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STANDARD OPERATING PROCEDURE	**EXTRAVASATION INJURIES MANAGEMENT FOR INPATIENTS**
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The WWL Way

AT ALL TIMES, STAFF MUST TREAT EVERY INDIVIDUAL WITH RESPECT AND UPHOLD THEIR RIGHT TO PRIVACY AND DIGNITY

CONTENTS	TITLE	PAGE NUMBER
1	INTRODUCTION	2
2	DEFINITIONS	2
3	PATIENT RISK FACTORS	3
4	MEDICATION RISK FACTORS	4
5	ADMINISTRATION RISK FACTORS	4
6	PREVENTION OF EXTRAVASATION	5
7	RECOGNITION OF EXTRAVASATION	6
8	PATIENT INVOLVEMENT	6
9	PROCEDURE FOR THE IDENIFICATION OF AN EXTRAVASATION INJURY	7
10	PROCEDURE FOR AN INFILTRATION TREATMENT PATHWAY	7
11	PROCEDURE FOR A DILUTE AND DISPERSE PATHWAY	8
12	PROCEDURE FOR A LOCALISE AND NEUTRALISE PATHWAY	9
13	ONGOING CARE AND MANAGEMENT OF ALL INJURIES	10
14	MEDICATION GUIDANCE	10
15	REPORTING OF EXTRAVASATION INJURIES	11
16	HUMAN RIGHTS ACT	11
17	ACCESSIBILITY STATEMENT	11

APPENDICES		PAGE NUMBER
App 1	MEDICINES WITH A HIGH OR LOW PH VALUE	12
App 2	DEFINITE LOCALISE AND NEUTRALISE SOLUTIONS	13
App 3	DEFINITE DILUTE AND DISPERSE SOLUTIONS	14

1 INTRODUCTION

1.1 Extravasation is the inadvertent leakage of a drug or fluid from a vein into the surrounding tissue during intravenous administration.

1.2 This may cause damage to the surrounding tissue, nerves, tendons or joints. The consequences of this action is often pain, erythema, inflammation or discomfort which, if left undiagnosed or inappropriately treated can lead to necrosis and functional loss of the tissue and limb concerned. The degree of injury can vary from apparently insignificant erythema to blistering, skin sloughing and severe necrosis.

1.3 Whilst extravasation is possible with any IV injection, it is only considered problematic with those compounds known to be vesicant or high risk non-vesicant.

1.4 Once an extravasation has occurred, because the full extent of the injury may be unclear and damage may continue for weeks or months.

1.5 Extravasation should be considered a medical emergency, a prompt and appropriate response is essential.

1.6 Identification of risk factors preceding extravasation injuries are paramount in circumventing such injuries. Risk factors include patient, pharmacological and administration factors.

2 DEFINITIONS

2.1 **Extravasation**

Accidental leakage into surrounding tissue from the vein usually occurring when an intravenous (IV) solution pass from the blood vessels into the tissue around the blood vessels and beyond. Depending upon the solution that extravasates, injury can range from very mild skin reactions to necrosis.

2.2 **Vesicants**

Vesicants are drugs (cytotoxic or non-cytotoxic) with the potential to cause blistering, ulceration and chemical burns that if left untreated can easily lead to tissue necrosis.

2.3 **Cytotoxic/Cytostatic**

2.3.1 **Cytotoxic**. The term cytotoxic drug is used to refer to all drugs with direct anti-tumour activity including anti-cancer drugs, monoclonal antibodies, partially targeted treatments and immunosuppressive drugs.

2.3.2 **Cycostatic.** Cytostatic refers to a cellular component or medicine that inhibits cell growth. Cytostasis is an important prerequisite for structured multicellular organisms. Chemotherapy of cancer, treatment of skin diseases and treatment of infections are common use cases of cytostatic drugs.

2.4 **High risk Non-vesicant**

Non-vesicants are relatively harmless substances; however some non-vesicants may still cause a reaction if they extravasate

2.4.1 **Exfoliants**
Can cause inflammation and shedding of the skin.

2.4.2 **Irritants**
Can cause inflammation and irritation of both skin and subcutaneous tissues.

2.4.3 **Inflammatants**
Can cause mild to moderate inflammation and flare (erythema).

2.5 **Neutrals (infiltrates)**
These are inert compounds that are easily absorbed through subcutaneous tissues and rarely cause damage.

