Royal Flying Doctor Service
WESTERN OPERATIONS

Clinical Manual

Part 2
Drug Infusion Guidelines

Version 8.0
August 2018

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Clinical Manual - Part 2 – Drug Infusion Guidelines

Version 8.0

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1. INTRODUCTION

1.1 Standard Guidelines

The guidelines which follow cover the common drugs used by the Service in patient transport. The guidelines are standardised to assist staff from widely differing clinical backgrounds. Use of standard guidelines assists in preventing drug administration errors and aids in the handover of patients. They do not preclude the infusion of other drugs or use of other concentrations, if these are required in individual patients.

A brief list of notes, indications, precautions and side effects are attached to each table but these are by no means comprehensive. Refer to the manufacturer's product information or the reference textbooks for full product details.

Care has been taken to ensure that the information in the guidelines is accurate at the time of printing but the user is advised to check the doses carefully. RFDS Western Operations shall not be held responsible for any errors in the guidelines. The final responsibility for any drug administered during transfer lies with the RFDS Medical Officer supervising the flight / transfer.

1.2 Use of Differing Concentrations

In general the infusions are presented in two concentrations; a concentrated format and one more dilute. The former is for use in 50 mL syringes. A syringe driver with minimal volume tubing allows very small flow rates to be used and is the preferred method for transport in most instances. Syringe drivers are often not available in country hospitals so more dilute infusions using standard 500 mL and 100mL fluid bags are offered. 500 mL formats are generally for use through an intravenous rate controlling device such as an Alaris or Bodyguard infusion pump. Although greater fluid volumes are necessary, there is a greater margin of safety in controlling rates, especially during transport and handover.

1.3 Quantity of Infusions

Where practical, the quantity of drugs used has been minimized so as to provide only that necessary for treatment during transport (up to 6-8 hours). This may differ from standard teaching hospital infusion guidelines where many infusions are designed to last for 24 hours.

1.4 Escorting of Patients with Drug Infusions

We do not consider it good clinical practice for ambulance officers to supervise and administer drug infusions. As a minimum, a patient receiving any of the following infusions should be escorted to the pickup airstrip by a registered nurse from the referring centre. An RFDS Flight Nurse Specialist or Medical Officer should escort them to the receiving hospital. Current exceptions to these guidelines are:

- Patients receiving Heparin, provided the Heparin is in a burette or the infusion is stopped for the duration of the transfer (to prevent accidental infusion of a large dose).

- Patients who have been receiving Salbutamol infusion for the suppression of labour, provided that the infusion has been ceased prior to departure of the ambulance. Salbutamol should only be ceased if the patient's contractions have settled and the patient will not be compromised by the cessation of treatment.

The need for a medical doctor escort on the flight is discussed under "special notes" in each individual infusion guideline.

1.5 Formulae for Converting mL/hr to μg/kg/min and Vice Versa

First work out the concentration of solution to be infused (in μg/mL)

- Drug concentration μg/mL $= \frac{\text{dose of drug added (mg) x 1000}}{\text{volume (mL)}}$

  eg Dopamine 200mg in 500 mL = 200 x 1000 / 500 = 400 μg/mL

⇒ To convert μg/kg/min:

- Choose desired rate (inμg/kg/min)
- rate (mL/hr) $= \frac{\text{desired rate (in in μg/kg/min) x 60 x wt (kg)}}{\text{drug conc'n (μg/kg)}}$

  eg Dopamine @ 5 μg/kg/min in a 40kg patient using Dopamine 400 in μg/mL
  rate (mL/hr) = 5 x 60 x 40 / 400 = 30mL/hr

⇒ To convert mL/hr to μg/kg/min:

- rate (μg/kg/min) $= \frac{\text{infusion rate (mL/hr) x drug conc'n (μg/mL)}}{\text{60 x wt (kg)}}$

  eg Dopamine @ 5 μg/kg/min in a 40kg patient using Dopamine 400 in μg/mL
  rate (μg/kg/min) = 30 x 400 / 60 x 40 = 5 μg/kg/min

1.6 Paediatric drug dosing

The dosing regimens used in these guidelines have paediatric doses in mg/kg. The correct dose must be calculated based on the child's weight. Examples have been given throughout the guidelines of quantities to be given for a range of weights.

1.7 Loading doses

Where a loading dose is prescribed the following steps must be undertaken.

1. Calculate the total dose to be given in mg. Dose = (dose in mg/kg) x weight of child.
2. Determine the volume required to deliver that dose. Volume = Dose (mg) /Concentration (mg/ml)
3. If using an infusion pump. Place loading dose in a paediatric burette attached to infusion pump giving set and deliver over the prescribed period. Infusion pumps deliver at a rate of ml/hr, if the loading dose is to be given over a shorter period the rate will be higher over a shorter period.

   E.g: If delivering 20ml over 1 hour set the pump at 20ml/hr. If delivering 20ml over 20 minutes set the pump at 60ml/hr

   Most infusion pumps will also allow you to enter the "volume to be infused". Use of this function with or without a burette will ensure the correct loading dose is given.

4. If using a syringe driver follow the same process for working out the volume to be given and the rate required to ensure the correct amount is given over the required period. Set the "volume to be infused" to ensure the pump stops when the loading dose has been given.

1.8 Maintenance dose

The infusions prepared using these guidelines provide sufficient amounts to allow for long transport times. There is no need to prepare separate mixtures for loading and maintenance, the same bag or syringe will be used at a slower rate.

1. Calculate the dose in mg/hr. Dose=mg/kg/hr x weight (kg).
2. Calculate the volume to be given per hour. Volume=Dose/Concentration (mg/ml)
3. Set infusion pump or syringe driver at volume to be given per hour.
4. If there is a limit to how long the infusion should run for, set a “volume to be infused limit”.

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Abbreviations

mL = millilitres
mg = milligrams
µg = micrograms
mEq = milliEquivalents
IU = International Units

1 ADRENALINE INFUSION

ADULT-ADRENALINE

A. Syringe Driver — **Adrenaline 3 mg/50 mL (60 μg/mL=0.06mg/mL)**

- Use Adrenaline 1 mg in 1 mL ampoules
- Dilute 3 mg (3 mL) up to 50 mL with Normal Saline or 5% Dextrose
- Commence at 0.05μg/kg/min and adjust rate according to clinical response

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver			
		40kg	***50kg***	***70kg***	***100kg***
	0.05μg/kg/min	2mL/hr	2.5mL/hr	3.5mL/hr	5mL/hr
	0.1μg/kg/min	4mL/hr	5mL/hr	7mL/hr	10mL/hr
	0.2μg/kg/min	8mL/hr	10mL/hr	14mL/hr	20mL/hr
	0.5μg/kg/min	20mL/hr	25mL/hr	35mL/hr	50mL/hr

B. Infusion Pump — **Adrenaline 3 mg/500 mL (6 μg/mL=0.006mg/mL)**

- Use Adrenaline 1 mg in 1 mL ampoules
- Dilute 3 mg (3 mL) up to 500 mL with Normal Saline or 5% Dextrose
- Commence at 0.05μg/kg/min and adjust rate according to clinical response

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump			
		40kg	***50kg***	***70kg***	***100kg***
	0.05μg/kg/min	20mL/hr	25mL/hr	35mL/hr	50mL/hr
	0.1μg/kg/min	40mL/hr	50mL/hr	70mL/hr	100mL/hr
	0.2μg/kg/min	80mL/hr	100mL/hr	140mL/hr	200mL/hr
	0.5μg/kg/min	200mL/hr	250mL/hr	350mL/hr	500mL/hr

Shaded cells - volume approaches or exceeds maintenance fluid requirements either use double strength or syringe driver guide above.

PAEDIATRIC-ADRENALINE

A. Syringe Driver — **Adrenaline 0.15mg/kg/50mL**

- Use Adrenaline 1 mg in 1 mL ampoules
- Dilute 0.15 mg/kg (0.15 mL/kg) up to 50 mL with Normal Saline or 5% Dextrose, see examples below.
- Commence at 0.05 μg/kg/min (1 mL/hr) and adjust rate according to clinical response.

