CLINICAL GUIDELINE FOR NEONATAL INTRAVENOUS EXTRAVASATION INJURY: PREVENTION AND TREATMENT

1. Aim/Purpose of this Guideline

1.1. To provide guidance to doctors and nurses caring for neonatal patients to prevent, identify, document and optimally treat soft tissue injuries arising from extravasation of intravenous drugs and fluids.

2. The Guidance

2.1. Definition and Epidemiology

2.2. Extravasation is the unintentional leakage of infused fluid into surrounding tissue, which may cause tissue damage. The degree of injury is related to the pH, osmolality, and pharmacological properties of the infused drug.

2.3. Risk factors and drugs/ infusates commonly associated with tissue damage include:

Patient factors	***Drugs and Fluids***
Extreme prematurity *Infusion of irritant or vasoactive drugs and fluids via peripheral venous cannulae (1)*	*Dextrose greater than 12.5% concentration* *Parenteral Nutrition (TPN)* *Fluids containing calcium, potassium, THAM, or sodium bicarbonate* *Blood* *Dopamine and other vasoactive drugs*

2.4. Extravasation injury leads to long-term cosmetic or functional compromise in a small but significant proportion of affected babies. A 2004 survey of 31 regional UK Neonatal Units reported extravasation with skin necrosis in 38 per 1000 babies (1). In 2010, the National Patient Safety Agency estimated that its database contained around 1,400 neonatal extravasation injury reports (2).

2.5. Evidence base and guidance sources

2.6. Current approaches to the management of intravenous fluid extravasation in neonates are largely based on case reports and uncontrolled studies with an absence of prospective trial data. Correspondingly there is no consensus on optimal management (1).

2.7. This guideline draws upon a review of six British local and regional neonatal guidelines (3-8) and one Australian local guideline (9). Six of the seven guidelines were produced within the past two years or are within their stated review date.

2.8. Prevention

2.9. Medical and Nursing staff should adhere to the prevention algorithm for paediatric and neonatal extravasation (Appendix). The following precautions are particularly important in preventing extravasation injury:

- Use of umbilical or percutaneous long lines for infusion of drugs and fluids likely to cause tissue damage on extravasation. Central line position should be confirmed radiologically before commencing infusion of any drugs with potential for tissue damage on extravasation.
- Hourly documented monitoring of cannula sites for oedema, firmness or discolouration.
- Use of transparent dressings to ensure visibility of cannula site.

2.10. Extravasation Grading

2.11.The grading system in Table 1 (10) can be used to assess the severity of extravasation at the time of detection, and may help determine the appropriate level of intervention:

Table 1: Assessment

Grade 1	***Grade 2***	***Grade 3***	***Grade 4***
Pain at infusion site	*Pain at infusion site*	*Pain at infusion site*	*Pain at infusion site*
No swelling	*Swelling*	*Swelling*	*Swelling*
	No skin blanching	*Skin blanching*	*Skin blanching*
		Capillary refill normal	*Reduced capillary refill*
			+/- Decreased or absent distal pulse
			+/- Blistering or skin breakdown

2.12. Management

2.13.When an extravasation injury is identified, in all cases:

- Stop infusion immediately;
- Note the drug or fluid that was being infused;
- Aspirate fluid if possible through cannula using a 2ml syringe;
- Then remove the cannula;
- Elevate the limb.
- Assess extravasation grade

2.14.Then act as described in Table 2 according to severity grade:

Table 2: Action

Grade 1	***Grade 2***	***Grade 3***	***Grade 4***
1. Remove all splints and tapes		*1. Remove all splints and tapes*	
2. Elevate limb		*2. Elevate limb*	
3. Document and communicate findings (Section 6)		*3. Document and communicate findings (Section 6)*	
		4. Inform middle grade doctor or consultant	
		5. Photograph site	
		6. Identify extravasated drug/ infusate	
		7. Consider active treatment (Section 7)	