3 PATIENT RISK FACTORS

3.1 Certain groups of patients are more likely to develop problems after extravasation and should be therefore monitored more closely.

3.2 **Neonates**
Neonates, particularly pre-term neonates, possess less subcutaneous tissue than adults and smaller more fragile veins. Any extravasated drug will be more concentrated in the affected area and they are less able to vocalise pain.

3.3 **Children**
3.3.1 The incidence may be higher among children because they have multiple risk factors, including small and fragile veins, decreased peripheral circulation, capillary leakage, and flexible subcutaneous tissue.
3.3.2 Children tend to me more mobile and less compliant with the “sick role” than adult patients as such they have a greater risk of potential partial or complete dislodgement of vascular access device (VAD).

3.4 **Patients unable to vocalise/ communicate their pain**
3.4.1 Comatose, anaesthetised patients and those being resuscitated are not able to provide clear vocalisation of pain that may be caused by the extravasation of an injectable medicine.
3.4.2 These patients (and neonates) are perhaps the group of patients at greatest risk if extravasation occurs.

3.5 **Patients unable to sense pain**
Special care should be taken when administering intravenous medicines to patients with an impaired ability to feel pain.

3.6 **Agitated or aggressive patients**
Agitated and aggressive patients are at greater risk of partial or complete dislodgement of VAD.

3.7 **Patients with loss of comprehension and/or cognitive ability**
Patients who have a loss of comprehension and or cognitive ability may be unable to report signs and symptoms.

3.8 **Bandaging over vascular access device insertion site**
3.8.1 Bandages should not be applied over a vascular access device insertion site as this prevents monitoring.
3.8.2 Bandages may also create a tourniquet effect should administration in the surrounding tissues occur, leading to risk of nerve damage and compartment syndrome

3.9 **Low weight Adults**
Patients with very little subcutaneous tissue or fatty tissues are more likely to suffer greater complications should an injectable medicine extravasate.

4 MEDICATION RISK FACTORS

4.1 Staff administering medications

4.1.1 Any staff member administering an IV infusion should be fully aware of what is being administered and what the risks of that medication are; this will enable appropriate measures to be taken to reduce those risks.

4.1.2 Particular note should be taken of the risks identified above.

4.1.3 This information gained be gained through a variety of resources

4.1.3.1 BNF

4.1.3.2 Pharmacy

4.1.3.3 Drug information leaflet supplied by manufacturer

4.1.3.4 Medusa – online injectable medication guide

4.2 Cytotoxic/cytostatic medicines

4.2.1 Several cytotoxic agents will cause extensive tissue damage if extravasated.

4.2.2 These agents may require specific treatment should extravasation occurs.

4.2.3 Please refer to TW13-056 SOP 1 for further advice.

4.3 Vasoconstrictive medicines

4.3.1 When administered by the peripheral route, extravasation can produce local vasoconstriction leading to severe tissue hypoxia and ischaemia.

4.3.2 Medications such as adrenaline (epinephrine), noradrenaline (norepinephrine), dobutamine, dopamine and vasopressin will reduce the ability of blood vessels, in the area of extravasation, to allow blood to flow freely.

4.3.3 As a result the area may become ischaemic and if the ischaemia is prolonged or severe, necrosis may develop in the extravasated area.

4.4 Extreme PH (see appendix 1)

4.4.1 Acidic preparations PH below 6.5

4.4.2 Alkaline preparations PH above 8

4.4.3 Both are likely to cause tissue damage through ulceration.

4.5 Osmolality

4.5.1 Most intravenous medicines are formulated to have an osmolality as close to that of plasma as possible to avoid tissue disturbance.

4.5.2 Injection solutions with an osmolality greater than that of plasma i.e., >290mosmol/L may cause tissue damage if extravasated.

4.5.3 The presence of these solutions in the tissues can lead to an osmotic imbalance across the cell membrane, a breakdown of cellular transport mechanisms and cell death. Appendix 1 lists a selection of injections with a high osmolality that may potentially cause problems if extravasated. Extra care should be taken when administering these medicines.

5 ADMINISTRATION RISK FACTORS

5.1 Site of administration

5.1.1 The site chosen for administration is a very important factor when administering an intravenous medicine.

5.1.2 Areas with very little subcutaneous tissue are most likely to be problematic should an injectable medicine extravasate.

5.2 Method of venous access

5.2.1 Venous access is a skill that should not be attempted by anybody who has not completed an approved training course and achieved the appropriate competency.

