

# HOSPITAL TAIPING ANTIBIOTICS DILUTION & ADMINISTRATION PROTOCOL

1<sup>ST</sup> EDITION

By Clinical Pharmacy Unit;  
Pharmacy Department; Hospital Taiping



# FOR E W O R D

Safe administration of medicines is an important part of patient safety that needs special attention.

Incorrect dilution and administration of medicines not only compromise patient safety but also result in wastage and ineffective use of medications. With the rising cost of antibiotics and increasing resistance, it is very important that antibiotics are prepared and administered correctly.

Therefore, initiative to produce this first edition of Antibiotics Dilution and Administration Protocol for Hospital Taiping is timely and a welcome step towards reduction of medication error involving injectable antibiotics.

I would like to congratulate all pharmacists involved in the compilation of this edition. It is our hope that this protocol would be a useful guide for all staff involved in the dilution and administration of injectable antibiotics in Hospital Taiping.

Thank you.

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# ACKNOWLEDGMENT

First and foremost, we would like to acknowledge and thank our Head of Pharmacy Department, Puan Kamariah Shamsinar bt Kamarul Baharin for her continuous support and words of advice in the development of this protocol.

We would also like to express our heartfelt appreciation to all pharmacists who have contributed to the design and content of this protocol. The latter represents a concerted effort by committee members of the Antimicrobial Stewardship Team from Pharmacy Department Hospital Taiping, as well as ward and clinical pharmacokinetic services pharmacists.

Being the First Edition, much effort has been made to ensure that all factual content is up to date, especially with the latest pharmacokinetic and pharmacodynamic (PK/PD) applications in beta-lactam antibiotics administration. It also incorporates additional information on preparation and administration of gentamicin and vancomycin locks.

We, therefore, hope that this protocol will serve its purpose well in meeting the needs and requirements of all healthcare personnel in our local setting of care.

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## ABBREVIATIONS

BD	2 times a day
CNS	Central nervous system
D5	Dextrose 5%
D10	Dextrose 10%
HS	Sodium chloride 0.45%
HSD5	Sodium chloride 0.45% and Dextrose 5%
IM	Intramuscular
IV	Intravenous
NS	Sodium chloride 0.9%
NSD5	Sodium chloride 0.9% and Dextrose 5%
NSAID	Non-steroidal anti-inflammatory drug
OD	Once daily
QSD5	Sodium chloride 0.18% and Dextrose 4%
SC	Subcutaneous
TDS	3 times a day
WFI	Water for injection



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## AMIKACIN

### Brand Name & Strength

Apalin 500mg , Apalin 250mg

### Reconstitution

Not required

### Further Dilution

IV Infusion : Dilute in 100–200ml of diluents (To produce final concentration of 0.25mg/ml or 5mg/ml)<sup>1,2,3</sup>

### Diluent

NS; D5; Hartmann's Solution; QSD5; HSD5<sup>2</sup>

### Administration & Infusion Rate

- IV Infusion (For Adult, Children and Adolescent) : Administer over 30-60 minutes<sup>1,2</sup>
- IV Infusion (For Infants) : Administer over 1-2 hours<sup>4</sup> (Slow Infusion may help to avoid neuromuscular blockade)<sup>1</sup>
- IM Injection : Administer at equispaced intervals (15mg/kg/day in 2 or 3 divided dose)<sup>1</sup>  
To be administered into large muscle mass<sup>4</sup>

### Storage & Stability

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge ( $2-8^{\circ}\text{C}$ )
After reconstitution	-	-
After dilution (Concentrations of 0.25mg/ml and 5mg/ml)	No longer than 24 hours <sup>1,2</sup>	Up to 60 days <sup>1,2</sup>

### Remarks

- Extemporaneous admixtures of penicillins and cephalosporins and aminoglycosides may result in substantial mutual inactivation. Do not mix in the same IV bag or bottle.<sup>1</sup>
- Amikacin is incompatible with amphotericin B, cephalosporin sodium, nitrofurantoin, and sulfadiazine sodium and tetracycline (in some solutions).<sup>1</sup>

### References

1. Duopharma. Amikacin Sulfate (Apalin for Injection) Product Information Leaflet
2. IBM Micromedex; January 2019
3. MIMS Gateway
4. Lexi-Comp;Inc.(Lexi-Drugs).Lexi-Comp.Inc. January 2019

## ACYCLOVIR

### Brand Name & Strength

Vaxcel 250mg

### Reconstitution

Reconstitute with 10ml of WFI (To produce final concentration of 25mg/ml)<sup>1</sup>

### Further Dilution

Dilute 250-500mg in 100ml of diluents<sup>1</sup>  
 Infusion concentration of 7mg/ml or lower is recommended<sup>3</sup>

### Diluent

NS; D5; Hartmann's Solution<sup>1</sup>

### Administration & Infusion Rate

IV Infusion : Administer over 1 hour<sup>1,2</sup>

### Storage & Stability

Do not store above 25<sup>0</sup>C and protect from light<sup>1</sup>

	Room Temperature (≤25°C)	Fridge (2-8°C)
After reconstitution	48 hours <sup>1,2</sup>	DO NOT REFRIGERATE (may cause precipitation) <sup>1</sup>
After dilution	24 hours <sup>2</sup> , 48 hours <sup>1</sup>	

### Remarks

- Do not use bacteriostatic WFI that containing benzyl alcohol or parabens for reconstitution.<sup>2</sup>
- Do not give acyclovir by IV bolus, intramuscular (IM) and subcutaneous (SC) routes.<sup>2</sup>
- IV infusion over 1 hour to prevent renal tubular damage.<sup>3</sup>
- Check for phlebitis and rotate the infusion sites.<sup>3</sup>

### References

1. Kotra Pharma.Acyclovir (Vaxcell.V For Infusion) Product Information Leaflet
2. IBM Micromedex; January 2019
3. Lexi-Comp;Inc.(Lexi-Drugs).Lexi-Comp.Inc. January 2019

## AMOXICILLIN/CLAVULANATE

### Brand Name & Strength

CLAVAM 1.2g (Co-Amoxiclav for Injection BP)

### Reconstitution

Reconstitute with 20mL WFI (Final volume 20.9ml)<sup>1</sup>

### Further Dilution

- IV Slow Bolus : Not required<sup>1</sup>
- IV Infusion : Dilute reconstituted solution with diluents up to 100ml<sup>1</sup>

### Diluent

NS<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over 3 – 4 minutes<sup>1</sup>
- IV Infusion : Administer over 30 – 40 minutes (complete within 4 hours of reconstitution)<sup>1</sup>

### Storage & Stability

Store below 30°C and protect from light<sup>1</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge (2-8°C)
After reconstitution	20 minutes <sup>1</sup>	-
After dilution	4 hours <sup>1</sup>	8 hours <sup>1</sup>

### Remarks

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### References

1. ALKEM Laboratories Limited. CLAVAM 1.2g (Co-Amoxiclav for Injection BP) Product Information Leaflet. Revised Sept 2017

## AMPHOTERICIN B SODIUM DEOXYCHOLATE

### Brand Name & Strength

AMPHOTRET (Amphotericin B for injection U.S.P) 50mg

### Reconstitution

Reconstitute with 10ml WFI<sup>1</sup>

### Further Dilution

Dilute the reconstituted solution with diluent to a concentration of 0.1mg/mL (peripheral infusion) or 0.25mg/ml (central infusion)<sup>1,2,3</sup>

### Diluent

D5<sup>1,3</sup>

### Administration & Infusion Rate

IV Infusion : Administer over 2 – 6 hours<sup>1,2</sup>; 4 – 6 hours<sup>3</sup>

### Storage & Stability

Protect vials from direct sunlight. Solution should be protected from sunlight during administration.<sup>1</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge (2-8°C)
After reconstitution	24 hours <sup>3</sup>	7 days <sup>1</sup>
After dilution	24 hours <sup>3</sup>	2 days <sup>3</sup>