5kg use 0.75mg	10kg use 1.5mg	15kg use 2.25mg	20kg use 3mg	30kg use 4.5mg

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver
	0.05 μg/kg/min	1 mL/hr
	0.1 μg/kg/min	2 mL/hr
	0.2 μg/kg/min	4 mL/hr
	0.5 μg/kg/min	10 mL/hr

B. Infusion Pump — **Adrenaline 0.15 mg/kg/100 mL**

- Use Adrenaline 1 mg in 1 mL ampoules
- Dilute 0.15 mg/kg (0.15 mL/kg) up to 100 mL with Normal Saline or 5% Dextrose
- Commence at 0.05 μg/kg/min (2 mL/hr) and adjust rate according to clinical response

5kg use 0.75mg	10kg use 1.5mg	15kg use 2.25mg	20kg use 3mg	30kg use 4.5mg

100 mL Bag	Dose Range	Rate of Infusion - Infusion Pump
	0.05 μg/kg/min	2 mL/hr
	0.1 μg/kg/min	4 mL/hr
	0.2 μg/kg/min	8 mL/hr
	0.5 μg/kg/min	20 mL/hr

Adrenaline (Continued)

Indications

Management of shock (after hypovolaemia has been excluded), status asthmaticus

Precautions and Side Effects

1. Correct hypovolaemia prior to administration.
2. Administer via a central venous line or into a large peripheral venous line (extreme caution with concentrated solution in a peripheral vein because of the risk of vasoconstriction, ischaemic pain and local necrosis).
3. Monitor ECG and blood pressure closely.
4. Side effects include pulmonary oedema, arrhythmias, tachycardia, myocardial ischaemia, anxiety, palpitations, hypertension and peripheral ischaemia.

Special Notes

1. Infusion should be titrated to achieve desired clinical endpoint e.g. systolic blood pressure 80 - 100 mmHg. Usual range is between 1 - 70 μg/min in adults.
2. Double strength solution may be needed on some occasions.
3. Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

2 AMINOPHYLLINE INFUSION

A. Syringe Driver — **Aminophylline 500 mg / 50 mL (10 mg /mL)**

- Use Aminophylline 250 mg in 10 mL ampoules. Dilute 500 mg (20 mL) up to 50 mL with 5% Dextrose
- If the patient is not already on oral Theophylline give a loading dose of 3 mg/kg over 20 minutes
- Follow this with an infusion of 0.5 mg/kg/hr

50 mL Syringe		Dose Range	Rate of Infusion - Syringe Driver						
			10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	Loading Dose 20 minutes	3mg/kg	3ml	6ml	9ml	12ml	15ml	21ml	30ml
	Maintenance Dose	0.5mg/kg/hr	0.5ml/hr	1ml/hr	1.5ml/hr	2 ml/hr	2.5ml/hr	3.5ml/hr	5ml/hr

B. Infusion Pump — **Aminophylline 500 mg / 500 mL (1 mg /mL)**

- Use Aminophylline 250 mg in 10 mL ampoules.Dilute 500 mg (20 mL) up to 500 mL with 5% Dextrose
- If the patient is not already on oral Theophylline give a loading dose of 3 mg/kg over 20 minutes
- Follow this with an infusion of 0.5 mg/kg/hr

500 mL Bag		Dose Range	Rate of Infusion – Volumetric Pump						
			10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	Loading Dose over 20 min	3mg/kg	30ml	60ml	90ml	120ml	150ml	210ml	300ml
	Maintenance Dose	0.5mg/kg/hr	5ml/hr	10ml/hr	15ml/hr	20ml/hr	25ml/hr	35ml/hr	50ml/hr

Aminophylline (Continued)

Indications

Severe Asthma

Precautions and Side Effects

1. The dose will need to be reduced in the elderly and patients with cirrhosis, congestive cardiac failure, acute fevers, patients receiving Cimetidine, Erythromycin or patients with acute viral infections. The dose may need to be increased in young patients, smokers without chronic obstructive airways disease or regular drinkers without liver disease.
2. Side effects include headache, nausea and vomiting, arrhythmias and convulsions.

Special Notes

Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

3 AMIODARONE INFUSION

A. Syringe Driver — **Amiodarone 600mg / 50mL (12mg/mL)**

- Use Amiodarone 150 mg in 3 mL ampoules. Dilute 600 mg (12 mL) up to 50 mL with 5% Dextrose.
- In emergency give 150 – 300 mg over 1-2 minutes, otherwise ***load*** with 5 mg/kg (max 300mg) over 20 minutes
- Follow this with an infusion of 0.6mg/hr for the next 24 hours (max 1200mg)

50 mL Syringe		Dose Range	Rate of Infusion - Syringe Driver						
			10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	Loading Dose 20 minutes	5mg/kg	4.2mL	8.4mL	12.6mL	16.8mL	21mL	25mL	25mL
	Maintenance Dose	0.6mg/kg/hr	0.5mL/hr	1mL/hr	1.5mL/hr	2mL/hr	2.5mL/hr	3.5mL/hr	4mL/hr

B. Infusion Pump — **Amiodarone 600 mg / 500 mL (1.2 mg /mL)**

- Use Amiodarone 150 mg in 3 mL ampoules. Dilute 600 mg (12 mL) up to 500 mL with 5% Dextrose.
- In emergency give 150 – 300 mg over 1-2 minutes, otherwise ***load*** with 5 mg/kg (max 300kg) over 20 minutes
- Follow this with an infusion of 0.6mg/kg/hr for the next 24 hours (max 1200mg)

500 mL Bag		DoseRange	Rate of Infusion – Volumetric Pump						
			10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	Loading Dose 20 minutes	5mg/kg	42mL	84mL	126mL	168mL	210mL	250mL	250mL
	Maintenance Dose	0.6mg/kg/hr	5ml/hr	10mL/hr	15mL/hr	20mL/hr	25mL/hr	35mL/hr	40mL/hr

Amiodarone (Continued)

Indications

Treatment and prophylaxis of serious arrhythmias refractory to other treatment, including ventricular arrhythmias, atrial tachyarrhythmias and junctional tachycardias.

Precautions and Side Effects

1. Infuse via a large or central vein.
2. Contraindicated in 2nd or 3rd degree AV block (without pacemaker) and in pregnancy.
3. Caution with use in patients on beta-blockers, verapamil or diltiazem, (increased risk of bradyarrhythmias) and in patients with thyroid or hepatic disease.
4. Side effects include nausea and vomiting (especially while loading), headache, dizziness, fatigue, photosensitivity, bradycardia, atrio-ventricular block, torsades de pointes and liver dysfunction.

Special Notes

Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

4 DOBUTAMINE INFUSION

A. Syringe Driver — **Dobutamine 250 mg/50 mL (5mg/mL)**

- Use Dobutamine 250 mg in 5 mL ampoules.
- Dilute 250 mg (5mL) up to 50 mL with 5% Dextrose
- Commence at a low dose (eg 2.5 μg/kg/min)

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	2.5 μg/kg/min	0.3mL/hr	0.6mL/hr	0.9mL/hr	1.2mL/hr	1.5mL/hr	2.1mL/hr	3mL/hr
	5 μg/kg/min	0.6mL/hr	1.2mL/hr	1.8mL/hr	2.4mL/hr	3mL/hr	4.2mL/hr	6mL/hr
	10 μg/kg/min	1.2mL/hr	2.4mL/hr	3.6mL/hr	4.8mL/hr	6mL/hr	8.4mL/hr	12mL/hr
	20 μg/kg/min	2.4mL/hr	4.8mL/hr	7.2mL/hr	9.6mL/hr	12mL/hr	16.8mL/hr	24mL/hr

B. Infusion Pump — **Dobutamine 250 mg/500 mL (0.5mg/mL)**

- Use Dobutamine 250 mg in 5 mL ampoules.
- Dilute 250 mg (5mL) up to 500 mL with 5% Dextrose
- Commence at a low dose (eg 2.5 μg/kg/min)

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	2.5 μg/kg/min	3mL/hr	6mL/hr	9mL/hr	12mL/hr	15mL/hr	21mL/hr	30mL/hr
	5 μg/kg/min	6mL/hr	12mL/hr	18mL/hr	24mL/hr	30mL/hr	42mL/hr	60mL/hr
	10 μg/kg/min	12mL/hr	24mL/hr	36mL/hr	48mL/hr	60mL/hr	84mL/hr	120mL/hr
	20 μg/kg/min	24mL/hr	48mL/hr	72mL/hr	96mL/hr	120mL/hr	168mL/hr	240mL/hr

Dobutamine (Continued)

Indications

Management of shock (where hypovolaemia has been excluded), especially cardiogenic shock.

Precautions and Side Effects

1. Hypovolaemia must be fully corrected prior to administration.
2. Administer via a central venous line or into a large peripheral venous line (extreme caution with concentrated solution in a peripheral vein because of the risk of vasoconstriction, ischaemic pain and local necrosis).
3. Side effects include ectopic beats, tachycardia, hypertension, angina, palpitations, nausea, vomiting, headache and dyspnoea.

Special Notes

1. Not currently stocked by RFDS but stocked at some regional hospitals.
2. Predominantly a β1 stimulant of the myocardium.
3. Infusion should be titrated to achieve desired clinical endpoint e.g. systolic blood pressure 80 - 100 mmHg. Usual dose range is 2.5 - 10 μg/kg/min. Discuss with receiving Intensive Care Unit before use.
4. Should only be administered on a doctor-accompanied flight.

