**Neonatal Intensive Care Unit Rotation Children’s & Women’s Health Centre of BC Rotation Manual**

# DESCRIPTION

Children's & Women's Health Centre of British Columbia (C&W) consists of B.C.'s Children's Hospital, B.C.'s Women's Hospital and Health Centre, and Sunny Hill Health Centre for Children. C&W has the largest maternal-fetal-newborn clinical service in Canada and is the major referral centre for acutely ill or injured children in B.C. C&W has more than 400 in-patient beds including a pediatric intensive care unit and neonatal special care nursery. The C&W Neonatal Intensive Care Unit (NICU) rotation is a mandatory rotation of the C&W Hospital Pharmacy Residency program.

C&W is a level 3 perinatal centre providing the full array of obstetrical and neonatal care. The C&W NICU is a 74 bed intensive care nursery capable of providing everything necessary for the life support of premature or term infants with medical or surgical problems. Infants admitted to the NICU are assigned to the care of one of two multidisciplinary teams each under the direction of a staff neonatologist. The acuity and number of infants each team is responsible for is approximately equal and the infants remain in the care of the same team throughout their stay to ensure continuity of care. A third complex care team exists to provide care for infants with long- term medical needs, such as with tracheostomies and gastric tubes. Each one of the two neonatal clinical pharmacists in the NICU is responsible for the pharmaceutical care of infants under one of the acute multidisciplinary NICU teams. The two NICU pharmacists split the responsibilities of the complex care team.

The NICU clinical pharmacists play an important role in the care of the infants in the nursery. The pharmacists are an integral member of the multidisciplinary medical team and work closely with physicians, nurses, respiratory therapists, dieticians and other disciplines in developing appropriate medication and nutritional regimens to meet each individual infant’s requirements.

Pharmacy is an integral member of the NICU Pharmacy and Therapeutics Committee. This committee is responsible for setting medication policies and procedures in the NICU. In addition the committee is responsible for the development of the NICU Drug Dosage Guidelines Manual. Pharmacy also is a member of the NICU Nutrition Committee.

*LMPS – Rotation Manual Revised: March 2019 Page 1 of 8*

# GOAL

* The Resident will develop organizational and clinical skills required to provide pharmaceutical care in the NICU.
* The Resident should be able to function effectively and independently in the NICU setting.

# LEARNING OBJECTIVES

Per those listed for all LMPS Direct Patient Care (DPC) Rotations, available on our Evaluation Outcomes page at [http://www.lmpsresidency.com/residents/resident-manual/evaluation-](http://www.lmpsresidency.com/residents/resident-manual/evaluation-outcomes) [outcomes](http://www.lmpsresidency.com/residents/resident-manual/evaluation-outcomes)

The expected level of resident performance by the completion of this 4-week rotation is outlined in the Direct Patient Care Assessment of the Resident.

# ROTATION-SPECIFIC OBJECTIVES

* 1. **CORE: Introduction to the Neonatal Intensive Care Unit**
		1. Learn the differences between: gestational age (menstrual age); chronological age (postnatal age); postmenstrual age; and corrected age (adjusted age)
		2. What are the differences in viability of premature neonates by gestational age?
		3. How are neonates classified by size and what outcomes are associated with the different size classifications?
		4. List 3 reasons why oral absorption may not be optimal in a premature neonate.
		5. What problems may you encounter in trying to provide medication to an infant that is less than 1000g in terms of drug administration?
		6. Describe the benefits of breastfeeding that are specific to preterm infants

# CORE: Analgesia and Sedation

* + 1. Identify two indications for sedation in neonatal intensive care.
		2. Describe the difficulties in assessing pain in neonates and the use of pain assessment tools
		3. List 4 iatrogenic causes of pain in the neonatal intensive care unit
		4. Describe the pharmacology and pharmacokinetics of morphine, fentanyl, midazolam, and acetaminophen in premature neonates
		5. Describe why NSAIDS are generally not used for analgesia in the NICU
		6. Describe the considerations that must be taken into account with the use of opioid analgesics.
		7. Identify when fentanyl would be the preferred opioid for a continuous infusion

over morphine (or indications to switch from a continuous morphine infusion to a continuous fentanyl infusion)

* + 1. Describe the role of midazolam for sedation and analgesia in the NICU
		2. Describe the controversy surrounding the use of midazolam in premature neonates.
		3. Explain why lorazepam is not used intravenously in neonates
		4. Describe the use of dexmedetomidine in premature neonates, and the controversies surrounding its use in this population.
		5. Explain why chloral hydrate is not a good sedative agent for long term sedation in neonates.
		6. Explain the advantages of using buffered lidocaine versus unbuffered lidocaine

for local analgesia.

