Pediatric IV Infiltration/Extravasation 2010 Update

Objectives

1) Define the problem of IV infiltrations/extravasations in pediatric patients.
2) Identify risk factors, signs and symptoms and IV staging guidelines for infiltrations/extravasations.
3) Discuss treatments and locate resources for managing IV infiltration/extravasations.

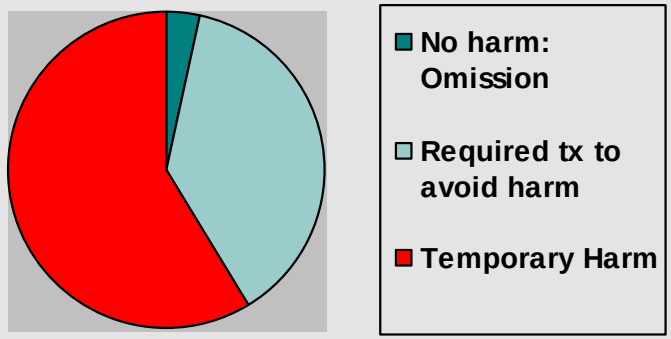
Problem

Extravasations are a significant problem, particularly in pediatric populations. The incidence of extravasations ranges from 11% to 28% in children, and 22% in neonates.

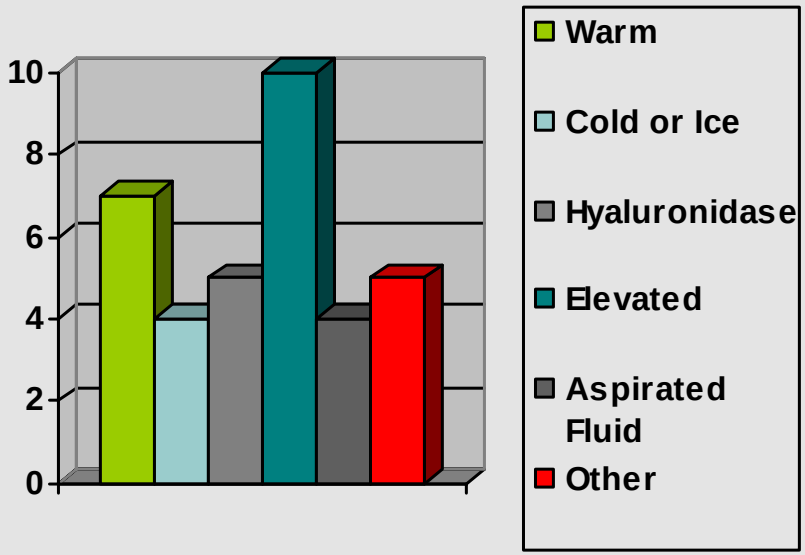
Over the past 2 years at UICH, there have been 58 IV extravasation incidents in pediatric patients per PSN reports.

UICH Extravasations
PSN report data 1/1/2007 to 12/31/2009 (n = 58)

- The majority of events reported in pediatrics required treatment and resulted in temporary harm.



- Treatment approaches varied considerably and some did not reflect current evidence.



Definitions

- **Infiltration** - The inadvertent administration of a nonvesicant solution/medication into a surrounding tissue.
- **Extravasation** - The inadvertent administration of a *vesicant* solution or medication into surrounding tissue.
- **Vesicant** - A solution or medication that causes a blistering process when inadvertently administered into the surrounding tissue.

For practical purposes we do not differentiate infiltrations and extravasations.