### Remarks

- Solution should be protected from light during administration<sup>1</sup>. However, short-term exposure (<24 hours) to light during IV infusion does not appreciably affect potency.<sup>3</sup>
- Final concentration should not exceed 0.1mg/mL (peripheral infusion) or 0.25mg/mL (central infusion).
- An in-line membrane filter with pore size 1µm or more may be used.<sup>1</sup>
- Test dose: 1mg in 20ml D5 administered over 20-30 minutes. Monitor temperature, pulse, respiratory rate and blood pressure every 30 minutes for 2 – 4 hours.<sup>1</sup>
- Rapid infusion may cause hypotension, hypokalemia, arrhythmias and shock.<sup>1</sup>
- Monitor for signs and symptoms of acute infusion-related reactions (e.g. chills, fever, hypotension, nausea, vomiting, headache and tachypnea) which commonly occurred within 1 - 3 hours after infusion begins.<sup>1,2,3</sup>
- Consider premedication in patient who develop infusion-related reactions. Premedication 30 – 60 minutes prior to drug administration: NSAIDs ± diphenhydramine OR paracetamol with diphenhydramine OR hydrocortisone.
- Incompatible with NS.<sup>2</sup> Flush existing IV line with D5 or use separate line.<sup>2,4</sup>

### References

1. Bharat Serums and Vaccine Limited. Amphotericin B for injection U.S.P. (AMPHOTRET) Product Information Leaflet
2. Patricia Dwyer Schull. McGraw-Hill's I.V. Drug Handbook 2009
3. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
4. Gray A, Wright J, Goodey V and Bruce L. Injectable Drugs Guide 2011

## AMPICILLIN

### Brand Name & Strength

KAMPIBIOTIC 500mg

### Reconstitution

- Intramuscular (IM) : Reconstitute with 1.5ml of WFI<sup>1</sup>
- Intravenous (IV)/ Intraperitoneal : Reconstitute in 10ml of WFI<sup>1</sup>
- Intrapleural : Reconstitute in 5-10ml of WFI<sup>1</sup>

### Further Dilution

IV Infusion : Dilute 500mg-1g in 50ml NS; 2g in 100ml NS (Maximum concentration : 30mg/ml)<sup>2</sup>

### Diluent

NS<sup>2</sup>

### Administration & Infusion Rate

- IM Injection : Deep IM into large muscle mass<sup>2</sup>
- IV Slow Bolus :  
Administer over 3-5 minutes (125-500mg) or over 10-15 minutes (1-2g)<sup>2,3</sup>  
Do not exceed 100mg/min<sup>3</sup>
- IV Intermittent Infusion : Administer over 15-30 minutes<sup>2,3</sup>

### Storage & Stability

Store below 30°C and protect from light<sup>1</sup>

Intravenous (IV) :

	Room Temperature (≤25 C)	Fridge (2-8 C)
After reconstitution	-	-
After dilution (Concentrations up to 30mg/ml)	8 hours <sup>2</sup>	24 hours <sup>2</sup>

Intramuscular (IM) : Use within 1 hour after preparation<sup>2</sup>

### Remarks

- Rapid infusion may cause seizures.<sup>2</sup>
- Administer over 30 minutes when using doses of greater than 50mg/kg.<sup>4</sup>
- Extemporaneous admixtures of beta-lactam antibacterials (penicillins and cephalosporins) and aminoglycosides may result in substantial mutual inactivation and should be administered in separate sites at least 1 hour apart. Do not mix them in the same IV bag, bottle or tubing.<sup>1</sup>
- Local use in abdominal surgery: 1 g sterile powder sprinkled into the wound extraperitoneally or into muscle layers to prevent wound infection post-operatively.<sup>1</sup>

### References

1. Karnataka Antibiotics & Pharmaceuticals Limited. Kampibiotic 500 Product Information Leaflet Revised 25 July 2017
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
3. <https://reference.medscape.com/drug/ampi-omnipen-ampicillin-342475#11>. Accessed 23 Feb 2019
4. BNF 70<sup>th</sup> Ed. Sept 2015 – Mar 2016

## AMPICILLIN/SULBACTAM

### Brand Name & Strength

AMPICILLIN & SULBACTAM POWDER for INJECTION 1.5g

### Reconstitution

- Intramuscular (IM) : Reconstitute with 3.2 ml WFI or 0.5% lignocaine HCl anhydrous<sup>1</sup>
- Intravenous (IV) : IV Slow Bolus or IV Infusion<sup>1</sup>  
Reconstitute with 3.2ml WFI<sup>1</sup>

### Further Dilution

IV Infusion : Dilute to concentration  $\leq 45\text{mg/ml}$  (Doses as high as 9g requires 200ml of diluent)<sup>2,3</sup>

### Diluent

NS<sup>2</sup>

### Administration & Infusion Rate

- IM Injection : Deep IM into large muscle mass<sup>2</sup>
- IV Slow Bolus : Administer over 10-15 minutes<sup>2</sup> or  $\geq 3$  minutes<sup>1</sup>
- IV Intermittent Infusion : Administer over 15-30 minutes<sup>2</sup>
- Extended IV Infusion (For high dose sulbactam) : Administer over 4 hours<sup>4,5</sup>

### Storage & Stability

Store below 25°C and protect from light<sup>1</sup>

Intravenous (IV) :

	Room Temperature ( $\leq 25\text{ C}$ )	Fridge (2-8°C)
After reconstitution	-	-
After dilution (Concentration $\leq 45\text{mg/ml}$ )	8 hours <sup>5</sup>	48 hours <sup>5</sup>

Intramuscular (IM) : Use within 1 hour after preparation<sup>2,3</sup>

### Remarks

- Ampicillin and gentamicin should not be mixed in the same IV tubing.<sup>2</sup> They should be administered at separate sites at least 1 hour apart.<sup>1</sup>

### References

1. Karnataka Antibiotics & Pharmaceuticals Limited. Ampicillin & Sulbactam Powder for Injection 1.5g Product Information Leaflet. Revised 9 August 2016
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
3. <https://reference.medscape.com/drug/unasyn-ampicillin-sulbactam-342476#11>. Accessed 20 February 2019
4. Malaysian Society of Intensive Care: Guide to Antimicrobial Therapy in the Adult ICU 2017
5. The Sanford Guide of Antimicrobial Therapy (Latest digital content update: January 22,2019)

## ARTESUNATE

### Brand Name & Strength

Artesun<sup>®</sup> 60mg

### Reconstitution

Reconstitute with provided solvent (1 ml 5% sodium bicarbonate solution)<sup>1</sup>

### Further Dilution

	<b>IV</b>	<b>IM</b>
NS or D5 <sup>1</sup>	5mL	2mL
Final artesunate 60mg solution concentration <sup>1</sup>	10mg/mL	20mg/mL

### Diluent

D5, NS<sup>1</sup>

### Administration & Infusion Rate

- IM Injection : Administer into anterior thigh<sup>1,2</sup>
- IV Slow Bolus : Administer at a rate of 3 – 4 ml/min<sup>1</sup>

### Storage & Stability

Do not store above 30°C and protect from light<sup>1</sup>

	<b>Room Temperature (≤25 C)</b>	<b>Fridge (2-8 C)</b>
After reconstitution	Use immediately <sup>1</sup>	-
After dilution	Use immediately <sup>1</sup>	-

### Remarks

- Do not use in intravenous drip.<sup>1</sup>
- If solution appear cloudy or sediment occurs, it should not be used.<sup>1</sup>

### References

1. Guilin Pharmaceutical Co. Ltd. Artesunate Powder for Injection 60 mg Product Information Leaflet
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## AZITHROMYCIN

### Brand Name & Strength

Azithromycin Vaxcel 500mg

### Reconstitution

Reconstitute with 4.8ml of WFI<sup>1</sup>

### Further Dilution

Dilute with 250ml (Final concentration : 2mg/ml) or 500ml (Final concentration : 1mg/ml) of diluent<sup>1</sup>

### Diluent

NS; D5; HS; Hartmann's Solution; HSD5<sup>1</sup>

### Administration & Infusion Rate

IV Infusion :

500ml (Concentration: 1mg/ml) : Administer over 3 hours<sup>1</sup>

250ml (Concentration: 2mg/ml) : Administer over 1 hour<sup>1</sup>

### Storage & Stability

Do not store above 30°C and protect from light<sup>1</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge (2-8°C)
After reconstitution	24 hours <sup>1</sup>	-
After dilution	24 hours <sup>1</sup>	7 days <sup>1</sup>

