Paediatric Intensive Care unit Nursing Procedure: The Administration of Inotropes

Definition The administration of drugs to maintain the child's circulatory system, thus ensuring oxygenation of vital organs.

Background The word 'inotrope' is commonly used as a blanket term for cardiovascular (CV) active drugs that have inotropic, pressor, chronotropic, lusotropic actions:

Inotrope – improves myocardial contractility and enhances stroke volume
Pressor – increases systemic vascular resistance and increases blood pressure (BP)
Chronotrope – increases heart rate (HR)
Lusotrope – improves relaxation during diastole and decreases end-diastolic pressure in the ventricles.

Many of the drugs act by stimulating alpha and Beta receptors in target organs.
A-receptor – stimulation causes vasoconstriction
B1-receptor – stimulation causes positive chronotropic and inotropic effects on the heart
B2-receptor – stimulation causes bronchodilation and vasodilation (n.b these are the main effects)
The drugs commonly used on PICU include adrenaline (epinephrine), noradrenaline (norepinephrine), dopamine, dobutamine, milrinone and prostacyclin (epoprostenol). The effects are dose-dependent (refer to 'existing protocols and customs') and most have a short half-life of 2-3 minutes necessitating continuous infusion.

Equipment needed,

50ml luer-lock syringe containing prescribed volume and concentration of inotrope
Anti-syphon, anti reflux administration set
Bionectors

Syringe pump labelled ‘suitable for high-risk infusions’, plus one spare, plugged into mains – red socket
Prescription chart
Observation chart
Continuous cardiac monitoring
Invasive arterial blood pressure (IABP) monitoring (or NIBP every 2 minutes until available)
Central venous access, one lumen dedicated to the infusion of inotropes
PICU drug monographs, BNF for children
Resuscitation drugs and equipment
Extravasation kit

Knowledge and Skills

Qualified nurse registered by NMC
Trained and assessed as competent in the use of the infusion pump
Trained and assessed as competent in the administration of intravenous drugs
A theoretical knowledge of the use and action of inotropic drug therapy

Procedure: Preparation and commencement of the Infusion

Action	Rational
1. Exercise extreme caution in the calculating and preparing of the inotrope.	Small errors in dosage can have serious adverse effects.
2. Both syringe and administration set must be clearly labeled.	Reduces risk of accidental rate change and disconnection.
3. Dedicate a lumen of the central line for inotrope use only. Connect giving set to bag securely.	Avoids bolus administration by adding other non-inotropic drugs; ensures that the concentration of the drug is adequately diluted. Peripheral access or intra-osseous needle may be used until central access is available.
4. Attach a Ready-Check 3 connector to the central line lumen.	
5. Attach Bionectors to all 3 ports.	Allows for the addition of more inotropes without interrupting the infusion of the existing inotrope.
6. Load infusion into syringe pump.	Allows circuit to remain in tact, reducing risk of infection and time taken to change over infusions.
7. Remove mechanical slack from syringe plunger by purging the syringe and allowing the inotrope to	Primes the pump to avoid delay in drug therapy.

drip before attaching it to identified lumen. 8. Attach to identified lumen. 9. The infusion may be purged to take up the dead space of the lumen only if requested by the consultant, the consultant is present, no other inotropes are being infused into this lumen, and the dead space of the lumen is known. 10. Check BP and HR. 11. Start the infusion at the prescribed rate, observing its effect upon HR, rhythm and BP. 12. Set high pressure limit on the infusion pump initially, reduce to two bars above recorded pressure after 1 hour.	Prevents delay in delivery of drug. Acts as a baseline from which response to the drug can be assessed. Rate may have to be changed to obtain a therapeutic dose. Prevents interruption of infusion due to high pressure of central infusion.

Procedure: Managing the infusion

Action	Rationale
1. Never administer non-inotropic drugs or bolus via this lumen. 2. Never stop an inotrope without first weaning. 3. The parameters for drug delivery and therapeutic goal must be known and recorded. 4. Continuously monitor heart rate, rhythm and blood pressure and record hourly. 5. Monitor child's colour, capillary refill time, toe-core gap, central venous pressure and urine output hourly and record. 6. Titrate the inotrope within the prescribed limit by 0.1ml/hr or as	A bolus of inotrope will be given causing CV instability. Can cause CV instability. Enables titration of the drug infusion to maintain a therapeutic dose and continuation of satisfactory CV stability. Tachyarrythmias, ST (ischaemic) changes and/or too high/low BP may necessitate rate change or additional/alternate therapy. Aids in determining effectiveness of therapy and need for change. Ensures administration of the drug is within therapeutic boundaries.

