

**Royal Hospital for Women (RHW)
BUSINESS RULE
COVER SHEET**



Health
South Eastern Sydney
Local Health District

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SUMMARY	Standardised perioperative guideline that outlines the required processes to ensure safe practice for emergency bedside surgical procedure.

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This Clinical Business Rule (CBR) is developed to guide safe clinical practice in Newborn Care Centre (NCC) at The Royal Hospital for Women. Individual patient circumstances may mean that practice diverges from this Clinical Business Rule. Using this document outside the Royal Hospital for Women or its reproduction in whole or part, is subject to acknowledgement that it is the property of NCC and is valid and applicable for use at the time of publication. NCC is not responsible for consequences that may develop from the use of this document outside NCC.

1. BACKGROUND

The decision to perform surgery in the neonatal intensive care unit (NICU) requires multidisciplinary discussion and analysis of risk versus benefits of transferring an unstable neonate to operating theatre (OT). Careful consideration and planning are required to ensure safe and efficient administration of general anaesthesia, blood products and medication along with determination of roles and responsibilities of staff, documentation and perioperative procedures performed.

2. RESPONSIBILITIES

Medical staff

- Neonatology team
- Paediatric anaesthetist
- Paediatric surgical team

Nursing Staff

- NCC
- Anaesthesia
- Surgical Scrub and scout

3. PROCEDURE

3.1 Equipment

Neonatology team

- Initiation of decision to perform bedside surgery - Procedure Flow Chart (Appendix 1)
- Complete Surgery at the bedside - Perioperative Guidelines Checklist (Appendix 2)
- Blood products in Esky sourced from Blood Bank
- Standing procedure or overhead light
- NCC bedspace with lights
- Wall suction with suction catheter attached
- Neopuff with appropriate size face mask
- Spare ETT and laryngoscope with appropriate size blade
- ETCO₂ or TCM monitor
- Dräger infinity C700 monitor

Surgical team

- Surgical equipment brought from theatre as per surgeons' preference and specific requests as communicated to scrub team for adjuncts such as haemostasis, sutures, silos, drains, and feeding tubes.
- Headlights
- Diathermy (mono & bipolar)

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Anaesthetic team (Picture1)

- Fentanyl from the paediatric theatre drug cupboard
- Emergency drugs such as rocuronium, calcium gluconate from the paediatric theatre drug cupboard
- 1 Mayo table
- 1-2 Trifuser
- 2-3 Simple blood giving set
- 4-5 pieces of 75cm paediatric IV extension lines
- 7 pieces of 3-way taps
- 4 back check valves
- Blood warmer
- Blood warmer line



Picture 1

3.2 Clinical Practice

Surgical team and neonatologist on-call decide the suitability of neonate for bedside surgery. (Appendix 1)

1. Pre-operative

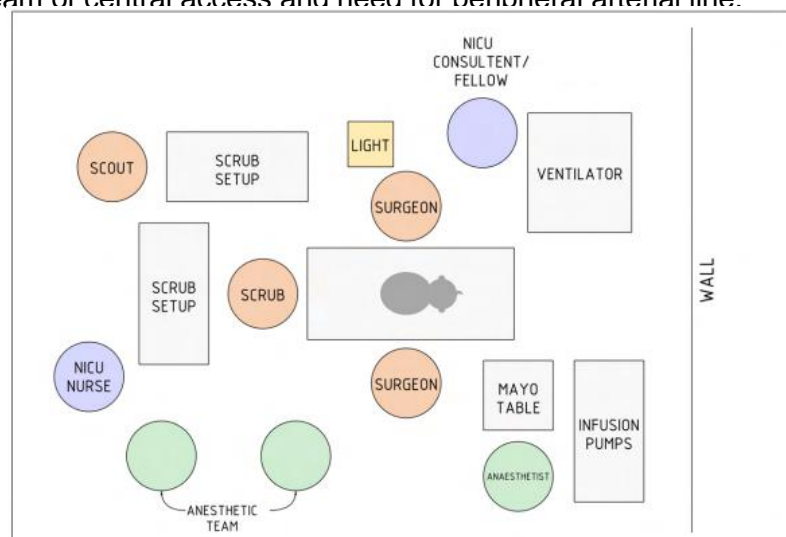
Surgical team

- Surgical team informs the anaesthetic team.
- Obtain informed consent from parents/carers for the procedure and blood products.
- Inform NCC medical team of the investigations and blood products for the procedure.
- Source preferred equipment.