### Remarks

- To be given by IV infusion only. Do not administer as IV bolus or IM injection.<sup>1</sup>
- Infuse IV azithromycin for a minimum duration of 1 hour.<sup>1</sup>
- Do not infuse other IV substances, additives or medications together using the same IV line as azithromycin.<sup>1</sup>
- Do not mix other IV substances, additives or medications with azithromycin.<sup>1</sup>

### References

1. Kotra Pharma. Azithromycin (Vaxcel) Product Information Leaflet

## BENZATHINE PENICILLIN

### Brand Name & Strength

Sterile Penicillin G Benzathine USP 2.4 Mega Units (MU)

### Reconstitution

Reconstitute with 8ml or more of WFI<sup>1</sup>

### Further Dilution

Not required

### Diluent

Not required

### Administration & Infusion Rate

IM Injection : Deep IM into the upper outer quadrant of the buttock. In children < 2 years old, IM injections should be made into the midlateral muscle of the thigh, not the gluteal region<sup>2</sup>

### Storage & Stability

Do not store above 30°C and protect from light<sup>1</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge ( $2-8^{\circ}\text{C}$ )
After reconstitution	Use immediately <sup>1</sup>	-
After dilution	-	-

### Remarks

- Potential occurrence of allergic reactions. Observe patients 30 minutes after drug administration.<sup>1</sup>
- In infants and small children, do not inject into the upper outer quadrant of the buttock to prevent sciatic nerve damage except in special cases e.g. in the presence of extensive burns.<sup>1</sup>
- Do not inject subcutaneously, intravenously, intra-arterially or intrathecally or instilled into body cavities.<sup>1,2</sup>
- Do not inject near an artery or a nerve; permanent neurological damage or gangrene may occur.<sup>2</sup>
- Do not mix benzathine penicillin with aminoglycosides (e.g. Gentamicin, Amikacin) in the same IV bag, bottle, syringe or tubing to prevent inactivation of both drugs. These drugs should be administered in separate sites at least 1 hour apart.<sup>1</sup>

### References

1. Karnataka Antibiotics & Pharmaceuticals Limited. Benzathine Penicillin (Sterile Penicillin G Benzathine USP 2.4MU) Product Information Leaflet. Revised 9 August 2016
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## BENZYL PENICILLIN SODIUM

### Brand Name & Strength

BEPEN INJECTION Benzylpenicillin Sodium 1MU (600mg) & 5MU (3g)

### Reconstitution

Intravenous (IV) or Intramuscular (IM)<sup>1</sup>

1MU: Dissolve the contents in 2ml or more sterilised WFI<sup>1</sup>

5MU: Dissolve the contents in 10ml or more sterilised WFI<sup>1</sup>

### Further Dilution

- IM Injection : Dilute up to final concentration of 100000 U/ml with appropriate diluents
- IV Intermittent Infusion : Dilute up to final concentration of 50000 to 145000 U/ml (with approximately 50-100ml of diluents)<sup>2</sup>
- Continuous IV Infusion : Dilute in 1-2L of diluents<sup>2</sup>

### Diluent

NS<sup>2</sup>

### Administration & Infusion Rate

- IM Injection : Deep IM into upper outer quadrant of the buttock<sup>2</sup>
- IV Intermittent Infusion : Administer over 15 to 30minutes<sup>2</sup>
- Continuous IV Infusion : Administer over 24 hours; preferred for large doses<sup>2</sup>

### Storage & Stability

Store below 30°C<sup>1</sup>

	Room Temperature (≤30 C)	Fridge (2-8°C)
After reconstitution	48 hours <sup>1</sup>	6 days <sup>1</sup>
After dilution	-	-

### Remarks

- Too rapid infusion especially at high doses (at least 2MU) may cause electrolyte imbalance and/or CNS disturbance.<sup>1</sup>
- 600 mg (1MU) benzylpenicillin contains 1.68mmol of sodium; massive doses of benzylpenicillin sodium can cause hypokalaemia and sometimes hypernatraemia.<sup>1</sup>
- Benzylpenicillin sodium and solutions that contain metal ions should be administered separately.<sup>1</sup>
- Benzylpenicillin sodium should not be administered in the same syringe/giving set as amphotericin B, cimetidine, cytarabine, flucloxacillin, hydroxyzine, methylprednisolone or promethazine due to incompatibility.<sup>1</sup>

### References

1. Karnataka Antibiotics & Pharmaceuticals. Benzylpenicillin (Benzyl Penicillin for Injection BP) Product Information Leaflet. Revised 14 February 2017
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## CASPOFUNGIN

### Brand Name & Strength

Candidas® 50mg

### Reconstitution

Reconstitute with 10.5ml of NS or WFI to give a final concentration of 5.2 mg/ml (50mg vial)<sup>1</sup>

### Further Dilution

50mg dose : Dilute reconstituted solution in a 100 ml IV bag or bottle<sup>1</sup>

35mg dose : Syringe out 7ml of the reconstituted solution and dilute in a 100 ml IV bag or bottle<sup>1</sup>

Pediatric patients (≥ 12 months old) : Syringe out volume of reconstituted drug required (concentration of reconstituted solution : 5.2mg/ml) and dilute in a 250ml IV bag or bottle not exceeding a final concentration of 0.5 mg/ml<sup>1</sup>

### Diluent

Adult : NS; Hartmann's Solution<sup>1</sup>

Pediatric : NS; HS; Hartmann's Solution<sup>1</sup>

### Administration & Infusion Rate

IV Infusion : Administer over 1 hr<sup>1</sup>

### Storage & Stability

The lyophilised compact powder in unopened vials should be stored at 2-8°C<sup>1</sup>

	Room Temperature (≤25°C)	Fridge (2-8°C)
After reconstitution	24 hours <sup>1</sup>	-
After dilution	24 hours <sup>1</sup>	48 hours <sup>1</sup>

### Remarks

- Do not use any diluents containing dextrose (α-D-glucose).<sup>1</sup>
- Do not mix or co-infuse with any other medications, additives, IV substances.<sup>1</sup>

### References

1. Merck Sharp & Dohme Corp. Caspofungin Acetate 50 mg & 70 mg (Candidas® for Injection) Product Information Leaflet. Revised January 2017

## CEFAZOLIN

### Brand Name & Strength

Cefazolin Sandoz 1g

### Reconstitution

- Intravenous (IV) : IV Slow Bolus or IV Infusion  
Reconstitute with 4ml of WFI or NS<sup>1</sup>
- Intramuscular (IM)  
Reconstitute with 2ml of 0.5% lidocaine solution for each 500mg<sup>1</sup>

### Further Dilution

IV Infusion : Dilute with 50-100ml of diluent<sup>1,2</sup>

### Diluent

NS; D5; D10; NSD5; QSD5; HSD5<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Inject over 3-5 minutes<sup>1,2</sup>
- IV Infusion (For doses more than 1g) : Infuse over 30-60 minutes<sup>1,2</sup>

### Storage & Stability

Powder for solution for injection. Do not store above 25°C and protect from light.<sup>1</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge (2-8°C)
After reconstitution	Use immediately <sup>1</sup> 24 hours <sup>2</sup>	No longer than 24 hours <sup>1</sup> 10 days <sup>2</sup>
After dilution	Use immediately <sup>1</sup> 48 hours <sup>2</sup>	No longer than 24 hours <sup>1</sup> 14 days <sup>2</sup>

### Remarks

- If combination of cefazolin with aminoglycosides (e.g. gentamicin; amikacin), to separate the doses and not mixing together as may cause inactivation of aminoglycosides *in-vitro*.<sup>2</sup>

### References

1. Novartis. Cefazolin (Cefazolin Sandoz) Product Information Leaflet
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## CEFEPIME

### Brand Name & Strength

Cefmex 1g

### Reconstitution

- Intravenous (IV) : IV Slow Bolus or IV Infusion<sup>1</sup>  
Reconstitute 1g with 10ml of diluents (Final concentration : 90mg/ml)<sup>1</sup>
- Intramuscular (IM)  
Reconstitute 1g with 3 ml of diluents (Final concentration : 230mg/ml)<sup>1</sup>

### Further Dilution

- IV Intermittent & Extended Infusion : Dilute in 50-100ml of diluents<sup>1</sup>
- Continuous IV Infusion: *Refer Administration & Infusion Rate*

