MOH/S/FAR/1120(GU)-e

PHARMACEUTICAL SERVICES PROGRAMME
MINISTRY OF HEALTH, MALAYSIA

DILUTION GUIDELINE FOR INJECTABLE DRUGS

MOH/S/FAR/11.20(GU)-e
No. Rujukan: A-GU-84
No. Keluaran: 1

December 2020

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eISBN 978-967-5570-96-4

DILUTION GUIDELINE FOR INJECTABLE DRUGS

(Part I – Antimicrobial)

DILUTION GUIDELINE FOR INJECTABLE DRUGS

Publication date	December 2020
Summary	**Dilution Guideline for Injectable Drugs** serves as a general reference for healthcare professionals on the preparation of injectable drugs before administering to the patient. The information provided in this guideline is mainly extracted from the package insert for relevant brand of injectable drugs used and valid at the time of publication. Nevertheless, users are strongly advised to refer to the dilution instruction as stated in the product package insert currently used at the respective facilities and update regularly.
Author	Medication Safety Section Pharmacy Practice and Development Division Pharmaceutical Services Programme Ministry of Health Malaysia
Applies to	All government and private healthcare facilities
Audience	Healthcare professionals
Review Date	December 2025

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DISCLAIMER

This guideline serves as a general reference for the healthcare professionals in the Ministry of Health on how to prepare dilution of certain injectable drugs before administering to the patient. The information provided in this guideline mainly extracted from the package insert for the brand of injectable drugs used and valid at the time of publication. Nevertheless, users are strongly advised to refer to the dilution instruction as stated in the product package insert currently used at the respective facilities and update regularly.

The medicines included in this guideline are selected from the Ministry of Health Medicines Formulary (MOHMF).

The users of this guideline must have the necessary knowledge and competency in order to interpret the information provided. In no event shall the Pharmaceutical Services Programme be liable for any direct, indirect, incidental, special or consequential event resulting from the use of or the inability to use this guideline. The committee reserves the right to amend, update or remove the content of this guideline when necessary.

PREFACE

The Malaysian National Patient Safety Council Technical Committee on Medication Safety had put in much effort through the various stakeholders to promote medication safety culture in both the public and private healthcare sector. The primary goal of medication safety is to ensure long term and continuous quality improvements in healthcare. One way of achieving it is by improving and strengthening medication safe practice. Hence, Pharmaceutical Services Programme, Ministry of Health Malaysia has taken the initiative and prepared the Dilution Guideline for Injectable Drugs.

The purpose of this guideline is to provide information and facilitate the healthcare professionals at all levels in the preparation of injectable drugs that are listed in the Ministry of Health (MOH) drug formulary which requires dilution. This guideline will also serve as a preventive measure to reduce medication errors related to incorrect dilution and administration of injectable drugs.

FOREWORD

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Medication safety has received much attention after the Institute of Medicine had published "To Err Is Human: Building a Safer Health System" report which was in line with the third World Health Organization (WHO) Global Patient Safety Challenge. Errors can never be entirely eliminated, but their numbers and severity can be reduced. The occurrence of medication errors can compromise patients' confidence in healthcare system by exposing them to the risk of adverse drug reactions and increased healthcare cost. Moreover, medication errors are preventable.

The Malaysian Patient Safety Council, Ministry of Health (MOH) had put in much effort through the various stakeholders to promote medication safety culture in both the public and private healthcare sectors. Pharmaceutical Services Programme, MOH has been given a mandate to lead the Technical Working Group of Medication Safety at the national level. The committee, which comprises various stakeholders, will identify any issues related to medication safety and plan for ongoing improvements in the quality and safety of the medication management system and practices.

With the aim of reducing the risks related to injectable drugs, initiatives have been taken to establish Dilution Guidelines for Injectable Drugs to promote safe medication use. Moreover, errors in intravenously administered medications may have serious consequences and incident can happen during preparation,dispensing and administration of these drugs. There are a few types of medication errors related to injectable drugs that are commonly reported to Medication Error Reporting System (MERS), for example: incorrect dilution, incorrect route of administration, incorrect infusion rate and incorrect diluent. Thus, promoting safe injection practices and establishment of standard for dilution and administration of injectable drugs are crucial to ensure patient safety.

Ensuring safer care for every patient, every time, everywhere is the vision established by WHO as the goals towards continuous improvements in patient safety and managing risks to prevent harm (particularly "avoidable harm" during treatment and care). Hence, medication safety is everyone's responsibility so as to make the healthcare system safer. This guideline aims to facilitate the healthcare personnel in preparing the dilutions of drugs which are available in the MOH drug lists. The availability of this guideline will assist in the expansion of quality clinical care pharmacy services throughout MOH facilities.

I would like to congratulate the editorial committee, accreditors and reviewers for their efforts and contributions in the development of this dilution guideline. It is hoped that this guideline would be a useful reference for all who are involved in the dilution and administration of injectable drugs in the healthcare facilities.

All the best and thank you.

ACKNOWLEDGEMENT

Special thanks dedicated to everyone who were involved directly or indirectly in the establishment of this guideline.

This guideline consumes enormous amount of work, time efforts and dedication. Thus, Pharmaceutical Services Programme, Ministry of Health would like to extend our utmost gratitude to all individuals and organizations that had provided valuable input, advice and information for this guideline.

We are also grateful for the provision of expertise and technical support in the development of this guideline. Hopefully, the information provided can lead to the improvements in quality and safe medication practice.

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ABBREVIATIONS & ACRONYMS

ABBREVIATION & ACRONYM	DESCRIPTION
BW	body weight
D10	10% dextrose
D5	5% dextrose
g	gram
gtt	drops
HCl	hydrochloride
HSD5	0.45% sodium chloride + 5% dextrose
IM	intramuscular
IV	intravenous
kg	kilogram
L	litre
max	maximum
mcg	microgram
mg	milligram
ml	millilitre
NS	0.9% sodium chloride
NSD5	0.9% sodium chloride + 5% dextrose
RT	room temperature
SC	subcutaneous
w/v	weight over volume
WFI	water for injection

Acyclovir Injection

Brand Name	Vaxcel® Acyclovir IV For Infusion (Strength: 250mg)
Reconstitution	Reconstitute 1 vial (250mg) with 10ml WFI or NS to provide a solution containing 25mg/ml.
Further Dilution	**IV infusion** ■ Dilute the required volume of reconstituted solution with diluent to give a concentration not greater than 5mg/ml (0.5%w/v) for administration by infusion. ■ For children and neonates, where it is advisable to keep the volume of fluid to a minimum, dilution is on the basis of 4ml reconstituted solution (100mg acyclovir) added to 20ml of infusion fluid. ■ For adult, infusion bags containing 100ml of infusion fluid are used, even when this would give an acyclovir concentration substantially below 0.5%w/v. Thus, one 100ml infusion bag may be used for any dose between 250mg and 500mg (10 and 20ml of reconstituted solution) but a second bag must be used for doses between 500mg and 1000mg. **Diluents** NS
Administration	**IV infusion** Administer by slow IV infusion over 1 hour.
Storage & Stability	See table below *Protect from light. *Reconstituted or diluted solutions SHOULD NOT BE REFRIGERATED.
Remarks	■ This infusion contains no preservative. Should visible turbidity or crystallization appear in the solution before or during infusion, the preparation should be discarded. ■ Do not give by IV bolus, IM or subcutaneous route. ■ Be aware that too-rapid infusion may damage renal tubules.
References	1. Product leaflet Vaxcel® Acyclovir IV For Infusion (Kotra Pharma (M) Sdn. Bhd, Malaysia). Revised date: 2.4.2019. 2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

	RT(<25℃)
After reconstitution	48 hours
After dilution	48 hours

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Amikacin Injection

Brand Name	Apalin (Strength: 500mg/2ml)
Reconstitution	Not required
Further Dilution	**IV infusion** Add 500mg amikacin solution to 100 – 200ml diluent. **Diluents** NS, D5
Administration	**IM** **IV infusion** ■ Adult: Administer slowly over 30 – 60 minutes. ■ Infants: Administer slowly over 1 – 2 hours.
Storage & Stability	
Remarks	■ Slow IV infusion may help to avoid neuromuscular blockade. ■ Do not physically premix amikacin injection or infusion solutions with other drugs at any point in the infusion apparatus.
References	1. Product leaflet Apalin (Duopharma (M) Sdn Bhd, Malaysia). Revised date: 16.1.2012. 2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

	RT(25°C)	Fridge (4°C)
After dilution	24 hours	60 days

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Amoxicillin & Clavulanate Injection

Brand Name

Clavam For Injection BP (Strength: 1.2 g).

