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# Extravasation

A Guide for  
Nurses

# Introduction

**Extravasation is the accidental leakage of an intravenously administered drug solution from the vein into the surrounding body tissue. Extravasation is reported to occur in between 0.1% and 6% of adults receiving intravenous (IV) drugs.**

What will you learn in this module?

- What is meant by extravasation?
  - How does extravasation differ from infiltration?
  - How can extravasation be recognised?
  - What are the signs and symptoms of extravasation?
  - What are the risk factors for extravasation?
- What is the management of extravasation?
  - How can extravasation be prevented?

If you would like any information on the sources used for this booklet, please email [communications@leukaemiacare.org.uk](mailto:communications@leukaemiacare.org.uk) for a list of references.

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# About Leukaemia Care

**Leukaemia Care is a national charity dedicated to ensuring that people affected by blood cancer have access to the right information, advice and support.**

## Our services

### Helpline

Our helpline is available 9:00am – 5:00pm Monday - Friday and 7:00pm – 10:00pm on Thursdays and Fridays. If you need someone to talk to, call **08088 010 444**.

Alternatively, you can send a message via WhatsApp on **07500068065** on weekdays 9:00am – 5:00pm.

### Nurse service

We have two trained nurses on hand to answer your questions and offer advice and support, whether it be through emailing **nurse@leukaemicare.org.uk** or over the phone on **08088 010 444**.

### Patient Information Booklets

We have a number of patient information booklets like this available to anyone who

has been affected by a blood cancer. A full list of titles – both disease specific and general information titles – can be found on our website at **www.leukaemicare.org.uk/support-and-information/help-and-resources/information-booklets/**

### Support Groups

Our nationwide support groups are a chance to meet and talk to other people who are going through a similar experience. For more information about a support group local to your area, go to **www.leukaemicare.org.uk/support-and-information/support-for-you/find-a-support-group/**

### Buddy Support

We offer one-to-one phone support with volunteers who have had blood cancer themselves or been affected by it in some

way. You can speak to someone who knows what you are going through. For more information on how to get a buddy call **08088 010 444** or email **support@leukaemiacare.org.uk**

### Online Forum

Our online forum, **www.healthunlocked.com/leukaemia-care**, is a place for people to ask questions anonymously or to join in the discussion with other people in a similar situation.

### Webinars

Our webinars provide an opportunity to ask questions and listen to patient speakers and medical professionals who can provide valuable information and support. For information on upcoming webinars, go to **www.leukaemiacare.org.uk/support-and-information/support-for-you/onlinewebinars/**

### Website

You can access up-to-date information on our website, **www.leukaemiacare.org.uk**.

### Campaigning and Advocacy

Leukaemia Care is involved in campaigning for patient well-being, NHS funding and drug and treatment availability. If you would like an update on any of the work we are currently doing or want to know how to get involved, email **advocacy@leukaemiacare.org.uk**

### Patient magazine

Our magazine includes inspirational patient and carer stories as well as informative articles by medical professionals: **www.leukaemiacare.org.uk/communication-preferences/**

# What is meant by extravasation?

Extravasation is the accidental leakage of an intravenously administered drug solution from the vein into the surrounding body tissue.

Extravasation is reported to occur in between 0.1% and 6% of adults receiving intravenous (IV) drugs.

Extravasation is inevitable because some drugs or fluids can only be administered intravenously such as:

- Chemotherapy drugs (doxorubicin, vincristine, cisplatin and paclitaxel)
- Antibiotics (vancomycin, meropenem and gentamicin)
- Antifungal drugs (micafungin and amphotericin)
- Pain medications (morphine)

Moreover, IV lines are vital for resuscitation and for real-time monitoring of patient parameters.

The degree of damage caused by extravasation is related to the following:

- Type of the drug

- Drug concentration, pH (both acidic and alkaline) and osmolality
- Site of the extravasation
- Volume of infusion
- Length of the infusion

Extravasated drugs can be divided into 3 types according to their potential for tissue. They are described as:

- Vesicant: A vesicant is a liquid capable of causing blistering, sloughing or necrosis of tissues.
- Irritant: Drug that can cause a burning sensation in the vein while being administered: e.g., fluorouracil
- Non-vesicant: Inert or neutral drug that do not cause inflammation, damage or ulceration, but can cause pain at the injection site and along the vein: e.g., cytarabine.

