NIVAS
National Infusion and Vascular Access Society

Infiltration and Extravasation

A toolkit to improve practice.

In association with

patient safety learning *the hub*

Version 1 February 2024

Contributors

Created and written by:

Andrew Barton - NIVAS chair

Editors:

Dr James Bennett – NIVAS Board

Paul Lee – NIVAS board

Heather Briscoe – NIVAS Board

Emily Smith – NIVAS Board

Julie Godfrey – NIVAS Board

With thanks to

Karl Emms and Birmingham Women's and Children's hospital patients' safety team.

Contributors:

Samantha Thomas - NHS Resolution

Dr Karen Harold - SACT & IV Access Nurse Consultant

Dr Virginia Aguado – Medusa, The NHS Injectable Medicines Guide

Reviewers

Maya Guerrero – NIVAS Board

Gemma Oliver – NIVAS Board

Fiona Nadin – Frimley Health NHS FT

Foreword

Andrew Barton
Nurse Consultant
IV therapy & Vascular access
NIVAS Chair

Intravenous therapy is an essential aspect of modern healthcare and commonly used within the National Health Services (NHS). The advantages of intravenous therapy include improved patient outcomes and survival due to constant drug bioavailability and consistent therapeutic drug levels in the blood. Unfortunately, the use of intravenous therapies is not without risk. While the benefits of using intravenous therapy usually outweighs such risks, it is necessary for all staff involved with such therapies to have sound knowledge of potential complications. Infection associated with intravenous therapy and vascular access devices is well known and great efforts have been taken throughout the NHS to mitigate this risk in recent years.

Occasionally the administration of IV therapies can go wrong. Infiltration and Extravasation is a complication whereby the drug or IV therapy leaks into the tissues surrounding the vascular access device. Extravasation is often associated with chemotherapy agents; however non-chemotherapy drugs have been reported as having a greater risk of serious complications. Extravasation may cause serious and often life changing injuries. This tool kit is designed to highlight the risks of infiltration and extravasation and facilitate healthcare organisations to implement best practice to improve patient safety and experience.

This tool kit is for everyone to use. NIVAS hopes that together we can make intravenous therapy safer for all.

The NIVAS Campaign

NIVAS Strategy.....

Prevention

Safe IV therapy administration and vascular access practice

Recognition

Recognise the early stages of extravasation

Treatment

Early intervention and treatment to reduce or stop tissue damage

Follow up

Ensure the patient is followed up and supported

Reporting

Standardised incident reporting of infiltration and extravasation

- ✓ All NHS hospitals should have an extravasation lead for non–chemotherapy and chemotherapy practice.
- ✓ All NHS hospitals should improve awareness of non–chemotherapy and chemotherapy extravasation and have guidelines in place.
- ✓ All NHS hospitals should standardise reporting of infiltration and extravasation incidents.
- ✓ National infiltration and extravasation guidelines for chemotherapy and non-chemotherapy practice.
- ✓ Support the creation of a vascular access service team in all NHS Hospitals

National Infusion and Vascular Access Society

Introduction

Infiltration and Extravasation

Infiltration is the inadvertent leakage of intravenous fluid or medication into extravascular tissue from an intravenous vascular access device, such as a peripheral cannula or central venous catheter. The resulting injury is likely to be minor. If the fluid or medication is a vesicant, the injury would be classed as an extravasation as the risk of tissue damage and serious injury is high. (Atay et al 2023; Gorski et al 2024)

Vesicants are drugs or solutions with the potential to cause serious skin or tissue damage including blistering, ulceration and necrosis (Gorski et al 2024; David et al 2020). There are 4 main groups of vesicant drugs commonly used.

- Chemotherapy agents
- Drugs with non-physiological pH – (high or low pH)
- Vasopressors
- Hyperosmolar solutions

Recent data published by NHS Resolution suggests the drugs most commonly responsible for reported infiltration and extravasation injuries within the NHS are the non-chemotherapy vesicant agents (NHSR 2022).

- Infiltration of large volumes of fluid can cause nerve compression and compartment syndrome.
- Other drugs, such as intravenous iron, can cause permanent skin discolouration.
- Extravasation of CT contrast media is also a common complication.

The most serious extravasation injuries are associated with peripherally administered vesicant drugs including antibiotics, antiepileptics and anaesthetic drugs

Drug pH Equivalents

Stomach Acid	1.5 – 2.0	Glucagon pH: 2.5-3
Cola	2.5	Vancomycin pH 2.4 – 4.5
Vinegar	2.9	Gentamycin pH 3 – 5.5
Orange Juice	3.5	Glyceryl trinitrate pH: 3.5-6.5
Coffee	5.0	Metoclopramide pH: 3-5
Healthy Skin	5.0	Amiodarone pH: 3.5-4.5
Urine	6.0	Glucose 5% pH: 4-4.2
Pure Water	7.0	Chlorpheniramine pH: 4-5.2
Human Saliva	6.5 – 7.5	Potassium pH: 4
Blood	7.3-7.5	0.9% Saline solution pH: 7
Sea Water	7.7-8.5	Tazocin pH: 5-7
Baking Soda	8.4	Aminophylline pH: 8.8-10
Hand Soap	9.0-10.0	Frusemide pH: 8.7-9.3
Bleach	12.5	Acyclovir pH: 10-11
		Phenytoin pH: 12

It is safer to administer vesicant drugs into a central vein.

Non-vesicant drugs and solutions can be administered via a peripheral vascular access device sited in a peripheral vein.

Vesicants

Hyperosmolar Solutions:

Solutions with a high osmolarity above 600 mOsm/L

Non-physiological pH:

Acidic pH below 5 or Alkaline pH above 9

Vasopressors:

Such as adrenaline, noradrenaline and dopamine.

Chemotherapy:

Anthracyclines

Studies suggest that hyperosmolar solutions above 600 mOsm/L; (normal range 285-310) (Pittiruti et al 2023 Manrique-Rodríguez et al 2021), extremely acidic or basic pH(<5 or >9), cytotoxic and vasoconstrictive drugs are associated with a higher risk of subsequent leakage and tissue damage when given peripherally (Couissi et al 2023; David et al 2020).

IV catheter related risks

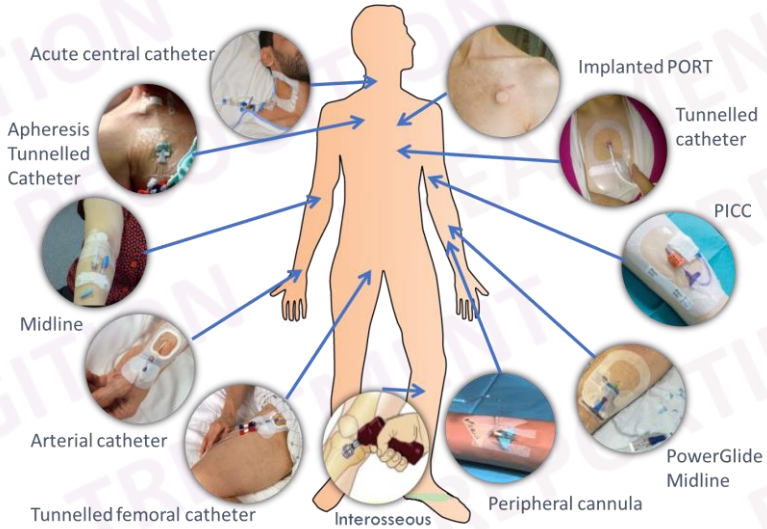
Infiltration and extravasation often results when a problem occurs with a vascular access device (VAD).

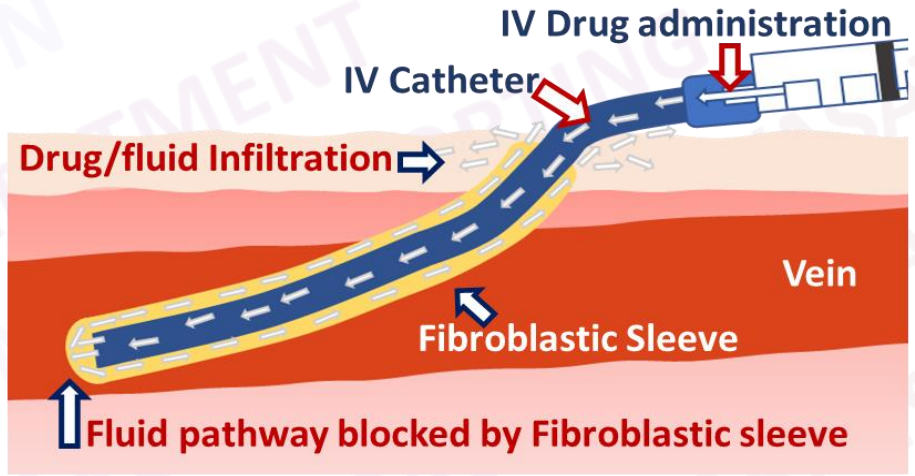
This may be because the VAD has been placed in an inappropriate anatomical location where patient movement displaces the device so the tip of the VAD migrates out of the vein into the tissues. Different VADs have different risks and complications associated with them.

All VADs are prone to the formation of fibroblastic sleeves. Fibroblastic cells can grow along the catheter from the point of vessel entry, so that eventually the catheter tip is encased by a closed sleeve of tissue (Cutuli et al 2023; Passaro et al 2021; Rousslang et al 2020).

Consequently, administered fluids flow back along this sleeve to the catheter exit site and potentially infiltrate into subcutaneous tissue to cause extravasation (Pittiruti et al 2023).

Regular flushing of a VAD and line locking can help prevent fibroblastic sleeve formation at the catheter tip (Gorski et al 2024; Meyer et al 2020).





NHS Resolution

Extravasation – Did you know

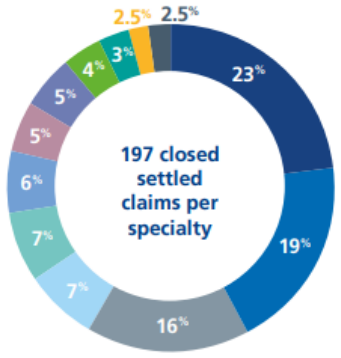
Document download link:
NHS Resolution – Did you know – Extravasation

NHS Resolution

From 1 April 2011 until 31 March 2021 NHS Resolution received 444 claims relating to extravasation injuries. Of those 444 claims, 138 remain open, 197 have settled with damages paid and 109 have closed with nil damages. This has cost the National Health Service (NHS) 15.6 million pounds. This includes payment for claimant legal costs, NHS legal costs and damages.

