Management of Extravasation and Infiltration Injuries

This guideline does not cover the extravasation of chemotherapeutic agents which are directly damaging to surrounding cells and require specific antidotes. These should be managed as per the Starship Paediatric Oncology and Haematology Service “Extravasation of Vesicants” Guideline.

Extravasation – inadvertent administration of a vesicant into the surrounding tissue instead of the intended intravenous pathway. Results in blistering and tissue necrosis and requires immediate attention to limit further injury.

Infiltration – inadvertent administration of an irritant into surrounding tissues instead of the intended intravenous pathway. Results in inflammation and pain but not tissue necrosis. Usually benign but large volumes can lead to nerve compression and compartment syndrome.

Risk Factors: neonates and small children, small fragile veins, poorly secured IV’s, use of metal cannula (ie butterfly needles), unconscious/altered mental state/nonverbal child, poor insertion technique, multiple venous punctures, IV placement across areas of flexion (wrist, antecubital fossa).¹

Table 1: High Risk Infusions and Medications (Vesicants):

<table>
<thead>
<tr>
<th>Hyperosmolar Solutions</th>
<th>Non-Physiological pH</th>
<th>Vasopressors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fluids:</strong> 10-50% Dextrose, 3% Saline, TPN, Mannitol</td>
<td>Acidic: Amioderone, Amphotericin, Caffeine, Doxycycline, Gentamicin, Metronidazole, Pentamidine, Promethazine, Vancomycin</td>
<td>Adrenaline Noradrenaline Dopamine Dobutamine Vasopressin Phenylephrine Methylene blue</td>
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<tr>
<td><strong>Medications:</strong> Aminophylline, Ampicillin, Calcium solutions, Diazepam, Digoxin, Lorazepam, Nitroglycerin, Phenobarbitone, Phenytoin, Potassium, Radiographic Contrast, Sodium Bicarbonate</td>
<td>Alkaline: Aciclovir, Ampicillin, Phenytoin, Thiopentone</td>
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</table>
**Saline Irrigation:** Used for severe hyperosmolar extravasations to assist with removal of extravasated material. Evidence for use is limited to case series reports which suggest that early treatment with saline irrigation +/- hyaluronidase results in good long-term functional and cosmetic outcomes.²

**Surgical Intervention:** Acute decompression of compartment syndrome may be required in severe cases of hyperosmolar extravasation.

### Table 2: Grading of Extravasation Injuries (Millam 1988)³

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painful IV site</td>
<td>Painful IV site</td>
<td>Painful IV site</td>
<td>Painful IV site</td>
</tr>
<tr>
<td>No erythema</td>
<td>Erythema present</td>
<td>Blanching</td>
<td>Blanching</td>
</tr>
<tr>
<td>No swelling</td>
<td>Slight swelling</td>
<td>Marked swelling</td>
<td>Very marked swelling</td>
</tr>
<tr>
<td>Flushes with difficulty</td>
<td>No blanching</td>
<td>Cool to touch</td>
<td>Cool to touch</td>
</tr>
<tr>
<td></td>
<td>Brisk capillary refill distal to infiltration site</td>
<td>Brisk capillary refill distal to infiltration site</td>
<td>Capillary refill &gt; 4sec*</td>
</tr>
<tr>
<td></td>
<td>Good pulse distal to infiltration site</td>
<td>Good pulse distal to infiltration site</td>
<td>Decreased or absent pulse*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skin breakdown or necrosis*</td>
</tr>
</tbody>
</table>

* The presence of any one of these signs constitutes a stage 4 injury

**Suggested Management:**

**At first concern of infiltration:**
- Stop infusion immediately and aspirate as much back from cannula as possible
- Leave IV cannula in situ
- Assess grade of injury (see Table 2)

**Stage 1 and 2 Injuries:**
- Remove IV cannula
- Elevate limb for 48 hours
- Remove any constricting bands/clothing
- Document injury in clinical notes

