Continuous Peripheral Nerve Catheters - What is the Current Thinking?

CPNB Outline:
- Problem of Pain
- Risks and Benefits
- Supplies, Equipment, Space
- Techniques
- Limitations, Billing
- Types of CPNBS:
  - Upper Extremity
  - Torso: PVB, TAP
  - Lower Extremity

Problem of Trauma and Pain:
- American Intensive Care Units:
  - 74% mod-sev pain (Whipple)
  - 35% received analgesics
  - <20% given analgesics for procedures
- Nashville Ortho Surgicenter:
  - Mod-Severe Pain Using Regional Anesthesia
  - 3% DOS; 27% POD1; 20% POD2

Multimodal < Stress Response
- Correlates w/ severity of trauma (Shekim)
- Pain directly accentuates stress response
- Stress response linked to mortality
- MMA < stress response
- SNS activation:
  - incr NE, epi
  - leading to > HR, BP, ischemia
- Endocrine response:
  - < thyroid, > aldosterone (> renin, angiotensin, aldosterone) w/ > water and sodium

Risk Factors for Persistent Postsurgical Pain

Duration of Multimodal Analgesia

NB: Fear = strongest intensifier of pain.
Providers can affect postop pain, fear expectations.
Preventative Analgesia: Timing / Duration

Preemptive Analgesia

Preventative Analgesia

CPNB Complications

Common:
- Leaking:
  - 17-50% incidence
- Adv > 2cm
- Cyano-acrylate glue
- Dermabond
- Surgicel
- Dislodgement 4%
- Disconnects
- 1% incidence
- Tagaderm over connector
- Skin irritation
  - (mastisol/tagaderm)

Rare:
- Entanglement / Cath breakage / Diff removal
- Hematoma:
  - Rare, even with lovenox
  - Superficial CPNBs with DVT prophylaxis is acceptable
  - Buckenmaier, 2006, BJ A.

CPNB Complications - Poor Analgesia/Failure

Risk Factors:
- Inexperienced/trained providers
- Opiate Tolerant patients

Incidence:
- Malchow Series 1164 CPNBs
- 85% "very good-Exc" analgesia
- 11% "fair-good" analgesia
- 4% failure

Ensuring success:
- Experience / Training
- Dosing thru cath
- Color Doppler
- Visualization of catheter
- Min cath depth (<3cm?)
- Out of Plane Technique?

CPNBs - Infectious Complications

Studies:
- Capdevila, 2005. 1416 pts
- Borgeat, 700 C-ISB
- Malchow, unpublished data of 1164 CPNBs
- Wiegel 2007; Aveline 2011

Findings:
- Colonization: 10-28.7%
- Local inflammation: 3%
- Superficial: 0.7-2% (requiring antibiotics)
- Deep: 0.07-0.17% (psoas abscesses, recent nec fascitis)
- NCS duration >2, DM, steroid, ICU, male, low socioeconomic, ? Abx
- Tunneling: Doubtful benefit (altho < dislodgement)
- Nonstim vs stimulating caths:
  - Stim caths may present with deep infection (Lai/Malachow, 2011)
- Fever and elevated WBC late findings
- Don't rely on surgeons to evaluate pts with CPNB (nec fascitis)

CPNBs – Neurologic Complications

- Capdevila, 2005, 1416 CPNBs
  - 0.21% rate, all resolved within 10 weeks
- Borgeat, 2003, 700 C-ISBs Rate of PONS:
  - 8% at POD10
  - 2% at 1mo
  - 0.3% at 3mos
  - 0.2% motor/sens deficits which resolved w/6mos
  - 3% residual sensory deficits 72hrs after cessation
  - 0.2% residual motor deficits 72hrs after cessation
  - Most resolved within 3-6 mos
- Wiegel, 2007, 1398 nerve stim CPNBs
  - 1 pt (0.07%) permanent FNB injury (retroperitoneal hematoma in C-FNB case)

CPNB advantages compared to systemic opiates

- Single Shot vs CPNB:
  - No difference in PONS rate
  - USG vs n.stim technique
  - No difference in PONS rate
- Single Shot:
  - No difference in PONS rate
- Continuous Peripheral Nerve Catheters - What is the Current Thinking?
Continuous Peripheral Nerve Catheters—What is the Current Thinking?