Anaesthetic team

- Obtain informed consent from parents/carers for anaesthesia.
- Set up the equipment. (Picture 2)
- Bring theatre equipment including fentanyl +/- rocuronium as listed in item 3.1.
- Set-up infusion lines - Infusion Set-Up Instructions for Anaesthetist. (Appendix 3)
- Inform NCC team of blood products to prepare for the procedure.
 - Prefer whole blood for anaesthetist.
- Inform NCC team of central access and need for peripheral arterial line.

Picture 2



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NOTE:

- Crib is moved forward off the wall.
- The ventilator remains on the right of the neonate.
- All infusions and mayo table for anaesthetist on the left of the neonate.

NCC team

- Neonatologist/CMO/Fellow to inform TL.
- TL and bedside nurse to set up bedspace 2 as a preferred option. (Picture 2)
 - Ensure standing light is working.
- TL and bedside nurse prepare and label infusions for sedation and inotropes.
- Ensure all intravenous lines are patent and ongoing infusions are labelled.
- Fellow to ensure
 - Necessary investigations are facilitated.(FBC, UEC, Coag studies, Group and Hold)
 - Intravenous accesses are available.
 - 1 central line and 1-2 peripheral IV lines, or at least 2 peripheral lines are necessary.
 - Discuss with anaesthetic team of the need for an arterial line.
- Secure ETT and confirm placement.
 - Secure tubing to the bed or surrounds.
 - Place spare ETT and laryngoscope next to ventilator.
 - Neopuff with face mask should be next to the ventilator due to the high risk of accidental extubation.
- End tidal CO₂ monitoring is preferred. (TcM is often difficult to place given surgical field.)
- Connect in-line suction (if not present already) with spare separate suction catheter present.
- Secure temperature probe and ensure all the necessary measures are in place to maintain normothermia during the procedure.
- Secure and confirm gastric tube placement and ensure the tube is easily accessible for anaesthetist for aspiration of gastric contents when required (Picture 3).

NOTE:

- Peripheral arterial line can be attempted but should not delay the operation.



Picture 3



Picture 4

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- Body temperature is displayed on the monitor measured with a skin sensor. The servo mode is set to feedback to the heating unit to keep the skin temperature near 37°C.
- During the surgery
 - Turn the feedback off and set the mattress heating unit to its maximum of 39°C (Picture 4).
 - Move the skin temperature sensor to the back of a shoulder to accommodate the diathermy plate

All teams

- Prior to the procedure, all team members should introduce themselves by name and roles.
- Complete the Level 3 procedure checklist in eRIC prior to commencement of surgery placed under NICU Medical icon → Procedures tab → RELATED ITEMS.

2. Intra-operative**Surgical team**

- In charge of operation

Anaesthetic team

- In charge of muscle relaxation, pain relief and sedation, volume resuscitation, cardiovascular support, management of bleeding, and thermoregulation.
- All infusions remain on the left of the neonate.
- In rare circumstances, may need to manage ventilation if neonatologist/fellow is not available.
- The nasogastric tube should have a syringe attached to it and be easily accessible by the anaesthetist in case the contents of the stomach need to be aspirated (Picture 3)

NCC team

- Neonatologist with CMO/fellow to manage ventilation and optimise ventilatory parameters unless not available. (Appendix 4)

3. Post-operative**Surgical team**

- Hand-over findings to medical and nursing team and update parents/carers.
- Send any samples for histopathology.
- Document operation notes.

Anaesthetic team

- Hand-over to medical and nursing team including medications or blood products administered.
- Perform a line check with the NCC nurse to visualise IV access sites and fluid lines.

