attempt again

Secure the Device!!

Use cut tapes to secure the hub of the cannula to the skin so device is secure but does not obscure the site! Also, do not apply tape so tight that circulation is impeded to area.

Attach transparent dressing over insertion site, secure with an arm board, and tape to secure.

After the dressing is secured, secure all connection sites and flush again with saline to ensure dressings and tapes are not so tight as to impede flow or circulation and clamp line or infuse fluids.

Documentation of Venipuncture

- ✓ Date and time of venipuncture
- ✓ Type and gauge of needle and catheter
- ✓ The location of the insertion site-is best to use the anatomical names of the veins
- ✓ Reason site was changed or initiated
- ✓ Number of attempts at venipuncture
(REMEMBER-Only **two** attempts per RN!!)
- ✓ The type and flow rate of IV solution or blood product
- ✓ Any adverse reactions and corrective actions taken
- ✓ Patient tolerance of procedure



Documentation example

7/28/11 13:40 22 gauge angiocath inserted into right lesser saphenous vein-successful on first attempt-flashback observed. Inserted for administration of blood products infusing at 3.2 mL/hr without difficulty. No swelling or redness noted. Patient tolerated well with swaddling and Sweetease for pain. Will continue to assess. Jane Doe, RN

Maintenance of Peripheral IV Sites and Saline Locks

IV site should be monitored at established intervals to insure the devices are working properly. This inspection includes both equipment and site inspection!

When inspecting equipment, examine for:

- ✓ The catheter itself for migration
- ✓ All connections are secure
- ✓ Fluids infusing without any difficulties
- ✓ Pump function and rate

When examining the site be sure to examine:

- ✓ The insertion site
- ✓ Patients sensitivity to touch at site-if infant winces, cries, withdraws limb- assess for infiltrate
- ✓ Signs of IV-related infections or complication:
 - Discoloration (i.e. blanching, erythema)
 - Pain or sensitivity at site (i.e. pain, tenderness)
 - Edema
 - Localized swelling
 - Exudate
 - Increase in skin or basal body temperature

Site changes

Site changes should only be done as needed. Regular, timed rotation of IV sites is unnecessary and not recommended in NICU!

Removal of peripheral IV line or saline lock

A peripheral catheter should be removed as soon as possible when therapy is completed (i.e. IV fluids have been discontinued, blood products have completed infusing), when contaminated, or when site is infiltrated. Do not leave saline lock in for long term if not being used for medication administration!

You will need:

- ✓ Alcohol
- ✓ Sterile gauze
- ✓ Adhesive remover
- ✓ SWEETEASE FOR PAIN

Procedure:

- ✓ Discontinue administration of all infusates
- ✓ Wash hands
- ✓ Don gloves

- ✓ Administer Sweetease as per policy
- ✓ With adhesive remover, gently wipe surface of dressing to be removed, saturating edges
- ✓ Gently remove tape and transparent dressing
- ✓ Inspect cannulation site
- ✓ Remove dressing and catheter from skin
- ✓ Inspect tip of catheter for any clots or irregularities of tip of catheter
- ✓ Cleanse area of adhesive remover and any glue residue
- ✓ Apply pressure for minimum of 30 seconds or until bleeding has stopped
- ✓ Apply new gauze to site and secure with tape or apply Band-Aid

Documentation of removal

- ✓ Date, time, and reason for removal
- ✓ Size, type, and condition of catheter upon removal
- ✓ Location and condition of the site
- ✓ Type of dressing applied
- ✓ How the patient tolerated procedure
- ✓ Any actions taken for phlebitis, infiltration, or extravasation



Documentation example

8/1/11 11:40 22g angiocath removed from right antecubital vein due to swelling and redness over site. Catheter tip intact. Sterile 2X2 applied. Patient tolerated well with Sweetease and swaddle. Warm soaks applied to area and elevated.