5.2.2 Inexperience increases the risk of problems arising from venous access. Venous access is probably as important a factor as the choice of site of administration in the development of extravasation.

5.2.3 The repeated use of a single vein for venepuncture increases the risk of extravasation of intravenous medication to the surrounding tissues.

5.3 **Choice of Venous Access Device (VAD)**

5.3.1 Extravasation can often be preceded by partial or complete dislodgement of a VAD. Therefore could be associated more with peripheral inserted venous catheter (PIVC).

5.3.2 Extravasation is associated with all VAD

5.3.3 Position and patency of all VAD should be established prior to commencing any therapy

5.3.4 Ongoing routine monitoring of therapy must take place.

5.3.5 Risk of device dislodgement should be assessed and appropriate interventions put in place to reduce this risk.

5.4 **Antiemetics**

Some investigators suggest delaying the administration of antiemetics until after vesicant administration. The sedative and anti-inflammatory effects of antiemetics often mask the early warning signs of extravasation and may impede the patient's ability to report any sensation at the infusion site.

6 PREVENTION OF EXTRAVASATION

6.1 The position, size and age of the venepuncture site are the factors, which have greatest bearing on the likelihood of problems occurring. However, if the following points are borne in mind, the likelihood of extravasation can be significantly reduced.

6.2 For slow infusion of high-risk drugs, a central line or PICC line should be used.

6.3 To ensure patency of a peripheral IV site, it is best to administer high risk drugs through a recently sited cannula.

6.4 Site the cannula so it cannot become dislodged; use the forearm and avoid, if possible, sites near joints.

6.5 Administer vesicants by slow IV bolus into the side-arm port of a fast-running IV infusion of compatible solution.

6.6 The most vesicant drug should be administered first.

6.7 Assess a peripheral site continually for signs of redness or swelling.

6.8 Verify patency of the IV site prior to vesicant infusion and regularly throughout; if there are any doubts, stop and investigate.

6.9 Re site the cannula if the patency of the cannulation is still not entirely satisfactory.

6.10 Ask the patient to report any sensations of burning or pain in the infusion site. Never hurry. Administer drugs slowly to allow the drug to be diluted by the carrier solution and to allow careful assessment of the IV site.

6.11 Document carefully the rate of administration, location and condition of site, verification of patency, and patient's responses, on giving any potentially extravasable drugs.

7 RECOGNITION OF EXTRAVASATION

7.1 Where extravasation is suspected to be the cause of any symptom, the injury should be treated as extravasation until proven otherwise

7.2 Extravasation can occur with any vascular access device.

7.3 Health Care practitioners should be aware of the extravasation risk of all substances they are administering.

7.4 The practitioner must constantly assess the infusion site and the surrounding tissue for any signs and symptoms of possible extravasation.

7.5 Symptoms may occur immediately after the blood vessel has been breached.

7.6 Symptoms may also be significantly delayed and may only present several weeks after the initial injury.

7.7 General signs and symptoms of extravasation include
- 7.7.1 Patient reports (through verbal and non-verbal indicators) changes in sensation or pain at infusion site.
- 7.7.2 Changes in infusion quality (eg free flowing IV slowing down)
  - 7.7.2.1 Reduction in flow rates are not visible with infusion devices as they will increase infusion pressures to maintain flow rates
  - 7.7.2.2 When using infusion devices persistent occlusion alarms may signify a significant reduction in flow rates
- 7.7.3 Swelling at the infusion site, along the vein pathway or in the surrounding subcutaneous tissues
- 7.7.4 Induration
- 7.7.5 Erythema
- 7.7.6 Venous discolouration/blanching
- 7.7.7 Increased resistance when administering IV drugs
  - 7.7.7.1 Infusion resistance can be observed be monitored via infusion devices
  - 7.7.7.2 Infusion resistance can be felt when administering bolus medications
  - 7.7.7.3 Persistent increased resistance is likely to lead to displacement of the vascular access device
- 7.7.8 Inflammation or blistering
- 7.7.9 Fluid leakage at or around exit site and along subcutaneous canal.

7.8 Central Infusion only symptoms
- 7.8.1 Aching discomfort in the shoulder/neck – this is the most common pain, burning, aching/discomfort, swelling of chest wall
- 7.8.2 Absence of blood return, this however can be a very misleading sign

8 PATIENT INVOLVEMENT

8.1 The patient is often the first person to be aware of a problem and so should be included in their care.

8.2 Prior to starting administration, patients should be fully informed of any acute changes that could signify a complication occurring.