NCC team

- Review neonate and order necessary post-operative investigations.
- Copy operation notes to eRIC.
- Scan anaesthesia notes as PDF and save in eRIC or eMR.
- Perform ongoing management and care of the neonate post procedure including:
 - Positioned neonate supine, head at the back of crib with appropriate neurodevelopmental measures.
 - Reinstate servo skin temperature monitoring.
 - Replace dirty linen on bed.

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3.3 Educational Notes

- While it has been widely known that neonates requiring surgery have a higher incidence of morbidity and mortality, ensuring the safety of these infants has been publicly advocated by both paediatric anaesthesiologists and neonatologists worldwide.¹ Utilizing meticulous planning by anaesthesiologists, paediatric surgeons, nursing specialists and close collaboration with the neonatology team promote both success and safety of these bedside surgeries.¹
- Communication errors account for 70% of preventable medical errors. With strong communication and coordination between neonatology, anaesthesia and surgical teams, success of bedside surgeries reduces loss or misinterpretation of information.² Preoperative checklist also ensures smooth conduct as recommended by Joshi et al². This includes each team's requirements for the surgical procedure, properly organized workspace, patient's requirements such as blood products and blood test results and well designated staff roles.³
- Typical perioperative concerns include patient's maintenance of temperature for which neonatal open-care systems under servo-controlled radiant warmer have been widely used, patency of peripheral IV lines should always be checked and not presumed while the use of low prime volume extension lines help maintaining access away from surgical field. Adequate antibiotic coverage pre- and post-operatively addresses infection concerns and detailed plan must be in place prior to the surgery for effective manual ventilation and ETT dislodgement.
- Essential understanding, evaluation, open communication, and introduction of new surgical techniques with ongoing advances in the perioperative management of neonates minimize both morbidity and mortality in this vulnerable group.⁴

3.4 Abbreviations

NICU	Neonatal Intensive Care Unit	TL	Team leader
OT	Operating Theatre	CO ₂	Carbon Dioxide
ETT	Endotracheal Tube	eRIC	Electronic Record of Intensive Care
ETCO ₂	End Tidal Carbon Dioxide	eMR	Electronic Medical Record
TCM	Transcutaneous Monitor	PDF	Portable Document Format
IV	Intravenous	SCH	Sydney Children's Hospital
CMO	Career Medical Officer	PICC	Peripherally Inserted Central Catheter

3.5 References

1. Houck C, Deshpande J, Flick R. The American College of Surgeon's Children's Surgery Verification and Quality Improvement Program: implication for anesthesiologists. 2017 June
2. Joshi RK, Aggarwal N, Aggarwal M, Joshi R. Anesthesia protocols for "bedside" preterm patent ductus arteriosus ligation: A single institutional experience. APC. Jul-Sep 2021; Volume 14:p343-349
3. Vinson A, Alrayashi W, Houck C. Educational Perspectives: Anesthesia 101: What the Neonatologist needs to Know About Anesthesiology. Neoreviews. Jan 2020.
4. McCann ME, Soriano S. Progress in anesthesia and management of the newborn surgical patient. Seminars in Pediatric Surgery. Oct 2014; Volume 23 Issue 5:p244-248

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4. RELATED BUSINESS RULES AND POLICY DOCUMENTS

- RHW NCC CBR Nursing - Post-operative Care
- RHW NCC CBR Nursing - Suction - Closed Tracheal Suction from an Endotracheal Tube
- RHW NCC CBR Nursing - Sterile aseptic procedures –
- RHW NCC CBR Nursing - Intravenous Line Management
- RHW NCC CBR Nursing - Dräger Babylog VN 500 set up
- RHW NCC CBR Nursing - Deteriorating Neonate

5. CULTURAL SUPPORT

- When clinical risks are identified for an Aboriginal family, they may require additional supports. This may include Aboriginal health professionals such as Aboriginal liaison officers, health workers or other culturally specific services.
- For a Culturally and Linguistically Diverse CALD family, notify the nominated cross-cultural health worker during Monday to Friday business hours.
- If the family is from a non-English speaking background, call the interpreter service: NSW Ministry of Health Policy Directive PD2017_044-Interpreters Standard Procedures for Working with Health Care Interpreters.

