Avoiding extravasation injury in Neonates

Background

Extravasation injury to the skin is one of the main iatrogenic injuries in neonatology. Difficult and fragile venous access and potentially caustic infusates combine to create this risk. While many of these injuries will heal without consequence, some cause permanent scarring and, particularly when close to joints, can cause movement restriction and damage to the bony growth plates in the ankle. Wilkins et al estimated the incidence at 38/1000 babies admitted to tertiary NICUs. Most occur from extravasation of peripheral venous cannulae (93%) with the veins in the dorsum of the foot (6 of 9 injuries described by Kumar et al) and back of the hand being particularly vulnerable. The relative lack of subcutaneous tissue at these sites makes them both attractive (because of visibility of the veins) for peripheral cannulation and also more vulnerable when extravasation occurs.

Skin necrosis from extravasation can result from a range of infusates but the main ones that cause these injuries are: any intravenous fluid containing calcium, the amino acid/glucose/electrolyte mix of TPN and antibiotics. It is incumbent upon us to ensure that the risks of the therapies that we deliver do not exceed the risks of what we are attempting to treat.

Guidelines for Prevention:

- Clinical circumstances will vary and there will be exceptions to all these guidelines. However, if these guidelines are to be overridden, this decision can ONLY be taken at Fellow or Consultant level.
- This policy does not replace the existing nursing guidelines with respect to management and monitoring of peripheral and central venous cannulae. This remains the main stay of avoiding extravasation injury. (link to these nursing policies)
In all babies:

1. Junior medical staff (residents and registrars) should have no more than three attempts at peripheral venous cannulation before asking for senior assistance.
2. TPN or any intravenous solution containing calcium should only be given via a central venous line, that is a peripherally inserted silastic central venous line or an umbilical venous line. No solution containing calcium should be given via a peripheral venous cannula. There will be exceptions to this rule but these must be approved at Consultant or Fellow level.

Term or near term babies prescribed antibiotics for transient respiratory distress:

- Experience suggests this group of babies is at particular risk of extravasation injury. The approach to this needs to balance the real risk of under-treating early onset infection against this extravasation risk. When the respiratory distress settles quickly, very few of these babies will have infection.
- The available information in the literature, which is low level evidence, and our recent experience suggest that peripheral cannulae inserted into the small veins on the dorsum of the foot are at particularly high risk of extravasation injury. The tips of such cannulae invariably end up close to the ankle joint and so are particularly likely to work their way out of the vein with movement.

1. **Consideration should be given to stopping the antibiotics and removing the cannula before 48 hours** in babies with low risk of sepsis where the respiratory distress settles quickly. For example if there is:
   - No risk of sepsis in the perinatal history (eg. PROM, maternal GBS status)
   - No or minimal radiological change in lung fields.
   - Normal results of investigations such as blood count, CRP, placental histology.
2. In babies where the first cannula does tissue before 48 hours, consideration, using the above criteria, should be given to stopping antibiotics and not re-siting the cannula.
3. Antibiotics should not usually be given through cannulae inserted into the small veins on the dorsum of the foot. There will be exceptions to this rule but these must be approved at Consultant or Fellow level. Acceptable sites in order of preference include:
   - The back of the hand and forearm
   - The saphenous vein (as long as the site of entry is close to the ankle joint and the cannula tip is beyond the ankle joint).
   - The antecubital fossa.
   - The umbilical vein.
   - The scalp veins.

*Don’t use these veins if it is likely that the baby will need a silastic long line in the future.

Wherever the cannula is inserted all the usual precautions to test that the cannula is in the vein should be performed prior to infusing the antibiotics.

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**Guidelines for Treatment of Extravasation.**
There are a range of possible rescue therapies that have been suggested for treatment of extravasation to prevent scarring and injury. These include hyaluronidase and saline flushes, glyceryl trinitrate creams and vasodilators (such as phentolamine) for dopamine extravasation. The evidence to support the use of any of these therapies is low level, mainly anecdotal or observational case series.

The therapy with the most observational evidence is saline irrigation of the subcutaneous tissue affected by the extravasation. Most reports are based in referral Plastic Surgery services so probably represent the worst cases.