8.3 Patients should be encouraged to report any complaints, including pain, burning stinging or altered sensation to nursing staff immediately.

8.4 .If a patient cannot communicate then they should be very closely monitored during administration.

8.5 Care should be taken with children, and adult patients with trypanophobia, as they may deny any pain or altered sensation to prevent future cannulation attempts.

8.6 Reassurance that if extravasation was to occur, prompt action will implemented.

9 PROCEDURE FOR THE IDENIFICATION OF AN EXTRAVASATION INJURY

9.1 Stop and disconnect the infusion/bolus immediately.

9.2 Do Not Remove the cannula/vascular access device.

9.3 Explain to the patient what you suspect has happened.

9.4 Identify the solution that has been infused, the extravasation risk of the substance and amount infused.

- 9.4.1 All solutions need to be identified as vesicant, high risk non vesicant or infiltrate.
- 9.4.2 On line Injectable medications guide (medusa) can be used to identify the extravasation risk of all drugs/infusions.
- 9.4.3 Pharmacy will assist in classification of the nature of the substance if not clearly identified through Medusa.

9.5 Mark around the affected area with an indelible pen.

9.6 DO NOT apply direct manual pressure to a suspected extravasation site.

9.7 Inform the medical staff immediately.

9.8 Refer to Vascular Access Service, Monday to Friday 08.00 to 16.00 or Critical Care Outreach Team outside of these hours.

9.9 Agree an infiltration, “dilute and disperse” or “localise and neutralise” pathway. All treatment pathways and medicinal support must be agreed by medical team, nursing team and pharmacy team.

9.10 Appendix 2 and 3 can be used as a guide for the identification of treatment pathways however these lists are not exhaustive, as a general principle extreme PH extravasations would be treated by localise and neutralise and hyperosmolar solutions by dilute and disperse unless otherwise stated.

9.11 Recent research has suggested that the use of cold compress therapy for the first 24hours will limit the immediate damage/injury followed by warm compress therapy to expedite healing times is an acceptable treatment pathway if the correct pathway is unknown.

9.12 Administer pain relief (if required) against a valid signed prescription

10 PROCEDURE FOR AN INFILTRATION TREATMENT PATHWAY

10.1 Stop the infusion immediately.

10.2 Reassure patient.

10.3 Check the colour, sensation and movement of the patients effected limb and document clearly the findings.

10.4 Remove the cannula/vascular access device if appropriate.

10.5 Provide first aid to patient as required
10.5.1 Elevation of the effected limb will help to reduce swelling.
10.5.2 Elevation will also help to prevent pooling of fluid and aid reabsorption.
10.5.3 Administer analgesia and anti-inflammatory as required.
10.5.4 Gentle exercise and movement will also aid fluid redistribution and aid reabsorption.

10.6 Document fully in nursing notes.

10.7 Complete Datix incident form.

11 PROCEDURE FOR A DILUTE AND DISPERSE PATHWAY

11.1 The principle behind dilute and disperse is to increase distribution and absorption and subsequently decrease the local drug concentration.

11.2 Vasodilation will vastly increase distribution of the substance, this can be achieved through applying heat and increasing movement of the affected limb.

11.3 Leave the cannula in place and try to aspirate as much of the drug as possible from the cannula with a 10ml luer lock syringe. If blood is being aspirated stop.

11.4 For all Central Vascular Access Devices an urgent early referral to a local plastic surgical team must be considered.

11.5 Cover the affected site with dry gauze dressing.

11.6 Consider the use of hyaluronidase to promote rapid reabsorption through the subcutaneous tissues.

11.7 To administer dilute 1500units hyaluronidase in 2ml of water for injection or sodium chloride 0.9%.

11.8 Inject the hyaluronidase subcutaneously at points of the compass around the area of extravasation.

11.9 Gently massage the area to facilitate dispersal.

11.10 Apply warm compress to affected area for 20 minutes to aid the natural dispersal of the drug and to aid absorption of the hyaluronidase. Apply the compress firmly, but without undue pressure.

11.11 It is the responsibility of the staff to ensure that the compress is a suitable temperature to increase the surface temperature of the affected area. Extreme care should be taken when preparing the compress as if these are too hot they can cause further damage through scalding.