Extravasation can cause serious complications, particularly if the drug is a vesicant as is the case for several chemotherapy drugs. Extravasation of chemotherapy

is seen in 1% to 7% of adults receiving drugs IV.

Vesicant chemotherapies can be:

- DNA-binding: These drugs (e.g., anthracyclines, like daunorubicin) are absorbed, enter the cells and bind to their DNA causing the death of the cell. The drug is then released from the dead cell ready to destroy other healthy cells. This leads to deep erosion of cells within the tissue.
- Non-DNA binding: These drugs (e.g., vinca alkaloids like vincristine) cause cell death without binding to the cell's DNA, therefore they are easily metabolised and removed from tissues. Tissue damage remains local and recovers eventually.
- Extravasation of vesicant chemotherapies, such as vincristine, daunorubicin and doxorubicin, can cause serious injuries from damage or necrosis of the surrounding tissues. Urgent treatment is required.

Extravasation of other vesicants such as contrast media and vasopressors can also cause serious damage of tissues.

There are 4 different types of tissue damage that can occur following extravasation:

- Vasoconstriction: Narrowing of the blood vessels

- Osmotic: Diffusion of a soluble fluid from an area of low concentration to one of higher concentration

Infusions of a drug with an osmolarity different to that of the body can irritate the lining of the vein and destroy the cell proteins. The physiological osmolarity is around 281 mOsm/L.

- pH-related: Associated with the acidity of a substance. pH is a scale of acidity from 0 to 14. The more acidic a solution, the lower its pH.

Infusions with a pH different to that of the body can irritate the venous endothelium and vessel wall and can damage the cell proteins and cause cell death. Physiological pH is around 7.35.

Consequently acidic drug solutions (pH<7) and alkaline drug solutions (pH>8) can damage vein linings.

- Cytotoxic: Harmful and destructive to body cells

# How does extravasation differ from infiltration?

Infiltration is similar to extravasation in that leakage of fluid from a vein occurs into body tissue, but crucially the infiltrating fluid does not cause blistering or necrosis of the tissue.

Since the infiltrating fluid is not a vesicant, complications are therefore less serious. While infiltrations can sometimes lead to serious complications, they result more commonly in minor self-healing complications.

Infiltration is one of the most common problems with IV fluid administration occurring in 7% to 40.5% of patients.

Infiltration can happen when:

- The tip of the catheter is dislodged
- The catheter is misplaced or passes through the wall of the vein

Although 25% of cases of infiltrations are serious enough for referral to a specialist, none have been considered as surgical emergencies.

The majority of infiltration injuries can be monitored and managed by doctors and nurses in primary care.

Infiltrations can be problematic when they occur:

- During an anaesthetic procedure, because large volumes of fluid can be infused before it is detected
- In patients who are unable to communicate as they cannot report the pain or swelling sensation



# How can extravasation be recognised?

Extravasation may be suspected if the patient complains of the following symptoms or signs at/or surrounding the injection site:

- Burning or stinging sensation
- Swelling
- Pain or acute change in the area of the IV administration

A clinical examination of the injection site will show the following:

- Erythema (redness caused by increased blood flow)
- Mottling/darkening of skin
- Swelling of the area compared with the other side
- Tenderness on pressure
- Local blistering (symptomatic of a partial thickness skin injury)
- White appearance with non blanching skin (no filling of the capillaries, symptomatic of full-thickness skin damage)
- Reduced flow rate in the

cannula/infusion pump

- Lack of blood return from the cannula (be aware that: drawing back to test for blood return can re-position the cannula in the vein which now has a hole in its wall and when administration recommences, a larger and more significant extravasation injury can ensue).
- Firm induration
- Ulceration (evident 1-2 weeks after injury)

# What are the signs and symptoms of extravasation?

There is huge variation in extravasation-related injuries depending on the reaction of the patient's skin and the damage sustained by the nerves, tendons and joints. This is invariably related to the toxicity of the medication extravasated.