Contains: Amoxicillin 1 g as sodium salt, Clavulanic acid 200mg as the potassium salt.

Reconstitution

Reconstitute 1 vial (1.2 g) with 20ml WFI (Final volume 20.9ml).

Further Dilution

IV infusion

Dilute the reconstituted solution to 100ml diluent.

Diluents

NS, WFI

Administration

Slow IV bolus

- Administer slowly over 3 – 4 minutes and within 20 minutes of reconstitution.
- It may be injected directly into the vein or via a drip tube.

IV infusion

Administer over 30 – 40 minutes and complete within the time stated.

Storage & Stability

	RT (25°C)	Fridge (5°C)
After reconstitution	20 minutes	-
After dilution	4 hours	8 hours

*Any residual antibiotic solutions should be discarded.

Remarks

- The colour of the reconstituted solution may range from a cream coloured solution to slight yellow/pale straw-coloured solution.
- Not suitable for intramuscular administration.
- Injection solution is less stable in infusions containing glucose, dextrose or bicarbonate.
- Should not be mixed with blood products, other proteinaceous fluids such as protein hydrolysates or with intravenous lipid emulsions.

References

Product leaflet Clavam For Injection BP (Alkem Laboratories Limited, India). Revised date: April 2016.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Amphotericin B Injection

Brand Name

Photericin B For Injection USP (Strength: 50mg)

Reconstitution

- Reconstitute 1 vial (50mg) with 10ml of WFI.
- Shake the vial immediately until the colloidal solution is clear.

Further Dilution

IV infusion

- Further dilute with diluent to produce the recommended concentration of 0.1mg/ml.
- Final concentration should not exceed 0.1mg/ml for peripheral infusion or 0.25mg/ml for central infusion.

Diluent

D5

Administration

IV infusion

- Administer by slow IV infusion over 2 to 6 hours (depending on the dose).
- A single IV test dose (1mg in 20ml of D5) administered over 20 to 30 minutes may be preferred.

Storage & Stability

	RT (25°C)	Fridge
After reconstitution	24 hours	7 days
After dilution	24 hours	2 days

*Protected from light

Remarks

- The patient's temperature, pulse, respiration, and blood pressure should be recorded every 30 minutes for 2 to 4 hours.
- Rapid IV infusion, over less than 1 hour, particularly in patients with renal insufficiency, has been associated with hyperkalemia and arrhythmias and should therefore be avoided.
- The infusion solution (0.1mg/ml) is obtained by further dilution with D5 of pH above 4.2. The pH of each container of dextrose injection should be ascertained before used.
- Do not reconstitute with saline solutions.
- An in-line membrane filter may be used for IV infusion of amphotericin B (the mean pore diameter of the filter should not be less than 1 micron).

References

1. Product leaflet Photericin B For Injection USP (Cipla LTD, India).
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

* The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Ampicillin Injection

Brand Name	Kampibiotic Injection (Strength: 500mg)
Reconstitution	**IV** Dissolve 1 vial (500mg) in 10 ml WFI. **IM** Dilute 1 vial (500mg) with 1.5 ml WFI.
Further Dilution	**IV infusion** Dilute with 50 to 100 ml NS (maximum concentration: 30mg/ml). **Diluent** NS
Administration	**Slow IV bolus** ■ Administer slowly over 3 to 4 minutes. ■ Do not exceed 100mg/minute. **Intermittent IV infusion** Administer over 15 – 30 minutes. **IM**
Storage & Stability	Use immediately
Remarks	■ Be aware that too-rapid infusion may cause seizures. ■ Extemporaneous admixtures of beta-lactam antibacterials and aminoglycosides may result in substantial mutual inactivation. If these administered concurrently, administered in separate sites at least 1 hour apart. Do not mix them in the same intravenous bag, bottle or tubing. ■ If ampicillin is prescribed concurrently with an aminoglycoside, the antibiotics should not be mixed in the syringe, intravenous fluid container or giving set because loss of activity of the aminoglycoside can occur under these conditions.
References	1. Product leaflet Kampibiotic Injection (Karnataka Antibiotics & Pharmaceuticals Limited, India). Revised date: 25.7.2017. 2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional. 3. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Ampicillin & Sulbactam Injection

Brand Name	Amsubac Injection (Strength: 1.5 g) Contains: Ampicillin 1000mg, Sulbactam 500mg
Reconstitution	**IV** ■ Reconstitute 1 vial (1.5 g) with 3.2 ml WFI. ■ To ensure complete dissolution, allow foaming to dissipate to permit visual inspection. **IM** Reconstitute with 3.2 ml WFI or 0.5% lignocaine HCl.
Further Dilution	**IV infusion** Further dilute to 50 – 100ml diluent. **Diluent** NS
Administration	**Slow IV bolus** Administer slowly over a minimum of 3 minutes. **IV infusion** Administer over 15 – 30 minutes. **IM** Administer by deep IM injection.
Storage & Stability	Not available
Remarks	■ Do not mix or give through same I.V. line with aminoglycosides, as this inactivates ampicillin/sulbactam. ■ Rapid infusion may cause seizures.
References	1. Product leaflet Amsubac Injection (Karnataka Antibiotics & Pharmaceuticals Limited, India). Revised date: 23.1.2018. 2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Anidulafungin Injection

Brand Name

Eraxis (Strength: 100mg)

Reconstitution

Reconstitute 1 vial (100mg) with 30ml WFI to provide a concentration of 3.33mg/ml. The reconstitution time can be up to 5 minutes.

Further Dilution & Administration

IV infusion

Dilution Requirements For Anidulafungin Administration Of Water For Injection Presentation

Dose	Number of Vials Required	Total Reconstituted Volume Required	Infusion Volume[A]	Total Infusion Volume[B]	Rate of Infusion	Minimum Duration of Infusion
100mg	1	30ml	100ml	130ml	1.4ml/minute	90 minutes
200mg	2	60ml	200ml	260ml	1.4ml/minute	180 minutes

[A] Either 9mg/ml (0.9%) sodium chloride for infusion or 50mg/ml (5%) glucose for infusion.

[B] Infusion solution concentration is 0.77mg/ml.

Diluents

NS, D5

IV infusion ONLY

The rate of infusion should not exceed 1.1mg/minute (equivalent to 1.4ml/minute or 84ml/hour when reconstituted and diluted per instructions).

Storage & Stability

	RT (25°C)	Fridge (Frozen)
After reconstitution	24 hours	-
After dilution	48 hours	72 hours

*For single use only

Remarks

- Anaphylactic reactions, including shock, have been reported; discontinue use and appropriate treatment administered.
- Infusion-related adverse events have been reported with anidulafungin, including rash, urticaria, flushing, pruritus, dyspnea, bronchospasm and hypotension.
- Infusion-related adverse events are infrequent when the rate of anidulafungin infusion does not exceed 1.1mg/minute.
- Do not give as IV bolus.

References

1. Product leaflet Eraxis (Pharmacia and Upjohn Company, USA).
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Artesunate Injection

Brand Name

Artesun Powder For Injection (Strength: 60mg)

Reconstitution

- Reconstitute 1 vial (60mg) with provided diluent (5% sodium bicarbonate solution).
- Shake the vial for 2– 3 minutes and wait until completely dissolved and a clear solution should emerge.

Further Dilution

Dilute the reconstituted solution (1 ml) with diluent to produce the required concentration.

Route of Administration	Diluent (NS or D5)	Total Volume	Final Concentration
IV	5ml	6ml	10mg/ml
IM	2ml	3ml	20mg/ml

Administration

Slow IV bolus

Administer the required dose slowly at a rate of 3 – 4 ml/minute.

IM

Storage & Stability

Use immediately

Remarks

- Do not use in intravenous drip.
- Discard if solution not clear.

References

Product leaflet Artesun Powder For Injection (Guilin Pharmaceutical Co. Ltd, China).