11.12 Encourage movement of the effected limb as much as possible.

11.13 Consider hydrocortisone cream 1% if local inflammation occurs.

11.14 Repeat the warm compress four to six hourly for 48 hours.

11.15 Contact medical illustrations for urgent digital imaging.

11.16 Refer to Tissue Viability Specialist Nurse.

11.17 Remove cannula or VAD once medical and nursing teams are in agreement.

12 PROCEDURE FOR A LOCALISE AND NEUTRALISE PATHWAY

12.1 The principle behind localise and neutralise is localising the drug. An antidote may be used at this stage, if available to neutralise the drug. The drug will then be dispersed via the local vascular and lymphatic systems. The antidote used will depend on the drug and the volume of extravasation.

12.2 Vasoconstriction will vastly decrease movement of the substance; this can be achieved through applying cold and immobilising the affected limb.

12.3 Leave the cannula in place and try to aspirate as much of the drug as possible from the cannula with a 10ml luer lock syringe. If blood is being aspirated stop.

12.4 For all Central Vascular Access Devices an urgent early referral to a local plastic surgical team must be considered.

12.5 Cover the affected site with dry gauze dressing.

12.6 Consider the use of Dimethyl sulfoxide DMSO as this will limit further tissue damage that may be caused through applying cold compresses.
12.6.1 Apply the DMSO by painting it on to the marked area with a cotton bud
12.6.2 Avoid contact with good skin; nursing staff should wear gloves.
12.6.3 If blistering occurs seek medical advice,
12.6.4 DO NOT apply DMSO to blistered skin.
12.6.5 Avoid intense exposure to sunlight.

12.7 Apply cold compress to affected area for 20 to 30 minutes. Apply the compress firmly, but without undue pressure.

12.8 Use antidote if indicated. Ensure this is prescribed.

12.9 Repeat cold compress four to six hourly for 48 hrs.

12.10 Consider the use of hydrocortisone cream 1% if local inflammation occurs.

12.11 Contact medical illustrations for urgent digital imaging.

12.12 Refer to Tissue Viability Specialist Nurse.

12.13 Remove cannula or VAD once medical and nursing teams are in agreement.

13 ONGOING CARE AND MANAGEMENT OF ALL INJURIES

13.1 As injury can progress over several weeks it is imperative injuries are monitored closely, even in the absence of obvious injury.

13.2 Injury sites must be monitored at least three times daily for signs of erythema, induration, blistering or necrosis.

13.3 Colour sensation and movement should be recorded three times daily to monitor for signs of nerve damage.

13.4 If any new visual signs of injury or any deterioration of injury is noted repeat photographs should be requested via medical illustrations.

13.5 If deterioration of injury is noted or the patient displays any signs of infection medical teams must be notified immediately.

13.6 All patients being discharged should receive written information explaining what has occurred, what management has been carried out, what they need to look for at the site and when to report any changes.

13.7 Tissue viability nurse will advise on dressings to be applied to help heal existing damage and prevent deterioration.

13.8 Where deep necrosis is evident or suspected patients must be referred to plastic surgeons.

13.9 Plastic surgeon teams can be contacted for advice on the management of all extravasation injuries

14 MEDICATION GUIDANCE

14.1 Many guidelines recommend the use of subcutaneous or intradermal steroids. However many reviews state that inflammation is not prominent in the aetiology of tissue necrosis.

14.2 There is also evidence that subcutaneous or intradermal steroids may be harmful in high doses, are ineffective in certain extravasations and may increase the skin toxicity of vinca alkaloids. For this reason, this policy does not recommend the routine use of subcutaneous steroids

14.3 Topical hydrocortisone 1% cream is unlikely to do harm and may reduce non-specific inflammation, except in vinca-alkaloid injuries.

14.4 Hyaluronidase is an enzyme which breaks down hyaluronic acid, a normal component of tissue ‘cement’ and helps to reduce or prevent tissue damage by allowing rapid diffusion of the extravasated fluid and promoting drug absorption.

14.5 Hyaluronidase increases the absorption of local anaesthetic. If local anaesthetic has been applied to the area (e.g. Ametop, Emla) prior to cannulation and within 6 hours of extravasation, then the patient must be monitored for signs and symptoms of systemic anaesthesia such as increased pulse rate and decreased respirations the medical team must be informed immediately.

14.6 Dimethyl sulfoxide (DMSO) is a potent free radical scavenger that rapidly penetrates tissues when applied topically. Reports on the clinical use of topical DMSO show it is effective and well tolerated in extravasation.