instructed by doctor to maintain the desired blood pressure, taking into account the action of the drug and all physiological parameters.	
7. Record changes in vital signs and subsequent infusion rate on observation chart.	Allows easy assessment of the response to the drug.
8. Inform nurse-in-charge of any changes.	Ensures changes are not inappropriate.
9. Observe infusion site hourly for signs of extravasation.	Extravasation can cause tissue necrosis.
10. Monitor blood sugars 4 hourly.	The anti-insulin effects of the drugs may cause hypoglycaemia.
11. Aspirate nasogastric tube 4 hourly and follow Unit feeding protocol accordingly.	Gut motility will be reduced.
12. Observe peripheries for signs of under-perfusion (cold, blue, mottled), wrap in gamgee if evident and inform doctor.	Therapy to improve perfusion may be indicated.
13. Assess/perform pressure area care as dictated by stability of patient.	Increased risk of skin breakdown due to reduced perfusion.
14. Monitor and record hourly the volume of drug infused and the rate of the infusion.	Ensures accurate fluid balance, and a record of amount of inotrope given.
15. Be aware of the volume left in the syringe.	Prevents delay in drug administration by being prepared for syringe change.

Procedure: Changing syringes
(The Quick Change Method -Arino et al 2004)

Aim: To minimize changes in the child's CV stability during infusion changes.

Action	Rationale
1. Perform this procedure during the day shift (if possible).	Procedure is safer as more nursing and medical cover, lighting and concentration is better.
2. Start procedure with at least 4	

hours of available drug in syringe (do not include KVO allowance i.e. 0.5mls).	Allows sufficient time for the procedure.
3. Load the new infusion into the spare syringe pump.	
4. Purge until the infusion drips.	Takes up the mechanical slack preventing delay in the delivery of the drug.
5. Program the pump to the same rate as the old infusion and start the pump (unless concentration is different).	Ensures therapy remains constant.
6. Run unattached at this rate for at least 10 minutes	Overcomes resistance in syringe and administration set (S. Keay, medical equipment).
PRIOR TO CHANGE:	
7. Organise work to facilitate minimal distraction for a maximum of 10 minutes and remain by the pump to tend to the effects of the change.	In the event of marked fluctuations in the child's condition the response time is reduced.
8. Inform parents/carers of your intentions and warn that an increase/decrease in BP and/or HR can be expected and not to be concerned if alarms sound.	Allays parents'/carers' anxieties.
9. Inform nurse-in-charge and doctor of your intentions to change the syringe.	Enables a quick response if assistance is needed.
10. Ensure the infusion you are about to disconnect the correct one.	Disconnecting incorrect infusion can result in haemodynamic instability.
11. Re-zero the volume infused of the new infusion.	So not to be included in the child's fluid balance.
12. Check the BP and the HR	A baseline is needed to determine any resultant haemodynamic instability.
13. Quickly disconnect old infusion, leaving Bionector in situ, and connect new infusion (still running) using a	Quick changeover reduces risk of haemodynamic instability.

non-touch technique. 14. Recheck BP and HR, and observe continuously over the next 10 minutes.	

15. If the BP does not respond seek medical assistance	
16.Record volume of old infusion infused before switching pump off	To maintain accurate fluid balance
17. Indicate time of syringe change on observation chart.	Enables easy identification of when CV stability may have fluctuated, even minimally.
18. Document the child's response to the change in the care plan.	Enables subsequent staff to anticipate and plan for infusion changes.
19. Relay CV instability during the change to risk management as a critical incident.	Highlights need for policy review

Procedure: Discontinuing the Infusion

As the child's condition improves, the inotrope will be weaned to a point where it can be stopped, usually at 0.1ml/hr. Inotropes are never stopped from a high rate.

Action	Rationale
1. NEVER leave inotrope in the lumen.	Prevents someone unknowingly flushing the lumen and blousing the inotrope.
2. Once stopped, disconnect the inotrope at the lumen and attach a slow flush of Sodium Chloride 0.9% labeled 'sodium chloride flush following inotrope'.	

3. Infuse at 0.1ml/hr until the volume of the lumen has been infused. The rate can then be increased.	Ensures that there is no inotrope left in the lumen.

Footnote

This policy reflects the current practice within our Unit. The literature review showed a lack of evidence supporting the procedure for changing syringes. Both the quick change and double pumping / piggy backing methods are documented. The use of Bionectors appears to reduce the time taken for the change and thus the risk to the child. However this has not been audited and no research was found to support this conclusion.

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