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Azithromycin Injection

Brand Name

Vaxcel® Azithromycin IV For Infusion (Strength: 500mg)

Reconstitution

Reconstitute 1 vial (500mg) with 4.8ml WFI to obtain a final concentration of 100mg/ml.

Further Dilution

IV infusion

Dilute the reconstituted solution to the required concentration as below:

Amount of reconstituted solution (ml)	Final infusion solution concentration (mg/ml)	Amount of diluent (ml)
5	1	500
5	2	250

Diluents

NS, D5

Administration

IV infusion

Concentration (mg/ml)	Rate of infusion
1	over 3 hours
2	over 1 hour

An IV dose of 500mg azithromycin should be infused for a minimum duration of 1 hour.

Storage & Stability

	RT	Fridge (2°C- 8°C)
After reconstitution	24 hours (25±2◦C)	-
After dilution	24 hours (<25◦C)	7 days

Remarks

- Do not administer as an IV bolus or an IM injection.
- Other intravenous substances, additives or medications should not be added to intravenous azithromycin or infused simultaneously through the same IV line.

References

Product leaflet Vaxcel® Azithromycin IV For Infusion, (Kotra Pharma (M) Sdn. Bhd, Malaysia).

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Benzathine Penicillin Injection	
Brand Name	Benzapen Sterile Penicillin G Benzathine USP (Strength: 2.4 Mega Units)
Reconstitution	Reconstitute with 8 ml of WFI.
Further Dilution	Not required
Administration	**IM only** *To avoid sciatic nerve damage, infants and small children should not be injected into the upper outer quadrant of the buttock except in special cases e.g. in the presence of extensive burns.
Storage & Stability	Use immediately
Remarks	■ Patient should be alerted to the potential occurrence of allergic reactions and instructed to report them. ■ Patient should be observed for 30 minutes after drug administration for any allergic reactions. ■ Must not be injected subcutaneously, intravenously or intrathecally or instilled into body cavities.
References	Product leaflet Benzapen Sterile Penicillin G Benzathine USP 2.4MU (Karnataka Antibiotics & Pharmaceuticals Limited, India). Revised date: 13.7.2009.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Benzylpenicillin Injection

Brand Name

Bepen Injection (Strength: 1MU (600mg), 5 MU (3g))

Reconstitution

- Reconstitute 1 MU vial (600mg) with 2 ml or more WFI immediately before use.
- Reconstitute 5 MU vial (3g) with 10 ml or more WFI immediately before use.

Further Dilution

Intermittent IV infusion

Further dilute in 50 – 100ml diluent.

Continuous IV infusion

Further dilute in 1000 – 2000ml diluent.

Diluent

NS

Administration

IM

Alternate sites should be used for repeated injections.

Intermittent IV infusion

- Administer over 1 – 2 hours (adults).
- Administer over 15 to 30 minutes (children and infants).

Continuous IV infusion

- Administer over 24 hours.
- Preferred for administration of large doses.

Storage & Stability

	RT (30°C±2°C)	Fridge (2°C- 8°C)
After reconstitution	2 days	6 days

*Reconstituted solutions of benzylpenicillin sodium BP are intended for immediate administration.

Remarks

- Should be administered separately with solutions that contain metal ions.
- Too-rapid infusion may cause electrolyte imbalance or seizures.

References

1. Product leaflet Bepen Injection (Karnataka Antibiotics & Pharmaceuticals Limited, India). Revised date: 14.2.2017.
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Caspofungin Acetate Injection

Brand Name

Cancidas® For Injection (Strength: 50mg, 70mg)

Reconstitution

Bring the refrigerated vial to room temperature.

50mg vial

Reconstitute 1 vial (50mg) with 10.5ml of NS or WFI to obtain a concentration of 5.2mg/ml.

70mg vial

Reconstitute 1 vial (70mg) with 10.5ml of NS or WFI to obtain a concentration of 7.2mg/ml.

Further Dilution

Depends on dose required

Preparation of the Patient Infusion Solutions in Adults:

Dose*	**Volume of reconstituted solution for transfer to IV bag/bottle**	**Typical preparation** (reconstituted solution added to 100ml) final concentration
70mg (from one 70mg vial) (Dilute in two bags of 100ml) **	5ml in each 100ml IV bag/ bottle	0.33mg/ml
50mg (from one 50mg vial)	10ml	0.45mg/ml
35mg for moderate hepatic insufficiency (from one 70mg vial)	5ml	0.33mg/ml
35mg for moderate hepatic insufficiency (from one 50mg vial)	7ml	0.33mg/ml

* 10.5ml should be used for reconstitution of all vials.

** Dilute 5ml of the reconstituted vial in a 100ml IV bag/bottle and the other 5ml in a second 100ml IV bag/bottle.

Note:

Paediatric patients (≥ 12 months old): Dilute reconstituted solution (volume equal to the calculated dose) to an IV bag or bottle containing 250ml of diluent or a reduced volume of diluent, not to exceed a final concentration of 0.5mg/ml.

Diluents

NS or 0.45% Sodium Chloride (Paediatric patients)

Administration

IV infusion ONLY

- Administer by slow IV infusion over approximately 1 hour.
- For a 70mg dose, administer each of the bags or bottles sequentially over 30 minutes, for a total infusion time of approximately 1 hour.

Storage & Stability

	RT (<25°C)	Fridge (2°C- 8°C)
After reconstitution	24 hours	-
After dilution	24 hours	48 hours

*The lyophilized compact powder in vials should be stored at 2°C – 8°C.

Remarks

- Do not use any diluents containing dextrose (α-D-glucose).
- Do not mix or co-infuse with any other medications.
- Visually inspect the reconstituted solution for particulate matter or discoloration during reconstitution and prior to infusion. Do not use if the solution is cloudy or has precipitated.

References

Product leaflet Cancidas® For Injection (Laboratories Merch Sharp & Dohme-Chibret, France). Revised date: September 2014.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Cefazolin Injection	
Brand Name	Cefazolin Sandoz® Dry Substance For Infusions (Strength: 1 g)
Reconstitution	**Slow IV or IV infusion** Reconstitute 1 vial (1 g) with 4 ml NS or WFI. **IM** Reconstitute 1 vial (1 g) with 4 ml 0.5% lidocaine solution.
Further Dilution	**IV infusion** Dilute in 50 – 100 ml diluent. **Diluent** NS
Administration	**Slow IV bolus** Administer slowly over 3 – 5 minutes. (Up to a dose 1 g cefazolin). **IV infusion** Administer doses > 1 g over 20 – 30 minutes. **IM** Inject into a major muscle mass.
Storage & Stability	Use immediately
Remarks	Do not mix in same infusion with aminoglycoside, because both drugs may be inactivated.
References	1. Product leaflet Cefazolin Sandoz® Dry Substance For Infusions (Biochemiestr, Austria). 2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Cefepime Injection

Brand Name	Cefmex Powder For Injection (Strength: 1 g)
Reconstitution	**IV** Reconstitute 1 vial (1 g) with 10ml of diluent (approximate concentration 90mg/ml). **IM** Reconstitute 1 vial (1 g) with 3ml of diluent (approximate concentration 230mg/ml). **Diluents** WFI, D5, NS
Further Dilution	**IV infusion** Dilute to a volume of 50 – 100ml of diluent. **Diluents** D5, NS
Administration	**Slow IV bolus** Administer slowly over 3 – 5 minutes. **IV infusion** Administer over 30 minutes. **IM** Administer through deep IM injection into a large muscle mass.
Storage & Stability	See table below
Remarks	Parenteral drugs should be inspected visually for particulate matter before administration, and not used if particulate matter is present.
References	Product leaflet Cefmex Powder For Injection (Duopharma (M) Sdn. Bhd, Malaysia). Revised date: 14.10.2014.

	Fridge (2°C- 8°C)
After reconstitution	48 hours
After dilution	48 hours

* Intravenous: Cefepime is compatible at concentration of 1– 40mg/ml when mixed with diluents.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Cefoperazone Injection

Brand Name

Bicafar (Strength: 1 g)

Reconstitution

IV

- Reconstitute 1 vial (1 g) with 5ml of D5, NSD5, NS or WFI.
- For continuous IV infusion, dissolve each gram in 5ml WFI.

IM

WFI may be used to prepare cefoperazone for IM injection. However, when concentrations of ≥250mg/ml to be administered, a lidocaine solution should be used. A 2-STEP dilution process is recommended.