5 DOPAMINE INFUSION

A. Syringe Driver — **Dopamine 200 mg/50 mL (4mg/mL)**

- Use Dopamine 200 mg in 5 mL ampoules
- Dilute 200 mg (5mL) up to 50 mL with Normal Saline
- Commence at a low dose (eg 2.5 μg/kg/min) and adjust rate to obtain desired blood pressure

50 mL Syringe

Dose Range	*10kg*	*20kg*	*30kg*	*40kg*	*50kg*	*70kg*	*100kg*
2.5μg/kg/min	0.4mL/hr	0.8mL/hr	1.1mL/hr	1.5mL/hr	1.9mL/hr	2.6mL/hr	3.8mL/hr
5 μg/kg/min	0.8mL/hr	1.5mL/hr	2.3mL/hr	3mL/hr	3.8mL/hr	5.3mL/hr	7.5mL/hr
10 μg/kg/min	1.5mL/hr	3mL/hr	4.5mL/hr	6mL/hr	7.5mL/hr	10.5mL/hr	15mL/hr
20 μg/kg/min	3mL/hr	6mL/hr	9mL/hr	12mL/hr	15mL/hr	21mL/hr	30mL/hr

B. Infusion Pump — **Dopamine 200 mg/500 mL (0.4mg/mL)**

- Use Dopamine 200 mg in 5 mL ampoules
- Dilute 200 mg (5 mL) up to 500 mL with Normal Saline
- Commence at a low dose (eg 2.5 μg/kg/min) and adjust rate to obtain desired blood pressure

500 mL Bag

Dose Range	*10kg*	*20kg*	*30kg*	*40kg*	*50kg*	*70kg*	*100kg*
2.5 μg/kg/min	4mL/hr	8mL/hr	11mL/hr	15mL/hr	19mL/hr	26mL/hr	38mL/hr
5 μg/kg/min	8mL/hr	15ml/hr	23mL/hr	30mL/hr	38mL/hr	53mL/hr	75mL/hr
10 μg/kg/min	15mL/hr	30mL/hr	45mL/hr	60mL/hr	75mL/hr	105mL/hr	150mL/hr
20 μg/kg/min	30mL/hr	60mL/hr	90mL/hr	120mL/hr	150mL/hr	210mL/hr	300mL/hr

Dopamine (Continued)

Indications

1. Management of shock (where hypovolaemia has been excluded).
2. Improvement in renal blood flow in oliguria.

Precautions and Side Effects

1. Hypovolaemia must be fully corrected prior to administration.
2. Administer via a central venous line or into a large peripheral venous line (extreme caution with concentrated solution in a peripheral vein because of the risk of vasoconstriction, ischaemic pain and local necrosis).
3. Side effects include ectopic beats, tachycardia, angina, palpitations, nausea, vomiting, headache and dyspnoea.

Special Notes

1. Low doses (2.5 - 5 µg/kg/min) are used to improve urinary output. Higher doses (5-10 µg/kg/min) have an additional inotropic effect. Doses greater than 10 µg/kg/min are rarely indicated - if additional effects are required Adrenaline, Noradrenaline or Dobutamine are more effective inotropic agents.
2. Most if not all patients requiring Dopamine will require a medical escort on board.

6 GLYCERYL TRINITRATE INFUSION – ADULT

A. Syringe Driver — **Glyceryl Trinitrate 50 mg/50 mL (1,000 μg/mL)**

- Use Glyceryl Trinitrate 50 mg in 10 mL ampoule
- Dilute 50 mg (10 mL) up to 50 mL with 5% Dextrose
- Commence at 25 - 50 μg/min (1.5 - 3 mL/hr)
- Increase by 1 mL/hr every 5 -10 minutes according to response

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver
	50 μg/min	3 mL/hr
	100 μg/min	6 mL/hr
	150 μg/min	9 mL/hr
	200 μg/min	12 mL/hr

B. Infusion Pump — **Glyceryl Trinitrate 50 mg/100 mL (500 μg/mL)**

- Use Glyceryl Trinitrate 50 mg in 10 mL ampoule
- Dilute 50 mg (10 mL) up to 100 mL with 5% Dextrose, preferably in a glass bottle
- Commence at 25 - 50 μg/min (3 - 6 mL/hr)
- Increase by 2 mL/hr every 5 -10 minutes according to response

100 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump
	50 μg/min	6 mL/hr
	100 μg/min	12mL hr
	150 μg/min	18 mL/hr
	200 μg/min	24 mL/hr

Glyceryl Trinitrate (Continued)

Indications

1. Ischaemic chest pain or unstable angina not adequately relieved by oral, sublingual or transdermal nitrates.
2. Acute left ventricular failure.
   Acute hypertension.

Precautions and Side Effects

1. Up to 80% of active agent may be absorbed by PVC giving sets or IV fluid bags. Absorption increases with increased concentration and increased exposure time to the plastic. Plastic syringes and minimum volume tubing reduce absorption but the dose may still need to be gradually increased. Use clinical response rather than calculated dose to get a dose that is appropriate for the patient.
2. Headache is common. Other CNS effects can include restlessness, dizziness, apprehension, vomiting. CVS side effects include hypotension, reflex tachycardia, palpitations and circulatory collapse.
3. Usual starting dose is 50 μg/min but some patients, particularly those with low blood pressure or pulmonary oedema, may require a lower starting dose.
4. Monitor blood pressure at least 15 minutely until stable. Once a blood pressure response is noted increments should be made more cautiously. Titrate rate against patient's tolerance and therapeutic response rather than a precise dose. Cease infusion if the systolic blood pressure falls below 95 mmHg.
5. Avoid skin contact with concentrated solution when preparing infusion.

Special Notes

The need for a medical escort on board for a patient with a GTN infusion should be critically reviewed.

7 HEPARIN INFUSION – ADULT

A. Syringe Driver	Heparin 25,000 IU/50 mL (500 IU/mL

- Use Heparin 5,000 International Units (IU) in 1 mL ampoule *or* 25,000 IU in 5 mL ampoule
- Give a loading dose of 5,000 IU intravenously
- Dilute 25,000 IU (5 mL) up to 50 mL with Normal Saline or 5% Dextrose
- Infuse at 1,000 IU/hr (2 mL/hr)

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver
	1,000 IU/hr	2 mL/hr

B. Infusion Pump	Heparin 25,000 IU/500 mL (50 IU/mL)

- Use Heparin 5,000 International Units (IU) in 1 mL ampoule *or* 25,000 IU in 5 mL ampoule
- Give a loading dose of 5,000 IU intravenously
- Dilute 25,000 IU (5 mL) up to 500 mL with Normal Saline or 5% Dextrose
- Infuse at 1,000 IU/hr (20 mL/hr)

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump
	1,000 IU/hr	20 mL/hr

Indications

1. Unstable Angina
2. Deep Venous Thrombosis or Pulmonary Embolism

Precautions and Side Effects

Contraindicated in the presence of actual or potential haemorrhagic states e.g. haemophilia, threatened abortion, severe hypertension, active peptic ulcer disease

Special Notes

Modify infusion rate according to APTT (where available)

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8 INSULIN INFUSION

A. Syringe Driver — **Insulin 50 IU/50 mL (1 IU/mL)**

- Use Actrapid Insulin 1,000 IU / 10 mL ampoules (100 IU /mL)
- Dilute 50 IU (0.5 mL) up to 50 mL with Normal Saline
- Commence infusion at 5-10 IU/hr (5-10 mL/hr) (0.1 IU/kg/hr in children if BSL>15mmol/L, 0.05 IU/kg/hr if BSL<15mmol/L)

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	0.1 IU/kg/hr	1mL/hr	2mL/hr	3mL/hr	4mL/hr	5mL/hr	7mL/hr	10mL/hr
	0.05 IU/kg/hr	0.5mL/hr	1mL/hr	1.5mL/hr	2mL/hr	2.5mL/hr	3.5mL/hr	5mL/hr

B. Infusion Pump — **Insulin 50 IU/500 mL (0.1 IU/mL)**

- Use Actrapid Insulin 1,000 IU / 10 mL ampoules (100 IU /mL)
- Dilute 50 IU (0.5 mL) up to 500 mL with Normal Saline
- Commence infusion at 5-10 IU/hr (50-100 mL/hr) (0.1 IU/kg/hr in children if BSL> 15mmol/l, 0.05 IU/kg/hr if BSL<15mmol/L)

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	0.1 IU/kg/hr	10mL/hr	20mL/hr	30mL/hr	40mL/hr	50mL/hr	70mL/hr	100mL/hr
	0.05 IU/kg/hr	5mL/hr	10mL/hr	15mL/hr	20mL/hr	25mL/hr	35mL/hr	50mL/hr

Insulin (Continued)

Indications

1. Diabetic Ketoacidosis
2. Non Ketotic Hyperosmolar Coma

Precautions and Side Effects

Some insulin will be adsorbed by the tubing and so the actual dose of insulin delivered may vary. Gelofusine gives better delivery of insulin than normal saline.