### Diluent

NS; D5<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over 3 to 5 minutes<sup>1</sup>
- IV Intermittent Infusion : Administer over 30 minutes<sup>1</sup>
- Extended IV Infusion : Administer over 4 hours<sup>3</sup>
- Continuous IV Infusion (To give over 24 hours)<sup>2,3,4</sup>  
Loading dose : Use intermittent infusion (over 30 minutes); then immediately begin with continuous infusion as below<sup>2</sup>

Dose	Dilution	Administration Time/Rate
6g/day (e.g. 2g TDS)	Every 1g diluted in 50ml of diluent	Every 1g over 4 hours (12.5ml/hour)
4g/day (e.g. 2g BD)		Every 1g over 6 hours (8.3ml/hour)
2g/day (e.g. 2g OD)		Every 1g over 12 hours (4.2ml/hour)

### Storage & Stability

Cefepime is compatible at concentration between 1-40 mg/ml<sup>1</sup>

	Room Temperature (<25°C)	Fridge (2-8°C)
After reconstitution	24 hours <sup>2</sup>	48 hours <sup>1</sup>
After dilution	24 hours <sup>2</sup>	48 hours <sup>1</sup>

### Remarks

- Should not be added to solutions of gentamicin; metronidazole; vancomycin; tobramycin and netilmicin because of physical or chemical incompatibility. If concurrent therapy with cefepime and antibiotics above as mentioned, each of these antibiotics can be administered separately to the same patient.<sup>1</sup>

### References

- Duopharma. Cefepime (Cefmex Powder for Injection) Product Information Leaflet
- The Sanford Guide of Antimicrobial Therapy (Latest digital content update: January 22,2019)
- Malaysian Society of Intensive Care: Guide to Antimicrobial Therapy in the Adult ICU 2017
- Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## CEFOPERAZONE

### Brand Name & Strength

Bicafar 1g

### Reconstitution

- Intravenous (IV) : IV Slow Bolus or IV Infusion<sup>1</sup>  
Reconstitute with 5ml of WFI, D5, D10, NSD5 or NS<sup>1</sup>
- Intramuscular (IM)

Vial	Final concentration (mg/ml)	Step 1 Volume of WFI (ml)	Step 2 Volume of 2% Lidocaine (ml)	Withdrawable Volume (ml)
1g	250	2.6	0.9	4.0
	333	1.8	0.6	3.0

### Further Dilution

- IV Slow Bolus : Dilute in appropriate diluent to give final concentration of 100mg/ml<sup>1</sup>
- IV Intermittent Infusion : Dilute with 20-100ml of diluent<sup>1</sup>

### Diluent

NS; D5; D10; Hartmann's Solution; NSD5<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over 3-5 minutes<sup>1</sup>
- IV Intermittent Infusion: Administer over 15-60 minutes<sup>1</sup>
- IM Injection : Deep IM into large muscle mass of gluteus maximum or anterior thigh<sup>1</sup>

### Storage & Stability

Do not store above 25°C and protect from light<sup>1</sup>

	Room Temperature (≤25 C)	Fridge (2-8 C)
After reconstitution	24 hours <sup>1</sup>	5 days <sup>1</sup>
After dilution	-	-

### Remarks

- Incompatibility or loss of activity has been reported between cefoperazone and aminoglycoside, perphenazine or pethidine hydrochloride.<sup>1</sup>
- If combination therapy with cefoperazone and aminoglycoside is needed, administer drugs using separate IV lines or ensure IV line is properly flushed with an approved diluent between doses. It is suggested that cefoperazone be administered prior to aminoglycosides.<sup>1</sup>

### References

- Duopharma. Cefoperazone (Bicafar) Product Information Leaflet

## CEFOPERAZONE/SULBACTAM

### Brand Name & Strength

Cefobactam 1g

### Reconstitution

- Intravenous (IV) : IV Slow Bolus or IV Infusion<sup>1</sup>  
Reconstitute with 3.4ml of WFI, D5 or NS<sup>1</sup>
- Intramuscular (IM)  
2-step dilution is required using 3.4ml WFI and further diluted with 2% lidocaine to yield solutions containing up to 250mg cefoperazone and 125mg sulbactam/ml in approximately 0.5% lidocaine hydrochloride solution<sup>1</sup>

### Further Dilution

IV Intermittent Infusion : Dilute with 20ml of the same diluent used for reconstitution<sup>1</sup>

### Diluent

WFI, NS; D5; NSD5; Hartmann's Solution<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over at least 3 minutes<sup>1</sup>
- IV Intermittent Infusion : Administer over 15-60 minutes<sup>1</sup>

### Storage & Stability

Do not store above 30°C and protect from light<sup>1</sup>

	Room Temperature (<25°C)	2-8°C
After reconstitution	24 hours <sup>1</sup>	-
After dilution	-	-

### Remarks

- Solutions of cefoperazone/sulbactam and aminoglycosides should not be directly mixed because of physical incompatibility.<sup>1</sup>
- If combination therapy needed, this can be accomplished by sequential intermittent intravenous infusion provided that separate secondary intravenous tubing is used and primary intravenous tubing is adequately irrigated with approved diluents between doses.<sup>1</sup>
- Initial reconstitution with Hartmann's Solution or 2% lidocaine HCL solution should be avoided since these mixtures are incompatible.<sup>1</sup>

### References

- Kotra Pharma. Cefoperazone/sulbactam (Cefobactam) Product Information Leaflet

## CEFOTAXIME

### Brand Name & Strength

Rekaxime 500mg & 1000mg

### Reconstitution

Intravenous (IV)/ Intramuscular (IM) :  
 500mg vial : Reconstitute with 2ml of WFI<sup>1</sup>  
 1000mg vial : Reconstitute with 4ml of WFI<sup>1</sup>

### Further Dilution

- IV Short Infusion : Further dilute in 40ml of diluents<sup>1</sup>
- Continuous Drip : Further dilute in 100ml of diluents<sup>1</sup>

### Diluent

NS; D5; D10 (For short infusion)<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over 3 to 5 minutes<sup>1,2</sup>
- IV Short Infusion : Administer over 20 to 60 minutes<sup>1,2</sup>
- Continuous Drip : Administer over 50-60 minutes<sup>1</sup>
- IM Injection : Inject deep into the gluteus muscle<sup>1</sup>

### Storage & Stability

The solution should be administered as soon as they are prepared<sup>1</sup>

	Room Temperature (<25 C)	Fridge (2-8 C)
After reconstitution	24 hours <sup>1</sup>	-
After dilution	24 hours <sup>1</sup>	-

### Remarks

- Incompatible with hetastarch sodium chloride and alkaline solution (pH>7.5) (e.g. sodium bicarbonate).<sup>1</sup>
- If daily dose exceeds 2g of cefotaxime, IV injection is preferred.<sup>1</sup>
- Dose given less than 1 minute have caused life threatening arrhythmias.<sup>1</sup>

### References

1. Duopharma. Cefotaxime (Rekaxime) Product Information Leaflet
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## CEFTAZIDIME

### Brand Name & Strength

Cefatum 1g & 2g

### Reconstitution

- Intramuscular (IM) : Reconstitute with 3ml of 0.5% lignocaine (To yield 260mg/ml)<sup>1</sup>
- Intravenous (IV) Infusion :  
Reconstitute 1g with 10ml of WFI (Final concentration 90 mg/ml)<sup>1</sup>  
Reconstitute 2g with 10ml of WFI (Final concentration 170 mg/ml)<sup>1</sup>

### Further Dilution

- IV Intermittent & Extended Infusion : Dilute in 100ml diluent<sup>1</sup>
- Continuous IV Infusion : *Refer Administration & Infusion Rate*

### Diluent

NS; D5; Hartmann's Solution<sup>1</sup>

### Administration & Infusion Rate

- IM Injection (Dose up to 1g) : Administer deep into large muscle mass<sup>1,2</sup>
- IV Slow Bolus : Administer over 3 to 5 minutes<sup>1</sup>
- IV Intermittent Infusion : Administer over 30 minutes<sup>1,2</sup>
- Extended IV Infusion : Administer over 4 hours<sup>3</sup>
- Continuous IV Infusion :  
Loading dose : Use IV intermittent infusion (over 30 minutes); then immediately begin with continuous infusion as below<sup>4</sup>