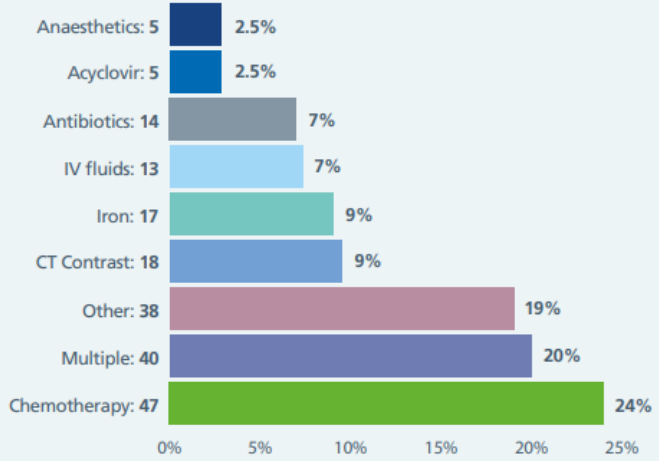
Key facts

Closed claims settled with damages paid per specialty



Paediatrics	45 (23%)	Anaesthesia	10 (5%)
Oncology	38 (19%)	Radiology	10 (5%)
Other	32 (16%)	Intensive care medicine	7 (4%)
Obstetrics	14 (7%)	General surgery	6 (3%)
General medicine	14 (7%)	Haematology	5 (2.5%)
Emergency medicine	11 (6%)	Plastic surgery	5 (2.5%)

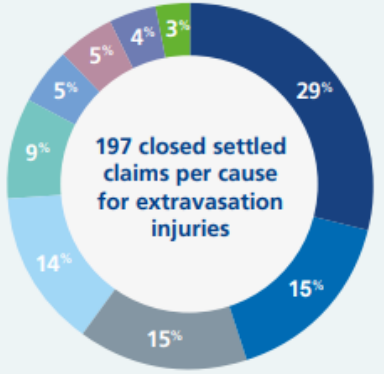
Number of settled claims closed with the payment of damages by drug type



Total claims: 197

Other contains amalgamated claims where there were fewer than five claims per medication type.

Closed claims settled with damages paid per cause of extravasation injuries



Infusion problems	57 (29%)
Inadequate nursing care	30 (15%)
Other	30 (15%)
Err with agent/dose/route/selec	28 (14%)
Fail/delay treatment	18 (9%)
Inappropriate treatment	10 (5%)
Fail to recog. complications	10 (5%)
Operator error	8 (4%)
Re-canalisation	6 (3%)

Other contains less common causes which occurred in areas with fewer than five claims such as equipment malfunction, inadequate intra-operative monitoring, incorrect injection site, fail/delay diagnosis, lack of assistance/care, medication errors, wrong route administration of chemotherapy, intra-operative problems and fail to warn-informed consent.

Extravasation – Did you know?

Did you know? Intravenous iron can cause permanent staining of the patient's skin and/or anaphylaxis? Ensure patients receive all relevant literature to enable an effective consent process prior to the infusion running.

Did you know? The most common site for extravasation injuries in children is the foot? Patient movement, bandaging of the cannula and inadvertent parental obstruction (parental bed position/ holding position of child) are contributing factors.

Did you know? Extravasation from cytotoxic drugs can take several hours or days to develop? Extravasation is not always apparent at an early stage. Greater consideration for the likelihood of extravasation injury should be given in cases where there have been multiple attempts at placing a needle or if the route of vascular access was incorrect.

Did you know? Extravasation of radiological contrast is much more common for CT compared to MRI? Placement of the cannula outside of the radiology department and arm positioning during the imaging are contributory factors to this.

NHS Resolution

Closed claims settled with damages paid per injury caused by extravasation

Bruising/extravasation	98 (50%)	Other	18 (9%)
Scarring	28 (14%)	Cosmetic disfigurement	5 (2.5%)
Tissue damage	24 (12%)	Adnl/Unnecessary operation	5 (2.5%)
Unnecessary pain	19 (10%)		

Total claims: 197

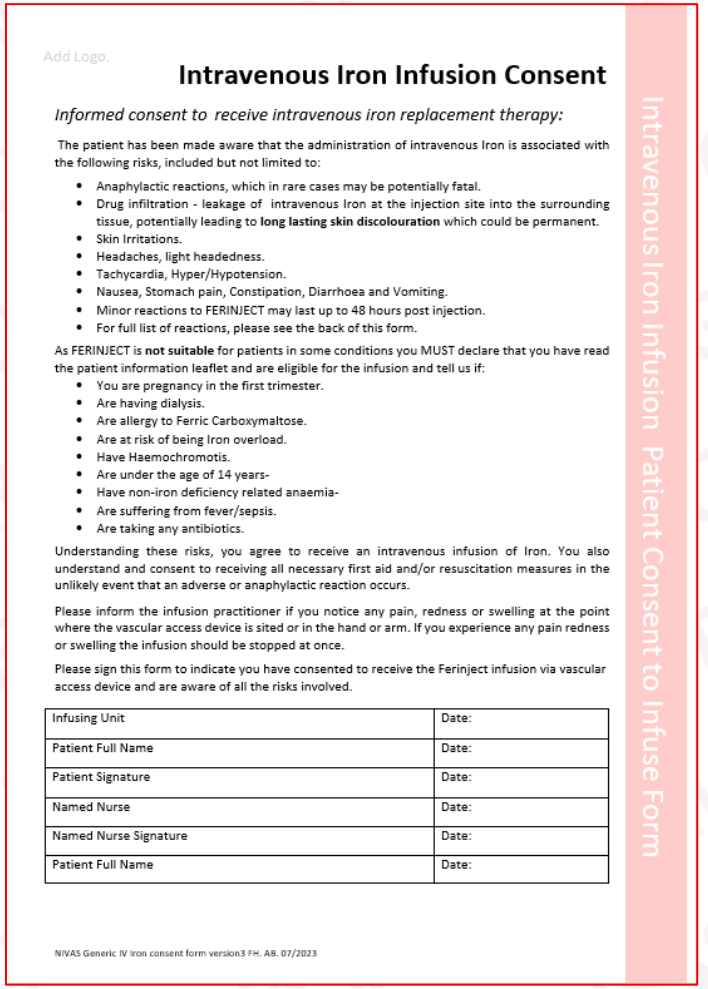
Other contains less common injuries which occurred in categories with fewer than five claims such as burns, fatalities, limb deformity, nerve damage, arterial damage, swelling, compartment syndrome, multiple injuries, joint damage and cardiac arrest.

National Infusion and Vascular Access Society

Consent

Consent and Intravenous Therapy

- Wherever possible informed consent should be obtained prior to giving any clinical treatment.
- This includes the administration of intravenous therapy, especially when administering vesicant agents or other medication with the potential to cause harm.
- The person giving consent must have the capacity to make the decision.
- Consent must be voluntary and informed.
- A process should be followed to manage situations where informed consent cannot be given.
- Consideration should be given to gaining informed consent prior to the administration of a vesicant.
- Intravenous Iron can cause permanent skin staining if infiltration occurs. Where possible, informed written consent should be obtained before administration. Written patient information should be given, and any complications recorded and reported locally.



Add Logo.

Intravenous Iron Infusion Consent

Informed consent to receive intravenous iron replacement therapy:

The patient has been made aware that the administration of intravenous Iron is associated with the following risks, included but not limited to:

- Anaphylactic reactions, which in rare cases may be potentially fatal.
- Drug infiltration - leakage of intravenous Iron at the injection site into the surrounding tissue, potentially leading to **long lasting skin discolouration** which could be permanent.
- Skin Irritations.
- Headaches, light headedness.
- Tachycardia, Hyper/Hypotension.
- Nausea, Stomach pain, Constipation, Diarrhoea and Vomiting.
- Minor reactions to FERINJECT may last up to 48 hours post injection.
- For full list of reactions, please see the back of this form.

As FERINJECT is **not suitable** for patients in some conditions you MUST declare that you have read the patient information leaflet and are eligible for the infusion and tell us if:

- You are pregnancy in the first trimester.
- Are having dialysis.
- Are allergy to Ferric Carboxymaltose.
- Are at risk of being Iron overload.
- Have Haemochromotis.
- Are under the age of 14 years-
- Have non-iron deficiency related anaemia-
- Are suffering from fever/sepsis.
- Are taking any antibiotics.

Understanding these risks, you agree to receive an intravenous infusion of Iron. You also understand and consent to receiving all necessary first aid and/or resuscitation measures in the unlikely event that an adverse or anaphylactic reaction occurs.

Please inform the infusion practitioner if you notice any pain, redness or swelling at the point where the vascular access device is sited or in the hand or arm. If you experience any pain redness or swelling the infusion should be stopped at once.

Please sign this form to indicate you have consented to receive the Ferinject infusion via vascular access device and are aware of all the risks involved.

Infusing Unit	Date:
Patient Full Name	Date:
Patient Signature	Date:
Named Nurse	Date:
Named Nurse Signature	Date:
Patient Full Name	Date:

NIVAS Generic IV Iron consent form version3 FH. AB. 07/2023

Intravenous Iron Infusion Patient Consent to Infuse Form

https://www.nhs.uk/conditions/consent-to-treatment/#:~:text=Consent%20from%20a%20patient%20is,and%20international%20human%20rights%20law.

Extravasation Clinical Lead

Every NHS organisation should appoint an extravasation lead to oversee the implementation and adherence to the extravasation pathway.

This could be a Specialist Nurse or Doctor.

The roles and responsibilities for the extravasation lead should include:

- A thorough knowledge of extravasation and be the organisation lead to promote and implement the extravasation and infiltration tool kit.
- Ensure local guidelines are in place and adhered to.
- Provide regular education and learning events about extravasation and infiltration.
- Ensure compliance with this tool kit.
- Undertake regular audit of practice.
- Lead on serious incident panels associated with extravasation injuries, incidents and claims.
- Ensure reporting is undertaken locally and audited.

At Risk Patient Groups

Paediatrics
Cautious lower limb vascular access
Bandaging of peripheral cannula, obscuring exit site observation during therapy.
Smaller vessel, shorter cannulae.

Altered levels of consciousness and sensation
Patient under sedation or general anaesthetic
Stroke patient with weakened limbs.

Oncology
Intravenous systemic anti-cancer therapy (SACT) is a vesicant and can permanently damage peripheral veins. Some SACT agents can cause tissue damage if extravasation occurs.

Central Venous Access such as peripherally inserted central catheters (PICCs) and implanted intravenous PORTs can reduce the risk of extravasation and offer safe administration for SACT.

Older people
Ageing skin, tissues and veins can be fragile which can increase the risk of extravasation.

Malnutrition and dehydration can also increase the risk of extravasation.

Difficult IV access patient
Obese patients, patients with deep vessels, IV drug users or patients which chronic loss of peripheral veins.

Dementia and delirium.
Patients in this group can be confused and inadvertently manipulate vascular access devices and IV infusion equipment which can lead to extravasation.

Patients in this group can be unable to express painful infusions sites and other signs of extravasation.

Skin associated risks.
Some skin conditions can make visualising vessels for cannulation difficult which can lead to extravasation due to difficulties in peripheral cannulation.

Variations in skin between patient populations, such as darker skin tones and excessive hair on the skin. (Shaikh et al 2022)

Learning Disabilities and Difficulties
Patients in this group can have challenging behaviour, be combative or uncompliant and inadvertently manipulate vascular access devices or IV infusion equipment which can lead to extravasation.

Systemic Anti-Cancer Therapy (SACT)

Oncology

Administration of SACT is a specialist practice. The risk of extravasation is well documented and included in the training for nurses who administer it.

Cancer services within the NHS already practice within locally ratified guidelines, and processes for the prevention and treatment of SACT extravasations should be in place locally.

This toolkit is not intended to replace these guidelines and protocols but aims to add further support to enable cancer services to strengthen their clinical practice.

The process of IV SACT administration practice is transferable to all IV drug administration practice. Learning from SACT services and how they manage extravasation should be part of the process when designing local non-SACT extravasation protocols and guidelines.

Patients receiving IV SACT who have difficult IV access are at risk of extravasation and long-term central venous access devices are considered a safe option.