2.15. Documentation and Communication

- All significant extravasation incidents (Grade 2-4) should be assessed immediately by a neonatal doctor or Advanced Neonatal Nurse Practitioner.
- The service or on-call consultant should be informed of any Grade 3 or 4 extravasation and involved in management as appropriate.
- The baby's parent(s) should be informed of the extravasation and its treatment as soon as possible. However prompt treatment is important and should not be delayed whilst establishing contact with parents.
- All details of extravasated drug or fluid, clinical findings, treatment given and discussion with parents should be documented in the baby's notes.
- For Grade 3 and 4 extravasations, clinical photographs taken when the injury is discovered and after any specific treatment should be filed in the baby's notes. The RCHT Policy for Recordings and Photography should be followed (available via Cornwall and IOS Health Community Documents Library).
- The Tissue Viability Team should be informed the same day of all Grade 3 and 4 extravasations, and asked to review within 24 hours or when next available, whichever is the sooner.
- A Datix Incident Report should be completed for all extravasations.

2.16. Active treatment

- Vaso-constrictive drugs (e.g. Dopamine, Adrenaline, Noradrenaline, Vasopressin)

Extravasation of vasoactive drugs must be acted on urgently to avoid severe ischaemic damage resulting from vasoconstriction. Topical or injected vasodilators have been used to neutralise this effect. Consider:

  - Subcutaneous infiltration of the area with Phentolamine (an alpha-blocker): Prepare phentolamine 0.5mg in 1ml by diluting in 0.9% saline. Inject 0.2 ml (0.1mg) of phentolamine 2-5 times into the area of extravasation, according to size of infant and extent of extravasation. Change the needle between injections (10).

- Hyper-osmolar substances (e.g. TPN, Calcium chloride, Potassium chloride, Dextrose >10%, Bicarbonate, Contrast media)

  - Irrigate as described in Section 8.

- Acids and Alkalis (e.g. Phenytoin, Amphotericin B)

  - Irrigate as described in Section 8.

- Blood products

  - Follow steps 1-6 in Table 2. Contact Plastic Surgeon immediately if signs of ischaemia or tissue necrosis.

2.17. Irrigation Procedure

2.18.Neonatal staff who are not competent to perform this procedure should request supervision from the on-call or service consultant. The knowledge and skills required to perform this procedure are core competencies that would be expected of all paediatric and neonatal consultants. Paediatric doctors in training should adhere to RCPCH-approved processes relating to practical procedure training and competency assessment. Prompt treatment is important.

- Give bolus morphine as analgesia (100 micrograms/kg in ventilated infant; 50-75 micrograms/kg in self-ventilating infant with caution for respiratory depression).
- Adopt a full aseptic technique
- Clean the site and surrounding area thoroughly.
- Place the affected limb on an absorbent sterile towel.
- Inflitrate the area and small area of surrounding skin with 1% lignocaine (maximum 0.3 ml/kg) for local anaesthesia.
- Make four small puncture holes over the area using a fine scalpel or 18G (white) needle.
- Infiltrate Hyaluronidase 500-1000 units through puncture holes into affected area*.

- Insert a 22G (blue) cannula** through one of the puncture holes and remove the needle.
- Irrigate the subcutaneous tissues with aliquots of 3-5ml 0.9% saline until the overlying skin is visibly improved, up to a suggested maximum of 50ml***. A 20ml syringe connected to the cannula via a 3-way may be used to avoid repeatedly connecting and disconnecting the syringe.
- Fluid should extrude through the puncture holes.
- Gentle massage may be necessary between aliquots to aid drainage through the puncture holes.
- Take a clinical photograph of the site and the end of irrigation.
- Dress the area as described in Section 9.