Risk Factors for Extravasations

Patient Factors

- Preterm infants
- Neonates
- ICU patients
- Comorbidities (diabetes, circulatory disorders, obesity)
- Inability to verbally communicate pain

Pharmacological Factors

- Hyperosmolar agents
- Ischemia inducing agents
- Alkaline agents
- Poorly water soluble agents
- Chemotherapies

More Risk Factors

Mechanical Factors

- Small, fragile, mobile or hard sclerosed veins
- Large catheter size relative to vein
- Choice of IV site (joints, flexors, dominant hand)
- Unstable catheter
- Uncontrolled patient movements

Physiological Factors

- Clot formation above the site
- Thrombus on catheter tip
- Impaired sensory perception, impaired circulation, lymphedema, superior vena cava syndrome or peripheral neuropathies

Signs and Symptoms

Redness

Edema

Discoloration

Blistering

Blanching

Delayed capillary refill

Skin cool to touch

Pain

May flush with difficulty

Decreased peripheral pulses

Skin breakdown (may be delayed)

Why is this important?

- An Extravasation can lead to the following:
  - Injury requiring surgical intervention
  - Loss of function of the extremity at the site of injury
  - Long term wound debridement and cares for the family

Nursing review of standard of care

Assess IV sites hourly

- Assess past the point of insertion to the point that the catheter ends in the vein
- Ensure the tape allows site to be visualized