There are pros and cons for administering SACT via peripheral or central veins. The evidence is clear that it is safer to administer vesicants via a central device, however there are other risks to consider with central venous catheters such as infection and thrombosis.

https://www.england.nhs.uk/cancer/cancer-alliances-improving-care-locally/

Recent evidence supports administering anthracyclines via a central venous device. Implanted IV ports followed by PICCs are considered the most suitable. (Baker et al 2023; Thrush et al 2023; Moss et al 2021).

Central Venous Access is considered essential in paediatric SACT administration. (Williams et al 2023).

Vein selection in peripheral SACT administration;

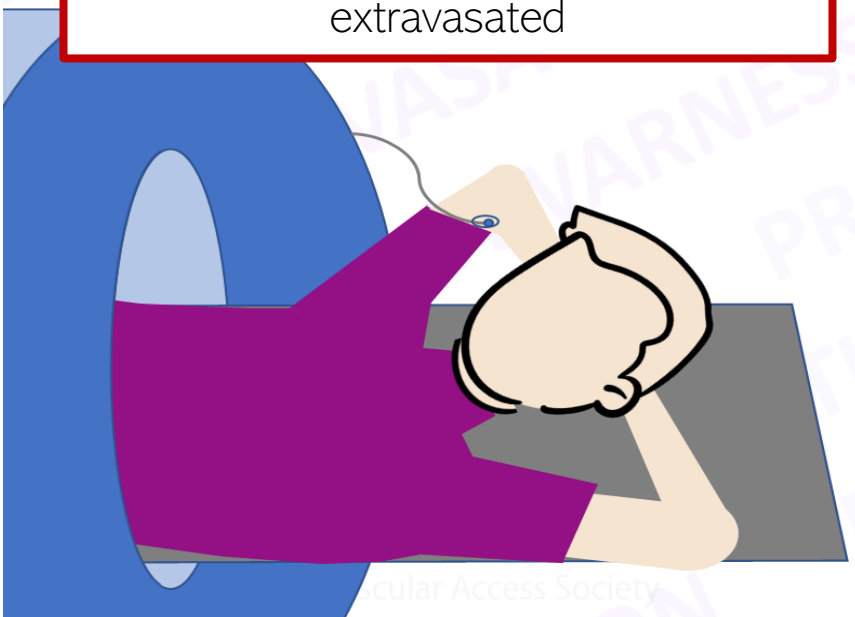
- Use the smallest gauge cannula
- At least two-thirds of the PIVC should reside within the vessel to reduce the risk of PIVC failure
- Avoid areas of flexion
- Danger zones: the wrist & the ACF
- Avoid areas over bony prominences
- Areas with compromised skin (e.g. infection, wounds)
- Avoid compromised veins (e.g. previous venepuncture and/or damage)
- Think vesicants – think bruising.....
- If repeat cannulation is necessary, the principle: Cannulation should start distally and proceed proximally must be adhered to (i.e. always cannulate above the previous failed attempt) (Upton et al 2021)

https://www.uksactboard.org/

Radiology

Contrast Media Administration

Cannulae placed in the antecubital fossa may occlude or dislodge when the patient places their arms above their head prior to and during the CT scan due to the catheter bending in the point of flexion.
Compartment syndrome is a risk when large volumes of contrast have extravasated



The Royal College of Radiologists.

- Always flush the cannula after the patient's arm is in the required position.
- Record details of the extravasation incident with a clear management plan.
- Elevate the affected limb and apply ice packs to the affected area
- If symptoms resolve the patient can be allowed home, and the patient supplied with advice and given an appropriate advice leaflet.
- If symptoms do not resolve quickly, admit and observe.
- Skin blistering, paraesthesia, altered tissue perfusion or persistent pain for more than four hours suggests severe injury. In this case seek urgent plastic surgical review.

Online Resources and original guidance.
https://www.rcr.ac.uk/career-development/audit-quality-improvement/auditlive-radiology/contrast-extravasation-in-ct-qsi-ref-xr-513/
https://www.acr.org/-/media/ACR/Files/Clinical-Resources/Extravasation-of-Contrast-Media----Bullet-Points-and-Chapter-Text---FINAL.pdf

Paediatrics

Paediatric Vascular Access

- Choose the most appropriate vascular access device; consider midline or PICC.
- Consider using real time ultrasound guidance for device placement using longer length devices.
- The insertion of cannulae over joints and points of flexion is associated with an increased risk of extravasation (Upton et al 2021; Welyczko 2020).
- Paediatric patients who endure repeated failed peripheral cannulation should be considered for central venous access.
- Appropriate securement of vascular access devices may reduce the risk of dislodgment which can reduce the risk of extravasation (Bennett and Cheung 2020).
- As an alternative to wrapping bandages around devices, elasticated tubular bandages allow easier inspection of the infusion site (Thom and James-McAlpine 2022).
- Infusion pump alarm levels need to be set appropriately for each infusion and vary depending on the vascular access device gauge and length.

Observe the infusion site, recognise the signs of extravasation, if pain and discomfort manifest act fast.

Section References

- Atay S, Üzen Cura S and Efil S, 2023. Nurses' knowledge and experience related to short peripheral venous catheter extravasation. The Journal of Vascular Access, 24(4), pp.848-853.
- David V, Christou N, Etienne P, Almeida M, Roux A, Taibi A, Mathonnet M, 2020. Extravasation of noncytotoxic drugs. Annals of Pharmacotherapy, 54(8), pp.804-814.
- Gorski LA, Hadaway L, Hagle ME, Broadhurst D, Clare S, Kleidon T, Meyer BM, Nickel B, Rowley S, Sharpe E, Alexander M. Infusion Therapy Standards of Practice, 9th Edition. J Infus Nurs. 2024 Jan-Feb 01;47(1S Suppl 1):S1-S285.
- Couissi I, Douhi Z, El Fid K, Soughi M, El Loudi S, BayBay H, Mernissi FZ, 2023. Cutaneous necrosis secondary to subcutaneous extravasation of acyclovir. Our Dermatol Online. 2023;14(e):e20.
- Rousslang LK, Wood JR. Rare case of a calcified catheter-related sheath embolizing to the right pulmonary artery. Case Rep Radiol 2020; 2020: 1–3.
- Passaro G, Pittiruti M, La Greca A, 2021. The fibroblastic sleeve, the neglected complication of venous access devices: a narrative review. The Journal of Vascular Access, 22(5), pp.801-813.
- Cutuli SL, Dell'Anna AM, Carelli S, Annetta MG, Antonelli M, 2023. Catheter-related thrombosis in critically ill patients: a clinical problem or just a matter of definition?. Intensive Care Medicine, pp.1-2.
- Pittiruti M, Van Boxtel T, Scoppettuolo G, Carr P, Konstantinou E, Ortiz Miluy G, Lamperti M, Goossens GA, Simcock L, Dupont C, Inwood S, 2023. European recommendations on the proper indication and use of peripheral venous access devices (the ERPIUP consensus): A WoCoVA project. The journal of vascular access, 24(1), pp.165-182.
- Meyer BM, Berndt D, Biscossi M, Eld M, Gillette-Kent G, Malone A, Wuerz L, 2020. Vascular access device care and management: a comprehensive organizational approach. Journal of Infusion Nursing, 43(5), pp.246-254.
- Shaikh N, Chanda A, Ganaw A, Sameer M, Hassan J, Farooqi MW, Haji, M.M.A., 2022. Vascular Access: From Cannulation to Decannulation. In Improving Anesthesia Technical Staff's Skills (pp. 171-195). Cham: Springer International Publishing.
- Upton, J., Flanagan, E. and Foulkes, M., 2021. Infusion-related. Fundamentals of Cancer Care, p.115.
- Thrush, C., Gartside, R. and Phillipson, L., 2023. Offering breast cancer patients, a choice of device for administration of chemotherapy: a service improvement project. Cancer Nursing Practice, 22(5).
- Moss JG, Wu O, Bodenham AR, Agarwal R, Menne TF, Jones BL, Heggie R, Hill S, Dixon-Hughes J, Soulis E, Germeni E, 2021. Central venous access devices for the delivery of systemic anticancer therapy (CAVA): a randomised controlled trial. The Lancet, 398(10298), pp.403-415.
- Williams N, Williams EM, Roberts R, 2023. Chemotherapy induced phlebitis experienced by women with breast cancer following administration of Epirubicin using a volumetric infusion pump: an observational study. European Journal of Oncology Nursing, 64, p.102322.
- Baker E, Farrell N, Patel B, Sparkes C, Bayliss J, 2023. Administration of systemic anti-cancer treatment (SACT). The Great Ormond Street Hospital Manual of Children and Young People's Nursing Practices, p.34.
- Welyczko N, 2020. Peripheral intravenous cannulation: reducing pain and local complications. British Journal of Nursing, 29(8), pp.S12-S19.
- Bennett J, Cheung M, 2020. Intravenous access in children. Paediatrics and Child Health, 30(6), pp.224-229.
- Thom LM, James-McAlpine J, 2022. Reducing pressure injuries in children caused by peripheral intravenous cannulae. Nursing children and young people, 34(6).
- David V, Christou N, Etienne P, Almeida M, Roux A, Taibi A, Mathonnet M, 2020. Extravasation of noncytotoxic drugs. Annals of Pharmacotherapy, 54(8), pp.804-814.
- NHS resolution 2022, Did you know? Extravasation. NHS Resolution, London. (https://resolution.nhs.uk/resources/extravasation/)
- Manrique-Rodríguez Silvia, Irene Heras-Hidalgo M. Sagrario Pernia-López, Ana Herranz-Alonso, M. Camino del Río Pisabarro, M. Belén Suárez-Mier, M. Antonia Cubero-Pérez et al. "Standardization and chemical characterization of intravenous therapy in adult patients: a step further in medication safety." Drugs in R&D 21 (2021): 39-64.

Prevention

Safe IV therapy administration and vascular access practice -
Standardisation -
Awareness -

Document download link:
VHP Tool.
https://engage.3m.com/VHP_Toolkit
https://nivas.org.uk/contentimages/main/TFX-VHP-Poster-V10-FINAL.pdf
NIVAS White Paper.
https://nivas.org.uk/contentimages/main/NIVAS-White-paper-for-standardisation-of-vascular- accessteams-within-the-NHS_FINAL-27.06.22.pdf

Prevention

Safe Peripheral Vascular Access Practice

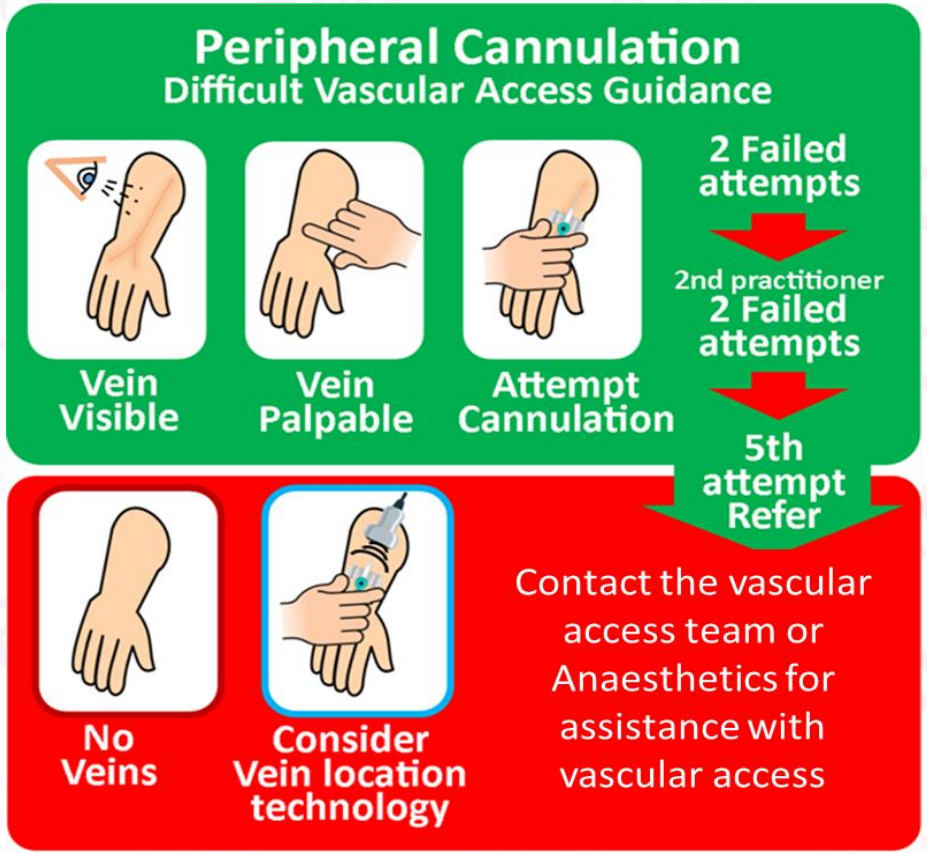
All healthcare professionals involved in the delivery of intravenous therapies and the use of vascular access devices should be aware of the preventative measures associated with infiltration and extravasation, vessel health and preservation and the principles of safe vascular access .

Multiple attempts at placing peripheral intravenous cannulae are painful and distressing to the patient and may damage the vessel and surrounding tissue therefore increase the risk of extravasation (Sweeny et al 2022).

A protocol for difficult IV access patients may reduce complications, improve safety and patient satisfaction (Rodriguez-Calero et al 2020).

A Vascular Access Service Team can take an active role in the prevention of extravasation.

Early escalation should be considered for difficult peripheral cannulation.



Prevention

Cautious IV therapy administration

Prevention of extravasation is imperative as treatment options are limited once the injury has occurred.

Many extravasation injuries are associated with human error and poor infusion practice.

The following actions can help prevent extravasations occurring.

- Extravasation prevention and recognition training for all clinical staff administering IV therapy with regular ongoing updates.
- Creation of a Vascular Access Service Team (VAST) to provide reliable and safe options for vascular access when peripheral cannula are not viable.
- Adopt the Vessel Health and Preservation pathway.
- Advocate the safest way to administer IV therapy, use Medusa, the NHS Injectable Medicines Guide, the medicine information leaflet or the BNF/C or agreed local guidelines.
- Ensure peripheral intravenous cannula (PIVC) are patent by flushing them before use. There should be no resistance, pain or swelling around the cannulation site.
- Training for community services and GPs to help diagnose extravasations.
- Consider the use of infusion technology to reduce the risk of extravasation.

Vascular Access Device Selection

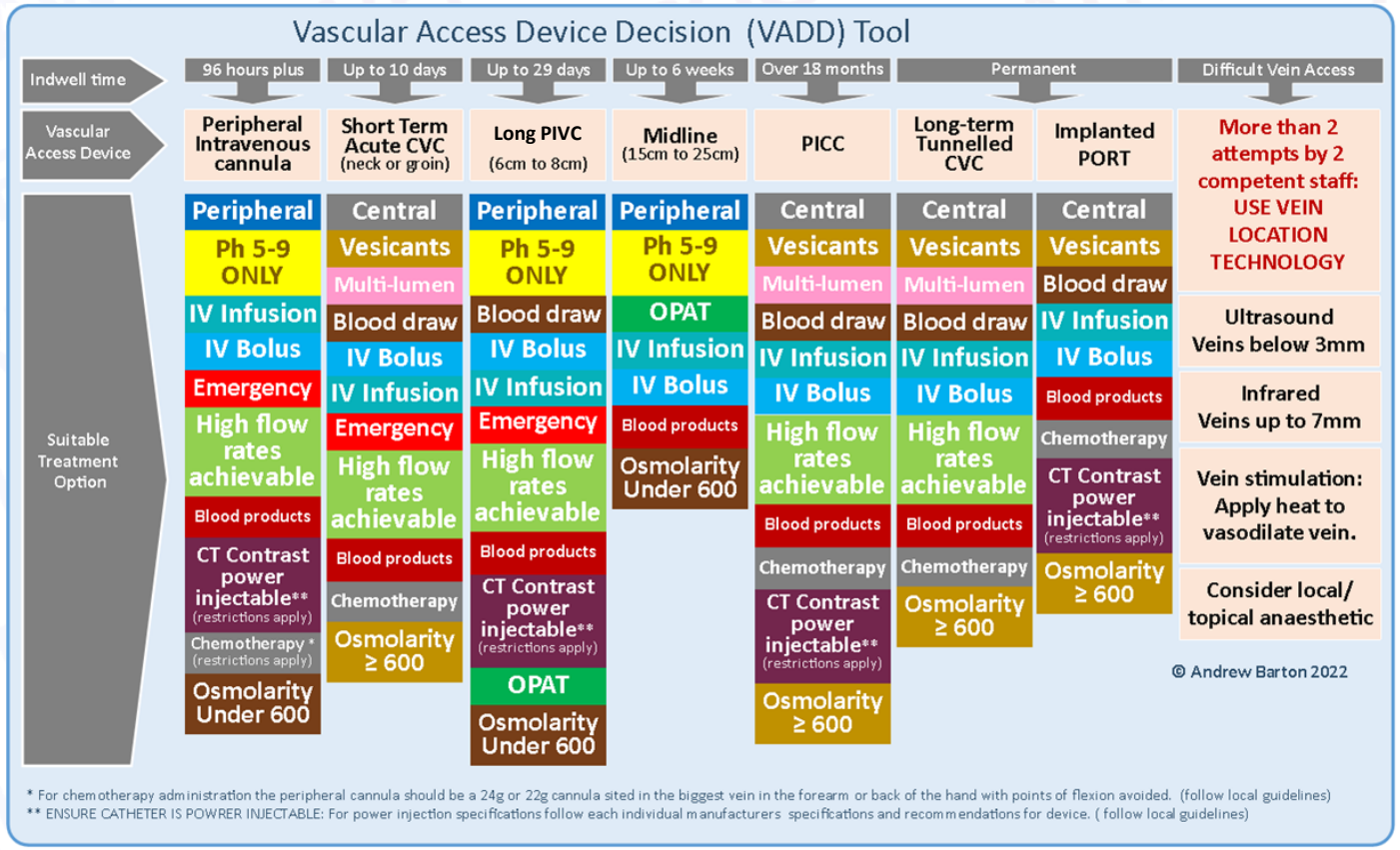
Prevention

Reduce the number of device insertions:
Right device for the
Right treatment at the
Right time for the treatment duration

The risk of extravasation can be reduced if the most suitable vascular access device is selected (Meyer et al 2020).

A vascular access device decision-making tool can be used to choose the most suitable device based on the intravenous treatment profile (Ray-Barruel et al 2020; Moureau and Chopra 2016)

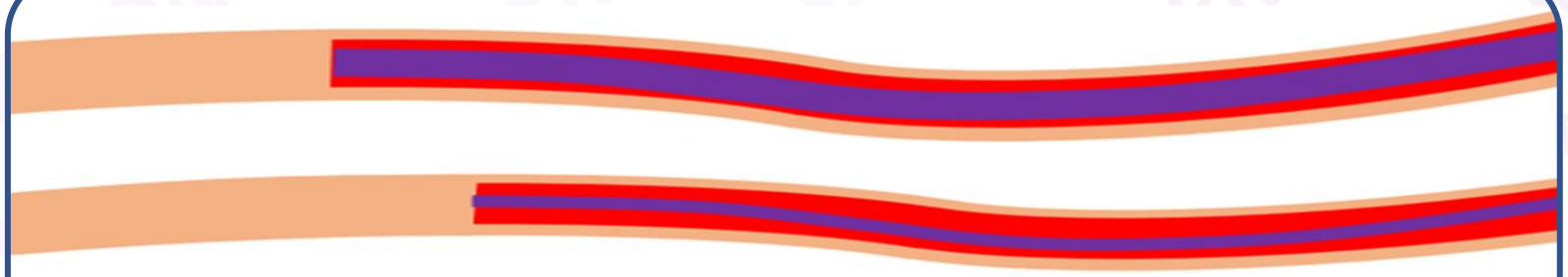
A UK Vessel Health and Preservation (VHP) framework has been developed to assist vascular access device assessment and selection. (Hallam et al, 2020, Moureau 2019). Planned duration of the IV therapy (do not confuse with maximum indwell times) is an additional factor to consider when assessing vascular access device choice.



Prevention

Catheter to vessel occupancy

Small diameter vascular access devices can increase turbulent blood flow over the outside of the cannula/catheter and reduce the risk of the catheter rubbing the vessel wall. Ideally a catheter to vessel occupancy of less that 45% is recommended (Spencer and Mahoney 2017; Sharp et al 2015).



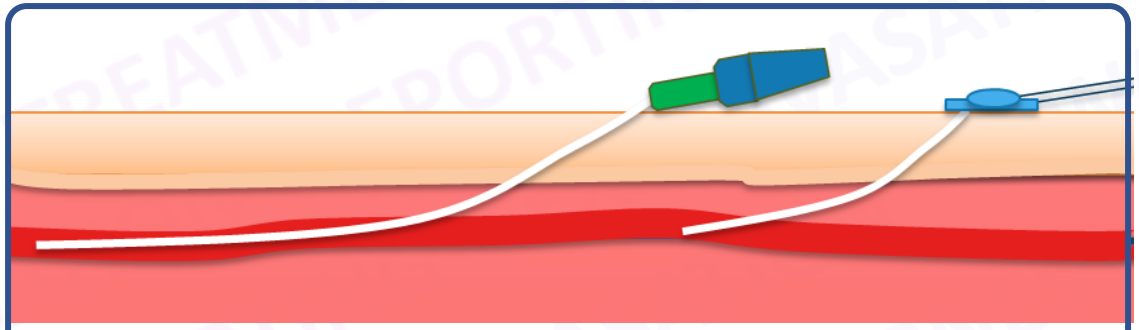
- Preference should be given to placing the smallest size peripheral cannula, either the 24g or 22g, as far down the arm as possible, avoiding points of flexion unless absolutely necessary.
- Cannula size should be selected by the flow rates required and location of device placement. 18g and 20g cannula should be used with caution.
- Vascular access devices should be inspected at least once a shift and flushed at least daily and removed if not working properly or no longer required (Lv and Zhang 2020; Welyczko 2020).

