PBLD Table # 10
Friday, February 24, 2012; 6:30-7:30am
Peripheral nerve blocks in pediatric anesthesia; is it really necessary?

Moderators:
Hyun Kee Chung, MD
Instructor of Anaesthesia
Harvard Medical School
Senior Associate in Perioperative Anesthesia and Pain Medicine
Children's Hospital Boston

David Whiting, MD, FAAP
Instructor of Anaesthesia
Harvard Medical School
Associate in Perioperative Anesthesia and Pain Medicine
Children's Hospital Boston

Goals:

1. To be familiar with the potential benefits of utilizing modern peripheral regional anesthesia techniques in children.
2. To be familiar with the potential benefits of utilizing the ultrasound technique when performing pediatric peripheral nerve blocks.
3. To be familiar with the current estimates of risks associated with peripheral regional anesthesia in adults and children.
4. To be able to give informed consent regarding the risks associated with modern peripheral regional anesthesia in children.
5. To know which patients are at increased risk of complications related to peripheral regional anesthesia.
6. To be able to identify which patients and families are not good candidates for regional anesthesia in general even when there is no medical contraindication.

Description:

Though pediatric peripheral nerve blocks are gaining popularity, there is still considerable reluctance to utilize this type of post op pain control by surgeons and our own anesthesia colleagues. With the advent of ultrasound imaging technology for regional anesthesia, there has been renewed interest in regional anesthesia for adults and children. Currently, many studies have demonstrated that pediatric patients can receive the same benefits from peripheral nerve blocks as adults. It has also been shown that the risks associated with peripheral nerve blocks in children are minimal. So why do we have to "beg" surgeons to allow us to do blocks on our patients? Why do our anesthesia colleagues not even consider offering this type of regional anesthesia when anesthesia consents are obtained?

Avoidance of a novel or experimental type of medical treatment in children would be understandable. But regional anesthesia in children is not new. Renewed interest better describes the current popularity of pediatric peripheral anesthesia. The introduction of a new technique, namely the ultrasound technique, is largely responsible for this.

After attending this PBLD, participants will be able to discuss the risks and benefits of pediatric peripheral nerve block with patients, families, surgeons, and other pediatric anesthesia providers.

Prior Presentation:
This PBLD was not presented by the moderators at any previous conference.

References:

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2. Ultrasound imaging for regional anesthesia in infant, children, and adolescents, Tsui BCH, Anesth, Vol 112, No 3, pp 719-728, March 2010
3. Pediatric regional anesthesia- update, Ecoffey C, Curr Opin Anaesth 20:232-235, 2007
4. A review of pediatric regional anesthesia practice during a 17-year period in a single institution, Rochette A, Pediatric Anesth 2007, 17:874-880
5. ASRA practice advisory on neurologic complications in regional anesthesia and pain medicine, Neal JM, RA & Pain Med, Vol 33, No 5 (Sept-Oct), 2008, pp 404-415
6. Regional anesthesia in anesthetized or heavily sedated patients, Bernards CM, RA & Pain Med, Vol 33, No 5 (Sept-Oct), 2008, pp 449-460
7. The ASRA evidence-based medicine assessment of ultrasound-guided regional anesthesia and pain medicine, executive summary, Neal JM, RA & Pain Med, Vol 35, No 2, Sup 1, March-April 2010, pp S1-S9
8. Ultrasound-guided regional anesthesia and analgesia, a qualitative systematic review, Liu SS, RA & Pain Med, Vol 34, No 1, Jan-Feb 2009, pp 47-59
9. Ultrasound guidance for pediatric peripheral nerve blockade, Ganesh A, Anesth Clin, 27 (2009) pp 197-212
10. Are peripheral and neuraxial blocks with ultrasound guidance more effective and safe in children? Rubin K, Pediatric Anesth 2009, 19:92-961
11. Regional anesthesia and the patient with preexisting neuropathy, Candido KD, Anesth News, Dec 2009, pp 1-8

Case # 1

Objectives:
- Discuss the potential benefits of using peripheral nerve blocks in children.
- Discuss the additional risks of regional anesthesia in children.
- To be familiar with dosing local anesthetics in children.
- To be able to recognize and treat local anesthetic toxicity in children.

Case # 1 history:
A 6 year old, 20 kg male with polydactyly presents for complex hand and foot reconstruction. The planned procedures include excision of synostosis of the left hand with local flap reconstruction of the thumb and index finger, and extensor lengthening of the left foot. His medical history is otherwise remarkable and he takes no medications. Previous general anesthetics have been uneventful. The patient will have a general endotracheal anesthetic for the surgery and the surgeon has consulted the regional anesthesia team for postoperative pain management.

Questions:
Is this patient an appropriate candidate for regional anesthesia?
What regional anesthetic techniques are appropriate for this patient?

