Kidz Medical Services
Intravenous Infiltrations

Purpose:
To provide the clinicians of Kidz Medical Services with guidelines for the consistent treatment of newborns with intravenous infiltrations.

Guideline:

I. History:
   A. JACHO recognizes the importance of IV infiltrations.
   B. Legal ramifications for poor treatment and scarring follow a physician for 18 years.
   C. The terms extravasation and infiltration often are used interchangeably.
      1. Infusion Nurses Society defines;
         a) Extravasation as the inadvertent administration of a vesicant solution (one
            that causes blistering, usually antineoplastic drugs) into surrounding tissues.
         b) Infiltration as the inadvertent administration of nonvesicant solution into
            surrounding tissues.
         c) However, the distinction between vesicant and nonvesicant solutions is not
            clear in neonates.

II. Etiology:
   A. The fragility of skin, particularly in the first 2 weeks of life, and the lack of subcutaneous
      tissue in preterm neonates makes them uniquely susceptible to injury and skin loss.
   B. Extravasation/infiltration may occur from:
      1. The tip of the cannula or needle piercing the vessel wall.
      2. Distal obstruction of the vein due to thrombosis or venoconstriction from irritation
         of the vessel wall may lead to increased back pressure and leakage from the entry point
         of the needle or cannula into the vein.
   C. Fluid escapes the vein and damages the subdermal plexus of vessels either by:
      1. Pressure.
      2. The irritant nature of the fluid.
   D. Injury to the skin results in an inflammatory response and heals by scar formation.
   E. The degree of cellular injury is determined by the volume of the infiltrating solution and
      physicochemical characteristic.
   F. Tissue necrosis from extravasation injury could result in partial or complete skin loss,
      infection, and nerve and tendon damage, with the potential risk of permanent cosmetic and
      functional impairment.
   G. Damage continues for 48-72 hours so site must be followed and observations documented.

III. Incidence:
   A. Incidence of extravasations of IV therapy has been reported to vary 23% to 78%.
   B. The wide variation in the incidence of extravasation injuries in neonatal units may reflect
      practice styles or the vulnerability of certain populations.

IV. Prevention of IV infiltration:
   A. Tape to prevent movement and allow for good visualization of IV site.
   B. RN to assess IV site hourly and document findings.
   C. RN to discontinue IV at first signs of trouble.
   D. Check for incompatibilities.
E. Know your vesicants- TPN, dextrose > D12.5%, osmolality > 1000 mOsm/kg (AAP recommends 300-900 mOsm/kg for PIV infusates), calcium, potassium, sodium bicarbonate, acyclovir, amphotericin B, vancomycin, dopamine, dobutamine, epinephrine, norepinephrine.

F. Use correct dilution and rate of administration.

G. Check IV pump pressure alarm limits- set at 3 PSI.

H. Stop infusion immediately for swelling, redness, blanching, or patient pain.

V. Assessment of IV site:
   A. Extravasation of IV fluids is marked initially by pain and swelling that subsequently progresses to blanching and signs of impaired perfusion.
   B. Fussiness, crying, and withdrawal of the limb when flushing the IV device are early warning signs, but these signs may be absent in infants who are sedated or critically ill.
   C. Begin assessment by visualizing the catheter insertion site.
      1. Compare findings with those on the opposing extremity or opposite side of the scalp.
   D. Evaluate the integrity of the dressing and replace soiled or nonadherent dressings.
   E. Observe insertion site and surrounding tissue for drainage, moisture, edema, erythema, blanching and bleeding.
   F. Follow the course of the vein past the end of the catheter observing for edema, erythema, pallor and blanching.
   G. Palpate the area surrounding the catheter; noting swelling, induration, leaking from insertion site or catheter and temperature. Observe for pain cues while palpating.
   H. Carefully evaluate any extremity secured to an arm board for pressure points, restrictive edema, moisture and drainage.

VI. Four stages of IV infiltration:
   A. Stage 1: swelling < 2cm from site.
   B. Stage 2: swelling >2 cm from site.
   C. Stage 3: swelling and skin changes.
   D. Stage 4: swelling and skin breakdown.

VII. Treatment of IV infiltration:
   A. Goal of treatment is lymphatic reabsorption of fluid and infection prevention.
   B. No randomized, controlled trials in humans have verified if certain interventions are more effective than others in reducing injury or scarring.
   C. Discontinue infusion immediately.
   D. Remove any constricting bands that may be acting as a tourniquet, (tape to an armboard).
   E. Do not use heat or cold compresses.
   F. Elevate the extremity if it is puffy.
   G. Stage the infiltrate.
   H. Stage 1 infiltrate:
      1. Turn off IV solution immediately and remove the IV catheter and elevate the extremity
   I. Stage 2 infiltrate:
      1. Turn off IV solution immediately and remove the IV catheter, elevate the extremity and reevaluate for improvement within 2 hours. If not improved go to stage 3.
   J. Stage 3 infiltrate and stage 4 infiltrate:
      1. RN to notify the MD/NP and inform of type IV solution infiltrated and stage of infiltrate.
      2. RN to assess and document site and response to any interventions every hour for 6 hours, every 4 hours for 24 hours and then PRN.
3. MD/NPN attempt to aspirate residual fluid from infiltrated IV catheter.
4. MD/NPN minimize damage by using hyaluronidase for plain IV solutions and regitine for vasoactive drugs such as dopamine or dobutamine.
   a) RN to monitor heart rate and BP every 30 minutes times two. These drugs may cause hypotension.
5. Apply warmed amorphous hydrogel (Vigilon) gel side in contact with skin.
6. Place small gauze over and wrap with cast padding.
7. Assure adequate circulation to distal extremity.
8. Change dressing every 24 hours or more often if drainage is present.
9. Change dressing by gently rubbing site with normal saline and 2 x 2 gauze
10. Check pulse and venous stasis after dressing applied and prn.
11. If site improves, continue treatment until complete resolution.
12. If site not improving and fibrinous exudate present change dressing every 12 hours with am Collagenase ointment/ 2 x 2 gauze/ cast padding dressing and PM Vigilon/cast padding dressing.
13. Continue alternating until fibrinous exudates is no longer present
14. If site not improved and exudates continues further consultation with plastic surgery.