Small cannula nominal flow rates are suitable for most infusion requirements

CANNULA SIZE	FLOW RATE
ORANGE 14G	240 ml/min 1 litre = -4 mins
GREY 16G	180ml/min 1 litre = 5.5 mins
GREEN 18G	90 ml/min 1 litre = 11 mins
PINK 20G	60ml/min 1 litre = 17 mins
BLUE 22G	36ml/min 1 litre = 28 mins
YELLOW 24G	20 ml/min 1 litre = 50 mins

Prevention

Device length and insertion location



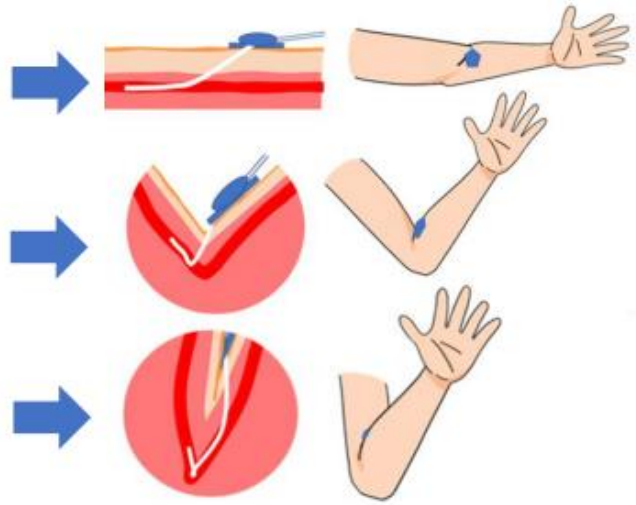
- Small diameter devices increase turbulent blood flow over the cannula and reduce the risk of the catheter rubbing the vessel wall.
- For deeper veins, a longer PIVC may be required.
- If up to 80% of the catheter is sitting in the vessel the catheter tip is far less likely to become dislodged out of the vein.
- Patients who are obese, have loose skin in the arms and those with deep veins are at increased risk of cannula dislodgement.
- Ultrasound guided placement of peripheral cannula can increase the success rate and reduce the risk of dislodgement (Tran et al 2021; Schoch et al 2023)

Peripheral cannula placed in joints and points of flexion are a risk for cannula occlusion leading to infiltration or extravasation.

Cannula is patent in the antecubital fossa when the elbow and forearm are in extension leaving the vessel unobstructed.

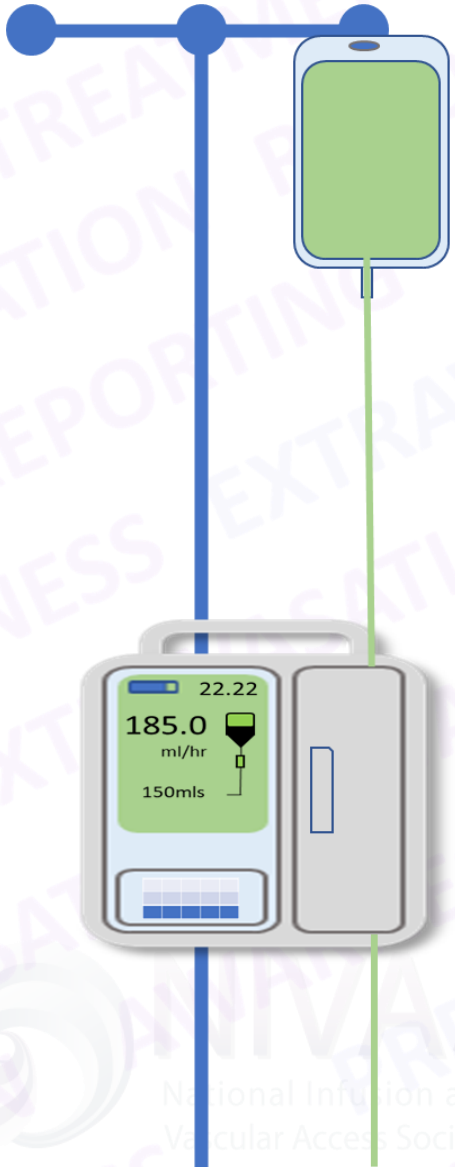
Cannula becomes partially occluded when the forearm and elbow are in flexion halfway, there is a risk of infiltration or extravasation, especially with high pressure injections with CT Contrast.

Cannula totally occluded with joint in full flexion. High risk of infiltration or extravasation, especially with high pressure injections with CT Contrast.



Prevention

Safe intravenous administration technology



Using an infusion pump can increase the safety of infusion therapy, especially when administering vesicant drugs however, these devices can also contribute to complications if used incorrectly.

The following checklist can reduce the risk of infusion complications:

- ✓ Use an infusion pump for all vesicant administration.
- ✓ Check the pump pressure alarm setting is set accordingly.
- ✓ Ensure IV giving sets are labelled to identify which drugs are being infused.
- ✓ Ensure compatibility between diluents, infusion solutions and flushing solutions.
- ✓ Check appropriate occlusion alarm levels
- ✓ Ensure a system for checking the programmed infusion rate is in place to avoid fast infusion errors, wrong doses and rates.
- ✓ Infusion sites should be examined regularly to ensure extravasation hasn't occurred.
- ✓ Empower the patient to call for help if they notice a complication.

Infusion and vein location technology

Prevention

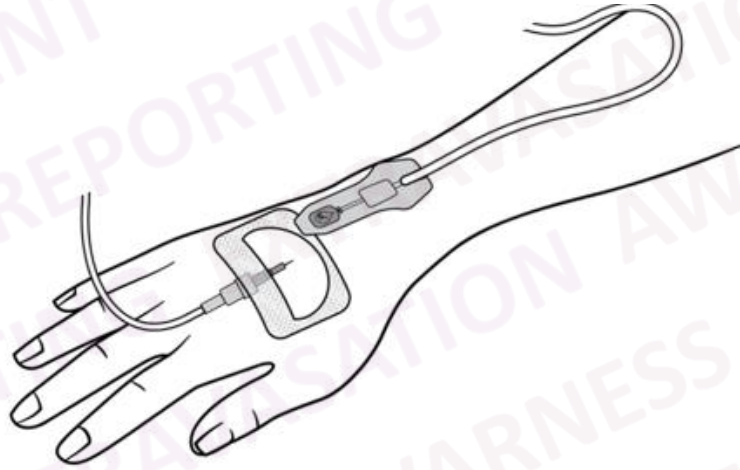
Vein location technology can help with difficult IV access, ensuring the device is placed with one needle stick, reducing patient pain and discomfort.

Ultrasound

Using real time ultrasound for vascular access is the safest way to ensure the best placement of the device. Ultrasound location of the vein, assessing the vein health and placing the device in real time reduces the risk of cannula malposition.

Infrared vein lights

These devices shine an infrared light onto the skin highlighting the veins below. They give a limited visualisation of the veins in 2D.



Safe Infusion Site Technology

Infusion monitoring technology is available which uses visible and near-infrared light to measure tissue changes surrounding the PIVC alerting clinicians to the early stages of extravasation.

Innovation and Best Practice

Birmingham Women's and Children's NHSFT.

Prevention

Reducing the risk and harm of extravasation – an example of a brilliant initiative to reduce extravasation harms in Birmingham Women's and Children's NHSFT.

To reduce the incidence of, and harm from, extravasations, Birmingham Women's and Children's NHSFT have developed a risk-based approach to bedside care for the administration, and monitoring of intravenous (IV) medicines and fluids.

The extravasation risk of each IV medicine / IV fluid (excluding chemotherapy, parenteral nutrition and blood products) was identified. This risk level is based on how likely the medicine / fluid is to cause moderate or serious injury if it is being administered at the point an extravasation occurs. The level of risk is based on factors including the medicine / fluid's pH, osmolarity, whether it is vasoactive, a vesicant or irritant.

Each medicine / fluid has been assigned a colour according to its level of risk.

IV site guidelines from Cincinnati Children's Hospital, called "Touch, Look and Compare", were adapted to maximise the chances that bedside nurses will identify early signs of extravasation, regardless of skin colour. This process was also adapted to increase observation of IV sites for the highest risk infusions (e.g. high-risk infusions administered into peripheral cannulas).

Risk level	Color
Critically high-risk	Red with yellow outline
High-risk	Red
Moderate risk	Amber
Low risk	Green

Cincinnati Children's (no date) *Vascular Access Materials for Healthcare Professionals.* Available at: Vascular Access Materials for Healthcare Professionals (cincinnatichildrens.org)

Prevention

Extravastion Risk RAG Rating
NEONATAL INTENSIVE CARE UNIT

NHS
Birmingham Women's and Children's
NHS Foundation Trust

LABEL	RAG RATING	RISK OF INJURY IF EXTRVASATION OCCURS	IV ACCESS & OBSERVATION OF SITE	
			CENTRAL LINE	NON – CENTRAL LINE
	CRITICAL RED RISK	VERY HIGH	Always use Central access Record E&P score: • At the start of the infusion • Hourly thereafter	NOT APPLICABLE ALWAYS use central access If no central access discuss with Dr/ANNP to arrange insertion of central access before administration
	RED RISK	HIGH	Always use Central access where available Record E&P score: • At the start of the infusion • Hourly thereafter	If only non-central access available, do not delay administration especially if time critical. Record E&P score: • At the start of the infusion • 30 minutes into the infusion • 60 minutes into the infusion • Hourly thereafter At next opportunity discuss with Dr/ANP risks/ benefits of inserting central access & document decision.
	AMBER RISK	MODERATE	Use central access if available unless doing so will lead to a greater risk. Record E&P score: • At the start of the infusion • Hourly thereafter	Non—central access acceptable if central access not available. Record E&P score: • At the start of the infusion • Hourly thereafter
	GREEN RISK	LOW RISK THIS DOES NOT MEAN NO RISK	Use central access when large volumes are involved or combining multiple infusions. Discuss with pharmacist if unsure. Record E&P score: • At the start of the infusion • Hourly thereafter	Non—central access acceptable Record E&P score: • At the start of the infusion • Hourly thereafter

Medication labels identifying the level of risk associated with extravasation have been produced and are displayed on the infusion. This allows the nurse administering the drug to understand the risk and prompts them to check the infusion at the correct interval to pick up any extravasation early, minimising the potential harm.

This innovation has reduced serious extravasation's injuries in the Trust.

Example:

IV FLUIDS CONTAINING GLUCOSE

NB: Parenteral Nutrition must be administered by an appropriate line. Please see Parenteral Nutritional Guidelines and Nutritional team for guidance.

CRITICAL RED RISK FLUIDS	RED RISK FLUIDS	AMBER RISK FLUIDS	GREEN RISK FLUIDS
Glucose ≥20% (with or without additives)	Glucose >12.5% but <20% (with or without additives) Glucose >12.5% with Sodium Chloride or Potassium Chloride (any amount) Glucose 10% with Sodium Chloride 0.9% and ≥20mmol Potassium/500ml	Glucose 12.5% no additives Glucose 5/10% with Sodium Chloride 0.45/0.9% and <20mmol Potassium/500ml	Glucose 5/10% no additives Glucose 5/10% with Sodium Chloride 0.45/0.9%

How has it helped – IV site monitoring?

- The frequency of IV site observations were adapted according to the extravasation risk level e.g. all high-risk medicines / fluids administered via a peripheral cannula require an additional check, 30-minutes after the start of the infusion.
- Incidents have demonstrated that this additional check has identified high-risk extravasations earlier.