**Stage 3 and 4 Injuries:**
- As above EXCEPT leave cannula in situ as antidote may be required
- Inform charge nurse and registrar – requires urgent medical review as injuries secondary to high risk infusions (Table 1) require individualized management (see below).
- Photograph injury for documentation in clinical notes +/- referral to plastic surgical team
- Log a Risk Monitor Pro Incident Report
Specific treatment for extravasation injuries:

**Hyperosmolar Agents:** Saline Irrigation to dilute and flush out as much of the infiltrated agent as possible. If available, hyaluronidase may be infiltrated into the area immediately prior to irrigation to aid in dispersion of the agent.4

**Agents with Non-Physiological pH:** No specific antidote. Warm compresses and elevation are recommended. Neutralisation should be avoided because this can produce exothermic or gas forming reactions that may worsen tissue injury.4

**Vasopressors:** Warm compressors recommended – apply proximal to the site of injury for 15-20mins at least 4 times daily for first 24-48hrs. Phentolamine injected subcutaneously into the area of infiltration reduces vasoconstriction and local ischaemia. DO NOT use hyaluronidase or cold compressors as this may worsen injury. The use of topical nitroglycerine 2% cream has been reported when phentolamine not available and may be more appropriate as first line treatment for vasopressin and methylene blue extravasations.4

**Saline Irrigation Technique:**

Perform under sterile conditions – topical antiseptic, sterile gloves, drape and dressing pack. This is a painful procedure - administer appropriate analgesia prior and infiltrate area proximal to affected area and within the affected area with local anaesthetic - 1% lignocaine. Make shallow incisions in the overlying skin with a scalpel or sharp needle 1-2cm apart over affected area.

Use the white plastic cannula sheath off a large bore angiocath (needle removed) attached to a 20ml syringe filled with 0.9% saline.

Begin at the center of the affected area (where agent is most concentrated) and gently infiltrate subcutaneous tissue via the skin incisions – fluid should be seen to leak from surrounding incision sites.

Refill syringe and repeat – 500mls saline washout volume is reported in the literature to give good results.2,5

When washout complete – elevate limb to allow further drainage and cover with a sterile non-stick dressing. Wound must be inspected at least Q6H over the next 24hrs.

Table 3: Antidotes

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dose and Administration</th>
<th>Caution</th>
<th>Mechanism of Action</th>
</tr>
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<tbody>
<tr>
<td>Hyaluronidase</td>
<td>150unit/ml solution - given as five 0.2ml subcutaneous injections into extravasation site via 25g needle. One injection may be administered via cannula if remains insitu. Total dose = 1ml = 150units6</td>
<td>Most effective if administered within 2hrs, reports of efficacy up to 12hrs post injury.4 Effect lasts 24-48 hrs. Only to be used in conjunction with saline irrigation7</td>
<td>Breaks down connective tissue hyaluronic acid increasing the distribution and absorption of locally injected substances.</td>
</tr>
<tr>
<td><strong>Phentolamine</strong></td>
<td>5mg made up to 10ml with 0.9% Saline solution - given as subcutaneous injections into extravasation site and via cannula if remains insitu. Dose = 0.1-0.2mg/kg, max dose 5mg. Effective up to 12 hrs post injury. Systemic absorption may result in tachycardia and hypotension. Competitive α-adrenergic blockade. Reverses the alpha mediated vasoconstriction properties of vasopressors.</td>
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<tr>
<td><strong>Topical nitroglycerin 2%</strong></td>
<td>1 inch strip Apply directly to affected area. Tachycardia and hypotension from systemic absorption. Use with extreme caution if cardiovascular instability. Vasodilatation of capillaries to improve blood flow and reduce ischaemia.</td>
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**Refer to Middlemore Plastic Surgical team:** injuries secondary to calcium solutions, any injury with signs of necrosis/skin breakdown or compromised perfusion and all injuries where the area of extravasation involves a joint.

Discuss case with on-call plastics registrar – via Middlemore Hospital call center

Email clinical details and photographs to: Plasticreferrals.Plasticreferrals@middlemore.co.nz

**References:**


7. New Zealand Formulary For Children release 35—1 May 2015 | ISSN: 2350-2916