Vial (g)	Final Cefoperazone Concentration (mg/ml)	Step 1: Volume of WFI (ml)	Step 2: Volume of 2% Lidocaine (ml)	Withdrawable Volume (ml)
1	250	2.6	0.9	4
	333	1.8	0.6	3

*There is sufficient excess present to allow for withdrawal and administration of the stated volume.

Further Dilution

IV (maximum dose of 2 g/day)

Dilute in appropriate diluent to give a final concentration of 100mg/ml.

Intermittent IV infusion

Dilute the reconstituted solution with 20 – 100ml of diluent.

Diluents

D5, NSD5, NS

Administration

Slow IV bolus

Administer slowly over a period of no less than 3 – 5 minutes.

Intermittent IV infusion

Administer over a period of 15 minutes – 1 hour.

IM

Deep IM injection into the large muscle mass of gluteus maximum or anterior thigh.

Storage & Stability

	RT (15°C - 25°C)	Fridge (2°C - 8°C)
After reconstitution	24 hours	5 days

*A solution of 300mg/ml

Remarks

Solution of cefoperazone and aminoglycoside should not be directly mixed since there is a physical incompatibility between them.

References

Product leaflet Bicafar (Duopharma (M) Sdn Bhd, Malaysia). Revised date: 14.8.2012.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Cefoperazone & Sulbactam Injection

Brand Name

Vaxcel® Cefobactam Injection (Strength: 1 g)

Contains: Cefoperazone 500mg and Sulbactam 500mg

Reconstitution & Further Dilution

IV

Total Dosage (g)	Equiv. Dosage of Sulbactam + Cefoperazone (g)	Volume of diluent	Maximum Final Conc. (mg/ml)
1	0.5 + 0.5	3.4	125 + 125

- Reconstitute 1 vial (1g) with 3.4 ml WFI, D5 or NS.

Intermittent IV infusion

Dilute the reconstituted solution to 20ml with the same solution.

IM

Reconstitute 1 vial (1g) with 3.4ml sterile WFI and further dilute with 2% lidocaine to obtain solutions containing up to 125mg cefoperazone and 125mg sulbactam/ml in approximately a 0.5% lidocaine hydrochloride solution.

Administration

Slow IV bolus

Administer slowly over a minimum of 3 minutes.

Intermittent IV infusion

Administer over 15 – 60 minutes.

IM

Storage & Stability

	RT (<25°C)
After reconstitution	24 hours

Remarks

Solutions of sulbactam/cefoperazone and aminoglycosides should not be directly mixed, since there is a physical incompatibility between them.

References

Product leaflet Vaxcel® Cefobactam Injection (Kotra Pharma (M) Sdn. Bhd, Malaysia).

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Cefotaxime Injection

Brand Name

Rekaxime Injection (Strength: 500mg, 1 g)

Reconstitution

- Reconstitute 1 vial (500mg) with 2ml of WFI.
- Reconstitute 1 vial (1000mg) with 4ml of WFI.

Further Dilution

IV infusion

- **Short infusion**
  Dilute in 40ml of WFI or 10% glucose solution.
- **Continuous drip**
  Dilute in 100ml of isotonic saline or glucose solution.

Diluents

NS, D5, D10 (for short infusion)

Administration

Slow IV bolus
Administer slowly over a period of 3 – 5 minutes.

Short infusion
Infused in approximately 20 minutes.

Continuous drip
Infuse over 50 – 60 minutes.

IM
Inject deep into the gluteus muscle. Not to inject >4ml into either side. If daily dose exceeds 2 g, IV injection is preferred.

Storage & Stability

	RT (<25°C)
Cefotaxime Solutions	24 hours

*Cefotaxime solutions should be administered as soon as they have been prepared.

Remarks

- Incompatible with alkaline solutions such as sodium bicarbonate and also incompatible with hetastarch sodium chloride.
- Admixture of ß-lactam antibacterials, aminoglycosides and metronidazole may result in substantial inactivation. Should not be administered concurrently/mixed/injected at the same site as cefotaxime.
- A pale yellowish solution does not mean an impairment of the antibiotic efficacy.
- IV bolus given over less than 1 minute have caused life- threatening arrhythmias.

References

1. Product leaflet Rekaxime Injection (Duopharma (M) Sdn Bhd, Malaysia). Revised date: 19.11.2013.
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Ceftazidime Injection

Brand Name

Cefatum Injection (Strength: 1 g, 2 g)

Reconstitution

May be constituted with WFI or, for IM injection, with 0.5% lignocaine.

Vial Size		Diluent	Amount of diluent to be added	Approximate Concentration (mg/ml)
1g (10ml vial)	**IM**	0.5% lignocaine	3ml	260
	IV	WFI	10ml	90
2g (20ml vial)	**IV**	WFI	10ml	170

Further Dilution

Intermittent IV infusion
Dilute in 100ml of diluent.

Diluents
NS, D5

Administration

Slow IV bolus
Administer slowly over 3 – 5 minutes.

Intermittent IV infusion
Infuse over 30 minutes.

IM
Administer by deep IM into a large mass muscle.

Storage & Stability

	Diluent	RT (< 25°C)	Fridge (2°C - 8°C)
After reconstitution	WFI	12 hours	7 days
	0.5% lignocaine	6 hours	4 days
After dilution	-	*12 hours	*7 days

*At concentration 1-40 mg/ml

Remarks

- Sodium bicarbonate injection is not recommended as a diluent.
- Solutions range from light yellow to amber depending on concentration, diluent and storage conditions used. Within the stated recommendations, product potency is not adversely affected by such colour variations.
- Individual doses in excess of 1g should be administered intravenously.
- The admixture of beta-lactam antibacterials (penicillins and cephalosporins) and aminoglycosides may result in substantial mutual inactivation.

References

1. Product leaflet Cefatum Injection (Duopharma (M) Sdn Bhd, Malaysia). Revised date: 21.6.2014.
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.
3. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Ceftriaxone Injection

Brand Name

Unocef Injection (Strength: 500mg, 1 g)

Reconstitution

IM

- WFI, NS, D5, 1% lidocaine solution (without ephinephrine)

Vial Dosage Size	Amount of Diluent to be Added	
	250mg/ml	350mg/ml
500mg	1.8ml	1 ml
1 g	3.6ml	2.1 ml

*If required, more dilute solutions could be utilized.

*A 350mg/ml concentration is not recommended for the 250mg vial since it may not be possible to withdraw the entire contents.

IV

- WFI, NS, D5

Vial Dosage Size	Amount of Diluent to be Added
500mg	4.8ml
1 g	9.6ml

Further Dilution

IV infusion

Dilute the reconstituted solution to 50 or 100ml diluent.

Diluents

NS, D5

Administration

IV infusion

Administer over a period of 30 minutes. Concentration between 10 - 40mg/ml are recommended, lower concentration may be used if desired.

IM (for Gonorrhoea, Chancroid)

- Administer deep IM into large muscle mass.
- Doses >1 g should be distributed between two injection sites.

Storage & Stability

After reconstitution, protection from normal light is not necessary. Stability varies with concentration and diluents used: The colour of solutions ranges from light yellow to amber, depending on the length of storage, concentration and diluent used.

IM

Diluent	Concentration (mg/ml)	RT (25°C)	Fridge (4°C)
WFI	100	3 days	10 days
	250, 350	24 hours	3 days
NS	100	3 days	10 days
	250, 350	24 hours	3 days
D5	100	3 days	10 days
	250, 350	24 hours	3 days
1% Lidocaine solution (without ephinephrine)	100	24 hours	10 days
	250, 350	24 hours	3 days

IV solutions stored in glass or PVC containers

Diluent	Concentration (mg/ml)	RT (25°C)	Fridge (4°C)
WFI	10,20,40	3 days	10 days
NS	10,20,40	3 days	10 days
D5	10,20,40	3 days	10 days

Remarks

- Diluents containing calcium, such as Ringer's solution or Hartmann's solution, are not to be used to reconstitute ceftriaxone vials or to further dilute a reconstituted vial for intravenous administration because a precipitate can form.
- Ceftriaxone must not be administered simultaneously with calcium-containing intravenous solutions, including continuous calcium-containing infusions such as parenteral nutrition via Y-site.
- In patients other than neonates, ceftriaxone and calcium-containing solutions may be administered sequentially to one another if the infusion lines are thoroughly flushed between infusions with compatible fluid.