Dose	Dilution	Administration time/Rate
8g/day	2g diluted in 50ml diluents <sup>3</sup>	Each 2g over 6 hours (8.3ml/hour)
6g/day	2g diluted in 50ml diluents <sup>3</sup>	Each 2g over 8 hours (6.3ml/hour)
4g/day	2g diluted in 50ml diluents <sup>3</sup>	Each 2g over 12 hours (4.2ml/hour)
2g/day	1g diluted in 50ml diluents <sup>3</sup>	Each 1g over 12 hours (4.2ml/hour)

### Storage & Stability

	Room Temperature (<25°C)	Fridge (2-8°C)
After reconstitution	6 hours (in lignocaine) <sup>1</sup> ; 12 hours <sup>1</sup>	4 days (in lignocaine) <sup>1</sup> ; 7 days <sup>1</sup>
After dilution	12 hours <sup>1</sup>	7 days <sup>1</sup>

### Remarks

- Do not mix with sodium bicarbonate solution.<sup>1</sup>
- May be given into the tubing of patients receiving parenteral fluids.<sup>1</sup>

### References

- Duopharma. Ceftazidime (Cefatum) Product Information Leaflet. Revised Feb 2017
- Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
- Malaysian Society of Intensive Care: Guide to Antimicrobial Therapy in the Adult ICU 2017
- The Sanford Guide of Antimicrobial Therapy (Latest digital content update : January 2019)

## CEFTRIAZONE

### Brand Name & Strength

Unocef Injection 1000 mg

### Reconstitution

- Intramuscular (IM) :

Reconstitute with appropriate diluents [WFI, NS, D5, bacteriostatic water + 0.9% benzyl alcohol, 1% lidocaine solution (without adrenaline)]<sup>1</sup>

Amount of diluent to be added	
Final concentration 250 mg/ml	Final concentration 350 mg/ml
3.6ml	2.1ml

- Intravenous (IV) Infusion :

Reconstitute with 9.6ml of diluents (WFI, NS, D5, D10, NSD5, HSD5)<sup>1</sup>

### Further Dilution

IV Infusion : Dilute to 50 – 100 ml with diluent (Final concentration : 10-40mg/ml)<sup>1</sup>

### Diluent

NS; D5; D10; NSD5; HSD5<sup>1,2</sup>

### Administration & Infusion Rate

- IM Injection : Administer deep IM into large muscle mass<sup>1</sup>
- IV Infusion : Administer over 30 minutes<sup>1,2</sup>

### Storage & Stability

Do not store above 30°C and protect from light<sup>1</sup>

#### Intramuscular (IM)<sup>1</sup>

Diluent	Concentration (mg/ml)	Room Temperature (≤25 C)	Fridge (2-8 C)
WFI	250, 350	24 hr	3 days
NS	250, 350	24 hr	3 days
D5	250, 350	24 hr	3 days
Bacteriostatic water + 0.9 % benzyl alcohol	250, 350	24 hr	3 days
1 % lidocaine solution (without adrenaline)	250, 350	24 hr	3 days

#### Intravenous (IV) solution at concentration 10-40mg/ml stored in glass or PVC containers<sup>1</sup>

Diluent	Room Temperature (≤25 C)	Fridge (2-8 C)
WFI	3 days	10 days
NS	3 days	10 days
D5	3 days	10 days
D10	3 days	10 days
NSD5	3 days (In PVC containers only)	Incompatible
HSD5	3 days	Incompatible

### Remarks

- Do not use diluents containing calcium, such as Lactated Ringer's solution or Hartmann's solution to reconstitute ceftriazone as particulate formation can result.<sup>1</sup>

### References

- Duopharma. Ceftriazone (Unocef Injection) Product Information Leaflet. Revised 2 October 2013
- Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## CEFUROXIME

### Brand Name & Strength

Anikef 750mg & 1500mg

### Reconstitution

- Intramuscular (IM) : Reconstitute 750mg vial with 3 ml WFI<sup>1</sup>
- Intravenous (IV) : IV Slow Bolus or IV Infusion<sup>1</sup>

Reconstitution <sup>1</sup>	750mg Vial	1500mg Vial
	6ml WFI	15ml WFI

### Further Dilution

IV Infusion : Dilute reconstituted solution with 50ml of diluent<sup>1</sup>

### Diluent

D5; NS<sup>2</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over 3 – 5 minutes<sup>1,2</sup>
- IV Infusion : Administer over 15 - 30 minutes<sup>1,2</sup>
- IM Injection : Deep IM into large muscle mass<sup>1,2</sup>

### Storage & Stability

Do not store above 25°C and protect from light<sup>1</sup>

	Room Temperature (≤25 C)	Fridge (2-8 C)
After reconstitution	5 hours <sup>1</sup>	48 hours <sup>1</sup>
After dilution	-	-

### Remarks

- Incompatible with aminoglycosides and should not be mixed in the same IV bag or bottle. If administered concurrently, the antibiotics should be administered in separate sites.<sup>1</sup>
- A dose of 1.5g injected IM can be divided between 2 injection sites.<sup>1</sup>

### References

- Duopharma. Cefuroxime (Anikef) Product Leaflet. Revised 2 September 2013.
- Lexi-Comp, Inc. (Lexi-Drugs®). Lexi-Comp, Inc; November 3, 2016

## CIPROFLOXACIN

### Brand Name & Strength

Ciproxol 200mg/100ml Intravenous Infusion

### Reconstitution

Not required

### Further Dilution

Infusion solution can be infused directly or after mixing with the other compatible infusion solution to a final concentration not exceeding 2mg/mL.<sup>1,2</sup>

### Diluent

NS; D5<sup>2,3</sup>

### Administration & Infusion Rate

IV Slow Infusion : Administer over 60 minutes into large vein<sup>1,2</sup>

### Storage & Stability

Store between 15°C to 30°C and protect from light<sup>1</sup>  
Do not refrigerate<sup>1</sup>

	Room Temperature (≤25 C)	Fridge (2-8 C)
After reconstitution	-	-
After dilution	-	-

### Remarks

- Slow infusion into large vein will minimise patient discomfort and reduce risk of venous irritation.<sup>1,2</sup>

### References

1. Ain Medicare. Ciprofloxacin (Ciproxol) Product Information Leaflet
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## CLOXACILLIN

### Brand Name & Strength

Cloxacillin Sodium 500mg

### Reconstitution

- Intramuscular (IM) : Reconstitute with 2ml or 4ml of WFI to make final concentration of 250mg/ml or 125mg/ml<sup>1</sup>
- IV Slow Bolus : Reconstitute with 10ml or 5ml of WFI to make final concentration of 50mg/ml or 100mg/ml<sup>1</sup>
- IV Intermittent/ Continuous Infusion : Reconstitute with 2ml of WFI to make final concentration of 250mg/ml<sup>1</sup>

### Further Dilution

IV Intermittent/ Continuous Infusion : Dilute reconstituted drug with diluents up to concentrations of 1-2mg/ml<sup>1</sup>

### Diluent

NS; D5<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over 2 to 4 minutes<sup>1</sup>
- IV Intermittent Infusion : Administer over 30-40 minutes<sup>1</sup>
- Continuous IV Infusion : Infuse total daily dose over 24 hours<sup>2</sup>

### Storage & Stability

Store below 25°C; balance solution should be discarded as per manufacturer's recommendation<sup>3</sup>

	Room Temperature (<25°C)	Fridge (2-8°C)
After reconstitution	24 hours <sup>1</sup>	48 hours <sup>1</sup>
After dilution	12 hours <sup>1</sup>	-

### Remarks

- Extemporaneous admixtures of beta-lactam antibiotics and aminoglycosides may result in substantial mutual inactivation. If to administer concurrently, should be administered in separate sites at least 1 hour apart. Do not mix them in the same intravenous bag, bottle or tubing.<sup>3</sup>

### References

1. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
2. Malaysian Society of Intensive Care: Guide to Antimicrobial Therapy in the Adult ICU 2017
3. Karnataka Antibiotics & Pharmaceutical Ltd. Cloxacillin Sodium Product Information Leaflet. Revised 9 August 2016

## COLISTIMETHATE SODIUM (POLYMYXIN E)

### Brand Name & Strength

Colomycin Injection 1MU

### Reconstitution

- Intravenous (IV) : IV Slow Bolus or IV Infusion  
Reconstitute with 5ml of NS or WFI<sup>1</sup>
- Inhalation (Nebuliser) : Reconstitute with 2-4ml of NS or WFI<sup>1</sup>