Symptoms and signs of extravasation surrounding the IV site frequently include:

- Pain, burning or stinging
- Swelling or oedema
- Subsequent blanching, discolouration and blistering of the skin.
- Persistent induration (increased fibrous tissue in the skin) or sclerosis
- Development of the indurated skin into dry black eschar (dead tissue) within 1 or 2 weeks. This usually sloughs off to reveal an ulcer.
- Damage caused by extravasation can continue

months after the incident has taken place.

- Unresolved tissue necrosis may require surgical debridement followed by skin grafting. If not treated correctly permanent disability or even death may ensue.
- Other long-term injuries following extravasation include nerve damage, compartment syndrome, loss of mobility in the affected extremity, and thrombosis.

# What are the risk factors for extravasation?

Risks for extravasation include factors relating to patients, procedures carried out and drugs administered.

## Patient-related factors:

- Very young and elderly patients who have small and fragile veins
- Patients with thickened and damaged veins following repeated IV access, for example cancer patients
- Patients with veins that made venous access difficult:
  - Patients with excised lymph nodes, limb amputation, or closed vena cava
  - Obese patients in which peripheral venous access is more difficult
  - Patients who are unable to remain still e.g., young children or patients with behavioural issues
- Patients receiving anticoagulants may lose more blood if extravasation occurs
- Patients on sedatives or analgesics may not notice the early signs or symptoms of

extravasation

## Procedure-related factors:

- Inadequately trained or inexperienced staff
- Multiple attempts at cannulation
- Inappropriate selection of equipment such as type of catheter or size of needle
- Poor fixation technique

**Drug-related factors: Drugs can be categorised for risk of tissue damage based on their osmolarity, pH and whether or not they are a vesicant:**

## High-risk:

- Osmolarity >600 mOsm/L
- pH <4 or >9
- Vesicant drug

## Moderate-risk:

- Osmolarity 450–600 mOsm/L
- pH 4 to 5 or 7.5 to 9
- Non-vesicant drug

## Low-risk:

- Osmolarity <450 mOsm/L,
- pH 5 to 7.5
- Non-vesicant drug

# How are extravasations managed?

Management of an extravasation will depend on the type of drug involved, the volume extravasated and the site of the extravasation.

While there is no formal NICE guideline for the management of drug extravasations, details of the drugs that are available for treating soft tissue extravasations, together with relevant advice, are available in the British National Formulary, currently presented on the NICE website (<https://bnf.nice.org.uk/treatment-summary/soft-tissue-disorders.html>).

- The British National Formulary (BNF) is co-authored by the British Medical Association and the Royal Pharmaceutical Society and published on the NICE website (<https://bnf.nice.org.uk/about/preface.html>).

Recommendations for extravasations on the NICE website are to:

- Follow local guidelines, where they exist
- Request specialist advice.

Management of extravasations is guided by the toxicity of the vesicant and the extravasation protocols at the relevant hospital.

Extravasation is managed mainly through nursing intervention. A senior nurse with relevant training or the Lead Chemotherapy Nurse will organise treatment of extravasation.

Nursing staff should be trained and familiar with both extravasation guidelines and the extravasation kit which is checked regularly.

## Treatment of extravasation

Extravasation is an emergency situation and immediate treatment should be started as soon as it is recognised. Early treatment of the extravasation will decrease the likelihood of tissue damage and necrosis.

Immediate treatment for extravasation involves:

- Rapid action to prevent tissue necrosis
- Discontinuation of IV fluids, but without removing the

cannula until aspiration via the cannula has been performed to remove any remaining drug

- Elevation of the limb with the extravasation site
- Application of compresses (warm or cold) in accordance with the hospital protocol and extravasated drug:
  - Heat treatment increases vasodilation to enhance dispersion of the vesicant and reduce its accumulation in the tissues.
  - Cooling packs help vasoconstriction to control dispersion of the drug.
- Frequent communication with the patient and monitoring of the IV site to identify sensory changes such as tingling, burning or tightening.
- Extravasation should be reported to the medical team, as appropriate
- Administration of

the following to treat inflammation:

- Dexamethasone or hydrocortisone can be given by subcutaneous injection locally, or they may be administered intravenously at a site far from the injury.
- Antihistamines and analgesics can be given for symptom relief.