Special Notes

1. In diabetic ketoacidosis the replacement of fluid and electrolyte losses should be given a higher priority than the control of blood glucose per se.
2. In diabetic ketoacidosis, if decrease in BSL is < 4 mmol/l/hr, double the rate of insulin infusion every hour *until* decrease in BSL is > 4 mmol/l/hr *or* until BSL < 15 mmol/l.
3. When decrease in BSL is > 4 mmol/l/hr, maintain insulin infusion until BSL < 15 mmol/l.
4. When BSL < 15 mmol/l decrease rate of infusion to 0.5 - 2 IU/hr with an aim of keeping BSL between 10 - 14 mmol/l. For Diabetic ketoacidosis commence 10% dextrose in addition once BSL less than 14 mmmol/L
5. Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.
6. These concentrations will not be suitable for high- dose insulin euglycaemic therapy to treat calcium channel and β blocker overdose.

9 ISOPRENALINE INFUSION

A. Syringe Driver — Isoprenaline 1 mg/50 mL (20 μg/mL)

- Use Isoprenaline hydrochloride 1 mg in 5 mL ampoules. Dilute 1 mg (5 mL) up to 50 mL with 5% Dextrose
- Give 20 μg (1 mL) (ADULTS ONLY), repeated according to clinical response, followed by an infusion at 0.05 -1 μg/kg/min titrate to HR and blood pressure.

50 mL Syringe

Dose Range	*10kg*	*20kg*	*30kg*	*40kg*	*50kg*	*70kg*	*100kg*
0.02μg/kg/min	0.6mL/hr	1.2mL/hr	1.8mL/hr	2.4mL/hr	3mL/hr	4.2mL/hr	6mL/hr
0.05μg/kg/min	1.5mL/hr	3mL/hr	4.5mL/hr	6mL/hr	7.5mL/hr	10.5mL/hr	15mL/hr
0.07μg/kg/min	2.1mL/hr	4.2mL/hr	6.3mL/hr	8.4mL/hr	10.5mL/hr	14.7mL/hr	21mL/hr
0.1μg/kg/min	3mL/hr	6mL/hr	9mL/hr	12mL/hr	15mL/hr	21mL/hr	30mL/hr
0.5μg/kg/min	15mL/hr	30mL/hr	45mL/hr	60mL/hr	75mL/hr	105mL/hr	150mL/hr

B. Infusion Pump — Isoprenaline 1 mg/500 mL (2 μg/mL)

- Use Isoprenaline hydrochloride 1 mg in 5 mL ampoules. Dilute 1 mg (5 mL) up to 500 mL with 5% Dextrose
- Give 20 μg (10 mL)(ADULTS ONLY), repeated according to clinical response, followed by an infusion at 0.05-1 μg/kg/min titrate to HR and blood pressure.

500 mL Bag

Dose Range	*10kg*	*20kg*	*30kg*	*40kg*	*50kg*	*70kg*	*100kg*
0.02μg/kg/min	6mL/hr	12mL/hr	18mL/hr	24mL/hr	30mL/hr	42mL/hr	60mL/hr
0.05μg/kg/min	15mL/hr	30mL/hr	45mL/hr	60mL/hr	75mL/hr	105mL/hr	150mL/hr
0.07μg/kg/min	21mL/hr	42mL/hr	63mL/hr	84mL/hr	105mL/hr	147mL/hr	210mL/hr
0.1μg/kg/min	30mL/hr	60mL/hr	90mL/hr	120mL/hr	150mL/hr	210mL/hr	300mL/hr
0.5μg/kg/min	150mL/hr	300mL/hr	450mL/hr	600mL/hr	750mL/hr	1050mL/hr	1500mL/hr

Isoprenaline (Continued)

Indications

Bradycardia with poor perfusion. Most commonly complete heart block.

Precautions and Side Effects

1. Side effects include palpitations, headache, flushing of the skin, angina, nausea, vomiting, tremor, dizziness, weakness and sweating.
2. If heart rate exceeds 80 *or* patient develops chest pain *or* other arrhythmias decrease dose or temporarily discontinue infusion.
3. Administer with caution in the elderly, diabetic, hyperthyroid, patients with ischaemic heart disease or concurrently with other inotropes.
4. Administer via a central venous line or into a large peripheral venous line (extreme caution with concentrated solution in a peripheral vein because of the risk of vasoconstriction, ischaemic pain and local necrosis).

Special Notes

1. Required response usually achieved at < 3 μg/min, though may increase up to 20 μg/min if necessary to obtain required response
2. Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

10 KETAMINE INFUSION

A. Syringe Driver — **Ketamine 200mg/50 mL (4mg/mL)**

- Use Ketamine 200mg in 2mL ampoules, dilute 200mg (2mL) up to 50mL with normal saline
- Loading dose / single bolus 0.25-1mg/kg (0.0625mL/kg-0.25mL/kg of diluted infusion) NB: 1-2mg/kg is induction of anaesthesia dose.
- Titrate infusion between 0.25mg/kg/hr up to 1mg/kg/hr (0.0625mL/kg/hr-0.25mL/kg/hr)

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	0.25mg/kg/hr	0.625mL/hr	1.25mL/hr	1.875mL/hr	2.5mL/hr	3.125mL/hr	4.375mL/hr	6.25mL/hr
	0.5mg/kg/hr	1.25mL/hr	2.5mL/hr	3.75mL/hr	5mL/hr	6.25mL/hr	8.75mL/hr	12.5mL/hr
	1.0mg/kg/hr	2.5mL/hr	5mL/hr	7.5mL/hr	10mL/hr	12.5mL/hr	17.5mL/hr	25mL/hr

B. Infusion Pump — **Ketamine 200mg/500mL (0.4mg/mL)**

- Use Ketamine 200mg in 2mL ampoules, dilute 200mg (2mL) up to 500mL with normal saline
- Loading dose / single bolus 0.25-1mg/kg (0.625mL/kg-2.5mL/kg of diluted infusion) NB: 1-2mg/kg is induction of anaesthesia dose.
- Titrate infusion between 0.25mg/kg/hr up to 1mg/kg/hr (0.625mL/kg/hr-2.5mL/kg/hr)

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	0.25mg/kg/hr	6.25mL/hr	12.5mL/hr	18.75mL/hr	25mL/hr	31.25mL/hr	43.75mL/hr	62.5mL/hr
	0.5mg/kg/hr	12.5mL/hr	25mL/hr	37.5mL/hr	50mL/hr	62.5mL/hr	87.5mL/hr	125mL/hr
	1.0mg/kg/hr	25mL/hr	50mL/hr	75mL/hr	100mL/hr	125mL/hr	175mL/hr	250mL/hr

Ketamine (Continued)

Indications for Infusion

1. Acute sedation of violent or disturbed (inc. psychiatric) patients, this is an off-licence and novel use of Ketamine
2. Ongoing conscious sedation of patients (inc. children) or maintenance of general anaesthesia in ventilated patients
3. Sedation in the setting of ventilation with status asthmaticus
4. May also be used at lower doses as analgesic for severe pain (opioid sparing) at doctor's discretion

Precautions and Side Effects

1. Can cause hypertension +/ or tachycardia (hence may be anaesthetic drug of choice in shocked patients)
2. Can cause abnormal muscle movements or jerking of limbs
3. Sudden cessation can cause emergence phenomena (agitation, hallucinations, confusion) which may aggravate psychosis. Small doses of benzodiazepines may ameliorate this effect.
4. Use on doctor accompanied flights only.

Precautions and Side Effects

1. At doses required for conscious sedation (eg Sedation of psychiatric patients) airway reflexes should remain intact ***but*** at higher doses airway reflexes will be lost (as with other anaesthetic drugs)

References

1. Ketalar (Ketamine Hcl) Product Information, Hospira Australia 2005
2. Le Cong M, Gynther B, Hunter E, et al. Ketamine sedation for patients with acute agitation and psychiatric illness requiring aeromedical retrieval. Emerg Med J 2012; 29: 335-337.
3. Toxbase. http://www.toxbase.org
4. Personal communication with Dr B Wilkinson (Medical Officer) RFDS Western Operations 2014

11 LIGNOCAINE INFUSION-ADULT

A. Volumetric Pump			Lignocaine 2 gm/500 mL (4 mg/mL
• Use Lignocaine hydrochloride 2 g in 20 mL ampoules (10% solution) – not carried by RFDS source from hospital. • Dilute 2 g (20 mL) in 500 mL of 5% Dextrose • Loading dose of 1 mg/kg slowly over 1-2 minutes if Lignocaine not given previously (use Minijet, *or* 10 mL 1% plain Lignocaine *or* 25 mL of 2gm/500 mL solution) • Commence infusion at 4 mg/min for 1 hour, then 2 mg/min for the next 2 hours then 1 mg/min maintenance			
500 mL Bag		**Dose Range**	**Rate of Infusion – Volumetric Pump**
	1st hour	4 mg/min	60 mL/hr
	next 2 hours	2 mg/min	30 mL/hr
	maintenance	1 mg/min	15 mL/hr

Indications

Ventricular tachycardia where the patient is haemodynamically compromised or if significant symptoms are present or if the tachycardia is persistent (e.g. greater than 30 seconds).