### Further Dilution

- IV Infusion :  
Dilute loading dose (9-12 MU) with 100ml of diluent<sup>1</sup>  
Dilute maintenance dose with 10-50ml of diluent<sup>1</sup>
- Inhalation (Nebuliser) : Dilute with 2-4ml of diluent<sup>1</sup>

### Diluent

NS<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over 3-5 minutes<sup>1:2</sup>
- IV Infusion :  
Loading dose : Administer over 1-2 hours<sup>2</sup>  
Maintenance dose : Infuse as intermittent infusion over 30 minutes<sup>1:2</sup>
- Continuous IV Infusion : One-half of the total daily dose is administered by direct IV injection over 3-5 minutes; followed by 1-2 hours later by the remaining one-half of the total daily dose infused over 22-23 hours<sup>2</sup>

### Storage & Stability

Do not store above 25°C and protect from light.<sup>1</sup>

Solution for infusion, injection & nebulization :

	Room Temperature (<25°C)	Fridge (2-8°C)
After reconstitution	Use immediately <sup>1</sup>	No longer than 24 hours <sup>1</sup>
After dilution	Use immediately <sup>1</sup> (For continuous infusion, administration should be completed within 24 hours of preparation <sup>2</sup> )	No longer than 24 hours <sup>1</sup>

### Remarks

- The solution is for single use only. Discard the remaining solution.<sup>1</sup>
- For nebulised colistin, do not store solution more than 24 hours to reduce risk for potential lung toxicity. Prepare solution immediately before administration.<sup>2</sup>

### References

1. Xellia Pharmaceuticals APS. Colomycin Injection Product Information Leaflet
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## ERTAPENEM

### Brand Name & Strength

Invanz 1g

### Reconstitution

- Intravenous (IV) : Reconstitute 1g with 10ml of WFI or NS<sup>1</sup>
- Intramuscular (IM) : Reconstitute 1g with 3.2ml of 1% or 2% lidocaine solution (without adrenaline)<sup>1</sup>

### Further Dilution

IV Infusion : Dilute with 50ml of diluent<sup>1</sup>

### Diluent

NS<sup>1</sup>

### Administration & Infusion Rate

- IV Infusion : Administer over 30 minutes<sup>1,2</sup>
- IM Injection : Administer by deep IM into large muscle mass (e.g. gluteal muscle)<sup>1</sup>

### Storage & Stability

Do not store lyophilised powder above 25°C<sup>1</sup>

Intravenous (IV) :

	Room Temperature (<25°C)	5°C
After reconstitution	-	-
After dilution	No longer than 6 hours <sup>1</sup>	No longer than 24 hours (Use within 4 hours after removal from fridge) <sup>1</sup>

Intramuscular (IM) : The reconstituted solution should be used within 1 hour after preparation<sup>2</sup>

### Remarks

- Do not mix or co-infuse with other medication.<sup>1</sup>
- Do not use diluents containing dextrose (α-D-glucose).<sup>1</sup>

### References

1. Merck Sharp & Dohme. Ertapenem for Injection (Invanz) Product Information Leaflet. Revised August 2016
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## ERYTHROMYCIN LACTOBIONATE

### Brand Name & Strength

ERITROTEX (Erythromycin Lactobionate Injection 500mg)

### Reconstitution

Reconstitute with 10ml WFI (Final concentration : 50mg/ml)<sup>1</sup>

### Further Dilution

Dilute reconstituted solution with at least 100ml of appropriate diluent to a final concentration of 1 – 5mg/ml<sup>1,2</sup>

### Diluent

NS (preferred); D5<sup>2</sup>

### Administration & Infusion Rate

- IV Intermittent Infusion : Administer over 20 – 60 minutes<sup>1,2</sup>
- Continuous IV Infusion : Administer total daily dose over 24 hours<sup>2</sup>

### Storage & Stability

Store below 30°C and protect from light<sup>1</sup>

Stability is affected by below pH 5.5; 5 ml of sterile sodium bicarbonate 8.4% solution should be used to neutralise 1L of D5 prior to addition of erythromycin lactobionate into bag<sup>2</sup>

	Room Temperature (<25°C)	Fridge (2-8°C)
After reconstitution (Concentration 50mg/ml)	24 hours <sup>1</sup>	14 days <sup>1</sup>
After dilution (In NS)	8 hours <sup>1</sup>	24 hours <sup>1</sup>

### Remarks

- Not to be administered rapidly by direct IV push or bolus.<sup>1,2</sup>
- Rapid infusion is more likely to be associated with prolongation of QT interval, ventricular arrhythmias or hypotension.<sup>1,2</sup>
- Erythromycin should not be reconstituted with inorganic salt solution (e.g. NS). Use only WFI for reconstitution.<sup>2</sup>
- Minimum volume of diluent for further dilution of reconstituted erythromycin is 100ml to minimise venous irritation during infusion.<sup>2</sup>
- Each vial contains 744.1mg of erythromycin lactobionate = 500mg erythromycin.<sup>2</sup>

### References

1. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
2. Averroes Pharmaceuticals. Erythromycin Lactobionate (Eritrotex) Product Information Leaflet. Revised 19 September 2016

## FLUCONAZOLE

### Brand Name & Strength

FLUCONOL (Fluconazole 2mg/mL)

### Reconstitution

Not required

### Further Dilution

Not required

### Diluent

Not required

### Administration & Infusion Rate

IV Infusion : Administer over 1 – 2 hours (Maximum rate: 200mg/hr)<sup>1</sup>

### Storage & Stability

Store below 30°C and do not freeze<sup>4</sup>

For single use only, any unused infusion should be discarded<sup>4</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge ( $2-8^{\circ}\text{C}$ )
After reconstitution	-	-
After dilution	-	-

### Remarks

- Do not use if cloudy or precipitated.<sup>1</sup>
- Although no specific incompatibilities have been noted, mixing with any other drug prior to infusion is not recommended.<sup>2</sup>
- Fluconazole can be infused through an existing IV line with these fluids : Hartmann's Solution, NS, sodium bicarbonate 4.2%, potassium chloride in dextrose.<sup>2</sup>

### References

1. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
2. Ain Medicare. Fluconazole (Fluconol) Product Information Leaflet. Revised 16/8/2011

## GENTAMICIN

### Brand Name & Strength

Garasent 80mg/2ml Injection

### Reconstitution

Not required

### Further Dilution

IV Infusion :

- Dilute in 100 to 200ml of diluents (Concentration should not exceed 1mg/ml)<sup>1</sup>
- In infants and children, volume should be less but allow for accurate measurement and administration<sup>2</sup>

### Diluent

NS; D5<sup>1,2,3</sup>

### Administration & Infusion Rate

- IV Bolus : Administer over 3-5 minutes<sup>3</sup>
- IV Infusion : Administer over 30 minutes to 2 hours<sup>1,2</sup>
- IM Injection : Administer by deep IM route if possible<sup>2</sup>

### Storage & Stability

Store below 30°C<sup>1</sup>

Intravenous (IV) : Recommended to use immediately

	Room temperature (<25°C)	Fridge (2-8°C)
After reconstitution	-	-
After dilution	48 hours <sup>1</sup>	48 hours <sup>1</sup>

Antibiotic Lock :

72 hours at room temperature<sup>3</sup>

### Gentamicin Antibiotic 1mg/ml & 5mg/ml Lock

Preparation (1mg/ml) :<sup>3</sup>

- Syringe out 1ml of gentamicin (40mg/ml) and mix with 19ml of NS to form a concentration of 2mg/ml → SOLUTION A
- Withdraw 1.5ml (3mg) of SOLUTION A and add with 1.5ml of heparin 5000unit/ml (7500 unit) → SOLUTION B
- Draw out 1 ml of SOLUTION B (consisted of 1mg gentamicin with 2500 IU/ml of heparin) for catheter lumen instillation
- The solution needs to be prepared immediately each time prior to administration

Preparation (5mg/ml) :<sup>4</sup>

- Syringe out 1ml of gentamicin (40mg/ml) and mix with 7ml of heparin 5000unit/ml to form a concentration of 5mg/ml → SOLUTION A
- Draw out 1 ml of SOLUTION A for catheter lumen instillation
- The solution needs to be prepared immediately each time prior to administration