- Need to minimize dressing for viewing capability

Required **hourly** assessment parameters

- Insertion site
- Intact dressing
- Apparent patency
- No apparent problems with catheter tip
- IV tubing intact
- IV solution rate(s)
  - checked hourly and recorded at the beginning of the shift and with any rate change, minimally

STAGING EXTRAVASATIONS

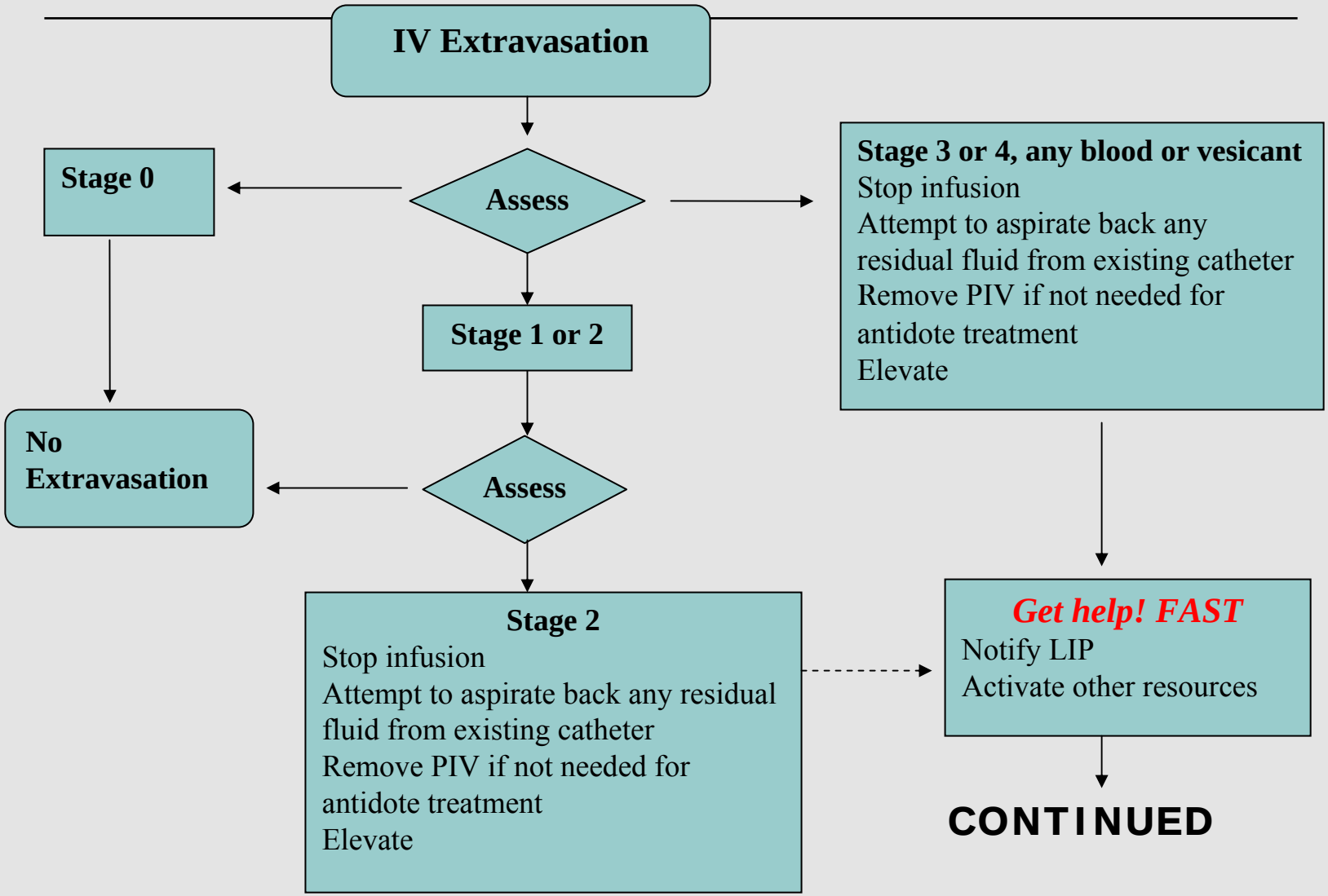
Stage 0	Stage 1	Stage 2	Stage 3	Stage 4
No redness, pain, edema, blanching, tenderness, drainage. **Flushes with ease**	**Mild redness** **Mild edema** **Flushes with ease** **Skin warm to touch** **Good distal pulses** **1-2 second distal capillary refill**	**Persistent mild redness** **Persistent mild edema** **Flushes with difficulty** **Pain at site** **Skin blanched** **Skin cool to touch** **Good distal pulses** **1-2 second distal capillary refill**	**Moderate edema** **Moderate redness** **Skin blanched** **Flushes with difficulty** **Pain at site mild-moderate** **Skin cool to touch** **Good distal pulses** **1-3 second distal capillary refill**	**Moderate to severe and/or pitting edema** **Persistent redness, discoloration, bruising** **Skin blanched** **Pain at site moderate-severe** **Skin cool to touch** **Skin breakdown or necrosis** **Decreased or absent distal pulses** **> 3 second distal capillary refill** **Infiltration of any amount of blood product, irritant or vesicant**