Precautions and Side Effects

1. Hypotension
2. Moderate overdose results in dizziness and drowsiness.
3. Larger overdose results in CNS stimulation (agitation, convulsions) or CNS depression (respiratory depression).

Special Notes

Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

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12 MAGNESIUM SULPHATE INFUSION - PRE-ECLAMPSIA / FOETAL NEUROPROTECTION

A. Syringe Driver — **Magnesium Sulphate 9.88 g [40 mmol] / 20mL(500mg/mL)**

- Use 4 ampoules of Magnesium Sulphate (2.47 g [10 mmol] per 5 mL ampoule)
  (*NB dose and rate are different for treatment of pre-term labour, see special notes*)
- Use 4 ampoules (9.88 g) of Magnesium Sulphate undiluted (20 mL)
- Give a loading dose of approx 4 g (8 mL) over 20 min (6g pre-term labour)
- Follow the loading dose with an infusion of 1 g/hr (2mL/hr) (2g/hr pre term labour)
- If further seizures occur, give 2 g (4 mL) over 5 minutes (48 mL/hr for 5 minutes

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver
Loading Dose (20 min)	4 g (8 mL)	24 mL/hr for 20 min only
Maintenance Dose	1 g/hr	2 mL/hr
If further seizures, give 2 g over 5 min	2 g (4 mL)	48 mL/hr for 5 min only

B. Infusion Pump — **Magnesium Sulphate 9.88 g [40 mmol] /120 mL (82mg/mL)**

- Use 4 ampoules of Magnesium Sulphate (2.47 g [10 mmol] per 5 mL ampoule)
  (NB *dose and rate are different for treatment of pre-term labour, see special notes*)
- Add to a 100 mL bag Normal Saline to equal 120 mL
- Give a loading dose of approx 4 g (50 mL) over 20 min (6g pre term labour)
- Follow the loading dose with an infusion of 1 g/hr (12 mL/hr) (2g/hr pre term labour)
- If further seizures occur, give 2 g (25 mL) over 5 minutes (300 mL/hr for 5 minutes)

120mL Bag	Dose Range	Rate of Infusion – Volumetric Pump
Loading Dose (20 min)	4 g (50 mL)	150 mL/hr for 20 min only
Maintenance Dose	1 g/hr	12 mL/hr
If further seizures, give 2 g over 5 min	2 g (25 mL)	300 mL/hr for 5 min only

Magnesium - Obstetric (Continued)

Indications

1. Prevention of Eclampsia
2. There is no evidence for its use in suppression of labour.

Precautions and Side Effects

1. Urine output should be maintained at > 30 mL/hr. Caution with fluid administration should be exercised to avoid fluid overload.
2. Magnesium toxicity is suggested by:
    - The disappearance of the patella reflex (check hourly) this **mandates cessation** of the infusion. Serum magnesium levels should be done when possible.
    - Respiratory rate, should ideally be maintained at >16/min and the infusion should be **ceased** if the rate drops below 12/min.
    - Bradycardia (HR<60/min) may result from complete heart block.
3. Contraindicated in the presence of myasthenia gravis and heart block, use with extreme caution with impaired renal function.
4. Visual disturbance is common with magnesium infusion, most commonly blurred vision, diplopia and ptosis. These effects resolve promptly with cessation of infusion.
5. Treatment of overdose
    - Cease infusion.
    - Intravenous administration of 5-10 mEq of 10% Calcium Gluconate (10 - 20 mL) to reverse respiratory depression or heart block.

Special Notes

1. Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.
2. Magnesium may be used for foetal neuroprotection for gestations less than 30 weeks where delivery is expected in the next four hours. It will generally not need to be routinely given in flight.
    - Give a loading dose of 4g (8mL of undiluted solution or 50mL of above dilute (0.08g/mL) solution) over 20min.
    - Commence infusion of 1g/hr of undiluted solution or 12.5mL/hr of above diluted solution (0.08g/mL)

13 MAGNESIUM SULPHATE – CARDIAC

A. Syringe Driver **(12 Magnesium Sulphate 9.88 g [40 mmol] / 20mL (2mmol/mL)(0.5 g/mL)**

- For Arrhythmias, use Magnesium Sulphate (2.47 g [10 mmol] per 5 mL ampoule). Use 2 ampoules (20mmol) of Magnesium Sulphate undiluted (10 mL)
- Give a loading dose of 0.1mmol/kg (max 2g =8mmol=4mL) over 10 min. Follow up with maintenance dose over 4 hours.
- For cardiac arrest with shockable rhythm and/or hypokalemia give loading dose stat.

50 mL Syringe		Dose	*10kg*	*20kg*	*30kg*	*40kg*	*50kg*	*70kg*	*100kg*
	Loading Dose over ***10 min***	0.1mmol/kg	0.5mL	1mL	1.5mL	2mL	2.5mL	3.5mL	5mL
	Maintenance over ***4 hours***	0.3mmol/kg	1.5mL	3mL	4.5mL	6mL	10.5mL	12mL	15mL

B. Infusion Pump **Magnesium Sulphate 2.47g [10 mmol] /100 mL (0.1mmol/mL)(0.025 g/mL)**

- For Arrhythmias, use Magnesium Sulphate (2.47 g [10 mmol] per 5 mL ampoule). Remove 5mL from a 100 mL bag Normal Saline then add 1 ampoule.(Makes 0.025g/mL)
- Give a loading dose of approx 0.1mmol/kg over 10 min. Follow up with maintenance dose over 4 hours.
- For cardiac arrest give undiluted as above.

100 mL Bag		Dose	*10kg*	*20kg*	*30kg*	*40kg*	*50kg*	*70kg*	*100kg*
	Loading Dose over ***10 min***	0.1mmol/kg	10mL	20mL	30mL	40mL	50mL	70mL	100mL
	Maintenance over ***4 hours***	0.3mmol/kg	30mL	60mL	90mL	120mL	150mL	240mL	300mL

Magnesium – cardiac (Continued)

Indications

Cardiac arrhythmia responsive to magnesium, or as a result of hypomagnesaemia or hypokalemia. Eg, Torsades de Pointes, Ventricular tachycardia, arrhythmia associated with prolonged QTc (eg TCA overdose)

Contraindications

1. Heart block
2. Renal failure, monitor level or clinical evidence of hypermagnesaemia.
3. Maintain cardiac monitoring, monitor reflexes and respiratory rate.
4. Have Calcium gluconate available to treat hypermagnesaemia.

Special Notes

Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

14 MAGNESIUM SULPHATE – ASTHMA

A. Syringe Driver — **Magnesium Sulphate 9.88 g [40 mmol] / 20mL(2mmol/mL)(500mg/mL)**

- For Asthma, use 4 ampoules of Magnesium Sulphate (2.47 g [10 mmol] per 5 mL ampoule). Use 4 ampoules (9.88 g) of Magnesium Sulphate undiluted (20 mL)
- Give a loading dose of approx 50mg/kg over 20 min. Follow the loading dose with an infusion of 30mg/kg/hr

50 mL Syringe		Dose Range	Rate of Infusion - Syringe Driver						
			10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	Loading Dose (20 min)	50mg/kg	1mL	2mL	3mL	4mL	5mL	7mL	10mL
	Maintenance Dose	30mg/kg/hr	0.6mL/hr	1.2mL/hr	1.8mL/hr	2.4mL/hr	3mL/hr	4.2mL/hr	6mL/hr

B. Infusion Pump — **Magnesium Sulphate 9.88 g [40 mmol] /100 mL (0.4mmol/mL)(100mg/mL)**

- For Asthma, use 4 ampoules of Magnesium Sulphate (2.47 g [10 mmol] per 5 mL ampoule). Remove 20mL from a 100 mL bag Normal Saline then add 20mL Magnesium Sulphate
- Give a loading dose of 50mg/kg over 20min. Follow the loading dose with an infusion of 30mg/kg/hr

100 mL Bag		Dose Range	Rate of Infusion – Volumetric Pump						
			10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	Loading Dose (20 min)	50mg/kg	5ml	10ml	15ml	20ml	25mL	35mL	50mL
	Maintenance Dose	30mg/kg/hr	3mL/hr	6mL/hr	9mL/hr	12mL/hr	15mL/hr	21mL/hr	30mL/hr

Magnesium – asthma (Continued)

Indications

Acute severe asthma unresponsive to β agonists.

Precautions and contraindications

1. Heart block.
2. Monitor rhythm, respiratory rate, reflexes.
3. Not compatible in same line as salbutamol, ketamine, aminophylline.