Case history (continued):
Physical examination and review of the patient's history confirm that the patient is an appropriate candidate for regional anesthesia. The family is agreeable to regional anesthesia techniques and requests that the blocks be performed after the patient is under general anesthesia. The patient's father mentions that he recently had knee surgery with a femoral nerve block, but his anesthesiologist insisted that block be done while he was lightly sedated.

Questions:
What are the pediatric specific challenges to regional anesthesia?
What benefits will an ultrasound guided peripheral nerve block provide?

Case history (continued):
The surgery is uneventful. The surgeons and anesthesiologist have used no local anesthetic during the case. The regional anesthesia team is called to the operating room to perform the blocks. The surgeon states that the lower extremity extensor lengthening was modest and is likely amenable to local infiltration of local anesthetic.

Questions:
What upper extremity peripheral nerve block is most appropriate for this patient?
What's the maximum amount of local anesthetic that can be used in this patient?
How much local anesthetic can the surgeon use for the local infiltration?

Procedure:
The infraclavicular block provides a complete sensory lock of the arm, including the hand, wrist, forearm, elbow and most of the upper arm. The medial, lateral, and posterior cords of the brachial plexus are adjacent to the axillary artery as it emerges from underneath the clavicle and are amenable to block at this level. An ultrasound guided infraclavicular block is performed using a needle in plane technique with a low frequency transducer.

The maximum local anesthetic dose for this patient is 20 mLs of 0.25% bupivacaine or 20 mLs of 0.2% ropivacaine. Ten milliliters of 0.2% ropivacaine with 40 mcg clonidine are injected under direct ultrasound visualization. The surgeons are then offered the balance of the local anesthetic for local infiltration of the lower extremity.

Questions:
What are signs and symptoms of local anesthetic toxicity in an anesthetized patient?
How is local anesthetic toxicity treated?

Case resolution:
There are no EKG changes or signs of local anesthetic toxicity, so the general anesthetic is discontinued, and the trachea is extubated and the patient is transferred to the PACU in stable condition. The patient was observed sleeping comfortably in the PACU. When awakened, he complained of minor (Wong-Baker Faces score 2) pain in the left lower extremity. He received 1 mg morphine (0.05 mg/kg) with good effect.

Questions:
Why was clonidine added to the local anesthetic?
What is the expected duration of the block?

Discussion:
Ultrasound Guided Peripheral Nerve Blocks in Children
Ultrasound guided regional anesthesia is of particular interest in pediatric patients because the blocks are frequently done under general anesthesia and the patients are not able to provide feedback related to needle-to- nerve contact or symptoms of local anesthetic intravascular injection. Furthermore, the ultrasound transducer demonstrates real time spread of local anesthetic and potentially allows for smaller volumes of local anesthetic to be used. The benefit is largely theoretical, as studies have not yet shown a decreased complication or increased success rate with the smaller volumes of local anesthetic. The data for peripheral nerve blocks, including the infraclavicular block is equivocal.

Local Anesthetic Toxicity
Toxicity of local anesthetics is a function of the serum concentration of the local anesthetic. Potential systemic toxicities include seizures, arrhythmias, and

cardiovascular collapse. The serum concentrations of local anesthetics depends on the amount of local anesthetic, site of injection, potency of the local anesthetic, and addition of additives like epinephrine that limit local spread. At low serum concentrations, local anesthetics produce symptoms of CNS depression (vertigo, ominous feelings, tinnitus), while higher concentrations lead to CNS excitation (tremors, myoclonus jerks, and seizures), followed by generalized CNS depression. Cardiovascular toxicity occurs at greater than three times the dose necessary to produce seizures, and is caused by dose-dependent blockade of cardiac sodium channels. Signs include hypotension, bradycardia, and ventricular dysrhythmias.

Maximum Local Anesthetic Doses for Peripheral Nerve Blocks

Local anesthetic dosing is calculated using ideal body weight. Local anesthetic toxicities are thought to be additive, so the total dose of local anesthetic should be below the additive maximum dose. Systemic absorption is dependent on the type of block performed, so dosing is incremental and must be done with full cardiopulmonary monitoring and resuscitation equipment available including Intralipid 20%. 50 kg is an arbitrary weight for a small adult and is often chosen as the maximum per kilogram dosing weight.

Pediatric Patients <50 kg and > 6 months

Bupivacaine with or without epinephrine 1:200,000: 2.5 mg/kg (1 mL/kg)
Ropivacaine: 3mg/kg (1-1.6 mL/kg)
Lidocaine plain: 5 mg/kg
Lidocaine with epinephrine 1:200,000: 7mg/kg

(Dosing is based on package inserts)

Local Anesthetic Toxicity Treatment

Call for help.
Provide PALS/ACLS.
Consider 20% lipid emulsion (20% Intralipid) therapy in cardiac arrest not responsive to standard therapy.
Bolus 1 mL/kg over 1 minute while continuing chest compressions. Repeat every 3-5 minutes to maximum dose of 3 mL/kg. Start a continuous infusion at 0.25 mL/kg/minute until hemodynamic recovery. Doses greater than 8 mL/kg are unlikely to be of any benefit.
Consider cardiopulmonary bypass (ECMO) early for patients refractory to resuscitation.

