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.
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
- 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

<table>
<thead>
<tr>
<th>Stage 0</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No redness, pain, edema, blanching, tenderness, drainage.</td>
<td>Mild redness</td>
<td>Persistent mild redness</td>
<td>Moderate edema</td>
<td>Moderate to severe and/or pitting edema</td>
</tr>
<tr>
<td>Flushes with ease</td>
<td>Mild edema</td>
<td>Persistent mild edema</td>
<td>Moderate redness</td>
<td>Persistent redness, discoloration, bruising</td>
</tr>
<tr>
<td>Good distal pulses</td>
<td>Flushes with difficulty</td>
<td>Skin blanched</td>
<td>Skin blanched</td>
<td>Skin blanched</td>
</tr>
<tr>
<td>1-2 second distal capillary refill</td>
<td>Pain at site</td>
<td>Skin blanched</td>
<td>Pain at site</td>
<td>Pain at site</td>
</tr>
<tr>
<td>Skin warm to touch</td>
<td>Skin cool to touch</td>
<td>Skin blanched</td>
<td>mild-moderate</td>
<td>moderate-severe</td>
</tr>
<tr>
<td>1-2 second distal capillary refill</td>
<td>Good distal pulses</td>
<td>Skin cool to touch</td>
<td>Skin cool to touch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-3 second distal capillary refill</td>
<td>Good distal pulses</td>
<td>1-3 second distal capillary refill</td>
<td></td>
</tr>
<tr>
<td>Infiltration of any amount of blood product, irritant or vesicant</td>
<td>1-2 second distal capillary refill</td>
<td>&gt; 3 second distal capillary refill</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

IV Extravasation

Stage 0
- Assess
  - No Extravasation

Stage 1 or 2
- Assess
  - Stage 2
    - Stop infusion
    - Attempt to aspirate back any residual fluid from existing catheter
    - Remove PIV if not needed for antidote treatment
    - Elevate

Stage 3 or 4, any blood or vesicant
- Stop infusion
- Attempt to aspirate back any residual fluid from existing catheter
- Remove PIV if not needed for antidote treatment
- Elevate

Get help! FAST
- Notify LIP
- Activate other resources

CONTINUED
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

<table>
<thead>
<tr>
<th>Drug</th>
<th>Extravasation potential</th>
<th>Treatment □ (Preferred in <strong>bold</strong>)</th>
<th>Thermal Modalities</th>
<th>Other notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dactinomycin (Cosmegen®)</td>
<td>Vesicant DNA binding</td>
<td>None † or Dimethyl sulfoxide †</td>
<td>Apply cold † Avoid heat and direct sunlight</td>
<td></td>
</tr>
</tbody>
</table>
| 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

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

*All costs are estimates
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

Extravasation

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 anthracyclines.
  - 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

- 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.
Review Test

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

ICON