Side effects

1. Arrhythmia
2. Respiratory depression / paralysis.

Special notes

Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

15 METARAMINOL

ADULT

A. Syringe Driver	Metaraminol 20mg/50mL (0.4mg/mL)

- Use two 10mg ampoules dilute up to 50mL in 5% Dextrose.
- Use boluses of 0.01mg/kg IV as required for transient hypotension post induction or whilst establishing infusions of other pressors.
- Titrate to desired blood pressure.

	Dose Range	Rate of Infusion - Syringe Driver
50 mL Syringe	0.05µg/kg/min	0.5mL/hr
	0.1µg/kg/min	1mL/hr
	0.2µg/kg/min	2mL/hr
	0.3µg/kg/min	3mL/hr
	0.4µg/kg/min	4mL/hr
	0.5µg/kg/min	5mL/hr

PAEDIATRIC

A. Syringe Driver

- Use 0.15mg/kg diluted up to 50mL in 5% Dextrose.
- Use boluses of 0.01mg/kg IV as required for transient hypotension post induction or whilst establishing vasopressor infusions.
- Titrate to desired blood pressure.

5kg use 0.75mg	10kg use 1.5mg	15kg use 2.25mg	20kg use 3mg	30kg use 4.5mg

	Dose Range	Rate of Infusion - Syringe Driver
50 mL Syringe	0.05 µg/kg/min	1mL/hr
	0.1 µg/kg/min	2mL/hr
	0.2 µg/kg/min	4mL/hr
	0.5 µg/kg/min	10mL/hr

Metaraminol (Continued)

Indications

Peripheral alpha agonist primarily used for correction of transient hypotension as a result of anaesthesia but may also be used as a pressor in the setting of sepsis and other distributive forms of shock eg neurogenic.

Contraindications

1. Sulfite sensitivity
2. Halothane anaesthesia
3. Correct hypovolaemia
4. Interacts with Digoxin, MOAI's and TCA's

Special notes

Can generally be given safely via peripheral lines though extravasation may cause local reaction.

16 MORPHINE INFUSION

A. Syringe Driver — **Morphine 30 mg/ 30mL (1 mg/mL)**

- Use Morphine 15 mg/mL *or* Morphine 10 mg/mL. Dilute 30 mg Morphine up to 30 mL with Normal Saline (or 45 mg to 45 mL)
- Administer a dose of 0.025-0.05 mg/kg bolus as loading or top up for breakthrough pain.
- Commence infusion at 20-80µg/kg/hr and adjust according to clinical response

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	20µg/kg/hr	0.2mL/hr	0.4mL/hr	0.6mL/hr	0.8mL/hr	1mL/hr	1.4mL/hr	2mL/hr
	40µg/kg/hr	0.4mL/hr	0.8mL/hr	1.2mL/hr	1.6mL/hr	2mL/hr	2.8mL/hr	4mL/hr
	50µg/kg/hr	0.5mL/hr	1mL/hr	1.5mL/hr	2mL/hr	2.5mL/hr	3.5mL/hr	5mL/hr

B. Infusion Pump — **Morphine 50 mg/ 500mL (0.1mg/mL)**

- Use Morphine 15 mg/mL *or* Morphine 10 mg/mL. Dilute 50 mg Morphine up to 500 mL with Normal Saline. Note: Expect wastage if using 15mg amps.
- Administer a dose of 0.025-0.05mg/kg bolus as loading or top up for break through pain.
- Commence infusion at 20-80µg/kg/hr and adjust according to clinical response

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	20µg/kg/hr	2mL/hr	4mL/hr	6mL/hr	8mL/hr	10mL/hr	14mL/hr	20mL/hr
	40µg/kg/hr	4mL/hr	8mL/hr	12mL/hr	16mL/hr	20mL/hr	28mL/hr	40mL/hr
	50µg/kg/hr	5mL/hr	10mL/hr	15mL/hr	20mL/hr	25mL/hr	35mL/hr	50mL/hr

Morphine (Continued)

Indications

Analgesia

Precautions and Side Effects

Side effects include nausea and vomiting, hypotension, CNS and respiratory depression.

Special Notes

1. Adjust rate according to clinical response.
2. Smaller volume solutions (e.g. 30mg made up to 30 mL) should be used for shorter flights.
3. Morphine infusion is preferable to Pethidine infusion because of the risk of nor-Pethidine induced fitting with large doses of Pethidine.
4. Treat nausea or vomiting with Prochlorperazine (Adults Only) 12.5 mg IV or IM 6/24 or Metoclopramide(Adults Only)10 mg IV or IM 6/24 or Ondansetron 0.1-0.2 mg/kg IV or Buccal (max 8mg).
5. If respiratory rate < 8 breaths / min, excessive sedation or symptomatic hypotension develops cease infusion and contact duty RFDS Medical Officer.
6. Overdose can be reversed with Naloxone 0.01mg/kg IV (max 0.4 mg), repeated if necessary.

17 MORPHINE & MIDAZOLAM INFUSION

A. Syringe Driver — **Morphine 30 mg + Midazolam 30 mg/30 mL (1 mg Morphine : 1 mg Midazolam :mL)**

- Use Morphine 15 mg/mL *or* Morphine 10 mg/mL and Midazolam 15 mg/3 mL.
- Dilute 30 mg Morphine plus 30 mg Midazolam up to 30 mL with Normal Saline (*or* 45mg + 45mg to 45 mL *or* 50mg + 50mg to 50 mL)
- Administer a dose of 0.025-0.05mL/kg as load or top-up bolus. Commence infusion at 0.02-0.08mL/kg/hr (20-80µg/kg/hr)

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	20µg:20µg/kg/hr	0.2mL/hr	0.4mL/hr	0.6mL/hr	0.8mL/hr	1mL/hr	1.4mL/hr	2mL/hr
	40µg:40µg/kg/hr	0.4mL/hr	0.8mL/hr	1.2mL/hr	1.6mL/hr	2mL/hr	2.4mL/hr	4mL/hr
	60µg:60µ/kg/hr	0.6mL/hr	1.2mL/hr	1.8mL/hr	2.4mL/hr	3mL/hr	4.2mL/hr	6mL/hr

B. Infusion Pump — **Morphine 50 mg + Midazolam 50 mg/500 mL (0.1 mg Morphine : 0.1 mg Midazolam :mL)**

- Use Morphine 15mg/mL *or* Morphine 10mg/mL and Midazolam 15mg/3 mL
- Dilute 50mg Morphine plus 50mg Midazolam up to 500 mL with Normal Saline. Note: expect wastage if using 15mg amps.
- Administer a dose of 0.25-0.5mL/kg as load or top-up bolus. Commence infusion at 0.2-0.8mL/kg/hr (20-80µg/kg/hr)

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	20µg:20µg/kg/hr	2mL/hr	4mL/hr	6mL/hr	8mL/hr	10mL/hr	14mL/hr	20mL/hr
	40µg:40µg/kg/hr	4mL/hr	8mL/hr	12mL/hr	16mL/hr	20mL/hr	24mL/hr	40mL/hr
	60µg:60µ/kg/hr	6mL/hr	12mL/hr	18mL/hr	24mL/hr	30mL/hr	42mL/hr	60mL/hr

Morphine and Midazolam (Continued)

Indications

Sedation

Precautions and Side Effects

Side effects include hypotension, CNS and respiratory depression

Special Notes

1. Adjust rate according to clinical response.
2. Smaller volume solutions (e.g. 30mg + 30mg made up to 30 mL) should be used for shorter flights.
3. Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

18 NORADRENALINE INFUSION

ADULT-NORADRENALINE

A. Syringe Driver — **Noradrenaline 4 mg/50 mL (80 μg/mL)**

- Use Noradrenaline 1:1,000 (2 mg/2mL) ampoules
- Dilute 4 mg (4 mL) up to 50 mL with 5% Dextrose
- Commence at 1 μg/min (0.75 mL/hr) and adjust rate according to clinical response

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver
	1 μg/min	0.75 mL/hr
	5 μg/min	3.75 mL/hr
	10 μg/min	7.5 mL/hr
	20 μg/min	15 mL/hr

B. Infusion Pump — **Noradrenaline 4 mg/500 mL (8 μg/mL)**

- Use Noradrenaline 1:1,000 (2 mg/2mL) ampoules
- Dilute 4 mg (4 mL) up to 500 mL with 5% Dextrose
- Commence at 1 μg/min (7.5 mL/hr) and adjust rate according to clinical response

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump
	1 μg/min	7.5 mL/hr
	5 μg/min	37.5 mL/hr
	10 μg/min	75 mL/hr
	20 μg/min	150 mL/hr

PAEDIATRIC-NORADRENALINE

A. Syringe Driver				**Noradrenaline 0.15 mg/kg/50 mL**
• Use Nordrenaline 2 mg in 2 mL ampoules • Dilute 0.15 mg/kg (0.15 mL/kg) up to 50 mL with 5% Dextrose, see examples below. • Commence at 0.05 μg/kg/min (1 mL/hr) and adjust rate according to clinical response.				
5kg use 0.75mg	***10kg*** use 1.5mg	***15kg*** use 2.25mg	***20kg*** use 3mg	***30kg*** use 4.5mg
50 mL Syringe	**Dose Range**		**Rate of Infusion - Syringe Driver**	
	0.05 μg/kg/min		1 mL/hr	
	0.1 μg/kg/min		2 mL/hr	
	0.2 μg/kg/min		4 mL/hr	
	0.5 μg/kg/min		10 mL/hr	