References

1. Product leaflet Unocef Injection (Duopharma (M) Sdn Bhd, Malaysia). Revised date: 2.10.2013.
2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Cefuroxime Injection

Brand Name

Pharmaniaga Cefuroxime Injection (Strength: 750mg, 1.5 g)

Reconstitution

IM

Reconstitute 750mg vial with 3 ml of WFI.

IV

- Reconstitute 750mg vial with 8ml of WFI.
- Reconstitute 1.5 g vial with 16ml of WFI.

Further Dilution

Intermittent IV infusion

Withdraw the required dose and add to 50 – 100ml of diluent.

Diluents

NS, D5

Administration

Slow IV bolus

Administer slowly over 3 – 5 minutes.

Intermittent IV infusion

Administer over 30 minutes.

IM

Inject deep IM into large muscle mass (such as gluteus or lateral part of the thigh).

Storage & Stability

	RT	Fridge (2°C – 8°C)
After reconstitution	-	2 hours
After dilution	24 hours	-

Remarks

- Do not mix with sodium bicarbonate.
- Do not mix in same infusion with aminoglycoside, because both drugs may be inactivated.
- Before injecting intramuscularly, aspiration is necessary to avoid inadvertent injection into a blood vessel.

References

1. Product leaflet Pharmaniaga Cefuroxime Injection (Pharmaniaga Manufacturing Berhad, Malaysia).
2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.
3. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Clindamycin Injection

Brand Name
Tidact Injection (Strength: 300mg/2ml)

Reconstitution
Not required

Further Dilution

- Must be **DILUTED** prior to IV administration.
- To prepare initial dilution for IV use:

Dose (mg)	Diluent (ml)	Duration of Administration
300	50	10 minutes
600	50	20 minutes
900	100	30 minutes
1200	100	40 minutes

*Maximum final concentration: 18mg/ml
*Infusion rates should not exceed 30 mg/minute

Diluents
NS, D5

Administration

IV infusion

- Do not administer more than 1200mg in a single 1 hour infusion.
- May be administered as a single rapid infusion on the first dose and followed by continuous IV infusion, as follows:

To Maintain Serum Clindamycin Levels	Rapid Infusion Rate	Maintenance Infusion Rate
Above 4 mcg/ml	10mg/minute for 30 minutes	0.75 mg/minute
Above 5 mcg/ml	15mg/minute for 30 minutes	1 mg/minute
Above 6 mcg/ml	20 mg/minute for 30 minutes	1.25 mg/minute

IM

- Single IM Injection should not exceed 600 mg.

Storage & Stability
Not available

Remarks

- Clindamycin is physically incompatible with ampicillin, diphenyldantoin, barbiturates, aminophylline, calcium gluconate and magnesium sulphate.
- IV administration should not be given undiluted or as IV bolus.
- Rare instances of cardiopulmonary arrest and hypotension have been reported following too rapid intravenous administration.
- Contains benzyl alcohol, should be avoided in children under 2 years of age and not to be used in neonates.

References

1. Product leaflet Tidact Injection (Yung Shin Pharmaceutical Ind. Co., Ltd, Taiwan).
2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.
3. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Cloxacillin Injection

Brand Name

Cloxabiotic Injection (Strength: 250mg, 500mg)

Reconstitution

The reconstituted solution must be shaken well before use.

Fill Size (mg)	Volume of Diluent Added (ml)	Withdrawable Volume (ml)	Nominal Concentration (mg/ml)
IM (Use WFI)			
250	1.9	2	125
500	1.7	2	250
IV Injection (Use WFI)			
250	4.9	5	50
500	4.8	5	100

IV infusion

Reconstitute 1 vial in 5ml of WFI.

Further Dilution

IV infusion

Dilute the reconstituted solution in 125ml to 250ml of diluent to obtain a final concentration of 1 – 2mg/ml.

Diluent

NS

Administration

Slow IV bolus

- Administer into a vein either directly or via a drip-tube over a period of 3 to 4 minutes.
- More rapid administration may result in convulsive seizures.

IV infusion

Infused over 30 to 40 minutes.

IM

Storage & Stability

	RT (≤25°C)	Fridge (2°C- 8°C)
After reconstitution	Use within 30 minutes of preparation	Up to 48 hours

* Solution for injection should be freshly prepared.
* Discard unused portion.

Remarks

- If cloxacillin is prescribed concurrently with an aminoglycosides, the two antibiotics should not be mixed in the same syringe, intravenous fluid container or giving set because of loss of activity of the aminoglycosides can occur under these conditions.
- Cloxacillin injection should not be mixed with proteinaceous fluids such as protein hydrolysates, blood or plasma, or with intravenous lipid emulsions.

References

Product leaflet Cloxabiotic Injection (Karnataka Antibiotics & Pharmaceuticals Limited, India). Revised Date: 12.2.2018.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Ertapenem Injection

Brand Name

Invanz® Injection (Strength: 1 g)

Reconstitution

IV infusion

Reconstitute 1 vial (1 g) with 10ml sterile WFI, NS or bacteriostatic WFI.

IM

- Reconstitute 1 vial (1 g) with 3.2ml of 1% or 2% lidocaine HCl injection (without epinephrine).
- The reconstituted solution should not be administered intravenously.

Further Dilution

IV infusion

Patients 13 years of age and older

Dilute reconstituted drug to 50ml of NS.

Patients 3 months to 12 years of age

Withdraw a volume equal to 15mg/kg of body weight (not to exceed 1g/day) and dilute in 0.9% Sodium Chloride Injection to a final concentration of 20mg/ml or less.

Diluent

NS

Administration

IV infusion

Administer the diluted solution over 30 minutes and complete the infusion within 6 hours of reconstitution.

IM

Administer the reconstituted solution by deep IM injection into a large muscle mass (e.g. gluteal muscle or lateral part of the thigh).

Storage & Stability

	RT (25°C)	Fridge (5°C)
After reconstitution	**IV:** 6 hours **IM:** use within 1 hour	24 hours and use within 4 hours after removal from refrigeration
After dilution	**IV:** 6 hours	24 hours and use within 4 hours after removal from refrigeration

Remarks

- Must be reconstituted and diluted prior to administration.
- Do not use diluents containing dextrose.
- Do not mix or co-infuse Invanz® with other medications.
- The diluted solution of Ertapenem should not be frozen.

References

1. Product leaflet Invanz® Injection (Laboratories Merck Sharp & Dohme-Chibret). Revised date: August 2015.
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Erythromycin Lactobionate Injection

Brand Name	Eritrotex Injection (Strength:500mg)
Reconstitution	Reconstitute 1 vial (500mg) with 10ml WFI to obtain final concentration 50mg/ml.
Further Dilution	**IV infusion** Dilute the reconstituted solution with not less than 100ml of diluent to a final concentration of 1–5mg/ml. **Diluents** NS, D5
Administration	**Intermittent IV infusion** Administer the diluted solution over 60 minutes every 6 hours. **Continuous IV infusion** Administer the diluted solution over 24 hours.
Storage & Stability	The injection should be freshly prepared and unused portion should be discarded.
Remarks	■ Erythromycin should not be reconstituted with inorganic salt solution. Use only WFI. ■ Do not administer IV push or bolus. ■ Rapid infusion is more likely to be associated with arrhythmias or hypotension.
References	1. Product leaflet Eritrotex Injection (Fisiopharma S.r.L, Italy). Revised date: November 2008. 2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press. 3. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Ganciclovir Injection

Brand Name

Cymevene® (Strength: 500mg)

Reconstitution

- Reconstitute 1 vial (500mg) with 10 ml WFI.
- The vial should be shaken to dissolve the drug.
- Reconstituted solution should be inspected for particulate matter prior to proceeding with admixture preparation.

Further Dilution

IV infusion

- Withdraw the required dose and dilute to 50 – 250ml of compatible infusion fluid.
- The final concentration must not exceed 10mg/ml.

Diluents

NS, D5

Administration

IV infusion

- Administer over 60 minutes via a large peripheral or central vein (adequate blood flow is essential to ensure rapid dilution and distribution).
- Infusion concentration greater than 10mg/ml are not recommended.