6. IMPLEMENTATION PLAN

This CBR will be distributed to all medical, nursing and midwifery staff via @health email. The CBR will be discussed at ward meetings, education and patient quality and safety meetings. Education will occur through in-services, open forum and local ward implementation strategies to address changes to practice. The staff are asked to respond to an email or sign an audit sheet in their clinical area to acknowledge they have read and understood the revised CBR. The CBR will be uploaded to the CBR tab on the intranet and staff are informed how to access.

7. RISK RATING

- Low

8. NATIONAL STANDARDS

- Standard 1 Clinical Governance
- Standard 2 Partnering with Consumers
- Standard 3 Preventing and Controlling Infections
- Standard 4 Medication Safety
- Standard 5 Comprehensive Care
- Standard 6 Communicating for Safety
- Standard 7 Blood Management
- Standard 8 Recognising and Responding to Acute Deterioration

9. REVISION AND APPROVAL HISTORY

Date	Revision No.	Author and Approval
24/03/2024	1	S Tapawan (CMO), F Perez (Fellow), A Duffield (POW Anaesthetist), D Wanaguru (SCHN Paediatric surgeon), KB Lindrea (CNC), R Jackson (NE), S Wise (Nursing Co-director), M Ward (Neonatologist), E Jozsa (CNS), S Bolisetty (Medical Co-director),

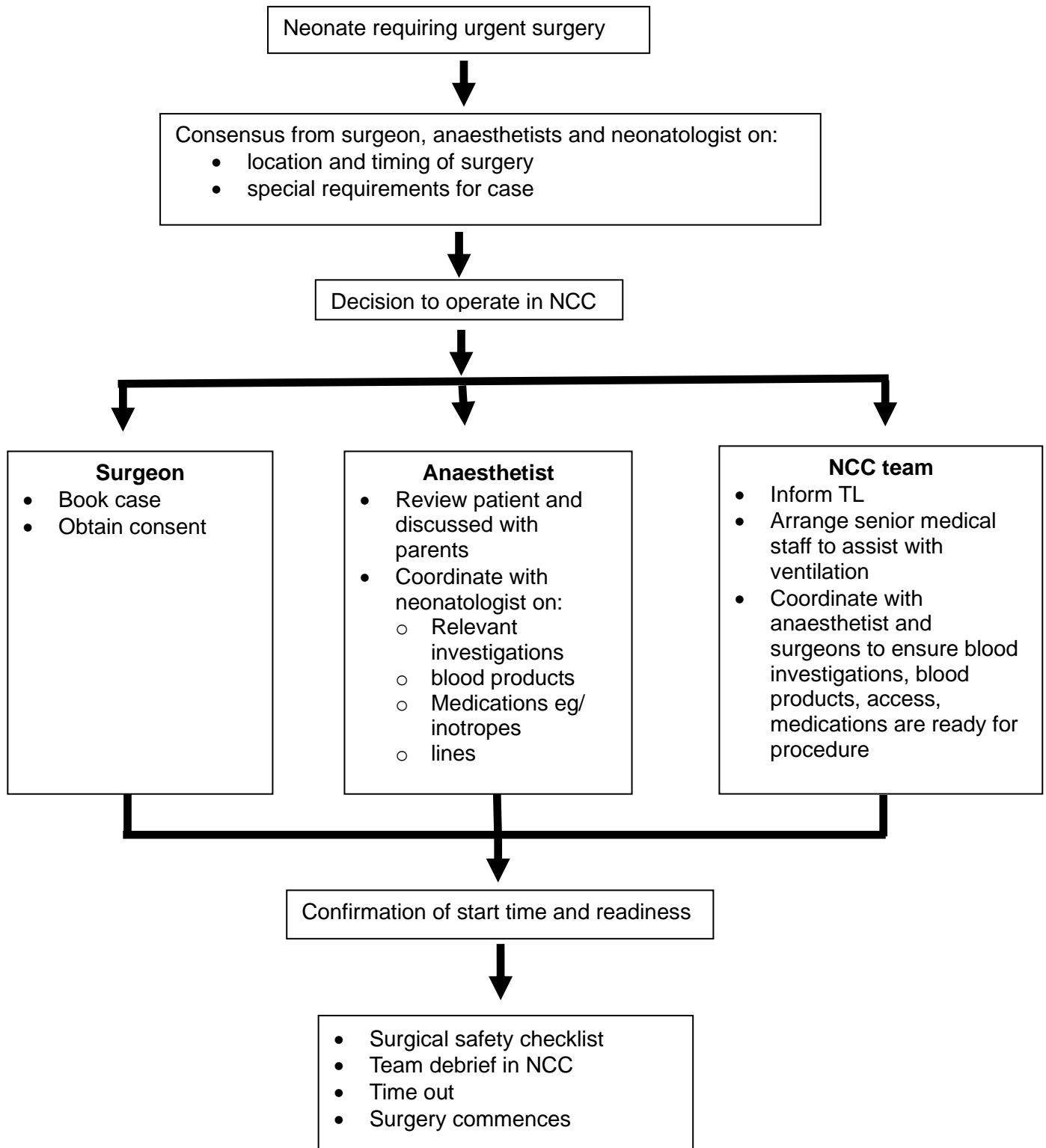
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APPENDIX 1