The Birmingham Women's and Childrens hospital team:

- Karl Emms, Lead Nurse for Patient Safety / Patient Safety Specialist (Project Lead)
- Muriam Ahmed, Junior Sister for Patient Safety
- Rhian Isaac, Pharmacist
- Amber Moreton, Patient Safety Educator

Section References

- Rodriguez-Calero MA, de Pedro-Gomez JE, Molero-Ballester LJ, Fernandez-Fernandez I, Matamalas-Massanet C, Moreno-Mejias L, Blanco-Mavillard I, Moya-Suarez AB, Personat-Labrador C, Morales-Asencio JM, 2020. Risk factors for difficult peripheral intravenous cannulation. The PIVV2 multicentre case-control study. Journal of clinical medicine, 9(3), p.799.
- Sweeny A, Archer-Jones A, Watkins S, Johnson L, Gunter A, Rickard C, 2022. The experience of patients at high risk of difficult peripheral intravenous cannulation: an Australian prospective observational study. Australasian Emergency Care, 25(2), pp.140-146.
- Meyer B.M, Berndt D, Biscossi M, Eld M, Gillette-Kent G, Malone A, Wuerz L., 2020. Vascular access device care and management: a comprehensive organizational approach. Journal of Infusion Nursing, 43(5), pp.246-254.
- Ray-Barruel G, Cooke M, Chopra V, Mitchell M. Rickard CM, 2020. The I-DECIDED clinical decision-making tool for peripheral intravenous catheter assessment and safe removal: a clinimetric evaluation. BMJ open, 10(1), p.e035239.
- Moureau N, Chopra V, 2016. Indications for peripheral, midline, and central catheters: summary of the Michigan appropriateness guide for intravenous catheters recommendations. Journal of the Association for Vascular Access, 21(3), pp.140-148.
- Moureau NL, 2019. Vessel health and preservation: the right approach for vascular access (p. 303). Springer Nature.
- Lv L, Zhang J, 2020. The incidence and risk of infusion phlebitis with peripheral intravenous catheters: A meta-analysis. The journal of vascular access, 21(3), pp.342-349.
- Welyczko N, 2020. Peripheral intravenous cannulation: reducing pain and local complications. British Journal of Nursing, 29(8), pp.S12-S19.
- Spencer TR, Mahoney KJ, 2017. Reducing catheter-related thrombosis using a risk reduction tool centred on catheter to vessel ratio. Journal of thrombosis and thrombolysis, 44(4), pp.427-434.
- Sharp R, Cummings M, Fielder A, Mikocka-Walus A, Grech C. Esterman A, 2015. The catheter to vein ratio and rates of symptomatic venous thromboembolism in patients with a peripherally inserted central catheter (PICC): a prospective cohort study. International journal of nursing studies, 52(3), pp.677-685.
- Tran Q K, Fairchild M, Yardi I, Mirda D, Markin K, Pourmand A., 2021. Efficacy of ultrasound-guided peripheral intravenous cannulation versus standard of care: a systematic review and meta-analysis. Ultrasound in Medicine & Biology, 47(11), pp.3068-3078.
- Schoch M, Bennett PN, Currey J, Smith V, Orellana L, Hutchinson AM, 2023. Point-of-care ultrasound-guided cannulation versus standard cannulation in haemodialysis vascular access: a controlled random order crossover pilot feasibility study. The Journal of Vascular Access, 24(5), pp.1140-1149.

Recognition

Awareness of extravasation

Diagnose the early symptoms and stages of extravasation

Standardisation of actions following recognition

Recognition

Infiltration/Extravasation SYMPTOMS

"Recognising the early stages of extravasation is vital. Early diagnosis can reduce the amount of damage done to the patient's tissue".

- Has a vascular access device been in situ near the area of concern?
- Has a vascular access device been removed from the area of concern in the past 2 weeks?
- Has IV therapy been given via a vascular access device near the area of concern in the past 2 weeks?
- Has a vesicant drug been administered near the area of concern?
- Is the whole limb swollen and or dusky and cold, with reduced capillary refill and poor peripheral pulses?

THINK EXTRAVASATION OR COMPARTMENT SYNDROME

If 'No' consider: Exit site infection, Phlebitis, Medical Adhesive Related Skin Injury (MARSI), Cellulitis, Oedema
Infiltration and Extravasation injury should always be suspected until proven otherwise.
Treatment should be commenced as soon as possible – Lost time is lost tissue.

Suspected or Confirmed Extravasation

Recognition

STOP THE INFUSION

Try to aspirate the device

Reassure patient

Call for Help

Manage pain

- Stop administration - Leave vascular access device in situ and attempt aspiration.
- Leave device in place until discussion with plastic surgical team, remove after 1 hour when safe to do so if not required for antidote or washout.
- Chemotherapy extravasations - refer to local cancer network guidance.
- Identify vesicant involved and check for antidote.
- Mark outline of extravasation injury with skin marker and document incident in patient record.
- Medical photography to record injury.
- Complete incident report and arrange follow up.

Alternative complications and symptoms

Recognition

Characteristic	Flare Reaction	Vessel Irritation	Venous Shock	Extravasation
Presenting Symptoms	Itchy blotches or hives; pain and burning sensation	Aching and tightness in vessel	Muscular wall of the blood vessel in spasm	Pain and burning at injection site; stinging may occur during Infusion
Colouration	Raised red streak, blotches or "hive-like" erythema along the vessel; diffuse or irregular pattern	Erythema or dark discolouration along vessel		Erythema around area of needle or around the venepuncture site
Timing	Appears suddenly and dissipates within 30–90 minutes	Appears within minutes after injection. Colouration may only appear later in the process	Appears right after Injection	Symptoms start to appear immediately after injection, symptoms evolve
Swelling	Usually	Usually		Occurs often; lasts for several days
Blood return	Usually, but not always	Usually, but not always	Often absent	Usually absent or sluggish

(Wengström and Margulies, 2008)

Evolving Injury – Timescale

Recognition

Extravasation injury timescale	
During Administration	• Blood return unable to aspirate blood. • Noticeable swelling at cannulation site due to infiltration • Burning and aching in cannulation/injection site.
Within 24hrs after extravasation	• Pain and burning sensation at injection site during or after infusion. • Erythema at cannulation/injection site. • Swelling localised around cannulation/injection site. • Small fluid filled blister can develop.
Up to 2 weeks after extravasation	• Non-blanching erythema extending around the cannulation/injection site. • Affected area hot and painful to touch. • Fluid filled blisters may have extended. • Swelling in the distal part of the affected limb.
Up to 4 weeks after extravasation	• Non-blanching dark erythema with dusky margins at the cannulation/injection site. • Affected area painful, hot and/or swollen. • Fluid filled blisters may still be present. • Areas of eschar developing with deeper areas of tissue necrosis. • Wound evolving.
Over 4 weeks after extravasation	• Non-blanching dark erythema with dusky margins around wound • Pain and swelling in affected limb. • Areas of eschar present with deeper areas of tissue necrosis. • Wound not improving without surgical intervention.

(Kim et al 2020; Ong and Van Gerpen 2020)

Extravasation Injury Staging

Recognition

Stage 1

- Capillary refill <2-3 secs
- Localised swelling < 3cm at site
- With or without pain

Stage 2

- Capillary refill >2-3 secs
- Oedema > 3cm to 15cm from site
- Erythema
- Skin hot to touch
- With or without pain
- Blistering

Stage 3

- Poor capillary refill
- Gross Oedema in limb
- Dark erythema
- Skin hot to touch
- Pain (moderate)
- Blistering
- Eschar forming
- Reduced limb function

Stage 4

- Absent capillary refill
- Gross Oedema in limb
- Dark erythema
- Skin cool to touch
- Pain (moderate)
- Blistering
- Eschar/Necrosis
- Limb tissue affected
- Reduced limb function

Stage 1 assessment and close monitoring

Stage 2 requires treatment action.

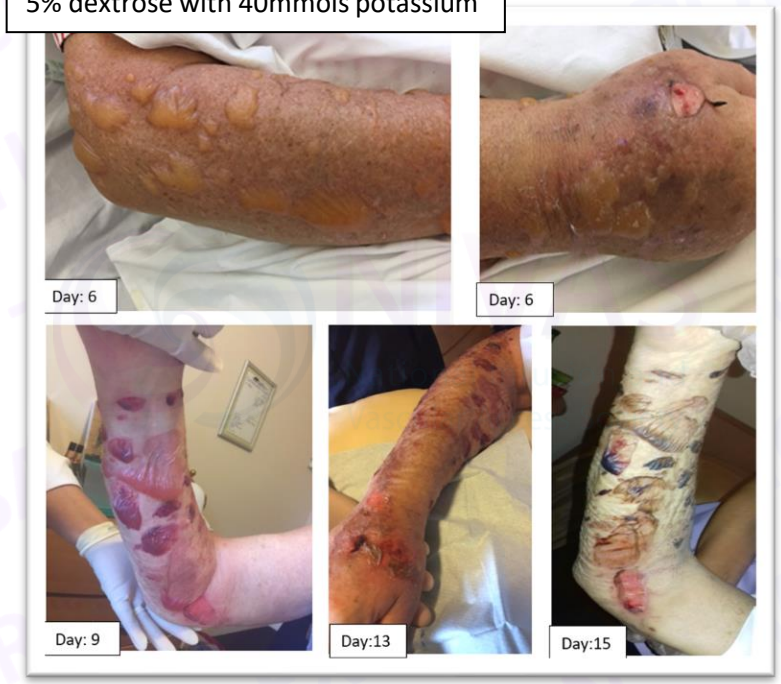
Stage 3 and 4 are clinical emergency and requires urgent action.

(Based on: Pathomjaruwat et al 2021, Kim et al 2020, Alexander 2020, Ong and Van Gerpen 2020)