**Some local guidelines recommend irrigation of saline without prior infiltration with hyaluronidase.*

***The reviewed guidelines and published literature suggest various needle and/or cannula sizes for this purpose. The original description (11) recommended use of a Verres insufflation needle, but these are not readily available on neonatal units. Use of a cannula with needle removed poses less risk of damage to underlying structures.*

****There is no apparent consensus in the reviewed guidelines or published literature on the optimal irrigation volume.*

Figure: Saline flush-out technique (11)

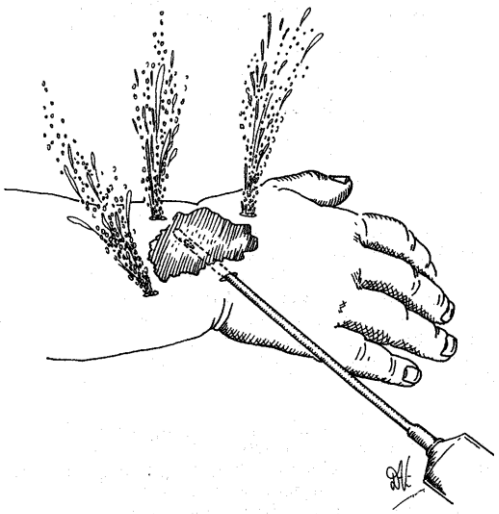


Figure 2 Saline flushout technique using a Verres needle.

2.19. Dressing

2.20.Suitable techniques include hydrocolloid dressings (e.g. Duoderm or Granuflex), hydrogels (Activheal gel), or sheet hydrogels (Actiform cool). The dressing must not impede limb movement. Bandaging of the affected limb should be avoided so as not to risk restricting circulation. If a hydrogel is used, it should be covered with a transparent film dressing such as Tegaderm or Opsite. Dry dressings are considered to be less effective, and exposure to air is not recommended as it may delay epithelialisation.

3. Monitoring compliance and effectiveness

Element to be monitored	Key components of extravasation prevention and treatment recommended by guidance
Lead	Dr. Andrew Collinson, Neonatal Operational Consultant Lead
Tool	Review of incidents via DATIX reports submitted following significant extravasation episodes, per guideline. Routine review of notes and summaries to ensure DATIX reports submitted.
Frequency	Review of each DATIX-reported extravasation incident. Wider audit if dictated by review of incidents.
Reporting arrangements	Child Health Directorate Audit and Clinical Guidelines Meetings
Acting on recommendations and Lead(s)	Neonatal Consultant Operational Lead Band 7 Neonatal Matron
Change in practice and lessons to be shared	Guideline describes current practice. Lessons relating to reported extravasation incidents will be shared and cascaded using existing Directorate Governance Structures and dissemination tools.