- Gault described a six year experience of extravasation cases referred to a Plastic Surgery Service. Forty four cases referred within 24 hours of the injury were treated with predominantly saline flushes (±hyaluronidase pre-treatment) and compared to 52 cases with late referral. Eighty eight percent of the early treated group had no tissue damage vs 15% of the late treated group. Not withstanding that the late group were probably included referrals because they had tissue damage, the early treated group included quite toxic extravasated agents (chemotherapy, calcium etc).
- Harris describes using a modification of this technique using only normal saline flush out in 56 babies, none of whom developed tissue damage.
- Casanova describes 14 neonates with extravasation in which saline flush and liposuction was used, with 11 cases having no skin necrosis and the other 3 having some damage that healed spontaneously.
- In contrast, in the series of Kumar et al where the management was conservative, 7 of 9 babies required prolonged scar management.

**Saline Flush Technique:**
This procedure involves making small puncture marks around the edge of the area of extravasation and the inserting a cannula into each of the puncture sites in turn and flushing normal saline through each puncture site. The volume in the literature is 500 mls, although this should be modified down in the neonate. The goal is that the flush solution will exit out of the other puncture site.

The evidence to support routine use of this procedure is not strong. There are potential adverse effects of introducing extra infection risk and of creating scars with the drainage incisions. Because skin necrosis can be difficult to predict early after the extravasation, this procedure may exchange a possible scar for definite scars. Consequently, this procedure should not be used routinely after extravasation but should be considered if a large extravasation of very caustic solution has occurred, for example a concentrated solution of calcium. The decision to use this technique should only be made at consultant level.

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**Management of Extravasation at RPA:**
1. Stop intravenous infusion
2. Try to aspirate any free extravasate through the cannula then remove cannula.
3. Notify the attending Neonatologist.
4. Consult with the Plastic Surgery team if there is evidence of evolving skin necrosis.

Management of site

- These are painful injuries and use of sucrose should be considered when any procedure to the affected limb is planned – see sucrose policy. Document use of sucrose on medication chart (nurse initiated medications). Record efficacy of sucrose, cannula site and evaluate interventions.
- Explain management strategy to parents and commence Multidisciplinary Care Plan. Document all consultations with the plastic team and invite team to document their assessment and recommendations on the Multidisciplinary Care Plan.

Intact Skin Dressing Procedure

- If the skin is intact observe closely and protect from injury due to friction or pressure. This may require application of a dry dressing if positioning of the infant is unable to reduce the risk. Use gauze from dressing pack – this is softer and less abrasive than gauze found in individual wrapping (synthetic).

Broken Skin Dressing Procedure

- Consider use of sucrose prior to dressing procedure and 2nd RN to contain infant and promote comfort during the procedure.
- Gently clean area with normal saline – be sure not to further traumatis the area. Allow to dry – approximately 2 minutes.
- Apply Atrauman® (Paul Hartman, Germany) on the area of broken skin, seal using gauze from the dressing pack (softer and less abrasive – cotton).
- Use hyperfix tape ™ (3M) to secure dressing. Do not encircle the limb with tape – it may impair circulation and cause oedema.
- Review site within 24 hours and reapply another Atrauman® dressing if site is clean and resolving.
- Review and re dress every 48 hours – document progress on Multidisciplinary Care Plan.
- Consultation with CNS (plastics) is available if there are concerns and wound is not healing – page 81090. Additional supplies of Atrauman® and Mepitel® can be obtained from the CNS (plastics) (Sr Nermani Narain – page 81090).

Key Points

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<th>Key Points</th>
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<td>Giving intravenous fluid containing calcium through a peripheral cannula should be avoided if at all possible.</td>
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<td>Consideration should be given to stopping antibiotics before 48 hrs in term babies with respiratory distress where the symptoms settle quickly and there is low risk of sepsis.</td>
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Consideration should be given to stopping antibiotics before 48 hrs in term babies with respiratory distress if the cannula tissue after the baby has been discharged to the postnatal ward

Cannulating the dorsal veins of the foot for intravenous antibiotics should be avoided if at all possible.

Saline Flush technique should only be considered in extravasation situations where there is a very high risk of tissue necrosis.

References:


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