Storage & Stability

	RT	Fridge (2°C- 8°C)
After reconstitution	12 hours	It should not be refrigerated
After dilution	Use immediately	24 hours

Remarks

- Do not use bacteriostatic water for injection containing parabens in solution since these are incompatible and may cause precipitation.
- The prepared solution should not be mixed with other IV products.
- It is a potential teratogen and carcinogen in humans, caution should be observed in the handling of ganciclovir. Avoid inhalation or direct contact of the powder contained in the vials or direct contact of the reconstituted solution with the skin or mucous membranes.
- Do not give by IV bolus or by IM or SC route.

References

1. Product leaflet Cymevene® (F. Hoffman-La Rocge Ltd. Basel). Revised date: June 2010.
2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.
3. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Gentamicin Injection

Brand Name	Garasent (Strength: 80mg/2ml)
Reconstitution	Not required
Further Dilution	**IV infusion** ■ Dilute the prescribed dose in 100 – 200ml of diluent. ■ Final infusion concentration should not exceed 1mg/ml. **Diluents** NS, D5
Administration	**IM** **Slow IV bolus** Administer slowly over 2 to 3 minutes. **IV infusion** Administer the diluted solution over 20 – 30 minutes.
Storage & Stability	See table below
Remarks	■ Should be used with caution in patients with impaired renal function (including elderly and premature infants). ■ IV administration is generally reserved for special indications and may be used when the IM route is not feasible, e.g. patients in shock, with haemorrhagic disorders, severe burns or reduced muscle mass.
References	1. Product leaflet Garasent (Duopharma (M) Sdn Bhd, Malaysia). Revised date: 16.1.2012. 2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.

	Fridge (2°C- 8°C)
After dilution	24 hours

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Imipenem & Cilastatin Injection

Brand Name

Imipenem /Cilastatin Kabi Powder For Solution For Infusion
Contains: 500mg Imipenam and 500mg Cilastin

Reconstitution

- Reconstitute 1 vial with 10ml of diluent to the container.
- Shake well and transfer the resulting mixture to the infusion solution container.
- Repeat with an additional 10ml of infusion solution to ensure complete transfer of container contents to the infusion solution.
- The resulting mixture should be agitated until a clear solution is obtained.

Further Dilution

- Dilute the reconstituted solution to 100ml of diluent.
- Final infusion concentration is approximately 5mg/ml.

Diluents

NS, D5

Administration

IV infusion ONLY

- Doses ≤ 500mg/500mg:
  Administer diluted solution over 20 – 30 minutes.
- Doses > 500mg/500mg:
  Administer diluted solution over 40 – 60 minutes.

Storage & Stability

	RT (30°C)	Fridge (5°C)
After reconstitution	4 hours	24 hours
After dilution	4 hours	24 hours

Remarks

- Should not be reconstituted in diluents containing lactate.
- In patients who develop nausea during the infusion, the rate of infusion may be slowed.
- Do not give by direct IV injection.

References

1. Product leaflet Imipenem/Cilastatin Fresenius Kabi Powder For Solution For Infusion (Facta Farmaceutical S.p.A, Italy). Revised date: November 2015.
2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.
3. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Meropenem Injection

Brand Name

Nuronem Injection (Strength: 500mg, 1 g)

Reconstitution

Reconstitute 1 vial (500mg) with 10ml WFI (5ml WFI per 250mg meropenem) to obtain a final concentration of 50mg/ml.

Further Dilution

IV infusion

Dilute reconstituted solution with 50 – 200ml of diluents.

Diluents

NS, D5

Administration

Slow IV bolus

Administer slowly over 5 minutes.

IV infusion

Administer over 15 – 30minutes.

Storage & Stability

	RT (25°C)	Fridge (4°C)
After dilution	8 hours (NS) 3 hours (D5)	48 hours (NS) 14 hours (D5)

* Reconstituted and diluted solution of meropenem should not be frozen.

Remarks

- Should not be mixed with or added to other drugs.
- All vials for single use only.

References

1. Product leaflet Nuronem Injection (Ranbaxy Lab. Limited, India). Revised date: August 2009.
2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.
3 . Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Micafungin Injection

Brand Name

Mycamine® Powder For Solution For Infusion (Strength: 50mg)

Reconstitution

- Reconstitute 1 vial (50mg) with 5ml of NS or D5 (taken from a 100 ml bag/bottle) by slowly injected into each vial along the side of the inner wall.
- Rotate the vial gently. Do not shake.
- Minimize the amount of foam generated.

Further Dilution

- All of the reconstituted concentrate should be withdrawn from each vial and returned to the infusion bag/bottle from which it was originally taken.

Preparation Of Solution For Infusion:

Dose	Vials to be used	Volume of NS or D5 to be added per vial	Volume (concentration) of reconstituted powder	Final concentration of standard infusion (made up to 100ml)
50mg	1x 50mg	5ml	Approx. 5ml (10mg/ml)	0.5mg/ml
100mg	2 x 50mg	5ml	Approx. 10ml (10mg/ml)	1mg/ml
150mg	3 x 50mg	5ml	Approx. 15ml (10mg/ml)	1.5mg/ml
200mg	4 x 50mg	5ml	Approx. 20ml (10mg/ml)	2mg/ml

- The infusion bag/bottle containing the diluted infusion solution should be inserted into a closable opaque bag for protection from light.

Diluents

NS, D5

Administration

IV infusion ONLY

- An existing IV line should be flushed with NS prior to infusion.
- Administer the reconstituted and diluted solution over approximately one hour.

Storage & Stability

	RT (30°C)
After reconstitution	24 hours
After dilution	6 hours (In transfusion bag without light protection) 24 hours (In transfusion bag with light protection)

*when reconstituted with NS or D5

Remarks

The concentrate should be used immediately for further dilution. This product is for single use in one patient only. Discard any residue.

References

Product leaflet Mycamine® Powder For Solution For Infusion (Astellas Pharma Tech Cp. Ltd, Japan). Revised date: July 2013.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Netilmicin Injection

Brand Name	Lotifar Injection (Strength: 150mg/2ml, 100mg/2ml)
Reconstitution	Not required
Further Dilution	**IV infusion** Dilute single dose in 50 to 200ml of diluent. **Diluents** NS, D5
Administration	**Slow IV bolus** Administer slowly over a period of 3 to 5 minutes. **IV infusion** Administer the diluted solution over 1.5 to 2 hours.
Storage & Stability	<table><tr><th></th><th>RT (<25°C)</th></tr><tr><td>After dilution</td><td>7 days*</td></tr></table>* when diluted with compatible diluent at concentration of 3mg/ml.
Remarks	Should not be physically premixed with other drugs, but should administered separately in accordance with the recommended route of administration and dosage schedule.
References	Product leaflet Lotifar Injection (Duopharma (M) Sdn Bhd, Malaysia). Revised date: 15.12.2004.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Pentamidine Isethionate Injection

Brand Name

DBL™ Pentamidine Isethionate For Injection (Strength: 300mg)

Reconstitution

Reconstitute 1 vial (300mg) with 3 to 5ml WFI.

Further Dilution

Dilute the required dose in 50 – 250ml of diluent.

Diluents

NS, D5

Administration

IV infusion

Administer over at least 60 minutes.

Storage & Stability

	RT (21 ±2°C)	Fridge (2°C- 8°C)
After reconstitution	48 hours	48 hours
After dilution	24 hours*	24 hours

*When diluted to 1mg/ml and 2.5mg/ml in diluent.

Remarks

- Direct bolus IV injection or rapid administration must not be used.
- Keep patient supine during administration to minimize hypotension.

References

1. Product leaflet DBL™ Pentamidine Isethionate For Injection (Hospira Australia Pty Ltd, Australia). Revised date: 1.12.2012.
2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.
3. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Piperacillin & Tazobactam Injection

Brand Name

Tapicin Powder For Injection (Strength: 4.5 g)
Contains: Piperacillin 4 g and Tazobactam 0.5 g

Reconstitution

Reconstitute 1 vial (4.5 g) with 20ml of diluent.

Diluents

WFI, NS, D5

Further Dilution

IV infusion
Dilute reconstituted solution with 50 – 150ml of diluent.

Diluents

NS, D5

Administration

Slow IV bolus
Administer over 3 – 5minutes.