Subsequent aspects of treatment will depend on the nature of the vesicant and will generally require specialist advice. There are two approaches to deal with vesicants:

- Localisation and neutralisation of the vesicant: Administration of an antidote (if available) following consultation with a specialist, in addition to application of cold compresses 3 to 4 times daily.
- Spreading and dilution of the vesicant:
  - Flushing out the

# How are extravasations managed? (cont.)

subcutaneous tissue of the affected area with physiological saline

- Administration of an enzyme to help dilute the vesicant:
  1. **Collegenase:** This enzyme has the ability to break down collagen
  2. **Hyaluronidase:** This is used to render the tissues more readily permeable to injected fluids, e.g., for introduction of fluids by subcutaneous infusion
  3. **Dexrazoxane** which is an iron chelator (bonding agent) approved for treating anthracycline extravasation

Pain relief can include:

- Counter-irritation of the skin with rubefacients to relieve superficial or deep-seated pain. A rubefacient is a substance that when applied topically cause redness of the skin by causing dilation of the capillaries and increasing blood circulation.

- Topical non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen, ketoprofen or piroxicam for musculoskeletal conditions.
- Oral NSAIDs may also be used for pain relief.

## Complications of extravasation

While extravasation injuries are generally slight and heal without treatment, serious complications may include full-thickness skin loss, and muscle or tendon necrosis.

Delay of treatment may result in significant injury which may require surgical debridement, skin grafting, reconstructive surgery or even amputation.

- Surgical debridement is required in the event of unresolved tissue necrosis or pain lasting more than 10 days, often in patients in which early treatment has not been initiated.
- Once surgical debridement has been carried out, skin grafting or limb reconstruction can be performed.

# How can chemotherapy extravasation be prevented?

Extravasations still cause significant tissue damage and should be prevented if at all possible.

The safety of IV treatment is becoming a priority in hospitals and healthcare settings. Knowledge of the properties of drugs helps assess the risk associated with their administration.

Prevention of extravasations is based on the following:

- Identification of patients at high risk of extravasation
- Appropriate cannulation techniques
- Monitoring of patients being administered high-risk solutions

Two major components in the prevention/early treatment of suspected extravasations are:

- Awareness of high-risk extravasation factors
- Implementation of easily accessible hospital care protocols

Extravasation guidelines are designed to help healthcare professionals prevent extravasation, and ensure patient safety in the event of an extravasation.

## Peripheral venous access extravasations

General precautions to prevent extravasations occurring include:

- Diluting the medication and setting a slow infusion rate
- Using a central line if:
  - The infusion is likely to be of long duration
  - A large peripheral vein is not available

## Precautions relating to inserted cannula

Frequent inspection of the sited cannula is recommended to detect signs of extravasation. Please see the section **How can extravasation be recognised?**

In patients receiving repeated doses of vesicant drugs peripherally, re siting of the cannula should be performed at regular intervals.

# Abbreviations

## BNF

British National Formulary

## DNA

Deoxyribonucleic acid

## IV

Intravenous

## mOsm/L

Milliosmoles (mOsm) of solute particles in a litre (L) of solution

## NICE

National Institute for Health and Care Excellence

## NSAID

Non-steroidal anti-inflammatory drug

## pH

Potential of Hydrogen. Measure of how acidic or alkaline a liquid is

## SACT

Systemic Anti-Cancer Therapy



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Leukaemia Care is a national charity dedicated to providing information, advice and support to anyone affected by a blood cancer.

Around 34,000 new cases of blood cancer are diagnosed in the UK each year. We are here to support you, whether you're a patient, carer or family member.

## Want to talk?

Helpline: **08088 010 444**

(free from landlines and all major mobile networks)

Office Line: **01905 755977**

**[www.leukaemicare.org.uk](http://www.leukaemicare.org.uk)**

**[support@leukaemicare.org.uk](mailto:support@leukaemicare.org.uk)**

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