VIII. Hyaluronidase (Wydase):
A. Hyaluronidase, a protein enzyme, enhances the distribution and reabsorption of extravasated fluids by breaking down hyaluronic acid in the ground substance of connective tissue, increasing tissue permeability, and reducing tissue destruction by decreasing the local concentration of noxious chemicals in the area of extravasation.
B. Animal experiments and clinical reports have shown the effectiveness of hyaluronidase in reducing the degree of skin loss and ulceration due to infiltration of vesicant chemotherapeutic agents and radiographic contrast agents.
C. Laurie and associates demonstrated in a rabbit model that hyaluronidase was most effective in reducing the area of necrosis when used immediately after extravasation of a calcium chloride hyperalimentation solution containing 25% dextrose and doxorubicin; delays of more than 1 hour in treatment with hyaluronidase resulted in no statistically significant reduction of the area of necrosis.
D. Zenk and colleagues showed that necrosis was avoided in two infants when hyaluronidase (15 U/1 mL of normal saline) was used within 1 hour of infiltration of nafcillin compared with severe tissue necrosis and skin sloughing in a 4-month-old infant who suffered extravasation of a less concentrated solution of nafcillin in a larger volume of fluid who did not receive hyaluronidase treatment.
E. The dose of hyaluronidase used in neonates ranges from 15 U/1 mL to 500 to 1,000 U used in conjunction with saline flushing techniques.
F. Although rare allergic reactions have been reported in adults, none have been reported in neonates.
G. Hyaluronidase is not recommended for use in infected areas because of the risk of spreading a localized infection.
H. Not indicated for treatment of extravasations of vasoconstrictive agents (dopamine, epinephrine and norepinephrine).
I. Administration:
   1. Concentration of Hyaluronidase in the prefilled syringe is 15 units/ml.
   2. If prefilled syringe not available, obtain 150 unit/ml vial. Withdraw 0.1ml of this solution and add it to 0.9ml of normal saline. The final concentration will be 15 units per ml.
3. Cleanse site with alcohol if the skin is intact. If skin is broken or blistered, cleanse with Hibiclens diluted 1:1 with normal saline. Use gentle cleansing, avoiding pressure at site.

4. Elevate the extremity.

5. If there is no blood return in the affected IV catheter, consider infusing 0.4 cc of dose directly through the affected IV catheter before removing the catheter and administering the remainder of the dose subcutaneously around the periphery of the extravasation.

6. Begin five subcutaneous injections of Hyaluronidase using 0.2ml aliquots (15units/ml). Inject around infiltrate on margin of infiltrate. Total volume injected will be 1 ml. Change needle after each injection.

7. Monitor BP and heart rate every 30 minutes times two. This drug may cause hypotension.

IX. Phentolamine (Regitine):
   A. A potent alphaadrenergic blocker, has been shown to reverse the ischemia caused by vasoactive drugs such as norepinephrine and dopamine in isolated case reports in humans.
   B. In the two case reports of neonates who had peripheral tissue ischemia due to dopamine extravasation, subcutaneous administration of phentolamine to the blanched area of infiltration resulted in immediate improvement of color and perfusion, with no untoward effects on the blood pressure and other vital signs.
      1. In both cases, phentolamine appeared to be effective, even when it was used more than 2 hours after the extravasation had occurred.
   C. Administration:
      1. Inject 1mg/ml solution of phentolamine subcutaneously into the affected area.
      2. Available in 5mg vial as lyophilized powder.
      3. Reconstitute one vial with 1ml of sterile water for injection.
      4. Dilute to a concentration of 1mg/ml with 4 ml sterile water for injection, use immediately.
      5. The use of repeated small doses, with close monitoring of blood pressure, probably is prudent in preterm infants because hypotension due to vasodilatation is a potential complication.
      6. The biologic half-life of phentolamine injected subcutaneously is less than 20 minutes.

X. Vigilon:
   A. Vigilon is a hydrogel sheet, consisting of cross-linked polyethylene oxide, and containing 96% water, supported upon a net of low density polyethylene, which provides additional strength to the dressing. The gel, which is capable of absorbing approximately its own weight of wound exudate, is permeable to water vapour and oxygen, but impermeable to water and bacteria. Once in position, Vigilon provides a moist environment at the surface of the wound in which healing can take place; provided it is not allowed to dry out, the gel will not adhere to the underlying tissue upon removal.
   B. Vigilon should not be applied to wounds that have been found to contain Pseudomonas aeruginosa, or that show evidence of clinical infection.

XI. Collagenase Ointment:
   A. Class: Enzyme preparation
   B. Trade Names: Collagenase Santyl- Ointment 250 units of collagenase enzyme/g
   C. Contributes to the formation of granulation tissue and subsequent epithelialization of dermal ulcers and severely burned areas.
D. May be applied directly to wound or to a sterile gauze pad, which is applied to the wound and secured.
E. To prevent irritation of surrounding healthy tissue, carefully apply ointment within wound area.
F. Prior to application, cleanse the wound of debris and digested material by gently rubbing with a gauze pad saturated with normal saline solution and normal saline rinse.

References:


