INTERPROFESSIONAL PROTOCOL - MUHC

X Medication included ☐ No Medication included

THIS IS NOT A MEDICAL ORDER

Title:	Paediatric Emergency Bier Block protocol
This interprofessional protocol is attached to:	- Interprofessional Protocol: Selection of an Antiseptic Skin Solution (200.6.1) - Collective Order: Topical Anaesthetic (200.10.1) - MUHC Pediatric Protocol Adverse Reaction Lidocaine Toxicity (in progress) - MUHC Pediatric Procedural Sedation with Ketamine

1. PURPOSE

The purpose of this protocol is to provide guidelines for nurses, and physicians performing Bier Blocks using the A.T.S. 3000 Tourniquet System to ensure a safe and consistent approach during pre-, intra, and post-procedure care.

The Bier block, a form of intravenous regional anesthesia, is achieved in three steps: 1) passive exsanguination of the extremity, 2) application of an arterial tourniquet to isolate the extremity from the circulation, 3) injection of a local anesthetic into the venous system of the extremity requiring the procedure

2. PROFESSIONALS AND PATIENT POPULATION

Professionals:

Nurses working in the MCH emergency department who have completed an orientation session related to Bier Blocks and who provide care of patients requiring regional analgesia to reduce forearm fractures, laceration repair or foreign body removal.

Emergency Physicians working in the MCH emergency department, who have completed an orientation session related to Bier Blocks and who provide care of the patient requiring regional analgesia to reduce forearm fractures, laceration repair or foreign body removal.

Patients:

Indications:

- Cooperative patients that are
  - Greater than or equal to 6 years old (best in the over 8 year age group, context to be assessed by physician)
  - Who require local analgesia to reduce forearm fractures
  - Who require local analgesia to repair lacerations, removal of foreign bodies in the upper extremities
- Anticipated procedure time is less than 60 minutes (if the anticipated procedure time is expected to be longer than 1 hour, it is recommended to strongly consider the operating room)

  ALERT: Absolute cuff inflation time maximum 90 minutes

Contraindications:

- Allergy to Lidocaine
- Pathologic Hypertension
- Seizure disorders
- Blood dyscrasia (hemophilia, or sickle cell)
- Crush injury or compromised circulation (Compartment syndrome, Raynaud's disease or peripheral vascular disease)
- Complex medical condition
- Non-verbal patients
- Open fracture
- Infection to the limb
- Methemoglobinemia
- Morbid obesity
- Procedure required in both arms
- Patient not eligible for procedural sedation (as per MUHC Pediatric Procedural Sedation with Ketamine)

3. ELEMENTS OF CLINICAL ACTIVITY

Professionals are responsible to know the limits and extent of their practice as related to the particular protocol.

Role of the Emergency Nurse

1. To assist with the preoperative preparation of supplies and equipment
2. To assist with technical aspects of the procedure as needed
3. To monitor the patient's status, vital signs and adequacy of pain control
4. To monitor tourniquet, tourniquet's site, and time of tourniquet inflation
5. To record medication as ordered by the physician
6. To ensure the parent's and patient's questions have been addressed and that support is available as needed

Role of the Emergency Physician

1. To ensure that there are no contraindication for the Bier block
2. To write orders for medication required for the procedure
3. To apply tourniquet, determine inflation tourniquet pressure, inflate/deflate tourniquet
4. To administer the medication necessary for the procedure
5. To anticipate and intervene if signs of hemodynamic instability occur

Role of the Procedural Physician

1. To perform the required procedure

Equipment needed:

- **Zimmer A.T.S. ® 3000** automatic tourniquet system with connection tubing and appropriate sized cuff
- Timer
- Soft roll
- Intravenous catheter 22 or 24 gauge
- Chlorhexidine and Alcohol swab according to the Interprofessional Protocol: Selection of an Antiseptic Skin Solution (200.6.1)
- T-piece
- Intravenous administration set with soluset
- Normal saline 0.9% IV bag 500 mL

- Occusive dressing
- Catheter Stabilization Device (optional)
- Syringe of appropriate size and needleless adaptor
- Normal saline vial (10mL)
- Gauze 2x2
- Band aid
- Kidney basin
- Sharp box
- Gloves
- Emergency cart

Procedure:

PREPROCEDURE PREPARATION

Physician will:

- Assess the patient, take a medical history including history of allergies, current medications and ensure that the patient has no contraindications to the Bier Block procedure
- Explain to the parent/caregiver: the Bier Block procedure, its benefits and possible adverse effects (for example cuff discomfort, low risk of toxicity from local anesthetic: seizures and dysrythmias, and potential for operating room if failed reduction)
- Obtain the verbal consent to perform the Bier Block procedure and to administer the medication from the patient, parent or care taker according to legal requirements
- Choose the adequate cuff size for the patient
- Apply tourniquet, determine the Limb Occlusion Pressure, Recommended Tourniquet Pressure and communicate this information to the nurse
- Perform local intravenous anesthesia

Nurse will:

- Assess the patient's baseline vital signs and neurovascular status of affected limb. If any abnormalities are noted the nurse will communicate this information to the physician performing the Bier block
- Prepare the patient and family for the procedure including providing them the Bier Block information sheet
- Insert a peripheral intravenous (IV) catheter in the affected limb.

> **Alert: Avoid the application of ice. Use a hot pack and topical anaesthetic as per the Collective Order: Topical Anaesthetic (200.10.1)**

- **Perform** calculations and prepare the medications as ordered
- Monitor and record vital signs, pain score, neurovascular status including palpating and noting location of the radial pulse prior to cuff inflation and confirm absence of radial pulse with physician after cuff inflation and prior to lidocaine injection.
- Prepare the procedure equipment and the resuscitation materials :
    - Check the emergency cart, cardiac monitor, suction, oxygen source and resuscitation sheet
    - Verify the tourniquet cuff, valve port and hose for leakage, holes, rips or tears that could cause complications during procedure
    - Performing Zimmer 3000 A.T.S. functional checks
- Record and communicate time and setting at inflation, at 30 minute intervals with remaining time and at deflation

PROCEDURE

Preparation of Bier block

- Patient should be nothing per os (NPO) following triage.
- Check the functionality of the tourniquet. Briefly inflate both cuffs one at a time, squeeze the inflated cuff and observe the pressure oscillations.
- Perform the procedure on a tilting stretcher, with resuscitation equipment nearby
- Insert IV catheter as distally as possible on the procedural extremity, minimum 10 cm below the tourniquet
- Choose cuff size
  - The size of the cuff must be individualized
    - Cuff shape should allow a snug fit at both proximal and distal edges
    - Cuff width should be the greatest width that still assures recommended distances from cuff edges to limb joints and surgical site
    - Cuff length should be the minimum that assures overlap around the limb sufficient to fully engage fasteners or overlap at least 8 cm but no more than 15 cm
- Cuff application:
  - Check correct procedural site before application of the tourniquet cuff
  - Ensure that both cuffs are completely deflated before applying them to the patient
  - The optimal position for placement is the upper arm
  - Wrap soft roll around limb where cuff will be placed to promote comfort
  - The tourniquet cuff should be applied to the widest part of the limb to allow as much tissue as possible to lie between the cuff and any nerves or vascular structures susceptible to damage
  - The dual cuffs tourniquet (red and blue cuffs), must be applied so that the red cuff is proximal and the blue cuff is distal
  - Apply the tourniquet cuff smoothly without wrinkles
  - A snugly applied cuff allows two fingers to slide easily under the cuff at both proximal and distal edges. If only one finger fits, the cuff is too tight; if three fingers fit, the cuff is too loose
  - The valve port and hose connections should be placed so that the hose will not be kinked
  - Apply pulse sensor to a finger on procedural extremity
  - Determine the “Limb Occlusion Pressure” (LOP) and the Recommended Tourniquet Pressure (RTP) for both tourniquet see **Dual Bladder Cuff LOP Measuring section below**
- Elevate limb for 2 minutes
- Inflate proximal cuff at the set RTP, or to 200 mm Hg whichever is greater. The radial pulse of the cuffed extremity should be absent
- Start the timer and set for 30 minutes
- Safety inflation check: after cuff inflation, the physician should squeeze the cuff, and observe whether it is well inflated and that the pressure measured on the machine oscillates with the squeezing of the cuff

Bier block

- Confirm Lidocaine dosage order:
- Physician to administer lidocaine IV over 60 seconds
- During medication administration
  - Ask patient about dizziness, metallic taste or tingling of lips/mouth. Use “LIDOCAINE” mnemonic to identify lidocaine toxicity

- L Lethargy
- D Dizziness
- O Ocular effects: blurred vision
- C Cardiac effects: bradycardia/hypotension
- A Achy head (headache)
- I Inflammation of the vein (thrombophlebitis)
- N Numbness of the tongue
- E Ears ringing

Alert: In the event of a suspected lidocaine toxicity

- **Stop injection**
- **Inflate both cuff tourniquets**
- **Support ABCs**
- **Treat adverse reaction according to MCH Bupivacaine Toxicity Treatment Protocol and Algorithm**

  - Watch for blanching of the skin
- Remove IV
- Wait 15 minutes before starting the procedure
- The physician will perform the specific intervention
- Monitor and record vital signs every 5 minutes, record temperature once during procedure
- Cuff can be deflated after a minimum of 30 minutes has elapsed post lidocaine injection
- If proximal cuff (red) is causing patient discomfort, inflate distal cuff (blue) and once it is fully inflated, deflate the proximal cuff (red). This allows a few more minutes of relief to the patient. Be sure that there is always one cuff inflated at all times during transition from the proximal to the distal cuff
- Consider oral analgesic as indicated

<u>Post Bier block</u>

Deflation of the cuff must occur a minimum of 30 minutes after the lidocaine injection

- Consider oral analgesic as indicated prior deflation of cuff to prevent sudden onset of pain
- Deflate cuff for 5 seconds and re-inflate for 1 minute. Repeat this process 3 times
- Observe closely for any signs or symptoms of systemic lidocaine toxicity. If any signs or symptoms are present re-inflate the cuff
- Assess procedural limb circulation
  - Transient pain upon tourniquet pressure release can be lessened by elevation of the limb,
  - If full color does not return within 3 to 4 minutes after release, the limb should be placed in a position slightly below body level
- Assess patient's
  - Vital signs, including oxygen saturation, pain score
  - Skin integrity under the tourniquet
  - Pulse distal to the tourniquet cuff

- Temperature
- Remove the cuff and any underlying padding immediately following final deflation.
- Patient can be discharged 20 minutes post Cuff deflation
- Provide parents with cast care/fracturereduction discharge information
- If the procedure (reduction) failed, consider performing required procedure in the operating room, Do not repeat Bier block within 2 hours.

Medications:

Lidocaine 1% plain

Indications: local anesthetic

Contraindications: hypersensitivity to lidocaine, and/or amide-type local anesthetics

Dosage: Lidocaine 1% 3 mg/kg mixed with equal parts of normal saline

- Bier block medication record

Monitoring

Pre-procedure

- Baseline vital signs, oxygen saturation, pain score, neurovascular signs and presence of distal pulse of the procedure extremity

During procedure

- Vital signs, oxygen saturation every 5 minutes,
- Pain score, every 15 minutes
- Lidocaine toxicity signs during administration of lidocaine

Post-procedure

- Vital signs, oxygen saturation, pain score, neurovascular signs, skin integrity under the cuff after deflation every 5 minutes for 10 minutes post-procedure

Documentation

See Bier Block Monitoring Record

IMPORTANT SAFETY INFORMATION REGARDING THE USE OF THE ZIMMER A.T.S. ® 3000 AUTOMATIC TOURNIQUET SYSTEM

Pressure Display should be visible whenever the cuff is inflated

An audible activation indicator(s) and alarm(s) should be present and loud enough to be heard by the personnel

The pneumatic tourniquet and electrical cord should be kept dry

IMPORTANT SAFETY INFORMATION REGARDING THE USE OF A TOURNIQUET

The patient's skin under the tourniquet cuff should be protected to prevent fluid accumulation under the cuff, which may cause skin injury

Never apply a tourniquet over the area of the peroneal nerve, or over the knee, or the ankle

The cuff tubing should be positioned on or near the lateral aspect of the extremity to avoid pressure on nerves and kinking of the tubing

Do not readjust an already inflated cuff by rotating it because this produce shearing forces which may damage the underlying tissue

Inflation should be done rapidly to occlude arteries and veins as near simultaneously as possible

Tourniquet users should be familiar with the inflation-deflation sequence when using a dual-bladder cuff. Severe injuries and deaths have occurred when the wrong cuff was deflated

Tourniquet users should be fully aware of which cuff is proximal, which cuff is distal, and the inflation/deflation status of each at all times.

The tourniquet should be deflated gradually as determined by the physician to minimize the potential for an adverse reaction.

Functional Checks

Test PRESSURE set point system as follows:

1. Press either PRESSURE button
2. The PRESSURE display should read "*250" for approximately 2 seconds
3. Within the 2 second time frame, rotate the SHUTTLE KNOB to change the pressure set point. The set pressure can be maintained between 50 mmHg and 475 mmHg.
4. Repeat above steps for the other PRESSURE set point

Test the TIME set point system as follows:

1. Press either Time button
2. The main TIME display should read "*60" for approximately 2 seconds
3. Within the 2 second time frame, rotate the SHUTTLE KNOB to change the pressure set point. The set time can be maintained between 5 and 240 minutes.
4. Repeat above steps for the other TIME set point

Determination of the "Limb Occlusion Pressure" (LOP)

- The LOP is the lowest pressure required to stop the flow of blood in the extremity
- The A.T.S. 3000 has the ability to estimate the patient's limb occlusion pressure based on their physiological characteristics. The A.T.S. 3000 will take into account anticipated changes in blood pressure during the procedure y adding an additional pressure margin to the LOP measurement at the end of the LOP determination.
- The patient blood pressure at the time of LOP measurement should be documented
- The LOP and RTP setting are confirmed by the Bier Block physician

Determination of the Recommended Tourniquet Pressure (RTP)

- The additional pressure margin added to the LOP measurement is referred to as the RTP. The RTP is calculated using the LOP with the following

  LOP 90 - 130 mmHg → LOP + 50 mmHg = RTP

  LOP 131 - 190 mmHg → LOP + 75 mmHg = RTP

  LOP 191 - 300 mmHg → LOP + 100 mmHg = RTP

- The RTP can be accepted or rejected based on the physician's discretion

Dual Bladder Cuff LOP Measuring

1. Apply cuff and sensor to the patient, press the corresponding LOP icon to start the LOP determination.
2. The LOP determination will last approximately 30 seconds depending on the quality of pulse sensed.
3. At the end of the LOP determination, the *A.T.S.* 3000 will beep and display the LOP and RTP pressures in the lower display area for that cuff. The unit will automatically display the RTP in the cuff pressure display area preceded by a "*".
4. A dual bladder dual port cuff tourniquet is connected to the unit (Reminder: Main Cuff is the *Red* ports, Second Cuff is the *Blue* ports).

5. At the end of the LOP determination using the first bladder, press the corresponding PRESSURE button to accept the RTP for that cuff.
6. Repeat step 1-5 with the second bladder to determine it's independent LOP and RTP.

REQUIRED MAINTENANCE

Biomedical engineer to clean, inspect and test the functional and calibration checks of the Zimmer A.T.S. every six months.

Cleaning

Limb Occlusion Pressure (LOP) Sensor: Disinfect with isopropyl alcohol

Exterior of the unit may be cleaned with a cloth that has been dampened (not dripping) with a mild detergent

Tourniquet cuffs may be cleaned with a disinfectant wipe

ALARM CONDITION TABLE

Alarm explanatory table will be available at all times near the Zimmer 3000 as a reference

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4. APPROVAL PROCESS

Institutional and professional approval

Committees	Date [yyyy-mm-dd]
☒ Pharmacy and Therapeutics Pediatrics (if applicable)	2012-04-19
☐ Adult Pharmacy and Therapeutics (if applicable)	
☐ MUHC Adult Site Medication Administration Policy (MASMAP) (if applicable)	
☒ MUHC Pediatric Medication Administration Policy (PMAP) (if applicable)	
☒ Clinical Practice Review Committee (if applicable)	2011-04-05
☐ Nursing Executive Committee and Council of Nurses (NEC and CN) (if applicable)	
☐ Multidisciplinary Council (if applicable)	
☐ MUHC Central Executive Committee of Council of Physicians Dentists and Pharmacists Committee (ECPDP) (Obligatory if attached to a collective order) — Final approval Signature of Chairperson: _____	

5. REVIEW DATE

To be updated in maximum of 5 years (2017) or sooner if presence of new evidence or need for practice change.

6. REFERENCES

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