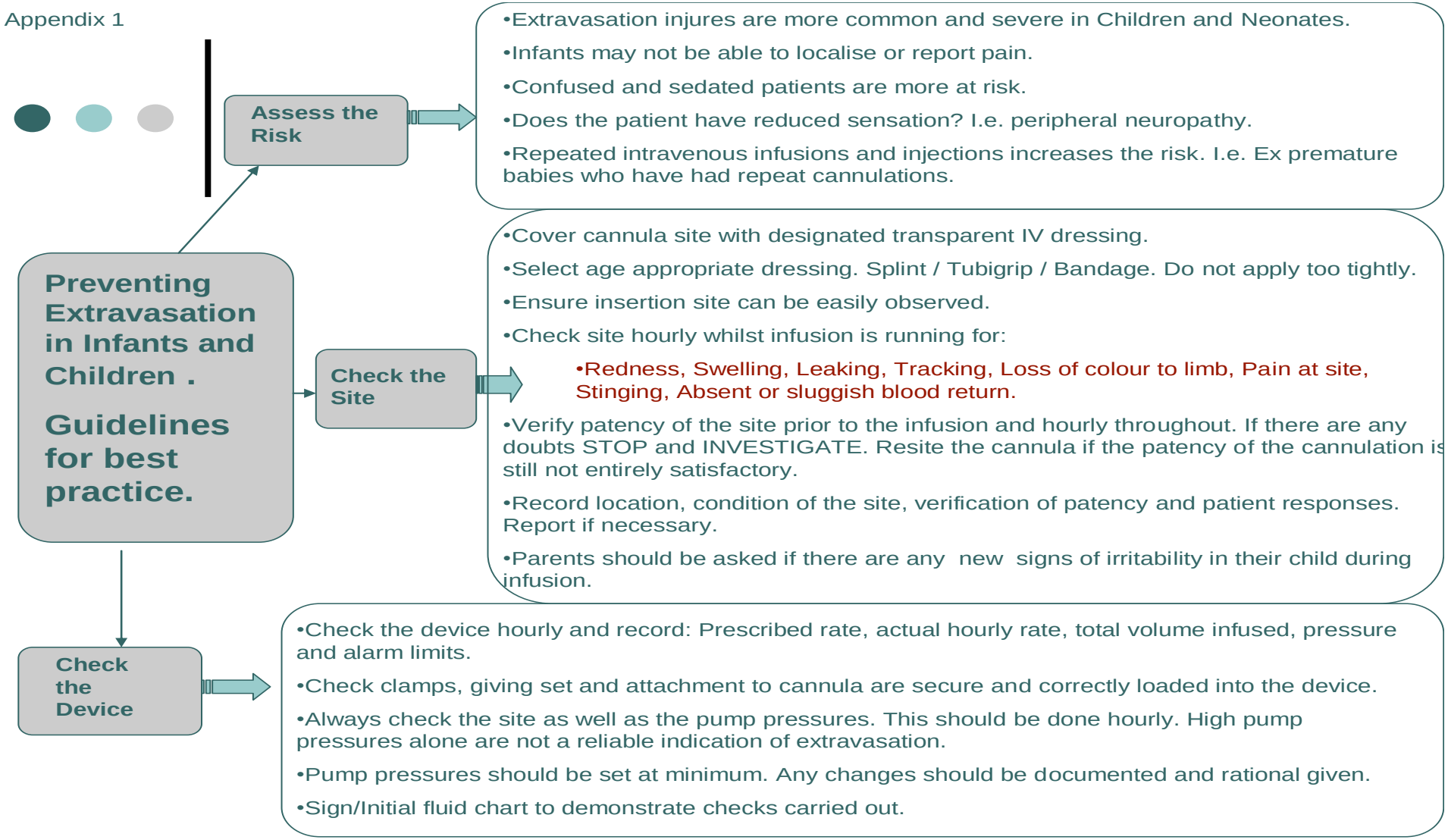
4. Equality and Diversity

4.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement.

4.2. Equality Impact Assessment

The Initial Equality Impact Assessment Screening Form is at Appendix 3

Appendix 1. Preventing Extravasation in Infants and Children



Appendix 2. Governance Information

Document Title	Neonatal Intravenous Extravasation Injury: Prevention and Treatment					
Date Issued/Approved:	25 September 2013					
Date Valid From:	25 September 2013					
Date Valid To:	1 September 2016					
Directorate / Department responsible (author/owner):	Andrew Collinson, Consultant Paediatrician					
Contact details:	01872 255081					
Brief summary of contents	To provide guidance to doctors and nurses caring for neonatal patients to prevent, identify, document and optimally treat soft tissue injuries arising from extravasation of intravenous drugs and fluids					
Suggested Keywords:	Extravasation, Neonatal, Cannula					
Target Audience	RCHT	PCT	CFT			
	✓					
Executive Director responsible for Policy:	Medical Director					
Date revised:	September 2013					
This document replaces (exact title of previous version):	Neonatal Intravenous Extravasation Injury. Prevention and Treatment.					
Approval route (names of committees)/consultation:	Neonatal Consultants Advanced Neonatal Practitioners Paediatric Consultants Directorate audit and guidelines					
Divisional Manager confirming approval processes						
Name and Post Title of additional signatories	Not Required					
Signature of Executive Director giving approval						
Publication Location (refer to Policy on Policies – Approvals and Ratification):	Internet & Intranet	✓	Intranet Only			
Document Library Folder/Sub Folder	Clinical / Neonatal					
Links to key external standards	See Related Documents					
Related Documents:	1. Extravasation injuries on regional neonatal units. Wilkins CE. Arch Dis Child Fet Neonat Ed 2004; 89: F274-F275.					