Jane Doe, RN

Key Points to Remember

- ✓ Assess IV site and extremity with every assessment and document any abnormalities
- ✓ Blood transfusion sites should be monitored more frequently; every 30 minutes minimum. Stop blood infusion IMMEDIATELY if any question about integrity of site
- ✓ The nurse should notify the physician immediately for any redness, swelling, drainage, blanching of any catheter site.
- ✓ Ensuring infant maintains neutral thermoregulation throughout IV experience is extremely important. Being mindful to cover infant with warm blankets, reducing drafts in and around infant, and limiting exposure outside of warmed environment will reduce vasoconstriction, thus increasing successful IV attempts
- ✓ Being mindful of exposure to light of neonates eyes during procedure; cover with blanket or bili mask to limit stressful exposure to bright lights needed by nurse to visualize fragile vasculature
- ✓ Providing infant with boundaries and swaddling of extremities not being examined for venipuncture will reduce fluctuations in infant's vital signs throughout procedure as well as helping to maintain neutral thermoregulation

IV Complications

When a peripheral intravenous infusion infiltrates or causes any type of adverse complication, protocol for documentation of complication and hospital policy of documentation of complication is as follows:

Notification of the covering physician

Explicit documentation in nursing notes of:

What time

What extremity

What IV fluid/blood product infusing

Physician notified

Time physician notified

Orders/actions prescribed by physician

Patient tolerance/reaction to adverse event and treatment

Incident report via Intranet system

Instructions on how to file an incident report for all adverse complications of IV therapy or any event are posted at each computer. (Filing incident reports are not punitive and can be filed anonymously!! They are simply to document the process in order to evaluate ways to improve the process!!!) It is nursing responsibility to report and improve our practice!!!

Common Complications of Peripheral Therapy

Phlebitis is the inflammation of the vein. Signs and symptoms of phlebitis include redness, swelling, pain, and edema at the insertion site and/or along the vein. Treatment includes removal of the catheter and application of warm soaks

Extravasation occurs when the venipuncture device is dislodged from the vein. Signs and symptoms include swelling at and above the site, discomfort, crying, tightness of dressing at site, cooler temperature of skin at site, and blanching at site. Treatment includes discontinue IV fluid administration, delivery of a local antidote as per unit policy by physician, and ice initially then warm soaks.

Hematomas occur when blood leaks into the extravascular space. The patient will have tenderness at site, a bruise may be evident at site, and infusion of fluids will not flow. IV catheter must be removed and restarted elsewhere. Additionally, you should apply pressure until bleeding stops and warm soaks to aid in absorption of blood.

Vasovagal reactions occur when patient experiences pain. The vein suddenly collapses during venipuncture and causes patient to become dusky and bradycardic. The patient may also have a sudden drop in blood pressure. If this occurs, take a break from procedure, provide containment and boundaries for infant, and administer Sweetease before proceeding.

Circulatory overload can occur when the IV fluids are infused at wrong rate, or for too long. The patient may experience respiratory distress, be anxious, have crackles in the lungs, increased blood pressure, and neck engorgement. Treatment includes correcting IV fluid rates, raising head of patient, administering oxygen, prompt notification of physician.

Systemic infection or bacteremia can occur as a result of phlebitis, poor taping that allows the venipuncture site to be exposed to air, prolonged dwelling time of catheter, and failure to maintain aseptic technique during insertion or site care. The patient may experience decreased/increased temperature, feeding intolerance, or mood change. Treatment includes informing physician, septic workup, and administering antibiotics as ordered.

Conclusion

IV therapy is a complex but necessary healthcare treatment for the patients of the NICU. Through the theoretical information provided in this course, the framework for IV management has been set. Through experience the nurse can fine tune IV skills in order to provide the highest level of care for patients receiving this treatment.

References

- Kenner, C.; & Lott, J.W. (2003). *Comprehensive neonatal nursing: A physiological perspective*. (3rd ed.) St. Louis, MO: Saunders Elsevier
- Merenstein, G.B.; & Gardner, S.L. (2002). *Handbook of neonatal intensive care*. (5th ed.). St. Louis, MO: Mosby Elsevier
- Newborn clinical care guidelines. (n.d.). Retrieved from www.adhb.govt.nz/newborn/guidelines/vascularc
- Rodriguez, J.F.B. (2011). Venous drainage anatomy. Retrieved from Medscape Reference <http://emedicine.medscape.com/article/1899411-overview#a30>