Procedure Flow Chart



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APPENDIX 2

Surgery at the bedside - Perioperative Guidelines CHECKLIST

THEATRE PAPERWORK	CHECK ✓
Signed surgical consent form	
SURGICAL REQUIREMENT	
Headlights Diathermy (mono & bipolar) Surgical equipment from OT	
ANAESTHETISTS REQUIREMENT	
Fentanyl for bolus administration from OT drug cupboard Rocuronium for bolus administration if baby is not yet on infusion from OT drug cupboard Mayo table Trifuser Blood giving set 4-5 pieces of 75cm paediatric IV infusion extensions 7 pieces of 3-way taps 5 back check valves Blood warmer Blood warmer line	
NCC REQUIREMENT	
Standing light Neopuff with appropriate size face mask Spare ETT and laryngoscope with appropriate size blade attached In-line and separate suction catheters attached to wall suction	
PATIENT REQUIREMENTS	
Valid blood group result Blood test results Blood products	
NCC STAFF ALLOCATION	

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APPENDIX 3

INFUSION SET-UP INSTRUCTIONS FOR ANESTHETIST

INFUSIONS

All infusions remain on the left of the neonate. If they are not on inotropes it is worth asking the NCC nurses to make up adrenaline to run with the infusions via the PICC line. The inotropes start at 0.1ml/hr. At low concentration this is 0.05mcg/kg/min. At high concentrations this is 0.2mcg/kg/min. At very high concentration this is 0.4 mcg/kg/min. The rationale for the differing concentrations is the NCC staff trying to minimise the volumes given in small neonates.

The 200-micron filter pictured below (A) left can be found on most cannulas. It must be removed because of the increased resistance it creates and the issue of it blocking with blood products. The blood giving sets used for blood transfusions (B) in theatres which have a 200-micron filter in situ should be used. These giving sets are to be used for all blood products including platelets, FFP, cryoprecipitate or packed cells. The line is kept clamped (C) unless filling a distal syringe or checking the drip for patency. By hanging the blood product, the patency of the cannula can be checked to see if the blood slowly drips when the tap is opened.