Case # 2

Objectives:

-Issues regarding asleep vs. awake peripheral nerve blocks (PNB) in adults and children.

-What pre-existing conditions may increase the risk of PNB?

-What risks do you discuss with your patients/families associated with PNB?

-When not to perform PNB even when there are no medical contraindications.

Case # 2 history:

An 18 y.o. high school student (today is his birthday), 90 Kg, with a football related left shoulder injury. Scheduled for an open shoulder repair in the beach chair position. The patient is a healthy college ball player, he has a documented axillary nerve palsy, confirmed by EMG. He has a hand sized patch of numbness over his lateral deltoid, and a mild decrease in abduction strength of his arm.

Questions:

Is the patient a candidate for a PNB?

Is the patient at increased risk of nerve injury?

Should the block be done under GA or sedated?

Case history (continued):

The surgeon recommends a block for post op pain control (scheduled for day surgery). The surgeon states this will be a long procedure (increased pain).

* What if the father had an ACL repair and his medial shin has been numb ever since, no weakness?

*What if the mother said she had a foot drop for 1 year after a labor epidural?

*what if the patient is being scouted by Boston College as a starting freshman quarterback?

Questions:

What risks and benefits do you discuss with the patient and family when you obtain consent?

Should this patient receive a single shot block or a PNB cath?

Procedure:

The decision by the patient, family, surgeon, and anesthesiologist was made for a single shot PNB. A supraclavicular block was performed under mild sedation in the pre-op holding area.

Questions:

Supraclavicular vs. interscalene, what's the difference for shoulder surgery?

Light sedation vs. deep sedation, what are the issues/risks?

Procedure (continued):

Tylenol 975mg, oxycontin 10mg po pre-med. Versed 2mg, fent 100mcg iv sedation. Pulse-ox, ECG, NBP, 4L facemask. Supine, back elevated, parents present. Ropivacaine 0.5%, 15 ml, in-plane ultrasound technique.

Four hour open shoulder surgery, under GA with LMA + supraclavicular single shout block. Beach chair position. Dilaudid 1mg iv inter-op.

Surgeon wants to know how much Bupivacaine 0.25% with epinephrine 1:200K local he can give at the end of surgery.

Questions:

What effect will local anesthetic dosing have on duration, quality, and toxicity?

What volume is required for an effective block?

What additives to your local are beneficial?

How much local can surgeon give?

Post-op:

Dilaudid 0.3mg x1 in pacu. D/c with home instructions after 1 hr.

Questions:

What block information should you give this patient/family?

Are there any post-op benefits of a PNB and orthopedic surgery outcomes?

Case # 3

Objectives:

-What pre-existing medical conditions may increase the risk of neurologic complications after a PNB?

-What bleeding issues/anticoagulation issues are relevant with a PNB?

-What risks and benefits do you discuss with your patients/families associated with PNB?

-PNB catheters, management and common pitfalls.

Case # 3 history:

A 12 y.o. girl, 30Kg, for right sided calcaneal osteotomy, history of Charcot-Marie-Tooth Disease. Multiple orthopedic surgeries with difficult post op pain control. Required ICU admission for respiratory depression on PCA after previous left sided calcaneal procedure.

*What if the patient has Von Willibran Disease?

*What if the patient will require LMWH therapy post-op due to a DVT complication she had with her last calcaneal procedure?

Questions:

Is the patient a candidate for a PNB, what type? Neuraxial block?

What if the patient has other medical/neurologic conditions: IDDM, Guillain-barre, Multiple sclerosis, Neurofibromatosis?

Case history (continued):

All parties agree that post-op pain is a major concern, and the benefits of regional anesthesia outweigh the risks. A popliteal sciatic catheter is planned for post-op pain control.

Questions:

What level sciatic block is required/recommended? Gluteal, sub-gluteal, mid-thigh, popliteal?

What are the differences in single shot blocks vs. catheters?

Are there any differences in complications between a single shot blocks and catheters?

Procedure:

GETA, MSO4 3mg inter-op, 4 hour procedure, Bupivacaine 0.25% + Epi 1:200K 15ml local used by surgeon.

Lateral popliteal sciatic catheter placed at end of surgery using ultrasound. Ropivacaine 0.2% 15ml bolus via catheter. The patient is extubated awake after a long leg cast is applied.

Questions:

How should you manage your post op local anesthetic infusion? Local, concentration, mode (rate/bolus), additives, duration.

Who will manage the catheter? Surgeon, you (OR anesthesia), Acute pain service, chronic service?

Post-op:

15 minutes after PACU admission, the patient complains of 5/10 pain in the foot, and cramping in the calf (45 minutes after the initial catheter bolus in the OR). The patient can wiggle her toes, but they feel numb. The PACU nurse pages you and says your block has failed.

Questions:

How do you determine quality of your block?

What is secondary failure of your catheter?