* + 1. Be able to formulate a care plan for an infant receiving a continuous morphine infusion for sedation while being mechanically ventilated.
		2. What role do paralytics (rocuronium) have when providing analgesia or sedation to a neonate?

# CORE: Neurology

* + 1. List the four major causes of seizures in neonates
		2. Describe the clinical patterns of seizures in neonates
		3. Describe how seizures commonly seen in the NICU differ from neonatal epilepsy.
		4. Identify the two drugs of choice for the treatment of neonatal seizures
		5. List 3 other drugs which can be used to treat seizures in neonates
		6. Describe the pharmacology and pharmacokinetics of phenobarbital in neonates
		7. Describe the overall approach to treatment of neonatal seizures
		8. Describe the negative effects of the commonly used neonatal anti-epileptic medications on neonatal brains
		9. Describe in detail the pathophysiology and clinical features of hypoxic-ischemic

encephalopathy

* + 1. Describe the effects of cooling on medications given to the neonate with HIE
		2. List the risk factors for intraventricular haemorrhage
		3. How is IVH graded? What outcomes are associated with each grade?
		4. What are the pharmacologic options for the prevention and treatment of IVH?

# CORE: Cardiovascular System

* + 1. Describe the anatomy and physiology of the fetal circulation, commenting on the differences between the fetal and adult circulatory pathways
		2. List two common cardiovascular disorders seen in premature neonates
		3. Describe the pathophysiology of patent ductus arteriosis of prematurity
		4. List 2 signs/symptoms commonly present with clinically significant PDA
		5. List the treatment options for patent ductus arteriosis of prematurity
		6. Describe the mechanism of action and pharmacokinetics of the medications used to treat PDA
		7. What are the major adverse effects of indomethacin and ibuprofen? Is there

evidence to use one over the other?

* + 1. What are the major contraindications to the use of indomethacin or ibuprofen?
		2. What are some clinically significant drug interactions for indomethacin or ibuprofen?
		3. List 3 common clinical manifestations of neonatal hypotension
		4. Understand the basic principles behind the use of the following vasopressors/inotropes in the NICU (mechanism of action, target receptors, side

effect profile): dopamine, epinephrine, norepinephrine, dobutamine, milrinone, vasopressin.

* + 1. Describe the indications and mechanism of action of steroids in the treatment of hypotension
		2. List 5 major adverse effects of steroids in neonates.

# CORE: Infections Diseases

* + 1. Describe the signs and symptoms of infection observed in neonates
		2. What are the differences between early-onset sepsis (EOS) and late onset sepsis (LOS) and why is it important to differentiate between the two?
		3. List the major risk factors for sepsis in neonates:
		4. List common organisms responsible for early-onset sepsis:
		5. List the common organisms responsible for late-onset sepsis:
		6. List antibiotics used in the empirical treatment of early-onset sepsis
		7. List anitibiotics used in the empirical treatment of late-onset sepsis
		8. Describe the pathyophysiology and management of the neonate with necrotising enterocolitis
		9. Describe the pharmacokinetics of gentamicin/tobramycin, vancomycin, cefotaxime, and ampicillin in neonates.
		10. Know the spectrum of antimicrobial activity for the following commonly used

antibiotics in the NICU:

* + - 1. Penicillin
			2. Ampicillin
			3. Cloxacillin
			4. Vancomycin
			5. Linezolid
			6. Cefotaxime
			7. Gent/Tobra
			8. Meropenem
			9. Pip-tazo
		1. Be able to formulate patient care plans for infants receiving gentamicin and vancomycin

# CORE: Respiratory

* + 1. List and describe the most common respiratory disorders seen in neonates
		2. Describe the 3 types of apnea observed in premature neonates.
		3. Define apnea of prematurity and how you can determine if a baby’s apnea’s are due to prematurity
		4. Describe the pharmacological management of apnea of prematurity
		5. Describe the pharmacology and pharmacokinetics of caffeine citrate in preterm neonates.
		6. Formulate a patient care plan for an infant with apnea of prematurity.
		7. Describe the treatment of Respiratory Distress Syndrome of Prematurity.
		8. Explain the issues surrounding the use of steroid therapy for bronchopulmonary dysplasia.
		9. For what reason are empiric antibiotics started on a patient admitted for

meconium aspiration syndrome?