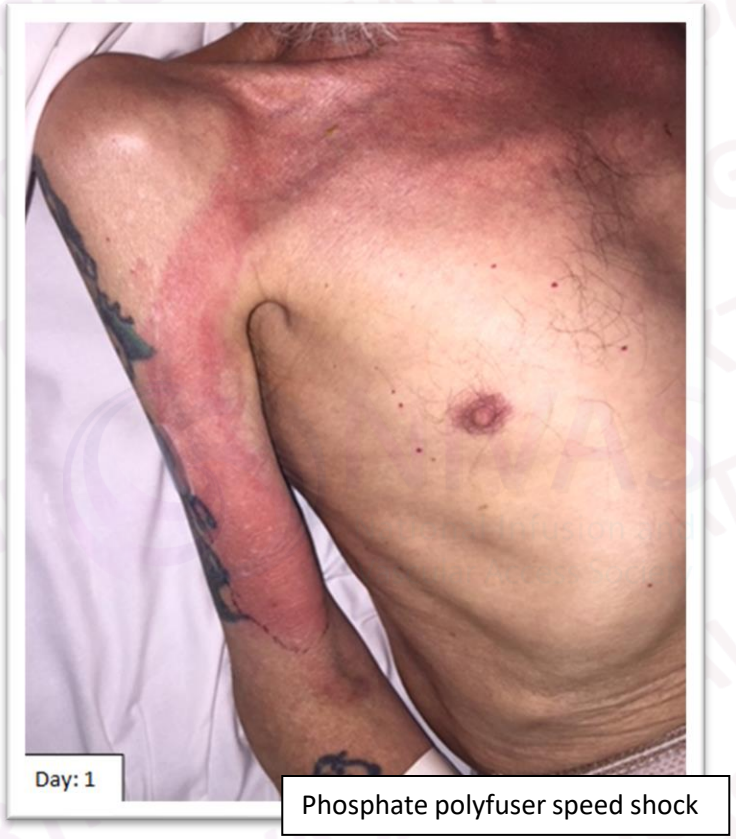
Recognition

Extravasation Injuries

5% dextrose with 40mmols potassium

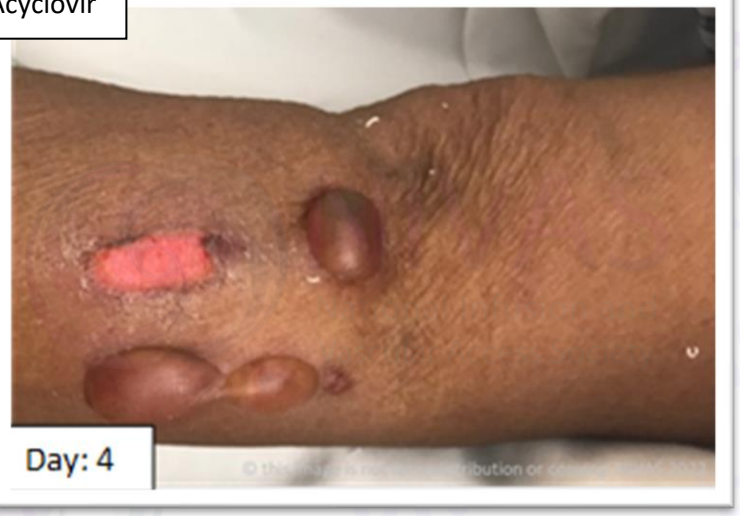


Vancomycin

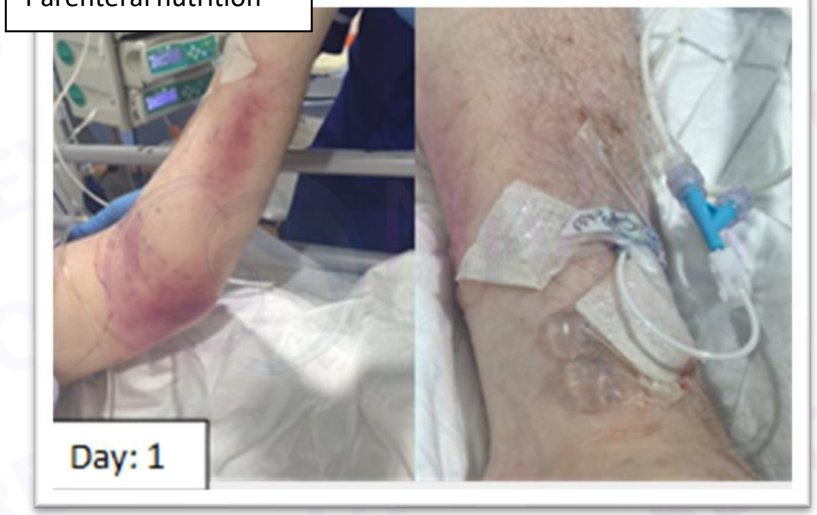


Phosphate polyfuser speed shock

Acyclovir



Parenteral nutrition



Compartment syndrome

Recognition

Compartment syndrome is a serious condition caused by bleeding or swelling within an enclosed bundle of muscles. This can occur when injectable infusions are inadvertently administered either rapidly or over a period of time because the vascular access device is not sited correctly in a vessel. Compartment syndrome is an emergency and should be dealt with as such, an urgent surgical review should be sought for any patient who may have a compartment syndrome as they may require an emergency fasciotomy (Savage et al 2023). Patients having rapid administration of CT contrast, infusions concealed under drapes during surgery and infusions where the occlusion alarm has been increased are among the highest group of patients at risk of compartment syndromes (Stefanos et al 2023 Kim and Kim 2020). Close monitoring of all infusions and vascular access devices in peripheral veins should be undertaken to reduce the risk.

Symptoms can include:

- Loss of pulse in affected limb
- Swollen limb
- Intense pain, especially when the muscle is stretched
- Tenderness in the affected area
- Tightness in the muscle
- A tingling or burning sensation, numbness or weakness in affected limb (these are signs of permanent damage) (Osborn and Schmidt 2021)

Act fast if compartment syndrome suspected

- ✓ Treat as an emergency
- ✓ Urgent surgical review
- ✓ CT imaging to confirm
- ✓ Urgent fasciotomy may be indicated.

Section References

- Ong J, Van Gerpen R, 2020. Recommendations for management of noncytotoxic vesicant extravasations. Journal of Infusion Nursing, 43(6), pp.319-343.
- Pathomjaruwat T, Petpichetchian W, Pongcharoen P, 2021. A comparative study of accuracy and usability between two extravasation injuries assessment tools. Pacific Rim International Journal of Nursing Research, 25(3), pp.437-451.
- Kim JT, Park JY, Lee HJ, Cheon YJ, 2020. Guidelines for the management of extravasation. Journal of educational evaluation for health professions, 17.
- Alexander L, 2020. Extravasation injuries: a trivial injury often overlooked with disastrous consequences. World journal of plastic surgery, 9(3), p.326.
- Wengström Y, Margulies A, 2008. European oncology nursing society extravasation guidelines. European Journal of Oncology Nursing, 12(4), pp.357-361.
- Savage SA, Fox C, Goldie SJ, 2023. Compartment syndrome of the hand following CT contrast extravasation. ANZ Journal of Surgery, 93(5), pp.1360-1362.
- Park C, Kim H, 2020. Acute compartment syndrome due to extravasation of peripheral intravenous blood transfusion. Saudi Journal of Anaesthesia, 14(2), p.221.
- Stefanos SS, Kiser TH, MacLaren R, Mueller SW, Reynolds PM, 2023. Management of noncytotoxic extravasation injuries: A focused update on medications, treatment strategies, and peripheral administration of vasopressors and hypertonic saline. Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy, 43(4), pp.321-337.
- Osborn PM, Schmidt AH, 2021. Diagnosis and management of acute compartment syndrome. JAAOS-Journal of the American Academy of Orthopaeic Surgeons, 29(5), pp.183-188.

Treatment

Early intervention and treatment to reduce or stop tissue damage -
Standardisation of treatment -
Awareness of evolving injury signs and symptoms -

Treatment

Treatment protocol

1	Stop and disconnect infusion. Leave VAD in place
2	Attempt to aspirate the extravasated solution from the VAD with a 10mL syringe
3	Avoid applying pressure over the site
4	Use a skin marker to outline the margins of the injury
5	Refer to clinical team for review – seek out drug antidote information
6	Administer antidote if available and competent to do so
7	Elevate affected limb and monitor regularly
8	Administer analgesia – apply hot or cold compress depending on the drug involved
9	Refer to medical photography to visually document injury – refer to plastic surgery.
10	Document in clinical notes, incident report and arrange clinical follow up

(Based on Kim et al 2020)

Treatment

Extravasation Kit

In addition to a SACT unit specific extravasation kit the following general extravasation kit should be available in clinical areas where IV therapy is administered.

Equipment	Action
Hyaluronidase 1500 units	Subcutaneous injectable antidote to for specific drug extravasations
10mL Water for injection	To mix the Hyaluronidase
Yellow bag	For disposal of clinical waste
Luer lock needles and blunt fill filter needles	To reconstitute and inject intravenous drugs
Luer lock syringes 10mL	For injection
Disposable heat packs	For treatment
Disposable cold compress	For treatment
Silicone dressings	To cover any breaks in skin around the extravasation
Non-sterile gloves	For PPE if required
Bandage	To cover the silicone dressings if required
Safety glasses (optional)	For PPE if required
Indelible pen	To mark areas of erythema
Local extravasation guidelines and action cards	To follow treatment guidelines
Arm sling	To elevate any peripheral arm extravasation injury

Treatment

Treatment Protocols

	Definition	Therapy	Comments	Examples
Osmolarity	High >600 mOsm/L Low <200 mOsm/L 200–500 mOsm/L physiological (290 mOsm/L)2	Warm compresses; possibly hyaluronidase Physiological: cold compresses when dispersion/dilution is not indicated	Osmolarity over 600mOsm/L increases the risk of damage. High osmolarity over 1000mOsm/l can cause significant tissue damage.	▶ Parenteral nutrition (PN) ▶ Infusion fluids such as mannitol 10%, and Glucose12.5% or more, etc. ▶ Contrast fluids ▶ Electrolyte solutions (Potassium solutions) ▶ Calcium Chloride 10%
pH	Low <5.0 High >9.0 Range considered 'physiological': 5.0–9.01 Physiological (7.4)	Warm compresses; possibly hyaluronidase Physiological: cold compresses when dispersion/dilution is not indicated	Extreme pH <2 and >11 are thought to cause most damage Closer to 7.4 means lesser damage Alkaline solutions are more likely to cause damage than acidic solutions	Alkaline ▶ Phenytoin ▶ Co-trimoxazole ▶ Dantrolene ▶ Thiopental ▶ Trometamol ▶ Aciclovir ▶ Phenobarbital Acidic ▶ Vancomycin ▶ Amiodarone ▶ Doxycycline ▶ Esmolol ▶ Glucose,
Vasopressor	N/A	Warm compresses; phentolamine	Do not use cold compresses because of additional vasoconstriction	▶ Terlipressin ▶ Desmopressin ▶ Dobutamine ▶ Dopamine ▶ Phenylephrine ▶ Dopamine ▶ Adrenaline ▶ Noradrenaline

(adopted from Smolders et al 2020)

Treatment

HOT & COLD compress

- Cold compresses are recommended for extravasation of all irritant and vesicant drugs except vinca alkaloids (vincristine, vinblastine, vinorelbine), epipodophyllotoxins (etoposide), oxaliplatin, and vasopressors, as cold worsens tissue ulceration caused by these drugs.
- Cold compresses cause vasoconstriction, limiting the spread of the extravasated drug. Additionally, cold reduces local inflammation and pain.
- Warm compresses are preferred for extravasation of specific drugs including vinca alkaloids, etoposide, vasopressors, and oxaliplatin to increase local blood flow and enhance drug removal
- Apply compresses for 20 to 60 minutes 3 or 4 times daily for the first 24 to 72 hours after extravasation occurs.
- Where possible a temperature regulated, electric warmer could be used with a disposable single use cover.
- Care should be taken to ensure warm compresses are not too hot and cold compresses are not too cold to avoid further tissue damage. Cold compresses from the freezer should not be directly applied to the skin.

(Smolders, 2021; Hadaway 2007)

Hyaluronidase subcutaneous injectable antidote

Treatment

- Hyaluronidase is used in managing the extravasation of vesicants.
- Hyaluronidase is an enzyme which breaks down hyaluronic acid (HA). It increases vascular permeability and temporarily disrupts the extracellular matrix, promoting diffusion of substances through tissues.
- Hyaluronidase increases tissue permeability, rapidly dispersing extravasated chemicals, which reduces the risk of skin necrosis and overall morbidity.
- Hyaluronidase should only be used if specifically indicated (see vesicant drug profiles in resources) or used in the saline flush-out technique.

BNF indications and dose: Hyaluronidase for treatment of extravasation by local infiltration Adult:

hyaluronidase 1500units reconstitute in 1mL water for injection or in sodium chloride 0.9% and infiltrate into affected area by subcutaneous injection as soon as possible after extravasation.