B. Infusion Pump				**Noradrenaline 0.15 mg/kg/100 mL**
• Use Nordrenaline 1 mg in 1 mL ampoules • Dilute 0.15 mg/kg (0.15 mL/kg) up to 100 mL with 5% Dextrose • Commence at 0.05 μg/kg/min (2 mL/hr) and adjust rate according to clinical response				
5kg (use 0.75mg	***10kg*** use 1.5mg	***15kg*** use 2.25mg	***20kg*** use 3mg	***30kg*** use 4.5mg
100 mL Bag	**Dose Range**		**Rate of Infusion - Infusion Pump**	
	0.05 μg/kg/min		2 mL/hr	
	0.1 μg/kg/min		4 mL/hr	
	0.5 μg/kg/min		20 mL/hr	
	1 μg/kg/min		40 mL/hr	

Noradrenaline (Continued)

Indications

Management of shock (after hypovolaemia has been excluded)

Precautions and Side Effects

1. Correct hypovolaemia prior to administration.
2. Administer via a central venous line or into a large peripheral venous line (extreme caution with concentrated solution in a peripheral vein because of the risk of vasoconstriction, ischaemic pain and local necrosis).
3. Monitor ECG and blood pressure closely.
4. Side effects include pulmonary oedema, arrhythmias, tachycardia, myocardial ischaemia, anxiety, palpitations, hypertension and peripheral ischaemia.
5. Incompatible with Normal Saline.

Special Notes

1. Infusion should be titrated to achieve desired clinical endpoint e.g. systolic blood pressure 80 - 100 mmHg (Adults). Usual dose is between 1 - 70 μg/min. Discuss with receiving Intensive Care Unit before use.
2. Should only be administered on a doctor-accompanied flight.

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19 OCTREOTIDE INFUSION – ADULT

A. Syringe Driver		Octreotide 0.1mg/50mL(2µg/mL)
• Use Octreotide 0.1 mg/mL in 1 mL ampoules • Dilute 0.1 mg (1 mL) up to 50 mL with Normal Saline or 5% Dextrose • Commence at 25 µg/hr (12.5 mL/hr)		
50 mL Syringe	**Dose Range**	**Rate of Infusion - Syringe Driver**
	25 µg/hr	12.5 mL/hr
	50 µg/hr	25 mL/hr
B. Infusion Pump		**Octreotide 0.1 mg/500mL(0.2 µg/mL)**
• Use Octreotide 0.1 mg/mL in 1 mL ampoules • Dilute 0.1 mg (1mL) up to 500 mL with Normal Saline or 5% Dextrose • Commence at 25 µg/hr (125 mL/hr)		
500 mL Bag	**Dose Range**	**Rate of Infusion – Volumetric Pump**
	25 µg/hr	125 mL/hr
	50 µg/hr	250 mL/hr

Octreotide (Continued)

Indications

Control of acute variceal bleeding. Has largely been replaced by Terlipressin, see Clinical Guideline 4.2.

Precautions and Side Effects

1. Blood glucose should be monitored regularly during administration.
2. At low doses, (less than 100 micrograms), there are generally no side effects. Greater doses may cause nausea, delayed abdominal pain and diarrhoea.
3. A loading bolus of 25-50 micrograms may be given.
4. Increase infusion rate to 50 micrograms per hour if bleeding is not adequately controlled.
5. Check ampoule concentration carefully. May be supplied at 0.05 mg/mL, 0.1 mg/mL or 0.5 mg/mL.

Special Notes

1. Octreotide (Sandostatin) is an analogue of somatostatin which inhibits intestinal motility, secretion of gastric acid, pepsin and intrinsic factor, splanchnic blood flow and bile flow. It also blocks secretion of growth hormone, thyroid stimulating hormone, insulin, glucagon, gastrin, VIP and secretin. Half-life is approximately 90 minutes.
2. Clinical uses include acromegaly, carcinoid tumours, VIPoma, Zollinger-Ellison syndrome, glucagonoma and dumping syndrome. It is widely used for variceal bleeding, although not formally approved by the TGA.
3. Studies have shown less morbidity with Octreotide than balloon tamponade in variceal bleeding.

Reference

Drug Sub-committee, Royal Perth Hospital. Indications for Octreotide. Revised 1998.

20 PANTOPRAZOLE INFUSION - ADULT

A. Syringe Driver		Pantoprazole 40mg/50mL (0.8mg/mL)
• Administer 80mg loading dose, see Special Notes below. • Use Pantoprazole powder for reconstitution, 1x 40mg ampoule. • Make up to 50 mL with Normal Saline or 5% Dextrose		
50 mL Syringe	**Dose Range**	**Rate of Infusion - Syringe Driver**
	Maintenance infusion 8mg/hr	10mL/hr
B. Infusion Pump		**Pantoprazole 40mg/100mL (0.4mg/mL)**
• Administer 80mg loading dose, see Special Notes below. • Use Pantoprazole powder for reconstitution, 1x40mg ampoule. • Make up to 100mL with Normal Saline or 5% Dextrose		
100 mL Bag	**Dose Range**	**Rate of Infusion – Volumetric Pump**
	Maintenance infusion 8mg/hr	20mL/hr

Pantoprazole (Continued)

Indications for infusion

Treatment of suspected bleeding peptic ulcer

Precautions and Side Effects

Known allergy to pantoprazole

Non-specific symptoms including headache, nausea, metallic taste

Special Notes

1. Loading dose: 80mg in 100mL over 15-30 minutes.
2. Pantoprazole requires a dedicated i.v. line.
3. Ensure that 80mg bolus dose is given, but ongoing infusion should not take precedence over resuscitation if line is required for fluids or blood products.

References

1. Pantoprazole MaxRx Injection: Drug insert, Max Pharma Pty Ltd, 2012.
2. Fremantle Hospital Upper GI Bleed Guidelines, 2012

21 PROPOFOL INFUSION

A. Syringe Driver **Propofol 500mg/50mL (10mg/mL)**

- Use Propofol 500mg in 50 mL glass bottle.
- DO NOT DILUTE
- Contents should be drawn up in 50mL syringe for syringe driver.
- Commence at 0.5mg/kg/hr and titrate up as required.
- Usual dose range 1 - 12 mg/kg/hr (Paeds max 4mg/kg/hr)

	Dose Range#	Rate of Infusion - Syringe Driver						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
50 mL Syringe	0.5 mg/kg/hr	0.5mL/hr	1mL/hr	1.5mL/hr	2 mL/hr	3 mL/hr	3.5 mL/hr	5 mL/hr
	1 mg/kg/hr	1mL/hr	2mL/hr	3mL/hr	4 mL/hr	6 mL/hr	7 mL/hr	10 mL/hr
	2 mg/kg/hr	1.5mL/hr	3mL/hr	6mL/hr	8 mL/hr	12 mL/hr	14 mL/hr	20 mL/hr
	3 mg/kg/hr	2mL/hr	4mL/hr	9mL/hr	12 mL/hr	18 mL/hr	21 mL/hr	30 mL/hr
	6 mg/kg/hr*	-	-	-	24 mL/hr*	36 mL/hr*	42 mL/hr*	60 mL/ hr*
	12 mg/kg/hr*	-	-	-	48 mL/hr*	72 mL/hr*	84 mL/hr*	120 mL/ hr*

* *Beware of hypotension at these doses.*

\# *See special notes regarding reducing dose at two hours.*

Propofol (Continued)

Indications for infusion

Sedation of ventilated patients especially where rapid awakening and extubation is desirable once tertiary hospital is reached. (For example, ventilated psychiatric patients or overdose cases).

May be used in management of status epilepticus.

Precautions and Side Effects

Side-effects include hypotension, local pain at site of infusion (can be avoided by mixing 2 mL of 1% lignocaine with propofol prior to infusion) and allergic reactions.

Special Notes

1. Propofol is a short-acting intravenous anaesthetic agent with onset and offset of action < 5 minutes. Initial (distribution) half-life of 2-4 mins, is followed by elimination half-life of 30-60 mins.
2. Long term administration is associated with toxicity, it is recommended to reduce the dose to two thirds after 2 hours.[#]
3. Propofol is compatible with 0.9% (normal) saline or 5% dextrose.
4. Only 4 vials of Propofol are carried in the drug box. Additional may be needed if planning to use in larger patient or on a long flight.
5. Monitor BP carefully and use with caution in hypovolaemic or hypotensive patients.
6. Propofol contains egg protein and should not be given to patients with egg allergies.
7. Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

References

1. Propofol Emulsion: Product information, Mayne Pharma Pty Ltd Melbourne, 2003.
2. Society of Critical Care Medicine. Diprivan (Propofol) Injectable Emulsion. AstraZeneca. 2003.
3. S.M. Green. Propofol in Emergency Medicine. Further Evidence of Safety. (Editorial) Emergency Medicine Australiasia. Oct 2007 Vol 19 No. 5 pp389-393 Blackwell (Pub).