* + 1. Describe signs, symptoms and management of persistent pulmonary hypertension.
		2. Describe the pathophysiology and management of congenital diaphragmatic hernia.

# CORE: Nutrition

* + 1. **Anemia of prematurity**
		2. **Vitamin D deficiency**
	1. **RECOMMENDED: Drug Therapy During Pregnancy and Lactation**

(May skip if resident has completed a Women’s Health rotation)

* + 1. What is a teratogenic drug?
		2. How do the risks of medication exposure to the fetus change by trimester?
		3. Discuss the properties of a medication that affect the transfer of maternal medication into breast milk
		4. Discuss your thought process in deciding if a medication is compatible with

breastfeeding a premature infant

# RECOMMENDED: Fluid and Electrolyte Management in the Neonate

* + 1. Diuretic use
		2. Fluid balance

# OPTIONAL: Neonatal Abstinence Syndrome

* + 1. Describe the overall management of neonatal abstinence syndrome and how you, as a pharmacist, can improve patient outcomes.

# OPTIONAL: Endocrine (Hyper/hypoglycaemia, Adrenal Insufficiency)

* + 1. Describe the normal neonatal metabolic adaptation process
		2. What is the definition of hyperglycemia and hypoglycaemia in a neonate?
		3. What are the risk factors for neonatal hyperglycemia and hypoglycaemia?
		4. What are the clinical signs and symptoms of hyperglycemia dand hypoglycaemia in a neonate?
		5. What are the treatment options for hyperglycemia in a neonate?
		6. What are the treatment options for hypoglycaemia (and neonatal hyperinsulinism) in a neonate?
		7. Recognize signs/symptoms of adrenal and pituitary insufficiency, and describe

appropriate endocrine replacement therapy

# OPTIONAL: Canadian Neonatal Resuscitation Guidelines

* 1. **OPTIONAL: Gastrointestinal System**
		1. Cholestasis
		2. Gastroschisis and Omphalocele

# OPTIONAL: Haematology

* + 1. Bleeding disorders
		2. Transfusions

# OPTIONAL: Metabolic Disorders

* + 1. Hyperbilirubinemia/Kernicterus
		2. Hyperammonemia
		3. Metabolic acidosis

# OPTIONAL: Renal

* + 1. AKI

# OPTIONAL: Mineral Bone Disease RESIDENT’S OWN OBJECTIVES

Residents will identify several of their own learning objectives for the rotation. These should be documented in their ePortfolio prior to the start of the rotation, discussed with the preceptor on day 1 of the rotation, and assessed at the various evaluation points throughout the rotation.

1.

2.

3.

# REQUIRED ACTIVITIES

The resident will:

1. Attend daily rounds with the NICU team.
2. Provide pharmaceutical care to the medical patients on the ward as per the objectives above. This involves daily patient evaluation for efficacy and toxicity of existing therapy as well as detecting and solving potential drug-related problems. Patient load will be determined based on the Resident’s previous experience and proficiency and will be modified at the discretion of the preceptor.
3. Assist in the initiation and continuation of appropriate drug therapy.
4. Provide medication counselling and perform medication histories on all patients under his/her care when appropriate.
5. Provide discharge counselling to all patients who require it and liaise with community pharmacist and/or physician whenever indicated (via letter, PharmaNet, verbal).
6. Document all clinical activities in the patient’s health record as deemed appropriate. Notes should be discussed with the preceptor BEFORE placing them in the chart.
7. Attend pharmacy education sessions (e.g., journal club and other scheduled presentations).
8. If time permits, the resident may attend Grand Rounds at The Chan Centre for Family Health Education from September to June on Friday mornings from 8:30am - 9:30am. Schedule of topics are available at:

<http://pediatrics.med.ubc.ca/events/grand-rounds-schedule-and-presentations/>

1. Prepare for scheduled topic discussions with preceptor.
2. Meet daily with preceptor to discuss the patients being followed, issues of interest, therapeutic controversies, ongoing evaluation, and special topics (outlined in #9).
3. If applicable during the rotation, identify an adverse drug reaction and report it to Health Canada using the proper form. The ADR should also be posted on the patient’s PharmaNet profile if appropriate.
4. Present one case to the pharmacy staff.
5. If time permits, provide an in-service to nursing or medical staff at the discretion of the preceptor OR lead a journal club for the pharmacy staff at the discretion of the preceptor.
6. Other activities as assigned by preceptor.
7. Complete and submit any relevant procedure logs to the preceptor via one45 during the course of the rotation. Please see [http://www.lmpsresidency.com/residents/resident-](http://www.lmpsresidency.com/residents/resident-manual/procedure-logs) [manual/procedure-logs](http://www.lmpsresidency.com/residents/resident-manual/procedure-logs) for further details.
8. Attend weekly medical grand rounds (optional)

# GENERAL STRUCTURE OF THE ROTATION

* The resident will be emailed a rotation calendar outlining their shift schedule, preceptor for each shift, and proposed daily topic discussion prior to the rotation**.**

# COMMUNICATION EXPECTATIONS

1. The resident will discuss all recommendations with the preceptor prior to implementation, unless otherwise arranged with the preceptor.
2. The resident will discuss all written chart notes with the preceptor prior to placing them in the chart, with the exception of medication histories and allergy clarifications, unless otherwise arranged with the preceptor.
3. The resident will notify the preceptor in advance (i.e.: prior to the start of the rotation) of all required off-site activities (e.g.: ADS, BC Wide case presentations, etc.) and absences during the rotation.
4. The resident is encouraged to provide on-going, daily feedback to the preceptor to assist in enriching his or her own learning experience throughout the course of the rotation.

# PRECEPTOR RESPONSIBILITIES

The preceptor will:

1. Meet with the resident on day 1 of the rotation to discuss the goals and objectives of the rotation and work with the resident to develop a schedule for all rotation-specific activities and therapeutic discussions.
2. Clearly communicate expectations of the resident at the start of the rotation and throughout the rotation as required.
3. Provide the resident with a brief orientation and introduction to the pharmacy department, ward, and health care team.
4. Meet with the resident briefly every morning to triage and identify patients for work-up.
5. Meet with the resident dail to discuss and review all patients under the resident’s care, incorporating clinical and therapeutic topic discussions at least 2-3 times per week.
6. Be available to the resident in person or by phone at all times during the rotation.
7. Schedule a presentation date and time with the department and assist the resident in selecting their topic for their journal club/nursing in-service/case presentation at least 2 weeks in advance of the scheduled date.
8. Review and provide feedback on any relevant procedure logs submitted by the resident via one45 during the course of the rotation.
9. Provide informal feedback to the resident on their performance on a daily basis, and complete and discuss all required written evaluations with the resident by the completion of the rotation.

# EVALUATION PROCESSES

Guidance on Evaluation Policies and workflow are available at

<http://www.lmpsresidency.com/residents/resident-manual/evaluation-policies>

1. The resident will receive a written, formative evaluation at the midpoint of the rotation. This evaluation will take into account the rotation-specific objectives and the resident’s own learning objectives.
2. The resident will receive a written, summative evaluation at the end of their rotation. This evaluation will take into account the rotation-specific objectives and the resident’s own learning objectives.
3. The resident will receive continuous feedback throughout the rotation and this will be considered part of the evaluation process.
4. The resident will provide written evaluations of both the preceptor and the rotation and complete a written self-evaluation prior to the last day of the rotation.
5. The preceptor and resident will discuss their respective evaluations in person at midpoint and on the last day of the rotation.

# REQUIRED READING & RESOURCES

* Pre-readings for the first couple of days will be emailed to the resident prior to the start of the rotation
* Once the rotation has started, pre-readings can be found on the teamsite