- **Contra-Indications: not for intravenous administration**; not to be used to enhance the absorption and dispersion of dopamine and/or alpha-adrenoceptor agonists

(Hadaway 2007; Sharma and Lahiri 2021).

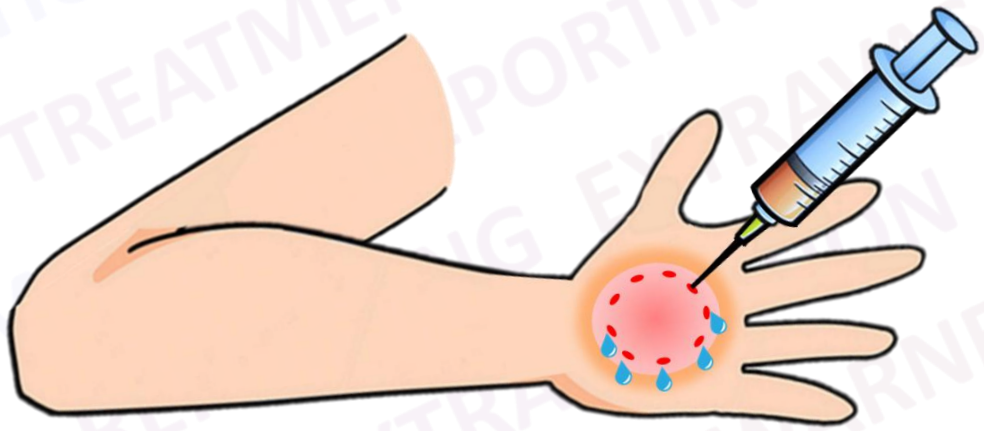
Treatment

Subcutaneous Saline Wash-out

Saline washout should only be performed by a competent and experience healthcare professional

1. Administer subcutaneous local anaesthetic
2. Administer Hyaluronidase subcutaneously
3. Create regular 2mm incisions around the affected area
4. Using a blunt fill needle or 2mm lipoaspiration cannula, flush sterile sodium chloride 0.9% into the affected tissue allowing it to infiltrate the area
5. Infiltrate between 300mL and 3000mL depending on the size of the extravasation
6. Aspirate the infiltrated fluid as much as possible and discard
7. Repeat several times as required
8. Do not close the incisions
9. Cover the area with a silicone/absorbent sterile dressing
10. Document procedure and arrange follow up

(Mas et al 2020; Napoli et al 2005)



Treatment

Management Overview

- ☑ Ensure referral to specialist - usually plastic surgery or orthopaedic surgery.
- ☑ Cover the area with a sterile silicone/absorbent dressing. (foam silicone dressings work very well).
- ☑ Manage pain and consider limb elevation if appropriate.
- ☑ Consider Occupational Therapy and Physiotherapy referral for long term management if limb movement is affected.
- ☑ Document affected limb pulses, wound margins and skin condition.
- ☑ Complete progress documentation in patients record including clinical photography.
- ☑ Consider counselling referral for emotional and psychological support.
- ☑ Arrange follow up after 24hrs, 72hrs then weekly until resolved.
- ☑ Consider duty of candour letter and escalate to the patient safety team.

Section References

- Kim JT, Park JY, Lee HJ, Cheon YJ, 2020. Guidelines for the management of extravasation. Journal of educational evaluation for health professions, 17.
- Hadaway L. 2007 Infiltration and extravasation: preventing a complication of IV catheterization. Am J Nurs. 107(8):64-7
- Smolders EJ, Benoist GE, Smit CCH, Ter Horst P, 2021. An update on extravasation: basic knowledge for clinical pharmacists. European Journal of Hospital Pharmacy, 28(3), pp.165-167.
- Sharma SC, Lahiri MA, 2021. Use of hyaluronidase in plastic surgery: A review. Journal of Plastic, Reconstructive & Aesthetic Surgery, 74(7), pp.1610-1614
- Napoli P, Corradino B, Badalamenti G, Tripoli M, Vieni S, Furfaro M Cordova A, Moschella F, 2005. Surgical treatment of extravasation injuries. Journal of surgical oncology 91. 264-8
- Mas V, Simon AL, Presedo A, Mallet C, Ilharreborde B, Jehanno P, 2020. Upper limb extravasation of cytotoxic drugs: results of the saline washout technique in children. Journal of Children's Orthopaedics, 14(3), pp.230-235.
- Hadaway L. Infiltration and extravasation: preventing a complication of IV catheterization. Am J Nurs. 2007;107(8):64-7
- Plum M, Moukhachen O. 2017 Alternative Pharmacological Management of Vasopressor Extravasation in the Absence of Phentolamine. Pharmacy and Therapeutics 42(9):581-592
- Smolders EJ, Benoist GE, Smit CCH, Ter Horst P, 2020. An update on extravasation: basic knowledge for clinical pharmacists. European Journal of Hospital Pharmacy.

Follow-up

Evolving extravasation injuries need to be monitored

Patient Follow-up Post Extravasation

Follow-up

- The severity of tissue damage can increase in the days or weeks after the initial injury.
- Extravasation injures should be followed up by the plastic surgical team and the referring clinical team.
- Discharge planning should include extravasation injury follow up.

24hrs
Day 3
Day 7
Weekly

- Review and redress injury daily for 3 days then weekly
- Document progress with clinical photography
- Observe for signs of infection, non-blanching skin and skin necrosis
- Discuss with speciality and wound care team if required to manage evolving wound
- Ensure patient has a point of contact to telephone and is given information to access help

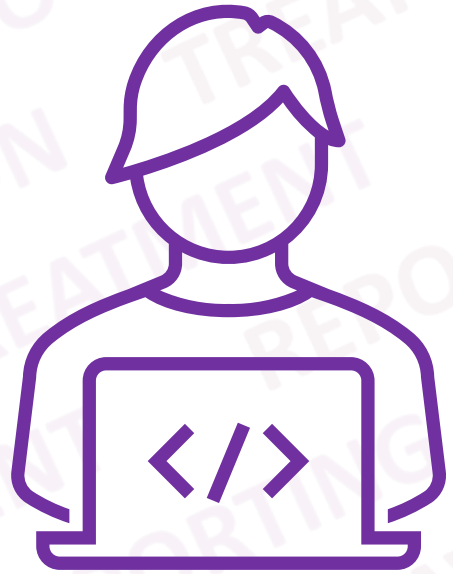
Reporting

Local and National incident reporting
Organisational standardisation
Audit and surveillance

Reporting

Incident Reporting

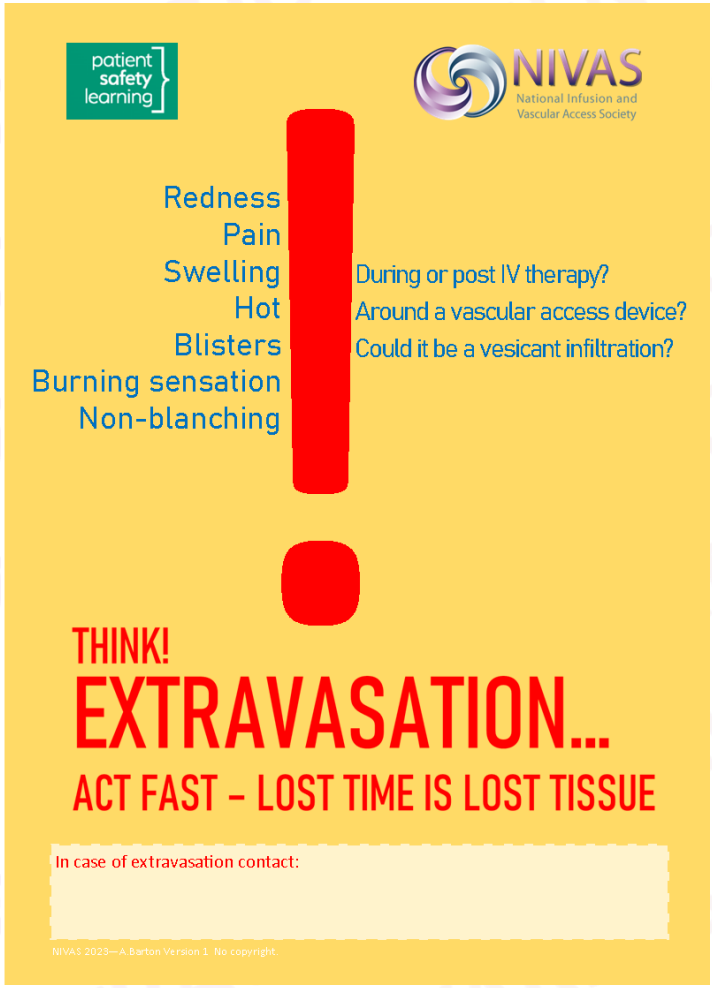
- ✓Standardised extravasation and infiltration reporting.
  - Nationally
  - Locally
  - Regionally
- ✓Dedicated category: Intravenous Therapy Injury.
  - Extravasation – drug or fluid involved
  - Infiltration – drug or fluid involved
  - Compartment Syndrome
- ✓Drug/Intravenous fluid involved
- ✓Infusion pump device
- ✓Stage / injury level.
- ✓Vascular Access Device (VAD) involved – central or peripheral.
- ✓Level of harm.
- ✓Serious incident.
- ✓Escalation and follow up plan
- ✓Duty of Candour letter.



NHS organisations need to set up categories in their incident reporting systems to capture IV complications including extravasation and infiltrations injuries

Resources

THINK! EXTRAVASATION... ACT FAST – LOST TIME IS LOST TISSUE



Download from QR

Download from QR

THINK! EXTRAVASATION...

Suspected Infiltration or Extravasation Action

Has a vascular access device been in situ in the affected limb in or around the area of current concern, now or in the past 2 weeks , which was used for IV therapy that would be classed as a vesicant?

How does the affected limb look?

Is the whole limb swollen and/or cold and dusky looking with reduced or absent capillary refill and poor or absent radial pulses?

If Yes: THINK EXTRAVASATION OR COMPARTMENT SYNDROME

If NO it could be: Exit site infection, Phlebitis, MARSI, Cellulitis, Oedema

ACTIONS - Reassure patient - Manage pain - call for help! (Plastics)

- Stop administration - Leave vascular access device in situ and attempt aspiration.
- Identify Vesicant involved and check for antidote in guidelines.
- If available administer antidote following guidelines.
- Consider referral for wash out treatment.
- If no antidote or washout—remove vascular access device.
- SACT extravasations—refer to SACT network guidance.
- Mark outline of extravasation injury and document incident in patient record.
- Apply Hot or Cold compress if appropriate.
- Complete referral to plastics - take medical photography and upload to patient record.
- Complete RL, inform clinical team and arrange follow up by specialist.

Contact:

Infiltration/Extravasation SYMPTOMS

STOP THE INFUSION

Try to aspirate the device
Reassure patient
Call for Help
Manage pain

- Stop administration - Leave vascular access device in situ and attempt aspiration, seek help and advice.
- **SACT extravasations - refer to network guidance.**
- Mark outline of extravasation injury and document incident in patient record.
- Medical photography to record injury.
- Identify vesicant involved and check for antidote if avaiable.
- Contact Plastics for urgent review.
- Complete incident report and arrange follow up.

Contact:


RECOGITION TREATMENT REPORTING EXTRAVASATION AWARNESS PREVENTION