	2. National Patient Safety Agency. 3. Extravasation Injuries. Staffordshire, Shropshire and Black Country Newborn Network Guideline; 2009-11. 4. Guideline for Extravasation Injuries in Neonates in North Trent Neonatal Network; reviewed 2009. 5. Extravasation injury in neonates: Treatment and Prevention. University Hospitals Bristol NHS Foundation Trust; January 2011. 6. Extravasation Injury in Neonates. Newcastle Neonatal Service Guideline; May 2010. 7. Neonatal Intravenous Extravasation Guidelines. Royal United Hospital Bath NHS Trust; October 2010. 8. Neonatal Extravasation Injuries. Royal Devon and Exeter NHS Foundation Trust; October 2005. 9. Neonatal Extravasation. Royal Childrens Hospital, Melbourne; Updated January 2010. 10. Peripheral intravenous extravasation: nursing procedure for initial treatment.Thigpen JL. Neonatal Network 2007; 26(6): 379-84. 11. Preventing the scars of neonatal intensive care. Davies J, Gault D, Buchdahl R. Arch Dis Child. 1994; 70: F50-F51.
Training Need Identified?	No

Version Control Table

Date	Version No	Summary of Changes	Changes Made by *(Name and Job Title)*
July 2011	V1.0	Initial document	Andrew Collinson Consultant in Neonatology and Paediatrics
Sep 13	V2.0	Reformat	Andrew Collinson Consultant in Neonatology and Paediatrics

All or part of this document can be released under the Freedom of Information Act 2000

This document is to be retained for 10 years from the date of expiry.

This document is only valid on the day of printing

Controlled Document

This document has been created following the Royal Cornwall Hospitals NHS Trust Policy on Document Production. It should not be altered in any way without the express permission of the author or their Line Manager.

Appendix 2.Initial Equality Impact Assessment Screening Form

Name of service, strategy, policy or project (hereafter referred to as *policy)* to be assessed: Neonatal Intravenous Extravasation Injury: Prevention and Treatment		
Directorate and service area: Neonatal		Is this a new or existing Procedure? existing
Name of individual completing assessment: Andrew Collinson, Consultant Paediatrician		Telephone: 01872 255081
1. Policy Aim*	To provide guidance to doctors and nurses caring for neonatal patients to prevent, identify, document and optimally treat soft tissue injuries arising from extravasation of intravenous drugs and fluids.	
2. Policy Objectives*	To improve the care of patients with soft tissue injuries arising from extravasation of intravenous drugs and fluids.	
3. Policy – intended Outcomes*	Improved patient care	
5. How will you measure the outcome?	As per section 3 of this document.	
5. Who is intended to benefit from the Policy?	All affected patients	
6a. Is consultation required with the workforce, equality groups, local interest groups etc. around this policy? b. If yes, have these groups been consulted? c. Please list any groups who have been consulted about this procedure.	No	

7. The Impact
Please complete the following table.

Are there concerns that the policy **could** have differential impact on:

Equality Strands:	Yes	No	Rationale for Assessment / Existing Evidence
Age	✓		**This guideline is specifically for neonatal patients and so is not to be used for other patient groups.**
Sex (male, female, trans-gender / gender reassignment)		✓	
Race / Ethnic communities /groups		✓	

Disability - learning disability, physical disability, sensory impairment and mental health problems		✓	
Religion / other beliefs		✓	
Marriage and civil partnership		✓	
Pregnancy and maternity		✓	
Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian		✓	

You will need to continue to a full Equality Impact Assessment if the following have been highlighted:

- You have ticked "Yes" in any column above and
- No consultation or evidence of there being consultation- this excludes any *policies* which have been identified as not requiring consultation**. or**
- Major service redesign or development

8. Please indicate if a full equality analysis is recommended.	**Yes**	**No** ✓

9. If you are not recommending a Full Impact assessment please explain why.

Not needed.

Signature of policy developer / lead manager / director	Date of completion and submission 19 Sep 13

Names and signatures of members carrying out the Screening Assessment	1. Andrew Collinson 2.	

Keep one copy and send a copy to the Human Rights, Equality and Inclusion Lead, c/o Royal Cornwall Hospitals NHS Trust, Human Resources Department, Knowledge Spa, Truro, Cornwall, TR1 3HD

A summary of the results will be published on the Trust's web site.

Signed _____A. Collinson_____

Date _____19/09/13_____