15 REPORTING OF EXTRAVASATION INJURIES

15.1 All extravasation incidents must be clearly documented in the patient's notes.

15.2 All extravasation, regardless of type, must be reported as a clinical incident on the Trust Datix reporting system.

15.3 All vesicant and high risk non vesicant extravasation injuries must be reported to MHRA via the yellow card scheme at https://yellowcard.mhra.gov.uk/

16 HUMAN RIGHTS ACT

Implications of the Human Rights Act have been taken into account in the formulation of this document and they have, where appropriate, been fully reflected in its wording.

17 ACCESSIBILITY STATEMENT

This document can be made available in a range of alternative formats e.g. large print, Braille and audio cd.
For more details, please contact the HR Department on 01942 77 3766 or email equalityanddiversity@wwl.nhs.uk

Appendix 1

Medicines with a high or low pH value (N.B. List is not exhaustive)

Intravenous medicine	pH	Intravenous medicine	pH	Intravenous medicine	pH
Acetazolamide	9.2	Furosemide	8 - 9.5	Oxytocin	3.7
Aciclovir	11	Ganciclovir	10 - 11	Pancuronium	3.8
Adrenaline (epinephrine)	2.5	Gentamicin	3 - 5	Papaveretum	2.5 - 4
Allopurinol	10.8	Glucagon	2.5 - 3.5	Phenobarbitone	9
Aminophylline	8.8	Glucose (pH dependent on concentration of solution)	3.5 - 6.5	Phenoxybenzamine	2.5
Amiodarone	3.5	Glyceryl trinitrate	3.5 - 6.5	Phenytoin sodium	12
Argipressin	2.5	Glycopyrronium	2.3 - 4.3	Potassium canrenoate	10.7
Atracurium	3.5	Haloperidol	3 - 3.8	Prochlorperazine	5.5
Atropine	3 - 4.5	Hydralazine	3.5 - 4.2	Propranolol	3
Azathioprine	10	Hyoscine butylbromide	3.7 - 5.5	Protamine sulphate	2.5
Buprenorphine	3.5	Ketamine	3.5 - 5.5	Quinine dihydrochloride	1.5 - 3
Cholecystokinin (CKK)	3-6	Labetalol	3.5 - 4.2	Salbutamol	3.5
Clonazepam	3.5	Lidocaine	3.5	Secretin	2.5 - 5
Co-trimoxazole	9-	Liothyronine	9.8	Sodium nitroprusside	3.5 - 6
Cyclizine	3.3	Methoxamine	4.4	Sulfadiazine	11
Dantrolene	9.5	Methyldopa	3	Terbutaline	3 - 5
Diazoxide	11.6	Metoclopramide	3 - 7	Tetracosactide	3.8 - 4.5
Dobutamine	2.5	Midazolam	3	Tetracycline	1.8
Dopamine	2.5	Morphine	3 - 6	Thiamine	2.5 - 4.5
Doxapram	3 - 5	Naloxone	3	Thiopental	10.5
Droperidol	2.7	Noradrenaline acid tartrate	3	Tobramycin	3.5 - 6
Ergometrine	2.7	Octreotide	3.9	Vancomycin	2.8 - 4.5
Fentanyl	4	Omeprazole	9	Radiographic contrast media	< 5
Folic acid	8	Ondansetron	3.3		

Appendix 2

Definite Localise and Neutralise solutions

Amiodarone	Ganciclovir
Amphotericin	GTN infusion
Aciclovir	Magnesium sulphate 20%
Cefotaxime	Mannitol
Clarithromycin	Methyleve Blue
Co-trimoxazole	Phenobarbitone
Diazemuls	Potassium chloride > 40mmol/l
Diazepam	Potassium phosphate
Digoxin	Prostaglandisn
Erythromycin	Thiopental
Foscarnet	Vancomycin
	Vasopressin

Appendix 3

Definite dilute and disperse solutions

Adrenaline (epinephrine)	Noradrenaline (nor-epinephrine)
Asparaginase	Sodium bicarbonate
Aminophylline	Parenteral nutrition
Calcium chloride	Phenytoin
Calcium gluconate 10%	X-ray contrast media
Dobutamine	**Monoclonal Antibodies:**
Dopamine	Alemtuzumab
Hypertonic solutions ie sodium chloride	Bevacizumab
0.9%, glucose 10% or more	Cetuximab
Interferon	Ipilumumab
Interleukin-2 (Aldesleukin	Rituximab
	Trastuzuma