(A) Remove this 200-micron connector



(B) 200-micron filter in blood giving set



(C) Keep line clamped

TRIFUSOR SET-UP



The volume and drugs that are required for anaesthesia can be given via a single 24G cannula with a trifusor connected for multiple access points. Three-way taps are placed on all the lines. To stop reflux of drugs or blood products backwards on another line the taps not being used should remain closed. A backcheck valve can also be inserted at the inlet of the three trifusor lines. One line will be the anaesthetic (fentanyl) and the other two are volume (blood and FFP or cryoprecipitate or albumin or saline). Leave a saline filled syringe at the inlet point of the trifusor with a three way tap. If required drugs can be given at this point closer to the patient (e.g. Calcium gluconate 0.5 ml/kg). You can put a line at this point but if you attach it to a syringe driver the alarm will sound frequently for back pressure. Two trifusors can be set up in series if more drugs or blood products are required.

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TRIFUSOR CONNECTED



In this photo you can see the setup in situ. The nest that the baby lies in has been removed for surgical access. The head is turned towards the ventilator with something supporting the ETT (e.g. towel).

OTHER ACCESS

The IV is accessed on the right hand and the arm is raised so it can be checked for tissing during the case. A second IV (if available) should be accessed with an extension so it can be used in case of an emergency.

It is best to leave the NCC infusions going through the PICC line and not access it for resuscitation. The one French PICC line can only have a maximum of 10ml/hr running through them and they already usually have TPN, inotropes rocuronium and morphine infusing so boluses are impossible.

It is great to have an arterial line but the time taken vs the urgency of the operation has to be considered. If using the NIBP make sure to reset it for one minutely readings.

MAYO TABLE



A mayo table from theatre (or other small bench) holds the drugs and blood warmer. The blood warmer is brought from theatre and the blood is hung with a three way tap in the line before the warmer in case any other products need to be warmed (eg. albumin). Boluses can be given slowly with a 10ml syringe. Leaking will occur if high pressures are used. Constant vigilance regarding the potential for the IV access to tissue is required.

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ROCURONIUM and FENTANYL



Initially the rocuronium is given as a push directly into the canula before the trifusor is connected (I use 5mg in a 1kg neonate). The next drug is fentanyl and it is given in 2-5mcg boluses through the connected trifusor depending on the stability of the child. I have diluted the fentanyl as 10mcg/ml and would expect to give 10-15mcg minimum (for a 1kg neonate) during the case with the majority early on. Then any volume resuscitation that is required can begin. Falling oxygen saturations is often a sign of poor perfusion and more volume is required.

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APPENDIX 4

VENTILATION STRATEGIES AND CO₂ MONITORING FOR NEONATOLOGIST AND ANAESTHETIST

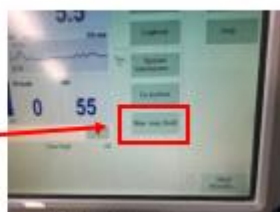
- The desired SpO₂ for the extremely premature babies is 88-92%.
- Check the position of the ETT. If it is close to the carina rather than retaping it a small bolster can be placed.
- In the NCC it is possible to do side stream capnography in the neonates who are conventionally ventilated. NCC use the same Medtronic line we use for transport with our Dräger bricks but it is a neonatal one designed with less dead space. Capnography is not routinely used in the NCC so it should be requested early. The dead space of the connector is 0.5ml and the sampling gas flow is 50mL/min. In cases where the CO₂ is very hard to reduce the added dead space may result in rebreathing and a rising CO₂ usually in a setting where ventilation is already challenging (eg. distended abdomen).



The waveform in blue seen above can be displayed. It is a visual representation of the outward movement of the ECG dots with each breath. If it is not displayed it can be easily added by accessing the ECG data and turning it on



Transcutaneous capnography can be helpful but it is difficult to get a reading and can be inaccurate. The sensor works best if placed over a fatty area rather than a bony area. The trend is more accurate than the actual result. The sensor takes time to warm up so needs to be applied early. It can potentially cause burns so they are moved twice daily. They are most useful in high frequency ventilation when standard capnography will not work.



The manual inspiratory hold button is on the bottom right of both the new and older Dräger ventilators. Hold the button to remain at the end of inspiration pressure until the button is released.



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Date	Revision	Approval
17.6.24	1	Endorsed BRGC