For Stage 1 Infiltration/Extravasation

Interventions

- Check tape/IV securement
- Elevate extremity
- Consider using alternative site for meds and IV fluids

Example: Decision Algorithm for Stages 2-4



Get help, FAST: Activate Resources

Timely administration of treatment is a key factor in achieving positive results.

Activate Resources:

- CWS Standard of Practice
- Pharmacy
- Page Nursing supervisor, charge nurse
- Contact LIP, attending staff as needed
- Consults: surgery, burn treatment team, wound care specialist, physical therapy as indicated

Treatments and Antidotes

- Hyaluronidase is an enzyme that disperses offending IV fluids and medications into the tissue and decreases tissue damage.
- For some agents, antidotes are available and should be used to treat infiltrations/ extravasations
  - Dexrazoxane
  - Dimethyl sulfoxide (DMSO)
  - Phentolamine
  - Sodium thiosulfate
- Refer to CWS standard of practice, table of treatments and agent specific resources for specific treatments and administration procedures.

Consult these Clinical Resources in the SOP ***N-CWS-PEDS-08.130***

- Resources
  - Medications at High Risk for Infiltration/Extravasation
  - Staging of IV Infiltration/Extravasations
  - Decision Algorithm for IV Extravasations
  - Treatments for Extravasation by Drug Name
  - Infiltration/Extravasations in Pediatric Patients QUICK REFERENCE
  - Hyaluronidase for IV Extravasations in Pediatric Patients QUICK REFERENCE
- Procedures for specific treatments
  - *Dexrazoxane administration*
  - *Dimethyl sulfoxide (DMSO) administration*
  - *Hyaluronidase administration*
  - *Phentolamine administration*
  - *Sodium thiosulfate administration*

Example from Table of Treatments

Drug	Extravasation potential	Treatment ¤ (Preferred in **bold**)	Thermal Modalities	Other notes
Dactinomycin (Cosmegen®)	Vesicant DNA binding	None † or Dimethyl sulfoxide †	Apply cold † Avoid heat and direct sunlight	
Daunorubicin (Cerubidine®)	Vesicant DNA binding	**Dexrazoxane** † or Dimethyl sulfoxide † **NOT** to be used together as combination may increase tissue damage	Apply cold (remove cooling packs at least 15 minutes prior to dexrazoxane infusion) Avoid heat and direct sunlight	Do not use extremity for 48 hours Corticosteroids are CONTRAINDICATED Hyaluronidase is **NOT** effective with this agent.
Dextrose solutions (≥ 10%)	Hyperosmolar solution	Hyaluronidase**		
Dobutamine	Ischemia inducing agent	**None** or Phentolamine is an option, but not generally needed		Hyaluronidase is CONTRAINDICATED

Treatment: Hyaluronidase

- Hyaluronidase: Re-introduced as Vitrase; approved by FDA 2004. No adverse effects, excellent clinical results from treatment.
- Hyaluronidase works by modifying the permeability of connective tissue to enhance the absorption and dispersion of other injected drugs.

Previous Barriers to Treatment with Hyaluronidase

- Availability
- Lack of Knowledge
  - Updated SOP
  - Education
  - Order sets
  - Forced documentation
- Pain
  - 30 g needles
  - Analgesics, opioids
- Costs

Cost Analysis

Cost of Treatment*

- Vitrase
  - Cost per dose = $37
- Supplies
  - Cost per dose < $3
- Nursing time

Total Cost < $40/dose

*All costs are estimates

Potential Cost Aversion*

- Surgical Intervention
  - $2,000+/treatment
- Litigation
  - $100, 000- $500,000+/case
- Nursing time

Return on Investment

50 x if avoid one surgery

250-1,250 x if avoid one lawsuit

Human life- priceless

Hyaluronidase Administration

Dosage:

- Typical doses for neonates and smaller infiltrations is 15 units/ml.
- Higher (150 unit/ml) doses may be indicated for vesicant chemotherapies or large extravasations in **non-infants**.

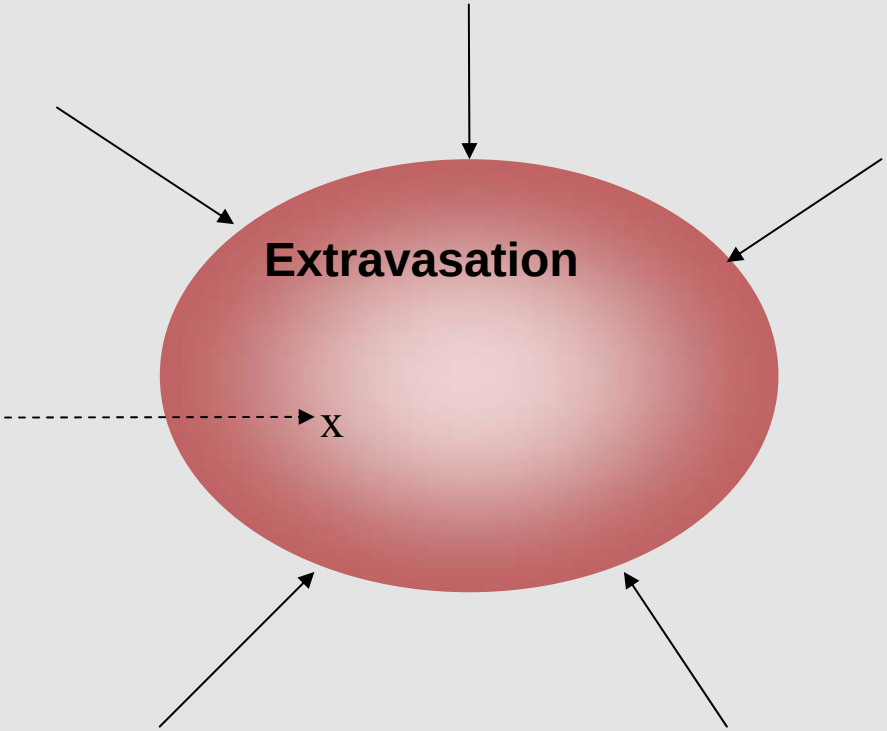
Route:

Hyaluronidase may be given subcutaneous (SQ) or intradermal (ID), **IV administration should be avoided**.

Administration:

Hyaluronidase in 5 injections (0.2 ml per injection for total 1 ml) around the circumference of the affected area, SQ or ID, using a new 30 gauge needle for each injection.

Hyaluronidase Administration



Area of injury

X Catheter insertion site

Aspirate through existing catheter, then remove

Administer hyaluronidase SQ or ID

Hyaluronidase- CAUTIONS AND CONSIDERATIONS

- Hyaluronidase is NOT for IV administration
- Hyaluronidase should NOT be used to treat vasoconstrictive agents (such as dopamine, dobutamine, epinephrine or norepinephrine).
- Hyaluronidase **may** be repeated..
- Treatment should always be STAT

Treatment: Principles for applying thermal modalities

- Apply cold: to localize the infiltrate (for 20 minutes, 4 times daily for 1-2 days).
  - Cold is recommended for anthracyclines (e.g. doxorubicin, daunorubicin) extravasations. In general, topical cooling appears to be a better choice after extravasations.
- Apply heat: to dispense the infiltrate into surrounding tissue (for 20 minutes, 4 times daily for 1-2 days).
  - Heat is recommended for vinca alkaloids (e.g. vincristine, vinblastine, vinorelbine) extravasations.
  - Avoid heat with anthracylines.
  - Heat therapy may not be applicable for premature or newborn infants. Moist heat should be avoided, especially in the neonatal population.
- Application of heat and cold therapy may not be warranted for patients with neurological limb impairments or inability to self-report.

References

- Banta, C. & Noerr, B. (1992). Hyaluronidase. Neonatal Network, 11(6), 103-105.
- Children's and Women's Services (2010). Standard of practice: Intravenous Therapy and Interventions for IV Infiltration. Policy and Procedure Manual of University of Iowa Hospitals and Clinics, N-CWS-PEDS_08.130.
- COG Pharmacy Committee & COG Nursing Clinical Practice Committee: Acute/Palliative Care Section. (2007). *Extravasation guidelines.* Children's Oncology Group unpublished guidelines.
- Garland, J. S., Dunne, M., Havens, P., Hintermeyer, M., Bozette, M. A., et al. (1992). Peripheral intravenous catheter complications in critically ill children: A prospective study. Pediatrics, 89(6), 1145-1150.
- Hanrahan, K (2010). Hyaluronidase for IV Extravasation Evidence-Based Guideline. The University of Iowa College of Nursing Gerontological Nursing Interventions Research Center, Research Translation and Dissemination Core.
- Infusion Nurses Society (2006). Infusion nursing standards of practice. Journal of Infusion Nursing, 29 (1), s1-s92.
- Montgomery, L., Hanrahan, K., Kottman, K., Otto, A., Barrett, T., Hermiston, B. (1999). Guidelines for IV Infiltrations in Pediatric Patients. *Pediatric Nursing, 25*(2), 167-180.
- Schulmeister, L. (2007). Extravasation management, Seminars in Oncology Nursing, 23(3), 184-190.

Review Test

Click on the ICON link below and answer the questions to record your participation. Passing score is 4.

ICON