Administration :<sup>3</sup>

- a. Prior to installation of antibiotic lock, withdraw the content from catheter lumen
- b. Flush the catheter with NS
- c. Instill 1ml of the antibiotic lock solution to fill catheter lumen
- d. Label the catheter with "DO NOT USE-Antibiotic Lock"
- e. Allow solution to dwell for a period of time specified by the physician/specialist
- f. After dwell time is completed, aspirate the antibiotic lock solution from catheter lumen
- g. Flush the catheter lumen with NS
- h. Repeat Step C onwards if still indicated
- i. The line should be flushed with NS prior to administration of medication

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**Remarks**

- Some penicillins have been shown to inactivate aminoglycosides in vitro. Concurrent use may pose a risk of reduced antibacterial efficacy in vivo especially in profound renal impairment. If combination therapy required, separation of dose is recommended.<sup>2</sup>

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**References**

1. Duopharma. Gentamicin (Garasent) Product Information Leaflet
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
3. Stanford Hospital and Clinics Pharmacy Development Policies and Procedures for Antibiotic Lock Guidelines 2015
4. Hospital Kuala Lumpur Protocol for Antibiotic Locking for Hemodialysis Catheter

## IMIPENEM/CILASTATIN

### Brand Name & Strength

Imipenem/Cilastatin Kabi 500mg/500mg

### Reconstitution

Reconstitute with 10ml of diluents (NS or D5). Shake well and transfer the resulting mixture to the infusion solution container. Repeat with an additional 10ml of diluents to ensure complete transfer of vial contents<sup>1</sup>

### Further Dilution

Dilute with 100ml of diluent (Final concentration: ~ 5mg/ml)<sup>1</sup>

### Diluent

NS; D5<sup>1</sup>

### Administration & Infusion Rate

- Slow IV infusion. Do not administer IV push.<sup>2</sup>  
For doses ≤ 500mg : Infuse over 20-30 minutes<sup>1</sup>  
For doses > 500mg : Infuse over 40-60 minutes<sup>1</sup>
- Extended IV Infusion : Administer over 4 hours<sup>3</sup>

### Storage & Stability

Do not store above 30°C and protect from light<sup>1</sup>

	Room Temperature (≤30°C)	Fridge (2-8°C)
After reconstitution	Use immediately (preferred) or 4 hours <sup>1</sup>	Use immediately (preferred) or 24 hours <sup>1</sup>
After dilution	Use immediately (preferred) or 4 hours <sup>1</sup>	Use immediately (preferred) or 24 hours <sup>1</sup>

### Remarks

- Incompatible with lactate and should not be reconstituted in solutions containing lactate. However, it can be administered into an IV system through which a lactate solution is being infused.<sup>1</sup>
- In patients who develop nausea during infusion, the rate of infusion may be slowed.<sup>1</sup>

### References

1. Fresenius Kabi. Imipenem/CilastatinKabi 500mg/500mg Product Information Leaflet. Revised Nov 2015
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
3. Malaysian Society of Intensive Care: Guide to Antimicrobial Therapy in the Adult ICU 2017

## KANAMYCIN SULFATE

### Brand Name & Strength

Kanamycin Sulfate Injection Meiji 1g/3ml

### Reconstitution

Not required

### Further Dilution

Not required

### Diluent

Not required

### Administration & Infusion Rate

- IM Injection<sup>1</sup>

### Storage & Stability

Store below 30°C.<sup>1</sup> Discard unused solution.

	Room Temperature (<25°C)	Fridge (2-8°C)
After reconstitution	-	-
After dilution	-	-

### Remarks

- This drug may cause an auditory nervous system disorders or hearing difficulty or hearing impairment.<sup>1</sup>
- Avoid potent diuretics due to increased risk of ototoxicity and nephrotoxicity.<sup>1</sup>
- For IM injection, avoid same site injections if repeated doses required.<sup>1</sup>

### References

1. Thai Meiji Pharmaceutical Co., LTD. Kanamycin Sulfate Injection Meiji Product Information Leaflet

## LINEZOLID

### Brand Name & Strength

Zyvox 600mg/300ml Solution for Infusion

### Reconstitution

Not required

### Further Dilution

Not required

### Diluent

Not required

### Administration & Infusion Rate

IV Infusion : Administer over 30 – 120 minutes<sup>1,2</sup>

### Storage & Stability

Store below 30°C.<sup>1</sup> Protect from light and freezing.<sup>1,2</sup>  
Keep infusions bags in overwrap until ready to use.<sup>1,2</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge ( $2-8^{\circ}\text{C}$ )
After reconstitution	-	-
After dilution	-	-

### Remarks

- Single use, ready to use infusion bags.<sup>1,2</sup>
- Do not use this infusion bags in series connection. Do not introduce additives into solution.<sup>1</sup>
- Flush IV line with compatible solution (e.g. NS, D5, or Hartmann's Solution) before and after administering drug to avoid incompatibilities.<sup>1,2</sup>
- Linezolid solution for infusion may exhibit a yellow colour that can intensify over time without adversely affecting potency.<sup>1,2</sup>
- Physical incompatibility when combined with the following drugs at simulated Y-site administration: amphotericin B, chlorpromazine HCl, diazepam, pentamidine isothionate, erythromycin lactobionate, phenytoin sodium, trimethoprim-sulfamethoxazole.<sup>1</sup>
- Chemical incompatible when combined with ceftriaxone sodium.<sup>1</sup>

### References

1. Fresenius Kabi Norge AS. Linezolid Injection Product Information Leaflet. Revised June 29 2018
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## MEROPENEM

### Brand Name & Strength

Nuronem 500mg or 1g

### Reconstitution

500mg vial : Reconstitute with 10 ml of WFI<sup>1</sup>  
 1g vial : Reconstitute with 20 ml of WFI<sup>1</sup>

### Further Dilution

- IV Intermittent Infusion : Dilute in 50-200ml of diluents (Final concentration 1-20mg/ml)<sup>1</sup>
- Extended IV Infusion : *Refer Administration & Infusion Rate*

### Diluent

NS; D5; D10; NSD5<sup>1</sup>

### Administration & Infusion Rate

- IV Slow Bolus : Administer over 3 to 5 minutes<sup>1,2</sup>
- IV Intermittent Infusion : Administer over 5-30 minutes<sup>1,2</sup>
- Extended IV Infusion : Administer over 3-4 hours<sup>2,3</sup>

Dose	Dilution	Administration Time/Rate
500mg	Dilute until 50ml of diluent	Over 3-4 hours
1g		
2g	Dilute until 100ml of diluent	

### Storage & Stability

Before reconstitution, the dry powder should be stored at temperature below 25°C. After reconstitution, do not freeze.<sup>1</sup>

	Room Temperature (25°C) <sup>1</sup>	4°C <sup>1</sup>
After dilution (Concentration 1-20mg/ml)	8 hours (NS) 3 hours (D5; NSD5) 2 hours (D10)	48 hours (NS) 14 hours (D5; NSD5) 8 hours (D10)

### Remarks

- Extended infusion has been shown to improve the time the free drug remains above MIC that predicts the killing characteristic of the antibiotic.<sup>3</sup>

### References

1. Sun Pharmaeutical Ind. Ltd. Nuronem Injection 500mg/1g. Product Information Leaflet. Revised May 2016
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
3. Malaysian Society of Intensive Care: Guide to Antimicrobial Therapy in the Adult ICU 2017

## METRONIDAZOLE

### Brand Name & Strength

Metronol® 0.5% w/v Injection

### Reconstitution

Not required

### Further Dilution

Not required

### Diluent

Not required

### Administration & Infusion Rate

IV Slow Infusion : Infuse over 20-60 minutes<sup>1</sup>

### Storage & Stability

Do not store above 30°C and protect from light<sup>1</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge ( $2-8^{\circ}\text{C}$ )
After reconstitution	-	-
After dilution	-	-

### Remarks

- In the absence of compatibility studies, product must not be mixed with other medicinal products.<sup>1</sup>
- Avoid contact of drug solution with equipment containing aluminium.<sup>2</sup>

### References

1. Ain Medicare Sdn Bhd. Metronidazole (Metronol®) Injection Product Leaflet. Revised 7 June 2017
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## PIPERACILLIN/AZOBACTAM

