		Type: Drug Guideline	Document reference: 2925	Manual Classification: Waikato DHB Drug Guidelines
Title: Heparin sodium for NICU			Effective date: 17 October 2017	
Facilitator <small>sign/date</small> <i>Catherine Wilson</i> Pharmacist	Authorised <small>sign/date</small> <i>David Bouchier</i> Clinical Director NICU	Authorised <small>sign/date</small> <i>John Barnard</i> Chair Medicines & Therapeutics	Version: 02	Page: 1 of 3
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1. Purpose and scope

To facilitate the safe and effective use of heparin within the Neonatal Intensive Care Unit (NICU).

2. Drug

Drug	Heparin sodium, heparinised saline
Drug action	<p>Heparin activates antithrombin III, which progressively inactivates both thrombin and Factor X_a, key proteolytic enzymes in the formation of fibrinogen and activation of prothrombin. Efficacy in neonates is decreased due to low antithrombin plasma concentrations.</p> <p>Metabolised by the liver. Renal excretion should occur within 6 hours but may be delayed with clearance in neonates being more rapid than in children and adults. Half-life is dose-dependent but averages 1-3 hours.¹</p>
Indications	<ol style="list-style-type: none"> Maintaining patency of umbilical or peripheral arterial lines Neonatal thrombosis <p>Note: ongoing where "1" and "2" are mentioned, the information relates to the indications above</p>
Presentation	<ul style="list-style-type: none"> Heparin sodium 1,000 units / 1 mL ampoule Clear, colourless to straw-coloured aqueous solution.⁵ pH of undiluted heparin sodium is 5-8.⁵
Route	<ol style="list-style-type: none"> Intra-arterial infusion^{4,6} or intravenous injection (load) and infusion depending on the indication.⁶
Dose	<ol style="list-style-type: none"> Maintaining Patency of Arterial Lines. <ol style="list-style-type: none"> Umbilical arterial catheter: 0.5mL/hour of dilute heparin solution.^{4,6} Use the 1unit/ml solution. Peripheral arterial line: 0.8 -1mL/hour of dilute heparin solution^{1,4} Use the 1unit/ml solution. Thrombosis: Initially 75 units/kg (50 units/kg if under 35 weeks corrected gestational age) over 10 minutes then 25 units/kg/hr adjusted according to APTT.⁶ Use the 100unit/ml solution.
Contraindications & Precautions	<ul style="list-style-type: none"> Known hypersensitivity to heparin³ Presence of uncontrollable bleeding or bleeding tendencies⁴ Intraventricular or gastrointestinal haemorrhage¹ Thrombocytopenia < 50 x 10⁹/L¹ Severe hepatic, biliary or renal dysfunction⁶ Severe hypertension⁶ Eye, brain or spinal cord surgery⁶ Ascorbic acid deficiency²
Compatibilities/ Incompatibilities	<ul style="list-style-type: none"> Compatible with glucose 5%, glucose 10% sodium chloride 0.9% and sodium chloride 0.45%⁵ Incompatible with amikacin, gentamicin, phenytoin and vancomycin¹
Adverse effects	<ul style="list-style-type: none"> Haemorrhage, haematomas, transient mild thrombocytopenia⁵ Hypersensitivity reactions (fever, rash, nasal congestion, asthma, anaphylaxis, alopecia)⁵ Hyperaldosteronism⁶ Hyperkalaemia⁶

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3. Administration


Competency for administration	This procedure is carried out by, or under, the direct supervision of a registered nurse/registered midwife who holds current Waikato DHB Generic Medicine Management competency skills verification and Neonatal specific competency NCV/NAC as well as Guardrails competency.
Preparation & Administration	<p>1. Maintaining Patency of Arterial Lines. Draw up 0.5mL of 1,000 units/mL heparin and add to a 500mL bag of sodium chloride 0.45% or other compatible fluid (resulting solution has a concentration of 1 unit/ml).^{4,6} Draw up 50ml of resulting solution and administer via a Guardrails profiled syringe driver.</p> <p>2. Thrombosis Prepare a solution of heparin 100 units/mL by drawing up 1mL of 1,000 units/mL heparin and adding to 9mL of compatible fluid. The volume of solution prepared should be calculated based on the anticipated usage of heparin in a 24 hour period based on the patient's weight.¹</p> <p>Note: Invert container a minimum of 6 times to ensure adequate mixing of heparin with solution. Also invert container several times throughout the infusion to prevent drug pooling (minimum of once per shift).⁵</p>
Observations and management	For thrombosis: Four hours after initiating therapy, measure APTT then adjust dose to achieve an APTT of 60-85 seconds ¹ . Recheck APTT every 8 hours.
Storage	Store at room temperature <25°C. The diluted solution (1 unit/mL) is stable for 24 hours at room temperature, and likely longer (but must keep inverting container to prevent drug pooling) ^{1,5}
Special considerations	Should only be used in pre-term babies following consultation with Auckland Children's Hospital Haematologist.
Rescue medication	<p>Management of heparin overdose and/or toxicity</p> <p>a) Stop heparin and treat hypovolaemia. b) Administer protamine sulphate undiluted (10mg/mL) according to dose schedule below by slow IV infusion over 10 minutes. Do not exceed 5mg/min and maximum dose of 50mg.</p> <p>NOTE: If necessary may be further diluted in glucose 5% or sodium chloride 0.9%¹</p> <p>Time since last heparin dose in minutes and protamine dose:¹ Less than 30 min: 1 mg per 100 units heparin received. 30 to 60 min: 0.5 to 0.75 mg per 100 units heparin received 60 to 120 min: 0.375 to 0.5 mg per 100 units heparin received Greater than 120 min: 0.25 to 0.375 mg per 100 units heparin received</p>

4. Guardrails (Note: only the heparinised saline is Guardrail profiled i.e. indication 1)

Guardrails Drug Name	Heparinised saline
Pump	CC
All weights	
Concentration (unit/mL)	
Minimum	1
Maximum	1
Administration Rate (units/hr)	
Soft minimum	0.25
Default	0.5
Soft maximum	1
Hard maximum	1.5

5. References

- 1 Micromedex® 1.0 (Healthcare Series), (electronic version). Paediatrics and Neofax – Heparin. Truven Health Analytics, Colorado, USA. Last accessed 30th November 2015. Available from : <http://www.micromedexsolutions.com/>
- 2 Auckland NICU Drug Protocols – Heparin sodium, May 2005. Available from: <http://www.adhb.govt.nz/newborn/DrugProtocols/Default.htm> Last accessed 30th November 2015.

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- 3 The New Zealand Medicines and Medical Devices Safety Authority (Medsafe): Heparin Sodium, Data sheet -New Zealand. Last accessed 30th November 2015. Available from <http://www.medsafe.govt.nz/profs/datasheet/SearchResult.asp>
- 4 Phelps SJ, Hak EB, Crill CM, editors. Teddy Bear Book: Pediatric Injectable Drugs. 10th Edition. Heparin Sodium. Bethesda, MD: American Society of Health-System Pharmacists; 2013.
- 5 New Zealand Hospital Pharmacists Association: Notes on Injectable Drugs, 7th Edition, Heparin Sodium. Published 2015,NZ.
- 6 New Zealand Formulary for Children. Heparin sodium. New Zealand Formulary, NZ. Last accessed 30th November 2015. Available from <http://nzfchildren.org.nz/>
- 7 The Royal Children's Hospital Melbourne: Paediatric Injectable Guidelines 4th Edition, 2011. Heparin. Australia.
- 8 Guardrails Data Sheets, Waikato Hospital, Hamilton, NZ May 2015.

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