IV infusion
Administer over 20 – 30minutes.

Storage & Stability

	RT (25°C)	Fridge (2°C- 8°C)
After reconstitution	24 hours	7 days

Remarks

- This product do not contain preservative, therefore appropriate aseptic technique should be performed during preparation.
- Whenever this product is used concurrently with another antibiotic, the drug must be administered separately.
- This product should not be used with solution containing only sodium bicarbonate and should not be added to blood products or albumin hydrolysates.

References

1. Product leaflet Tapicin Powder For Injection (Yung Shin Pharmaceutical Ind. Co, Ltd, Taiwan, ROC).
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Sulphamethoxazole -Trimethoprim Injection

Brand Name

DBL™ Sulfamethoxazole 400mg and Trimethoprim 80mg Concentrate Injection BP (5ml per ampoule)

Reconstitution

Not required

Further Dilution

Dilution Options:

1. Dilute 1 ampoule (5 ml) to 125 ml of diluent.
2. Dilute 2 ampoules (10 ml) to 250 ml of diluent.
3. Dilute 3 ampoules (15 ml) to 500 ml of diluent.

Diluents

D5, NS, D10

Administration

IV infusion

- Administer slowly over 60 – 90 minutes.
- Duration of infusion should not exceed 1.5 hours.

Storage & Stability

	RT
After dilution	24 hours

*Do not refrigerate the prepared solution.

Remarks

- Must be diluted prior to administration.
- Must be administered intravenously only in the form of an infusion solution, and may not be injected undiluted either intravenously or direct into infusion tube.
- The prepared infusion should be shaken well to ensure thorough mixing. Should visible turbidity or crystallisation appear in the solution during its preparation or infusion, it must be discarded and replaced by a freshly prepared solution.

References

1. Product leaflet DBL™ Sulfamethoxazole 400mg and Trimethoprim 80mg Concentrate Injection BP (hameln pharmaceuticals GmbH, Germany). Revised date: 1.12.2012.
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Vancomycin Injection

Brand Name

Celovan Powder For Solution For Injection/Infusion (Strength: 500mg)

Reconstitution

Dissolve 500mg in 10 ml of WFI to obtain final concentration 50mg/ml.

Further Dilution

Intermittent IV infusion

- Dilute reconstituted solutions with at least 100ml of diluent.
- Max concentration= 5mg/ml.
- For fluid restricted patients, a concentration of up to 10mg/ml may be used.

Diluents

NS, D5

Administration

Intermittent IV infusion

- Administered the desired dose over a period of at least 60 minutes.
- Max rate = 10mg/minute.
- 1 g dose is usually given over 2 hours.

Storage & Stability

	RT (<25°C)	Fridge (2°C - 8°C)
After dilution	48 hours	48 hours

Remarks

- Not for IM administration.
- Watch for "red-man" syndrome, a nonallergic histamine reaction caused by rapid IV infusion. Signs and symptoms include hypotension, pruritus, and maculopapular rash on face, neck, trunk and limbs.

References

1. Product leaflet Celovan Vancomycin Powder For Solution For Injection/Infusion (Mylan Laboratories Limited, India). Revised date: January 2018.
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.
3. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide, Pharmaceutical Press, 2011.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Voriconazole Injection

Brand Name

Vfend® (Strength: 200mg)

Reconstitution

Reconstitute 1 vial (200mg) with 19 ml of WFI (Concentration: 10 mg/ml and extractable volume: 20ml).

Further Dilution

Further dilute the required volume of reconstituted solution according to patient's BW to a final concentration of 0.5 – 5mg/ml.

Body Weight (kg)	Volume of VFEND® Concentrate (10mg/ml) required for:				
	3mg/kg dose (no. of vials)	4mg/kg dose (no. of vials)	6mg/kg dose (no. of vials)	8mg/kg dose (no. of vials)	9mg/kg dose (no. of vials)
10	-	4ml (1)	-	8ml (1)	9ml (1)
15	-	6ml (1)	-	12ml (1)	13.5ml (1)
20	-	8ml (1)	-	16ml (1)	18ml (1)
25	-	10ml (1)	-	20ml (1)	22.5ml (2)
30	9ml (1)	12ml (1)	18ml (1)	24ml (2)	27ml (2)
35	10.5ml (1)	14ml (1)	21ml (2)	28ml (2)	31.5ml (2)
40	12ml (1)	16ml (1)	24ml (2)	32ml (2)	36ml (2)
45	13.5ml (1)	18ml (1)	27ml (2)	36ml (2)	40.5ml (3)
50	15ml (1)	20ml (1)	30ml (2)	40ml (2)	45ml (3)
55	16.5ml (1)	22ml (2)	33ml (2)	44ml (3)	49.5ml (3)
60	18ml (1)	24ml (2)	36ml (2)	48ml (3)	54ml (3)
65	19.5ml (1)	26ml (2)	39ml (2)	52ml (3)	58.5ml (3)
70	21ml (2)	28ml (2)	42ml (3)	-	-
75	22.5ml (2)	30ml (2)	45ml (3)	-	-
80	24ml (2)	32ml (2)	48ml (3)	-	-
85	25.5ml (2)	34ml (2)	51ml (3)	-	-
90	27ml (2)	36ml (2)	54ml (3)	-	-
95	28.5ml (2)	38ml (2)	57ml (3)	-	-
100	30ml (2)	40ml (2)	60ml (3)	-	-

Diluents

NS, HSD5, D5

Administration

IV infusion ONLY

- Administer over 1–2 hours.
- Maximum rate: 3mg/kg/hour.

Storage & Stability

	Fridge (2°C- 8°C)
After reconstitution	24 hours

*The product must be used immediately.

Remarks

- Voriconazole must not be infused concomitantly with any blood product or any short-term infusion of concentrated electrolytes, even if the two infusions are running in separate intravenous line.
- Not recommended for IV bolus administration.
- Must not be diluted with 4.2% sodium bicarbonate infusion.

References

Product leaflet Vfend® (Pharmacia & Upjohn Company, USA). Revised date: April 2014.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

Zidovudine Injection

Brand Name

Retrovir ™ (Strength: 200mg/20ml)

Reconstitution

Not required

Further Dilution

- Add and mix the required dose with diluent to obtain a final concentration of either 2mg/ml or 4mg/ml.
- Dilution must be carried out under full aseptic conditions.

Diluent

D5

Administration

IV infusion

- Administer slowly over 1 hour.
- Avoid rapid infusion or bolus injection.

Storage & Stability

	RT (25°C)	Fridge (5°C)
After dilution	48 hours	48 hours

*Any unused portion of the vial should be discarded.

Remarks

- Do not administer as IM injection.
- Must be DILUTED prior to administration.
- Discard if any visible turbidity appears in the product either before or after dilution or during infusion.

References

1. Product leaflet Retrovir™ (Glaxo Wellcome Operations, UK). Revised date: 11.4.2012.
2. Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

*The information provided in this guideline may be used as general reference only. Please refer to the current product inserts for relevant brand used in facility.

APPENDICES

APPENDIX 1: GLOSSARY

No.	Name	Definition
1.	Injection	Use of a syringe and needle to push fluids or drugs into the body; often called a "shot."
2.	Intravenous (IV)	Into or within a vein. Intravenous usually refers to a way of giving a drug or other substance through a needle or tube inserted into a vein.
3.	Intravenous (IV) bolus	■ A method of administering concentrated medication (diluted or undiluted) directly into the vein using a syringe through a needleless port on an existing IV line or a saline lock. ■ A discrete dose of medication or solution given slowly over at least 1 minute. ■ It is usually administered in a small volume of fluid/ medicine (max 20ml) that is pushed manually into the vein slowly over at least 1 minute.
4.	Intravenous (IV) push	Intravenous push is commonly used when rapid administration of a medication is needed such as in emergency (less than 30 seconds).
5.	Continuous intravenous (IV) infusion	The administration of a fluid into a blood vessel, usually over a prolonged period of time.
6.	Intermittent intravenous (IV) infusion	■ This is the technique used to administer an injectable drug in an intravenous infusion over a period of time ranging from 20 minutes to several hours. Repeated doses or single doses are given in this way. ■ The infusion may be connected to the primary intravenous giving set or to a secondary administration set via a Y-connector. ■ The volume of intravenous fluid used to dilute the drug ranges from 50ml (the smallest intravenous fluid bag) up to 500ml. In clinical practice most drugs are given in 100ml and are set to infuse over 20-30 minutes.
7.	Intramuscular (IM) injection	■ Intramuscular injections are administered into the muscle beneath the subcutaneous tissue. ■ They are most commonly given into the thigh or the gluteal muscle, and occasionally into the deltoid muscle (which attaches the upper arm to the shoulder). ■ The volume given at any one site is usually limited to 5ml for the thigh (or 4ml if it is a depot injection because depots can be more irritant), and 2ml for the deltoid muscle.