22 SALBUTAMOL INFUSION – OBSTETRIC

A. Syringe Driver — **Salbutamol 5 mg/100 mL (50 μg/mL)**

- Use Salbutamol 5 mg in 5 mL ampoule. Dilute 5 mg (5 mL) up to 100 mL with Normal Saline (bag) draw up 50mL in syringe.
- Commence infusion at 10 μg/min (12 mL/hr)
- Increase in increments of 10 μg/min (12 mL/hr) at 30 minute intervals until contractions cease or limits (as listed below) are reached

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver
	10 μg/min	12 mL/hr
	20 μg/min	24 mL/hr
	30 μg/min	36 mL/hr
	40 μg/min	48 mL/hr
	50 μg/min	60 mL/hr

B. Infusion Pump — **Salbutamol 5 mg/500 mL (10 μg/mL)**

- Use Salbutamol 5 mg in 5 mL ampoule. Dilute 5 mg (5 mL) up to 500 mL with Normal Saline
- Commence infusion at 10 μg/min (60 mL/hr)
- Increase in increments of 10 μg/min (60 mL/hr) at 30 min intervals until contractions cease or limits (as listed below) are reached

500 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump
	10 μg/min	60 mL/hr
	20 μg/min	120 mL/hr
	30 μg/min	180 mL/hr
	If rate exceeds 180 mL/hr double the concentration of Salbutamol (10 mg/ 500 mL, 20 μg/mL) and halve rates accordingly	
	40 μg/min	120 mL/hr (of 20 μg/mL solution)
	50 μg/min	150 mL/hr (of 20 μg/mL solution)

Salbutamol- Obstetric (Continued)

Indications

Inhibition of labour

Precautions and Side Effects

1. Cease infusion if
   - contractions cease *or*
   - maternal pulse = 130/min *or*
   - there are signs of fetal distress or FHR exceeds 190 or
   - the maximum drip rate of 50 μg/min is reached
2. Side effects include palpitations, tachycardia, tremor, hypotension, pulmonary oedema, cardiac arrhythmias, myocardial ischaemia, hypokalaemia, hyperglycaemia, flushing, headache, dizziness, anxiety, nausea and vomiting.
3. Use with caution in patients with heart disease, diabetes or hypertension.
4. Absolute obstetric contraindications include fetal death in utero and severe antepartum haemorrhage.
5. May be use when relative contraindications exist, if risks outweighed by the risk of delivery during transport.

Special Notes

1. In this RFDS protocol both the rate of increase of infusion and the maximum limits are greater when compared with the King Edward Memorial Hospital protocol. This reflects the different risks involved in the delivery of the pre-term infant outside the tertiary Hospital setting. Care must be exercised at high doses.
2. Alternatives / adjuncts to Salbutamol infusion for tocolysis include Nifedipine, Ritodrine, Indomethacin and GTN. Consult Clinical Guideline on Preterm Labour.

23 SALBUTAMOL INFUSION – RESPIRATORY - PAEDIATRIC

A. Syringe Driver — **Salbutamol 6µg/kg/ml**

- Use Salbutamol 5 mg in 5 mL ampoules
- Dilute 0.3 mg/kg (0.3 mL/kg) up to 50 mL with Normal Saline or 5% Dextrose, see examples below.
- Commence at 1 µg/kg/min (10 mL/hr) and adjust rate according to clinical response maximum 5µg/kg/min (50mL/hr)

10kg use 3mg	15kg use 4.5mg	20kg use 6mg	30kg use 9mg

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver
	1 µg/kg/min	10 mL/hr
	2 µg/kg/min	20 mL/hr
	3 µg/kg/min	30 mL/hr
	5 µg/kg/min	50 mL/hr

B. Infusion Pump — **Salbutamol 6µg/kg/ mL**

- Use Salbutamol 5mg in 5 mL ampoules
- Dilute 3 mg/kg (3 mL/kg) up to 500 mL with Normal Saline or 5% Dextrose
- Commence at 1 µg/kg/min (10 mL/hr) and adjust rate according to clinical response maximum 5µg/kg/min (50mL/hr)

10kg use 6mg	15kg use 9mg	20kg use 12mg	30kg use 18mg

500 mL Bag	Dose Range	Rate of Infusion - Infusion Pump
	1 µg/kg/min	10 mL/hr
	2 µg/kg/min	20 mL/hr
	3 µg/kg/min	30 mL/hr
	5 µg/kg/min	50 mL/hr

Salbutamol-Respiratory (Continued)

Indications

Severe bronchospasm.

Precautions and Side Effects

1. Side effects include palpitations, tachycardia, tremor, hypotension, pulmonary oedema, cardiac arrhythmias, myocardial ischaemia, hypokalaemia, lactic acidosis, hyperglycaemia, flushing, headache, dizziness, anxiety, nausea and vomiting.
2. Consider continuous nebulised Salbutamol, intravenous Aminophylline and/or Adrenaline infusion as alternative or additional therapies.
3. Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

References

PMH ED Guidelines. http://kideshealthwa.com/guidelines/salbutamol-intravenous/

24 SALBUTAMOL – RESPIRATORY - ADULT

A. Syringe Driver — **Salbutamol 5mg/50mL (100µg/mL)**

- Use Salbutamol 5 mg in 5 mL ampoules
  - Dilute 5 mg (5 mL) up to 50 mL with Normal Saline or 5% Dextrose
  - Give loading dose of 5µg /kg (0.05mL/kg) over 10 minutes (maximum 500µg or 5mL)
  - Commence maintenance at 5µg/min (3mL/hr) and titrate to effect (maximum 50µg/min, ie. 30mL/hr)

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver
	5µg/min	3mL/hr
	10µg/min	6mL/hr
	20µg/min	9mL/hr
	50µg/min	30mL/hr

B. Infusion Pump — **Salbutamol 10mg/100mL (100µg/mL)**

- Use Salbutamol 5 mg in 5 mL ampoules
- Dilute 10 mg (10 mL) up to 100 mL with Normal Saline or 5% Dextrose
- Commence at 5µg/kg/min and adjust rate according to clinical response

100 mL Bag	Dose Range	Rate of Infusion – Volumetric Pump
	5µg/min	3mL/hr
	10µg/min	6mL/hr
	20µg/min	9mL/hr
	50µg/min	30mL/hr

Salbutamol-Respiratory (Continued)

Indications

Severe bronchospasm.

Precautions and Side Effects

1. Side effects include palpitations, tachycardia, tremor, hypotension, pulmonary oedema, cardiac arrhythmias, myocardial ischaemia, hypokalaemia, lactic acidosis, hyperglycaemia, flushing, headache, dizziness, anxiety, nausea and vomiting.
2. Consider continuous nebulised Salbutamol, intravenous Aminophylline and/or Adrenaline infusion as alternative or additional therapies.
3. Should only be administered on a doctor-accompanied flight unless under exceptional circumstances.

References

Bersten A D, Soni N. Oh's Intensive Care Manual. 7th Ed. Elsevier 2014

25 VECURONIUM INFUSION

A. Syringe Driver **Vecuronium 20 mg / 20 mL (1 mg /mL)**

- Use Vecuronium 4 mg or 10 mg ampoules
- Reconstitute the powder in the ampoules with water for injection
- Dilute 20 mg up to 20 mL with Normal Saline (*or* 10 mg to 10 mL *or* 30 mg to 30 mL)
- After patient has been intubated give a loading dose of 0.05 mg/kg (Adults), 0.1mg/kg (Children)
- Run infusion at 0.1 mg/kg/hr (Adults), 0.5mg/kg/hr (Children)

50 mL Syringe	Dose Range	Rate of Infusion - Syringe Driver						
		10kg	***20kg***	***30kg***	***40kg***	***50kg***	***70kg***	***100kg***
	Loading Dose	1mL	2mL	3mL	4mL	2.5mL	3.5mL	5mL
	0.1mg/kg/hr	1mL/hr	2ml/hr	3mL/hr	4mL/hr	5mL/hr	7mL/hr	10mL/hr
	0.5mg/kg/hr	5mL/hr	10mL/hr	15mL/hr	20mL/hr	-	-	-

Indications

Maintenance of muscle relaxation in ventilated patients.

Precautions and Side Effects

1. Patient must be adequately sedated with Morphine and Midazolam in addition to being paralysed.
2. Patients with hepatic or renal disease may have reduced excretion resulting in prolongation of neuromuscular blockade. Use lower doses in these patients.

Special Notes

Should only be administered on a doctor-accompanied flight.