### Brand Name & Strength

AUROTAZ-P Powder for Injection 4.5g

### Reconstitution

Reconstitute with 20ml of diluents (WFI or NS)<sup>1</sup>

### Further Dilution

IV Infusion : Dilute with 50-150ml of diluent<sup>1,2</sup>

### Diluent

NS; D5<sup>1,2</sup>

### Administration & Infusion Rate

- IV Bolus : Administer over 3-5 minutes<sup>1</sup>
- IV Infusion : Administer over 30 minutes<sup>2</sup>
- Extended IV Infusion : Loading dose using intermittent infusion over 30 minutes, then start maintenance dose 4 hours after loading dose administered over 4 hours<sup>3,4</sup>

### Storage & Stability

Do not store above 30°C<sup>1</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	Fridge (2-8°C)
After reconstitution	Use immediately <sup>1</sup> 24 hours <sup>2</sup>	24 hours <sup>1</sup> 48 hours <sup>2</sup>
After dilution	24 hours <sup>2</sup>	7 days <sup>2</sup>

### Remarks

- Not to be used with:
  - Hartmann's Solution<sup>1</sup>
  - Solution containing only sodium bicarbonate<sup>1</sup>
- Not to be added to blood products/ albumin hydrolysates.<sup>1</sup>
- Must be administered separately when use concurrently with another antibiotics.<sup>1</sup>

### References

1. Aurobindo Pharma Ltd. AUROTAZ-P Powder for Injection Package Insert. Revised April 2016
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
3. The Sanford Guide of Antimicrobial Therapy (Latest digital content update: January 22,2019)
4. Malaysian Society of Intensive Care: Guide to Antimicrobial Therapy in the Adult ICU 2017

## STREPTOMYCIN

### Brand Name & Strength

STREPTIN INJECTION 1g

### Reconstitution

Reconstitute with 4.2 to 4.5 ml NS or WFI (Final concentration : ~200mg/ml) or 3.2 to 3.5 ml NS or WFI<sup>1</sup> (Final concentration : ~250mg/ml)<sup>1,2</sup>

### Further Dilution

IV Infusion (Off-label route) : Dilute reconstituted solution to concentration of 5-10mg/ml<sup>2</sup>

### Diluent

IV Infusion (Off-label route) : NS; D5<sup>2</sup>

### Administration & Infusion Rate

- IM Injection : Inject deep IM into large muscle mass; midlateral thigh muscle (preferred site for children); midlateral thigh muscle or upper buttocks (adults)<sup>2</sup>
- IV Infusion (Off-label route): Administer over 30-60 minutes<sup>2</sup>

### Storage & Stability

Store below 25°C and protect from light<sup>1</sup>

	Room Temperature (<25°C)	Fridge (2-8°C)
After reconstitution	24 hours <sup>1</sup>	-
After dilution	-	-

### Remarks

- Alternate IM injection site areas/ rotate injection sites for repeated doses.<sup>2</sup>

### References

1. SM Pharmaceuticals. Streptomycin Sulfate (Streptin Powder for Injection) Product Information Leaflet. Revised 14 October 2010
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019

## VANCOMYCIN

### Brand Name & Strength

CELOVAN 500MG

### Reconstitution

Reconstitute 500mg with 10ml WFI (Final concentration : 50mg/ml)<sup>1,2</sup>

### Further Dilution

- IV Intermittent Infusion :  
Dilute with at least 100ml of diluent per 500mg of vancomycin (Final concentration : 5ml/ml)<sup>1,2</sup>  
Maximum concentration up to 10mg/ml may be used in fluid restriction patients<sup>1,2</sup>
- Continuous IV Infusion : Split total daily dose into two and dilute each dose in 250ml of diluents<sup>3</sup>
- Oral Route/ Nasogastric Tube : Dilute reconstituted solution in 30ml of water<sup>2</sup>

### Diluent

NS; D5<sup>1,2</sup>

### Administration & Infusion Rate

- IV Intermittent Infusion :  
Administer over  $\geq 1$  hour or  $\geq 30$  minutes for every 500mg (Maximum infusion rate: 10mg/min)<sup>1,2</sup>
- Continuous IV Infusion (Two 250ml bags, each over 12 hours) :  
Start infusion immediately after loading dose. Infuse each 250ml bag at a set rate of 20.8ml/hr.<sup>3</sup>

### Storage & Stability

Store below 30°C and protect from light<sup>1</sup>

Intravenous (IV) :

	Room Temperature (<25°C)	Fridge (2-8oC)
After reconstitution	-	-
After dilution	48 hours <sup>1</sup>	48 hours <sup>1</sup>

Antibiotic Lock :  
72 hours at room temperature<sup>3</sup>

### Vancomycin Antibiotic 2.5mg/ml Lock<sup>4</sup>

Preparation :

- Reconstitute 500mg vial with 10ml NS to form a concentration of 50mg/ml
- Syringe out 1ml of the reconstituted vancomycin solution (50mg/ml) and mix with 9ml of NS to obtain a final concentration of 5mg/ml → SOLUTION A
- Draw out 1ml of SOLUTION A and mix with 1ml of heparin 5000IU/ml to get a volume of 2ml (which consisted of 2.5mg/ml vancomycin plus 2500 IU/ml of heparin) for catheter lumen instillation
- The solution needs to be prepared immediately each time prior to administration

Administration :

- Prior to installation of antibiotic lock, withdraw the content from catheter lumen
- Flush the catheter with NS

- c. Instill 2ml of the antibiotic lock solution to fill catheter lumen
- d. Label the catheter with "DO NOT USE-Antibiotic Lock"
- e. Allow solution to dwell for a period of time specified by the physician/specialist
- f. After dwell time is completed, aspirate the antibiotic lock solution from catheter lumen
- g. Flush the catheter lumen with NS
- h. Repeat Step C onwards if still indicated
- i. The line should be flushed with NS prior to administration of medication

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**Remarks**

- Fluid restriction: Max concentration 10mg/ml (but may increase risk of infusion-related adverse effects).<sup>1,2</sup>
- If Red-man syndrome appears, slow infusion rate to over 1 ½ - 2 hours and increase dilution volume.<sup>2</sup>
- May cause extravasation. Ensure proper needle or catheter placement prior to and during infusion.<sup>2</sup>
- Not for intramuscular (IM) use.<sup>2</sup>
- Safety and efficacy of vancomycin by intraperitoneal and intrathecal (intralumbar or intraventricular) routes have not been assessed.<sup>1</sup>

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**References**

1. Mylan. Vancomycin Hydrochloride (Celovan Powder for Injection) Product Information Leaflet
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019
3. Clinical Pharmacokinetics Pharmacy Handbook 2015
4. Stanford Hospital and Clinics Pharmacy Development Policies and Procedures for Antibiotic Lock Guidelines 2015

## ZIDOVUDINE

### Brand Name & Strength

Zidovudine Injection (Retrovir<sup>TM</sup> 200mg/20ml)

### Reconstitution

Not required<sup>1</sup>

### Further Dilution

Must be further diluted immediately prior IV infusion in full aseptic conditions<sup>1</sup>  
Dilute up to a final concentration of 2mg/ml (Maximum concentration : 4mg/ml)<sup>1,2</sup>

### Diluent

D5<sup>1,2</sup>

### Administration & Infusion Rate

IV Infusion : Prevention of maternal-fetal transmission

- Adults : Administer 2mg/kg over 60 minutes, followed by 1mg/kg/h continuous infusion until umbilical cord clamped<sup>1,2</sup>
- Newborn : Administer 1.5mg/kg over 30 minutes every 6 hours<sup>1</sup>

### Storage & Stability

Store below 30°C and protect from light<sup>1</sup>  
Discard unused portion<sup>1</sup>

	Room Temperature ( $\leq 25^{\circ}\text{C}$ )	5°C
After reconstitution	-	-
After dilution	48 hours <sup>1</sup> 8 hours <sup>2</sup> (preferred due to no preservatives)	48 hours <sup>1</sup> 24 hours <sup>2</sup> [2-8°C] (preferred due to no preservatives)

### Remarks

- Must not be given IM.<sup>1,2</sup>
- Avoid rapid infusion or bolus injection.<sup>1,2</sup>

### References

1. GlaxoSmithKline (GSK). Zidovudine (Retrovir<sup>TM</sup>) Product Information Leaflet. Revised 7 December 2004.
2. Lexi-Comp; Inc (Lexi-Drugs). Lexi-Comp; Inc; January 2019