No.	Name	Definition
8.	Subcutaneous (SC) injection	■ Subcutaneous injections are given by injecting a fluid or a solid pellet into the subcutis (the fatty layer of tissue just under the skin). ■ Appropriate sites for subcutaneous injection include: • The outer aspect of the upper arm • The anterior aspect of the upper arm • The abdomen below the costal margins to the iliac crests • The anterior aspect of the thigh
9.	Reconstitute	The act of adding diluent to powder to create a solution.
10.	Dilution	To add a diluent (e.g., normal saline, sterile water) to a solution of medication in order to make it less concentrated or to provide additional solution for ease of administration and titration or to decrease tissue irritation.

References:

1. Ministry of Health, Malaysia, 2017. Safe Operating Procedure for Administration of Intravenous (Bolus), Nursing Division.
2. Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.
3. https://www.cancer.gov/publications/dictionaries/cancer-terms/search [online]

APPENDIX 2: BEST PRACTICES FOR INJECTION

General Information:

- All preparations should be done using aseptic technique.
- Do NOT use the initial concentrate or the infusion solution if there is any sign of precipitation and presence of foreign matter in either one.
- Do NOT mix other drugs to the infusion solution to avoid any possible drug interactions.
- Any unused portion should be discarded after the recommended period of use.
- For multiple use vials, reconstituted solution must be labelled with time and date immediately after preparation and must be placed under recommended storage condition.
- Flush IV line before and after administration. The most common fluid administered as an IV flush is sodium chloride 0.9%. In some instances, glucose 5% may be used if it is more suitable for use due to compatibility with the IV medicine being administered.

*This general information may not be applicable to all the medications stated in this guideline. Please refer to the product inserts or consult your pharmacist for further information.

Table 1: Infection prevention and control practices

Do	Do Not
DO carry out hand hygiene (use soap and water or alcohol rub), and wash carefully, including wrists and spaces between the fingers, for at least 30 seconds. (follow WHO's 'My 5 moments for hand hygiene')	DO NOT forget to clean your hands.
DO use one pair of non-sterile gloves per procedure or patient.	■ DO NOT use the same pair of gloves for more than one patient. ■ DO NOT wash gloves for reuse.
Do disinfect the skin at the venepuncture site.	DO NOT touch the puncture site after disinfecting it.
DO discard the used device (a needle and syringe is a single unit) immediately into a robust sharps container.	DO NOT leave an unprotected needle lying outside the sharps container.
DO seal the sharps container with a tamper-proof lid.	DO NOT overfill or decant a sharps container.
DO immediately report any incident or accident linked to a needle or sharp injury, and seek assistance; start Post-Exposure Prophylaxis (PEP) as soon as possible, following protocols.	DO NOT delay PEP after exposure to potentially contaminated material; beyond 72 hours, PEP is NOT effective.

References:

1. World Health Organization, 2010. WHO best practices for injections and related procedures toolkit (No. WHO/EHT/10.02). World Health Organization.
2. Pharmaceutical Services Division, Penang State Health Department, 2016. Antimicrobial Dilution Protocol.

APPENDIX 3: STORAGE CONDITIONS

The storage conditions for materials and/or products and/or cosmetics should follow the required storage specification of the materials and/or products and/or cosmetics.

Where temperature is not stated (in terms of range) on the labels of the materials and/or products and/or cosmetics the following definitions should be followed:

ON THE LABEL	MEANS
Freezer	The temperature is thermostatically controlled between -20°C and -10°C
Refrigerator	The temperature is thermostatically controlled between 2°C and 8°C
Cold place	The temperature does not exceed 8°C
Cool place	The temperature is between 8°C and 15°C
Room temperature	The temperature is between 15°C and 30°C
Warm	The temperature is between 30°C and 40°C
Excessive heat	The temperature is above 40°C
Do not store over 30°C	The temperature is between 2°C and 30°C
Do not store over 25°C	The temperature is between 2°C and 25°C
Do not store over 15°C	The temperature is between 2°C and 15°C
Do not store over 8°C	The temperature is between 2°C and 8°C
Do not store below 8°C	The temperature is between 8°C and 25°C
Dry place	No more than 75 ± 5% relative humidity in normal storage conditions; to be provided to the user in a moisture resistant container.
Protect from light	To be provided to the user in a light resistant container.

Reference:

Ministry of Health Malaysia, 2nd Edition 2013. Guidelines on Good Distribution Practice (GDP).

APPENDIX 4 : CONVERSIONS & CALCULATIONS

Accurate conversions and calculations of medication dosages are crucial to ensure safe drug administration.

1. Metric measures

1 milligram (mg) = 1,000 micrograms (mcg)
1 gram (g) = 1,000 mg
1 kilogram (kg) = 1,000 g
1 liter (L) = 1,000 milliliter (ml)

2. Calculating dosages & administration rates

Concentration of solution in mg/ml = $\frac{\text{mg of drug}}{\text{ml of solution}}$
Infusion rate in mg/minute = $\frac{\text{mg of drug}}{\text{ml of solution}}$ x flow rate (ml/hour) ÷ 60 minutes
Concentration of solution in mcg/ml = $\frac{\text{mg of drug x 1,000}}{\text{ml of solution}}$
Infusion rate in mcg/minute = $\frac{\text{mg of drug x 1,000}}{\text{ml of solution}}$ x flow rate (ml/hour) ÷ 60 minutes
Infusion rate in mcg/kg/minute = $\frac{\text{mg of drug x 1,000}}{\text{ml of solution}}$ x flow rate (ml/hour) ÷ 60 minutes ÷ weight in kg
Infusion rate in ml/hour = ml of solution ÷ 60 minutes
Infusion rate in gtt/minute = $\frac{\text{ml of solution}}{\text{time in minutes}}$ x drip factor (gtt/ml)

Reference:

Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.

REFERENCES

[1]	Clinical Pharmacy Unit, Pharmacy Department, Hospital Taiping. Hospital Taiping Antibiotics Dilution & Administration Protocol . (1st ed.). Ministry Of Health Malaysia.
[2]	Dilution Protocol 2017 Hospital Tuanku Ampuan Najihah, Kuala Pilah. Ministry Of Health Malaysia.
[3]	Gray, A., Wright, J., Goodey, V. and Bruce, L., 2011. Injectable Drugs Guide. Pharmaceutical Press.
[4]	Mimsgateway.com. 2020. Mims Gateway > Malaysia > Overview. [online] Available at: <http://www.mimsgateway.com/malaysia/overview>.
[5]	Ministry of Health Malaysia, 2nd Edition 2013. Guidelines on Good Distribution Practice (GDP).
[6]	Ministry of Health, Malaysia, 2017. Safe Operating Procedure for Administration of Intravenous (Bolus), Nursing Division.
[7]	Ojerinde, A. and Adejumo, P., 2014. Factors Associated With Medication Errors Among Health Workers In University College Hospital, Nigeria. IOSR Journal of Nursing and Health Science, 3(3),pp.22-33.
[8]	Pharmaceutical Services Division, Penang State Health Department, 2016. Antimicrobial Dilution Protocol.
[9]	Pharmacy.gov.my. 2020. *Formulari Ubat KKM (FUKKM) | Pharmaceutical Services Programme*. [online] Available at: <https://www.pharmacy.gov.my/v2/en/apps/fukkm>.
[10]	Schull, P.D., 2009. McGraw-Hill's IV Drug Handbook. McGraw Hill Professional.
[11]	Selangor State Health Department (2017). Dilution Protocol . (1st ed.). Ministry Of Health Malaysia.
[12]	World Health Organization, 2010. WHO best practices for injections and related procedures toolkit (No. WHO/EHT/10.02). World Health Organization.

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