CPNB advantages compared to Epidurals
- Ability to ambulate
- No urinary retention
- No pruritis (epidural opiates)
- Hypotension
- Min concern with anticoagulation (excluding PVB, LPB caths) with extensive military use
- Capdevila, 1999, 56 TKA pts
  - C-FNB vs LEC vs PCA-M
  - Both RA grps >> analgesia, ROM
  - C-FNB << side effects

CPNBs—Improved Quality of Life
- Ilfeld Series of Studies
  - Home C-PVB for mastectomy, 2014
  - < pain, opiates and SEs
  - Wu > Quality of life with > function, mental health, sleep, cognition

CPNBs—Improved Patient Satisfaction
- Very high. Huge PR impact.
  - Most patients thrilled to have CPNB available.
  - 90% desired same pain mgmt next time (Rawal, 2002)
  - C-ISB vs SS/ opiates after shoulder surg.
    - Borgeat, 2000. C-ISB vs IV-PCA
      - > pt satisfaction in C-ISB group (9.7 vs 7.5)
  - Marianos, 2009, C-ISB vs SS/ opiates
    - > pt satisfaction in C-ISB group (10 vs 7)

CPNBs—Improved Sleep
- Ilfeld, 2002, Anes. X 2
  - Study 1: C-POP for foot/ankle surg
  - Study 2: C-ICB for upper extremity surgery
  - Placebo 10 x insomnia rate and sleep disturbances in both studies
  - Mariano, similar findings for C-ISB for shoulder surg
  - Eg. important in OSA patients

CPNBs—Improved Cost
- Lenart/Malchow 2012:
  - LOS analysis: CPNB << PNB << opiates postop.
  - <Length of Stay
  - 3.8 vs 5.0d for TKA (even 23hr observation possible)
  - Earlier ambulation for TKA (88% on POD1)
  - Avoiding Hospitalization
  - Outpatient Shoulder Surgery with C-ISB (Ilfeld, Gallay)
  - Major Foot/Ankle Reconstruction outpt with C-POP
  - < Cost of Hospitalization (Hebl, Williams)
  - < Rehab center stays (TKA—Capdevila)
Improved Post-Op Analgesia and Rehabilitation
- 603 pts, meta-analysis
- Pain with CPNB comp to opiates
- at 24, 48, 72 hours
- at rest and activity

C-PVBs Decrease Pulmonary Complications
- C-PVB T3-8 in Mult Rib Fx
- 2-3 cm in space (50% difficulty)
- B0.25% at 0.1-0.2 ml/kg/hr
- 20% contralat spread; some epid spread.
- < VAS, RR
- > SaO2, FRC, PEF, cough

C-PVB May Improve Survival
- Exadaktylos, Anes, 2006. 129 pts Breast CA
- 94% CA-free in C-PVB grp vs 77% in opiate grp at 3 yrs
- Mechanism:
  - Stress resp < Natural Killer cell fn
  - opiates < cellular/humoral immune fn (Gupta, 2002)
- Deegan, Yeager, 2010
  - Prop cytokines x 10
  - 32 Breast CA patients
  - Propofol/PVB vs Sevo/ opiates
  - < IL1B, MMP3, MMP9
  - > IL10 (enhances NK cell act)
  - Favorable immunologic changes

CPNBs: Decreasing Chronic Pain
- Borghi, 2010, Italy
- 71 mainly CA, LE pts, prospective, obs, cohort controls
- C-SCI + C-FNB periop x 30d!
- Ropiv 0.5% @ 5 ml/hr; refilled Home Pumps
- NSAID, tramadol, OC pm
- Patients instructed only to remove catheters if no PLP or phantom sensations
- No PLP at 1yr pts who completed protocol

CPNB- Block Room
- Critical for CPNBs:
  - Success
  - < Complications
  - Patient Safety
  - Privacy, Monitors
- IV Premed
  - Anxiolyis
  - Our Std: V2/K10
- Emergency
  - Intralipid, propofol, sux
- Airway, suction
- Supplies:
  - Cabinets, Carts, lockable
  - Needles, Syringes, Meds
- Challenges:
  - Space
  - Personnel (pre, during, post)

CPNB- Sterile Procedure
- Probe Covers:
  - Sterile pouch required unlike single shot
  - Various products avail
- Gel inside/ outside sheath (x Safersonic)
- Sterile drapes, gloves
- Chlorhexidine prep
- Mask, hat
**Continuous PNB Needle/Catheter Systems**

- Catheter systems:
  - Non-stimulating caths
  - Stimulating caths
  - More difficult to place

- Morin, 2010, RAPM. Review
  - Suggestive of benefit with Stim caths…
  - C-ISB (< pain)
  - C-Pop, C-FNB (< onset time)

- Catheter:
  - multi vs single orifice
  - No less 20 gu

**CPNBs – USG and Cath Depth**

- Ultrasound Guided:
  - < procedure time
  - ? > success
  - Primary benefit (< LATs and pneumo risk)
  - Helpful in fractures and amputations
  - Min help with C-PVB and C-SCI

- Confirmation:
  - 3-5ml LA, saline, or D5W, agitated saline (+/- color)
  - Visualization of catheter
  - Extra providers needed

- Catheter Depth:
  - 1-5 cm in neural sheath (success vs dislodgement)
  - Iffeld, 2011 Min difference. (Similar study at Vandy)

**Probe, Needle, Nerve Orientation Options**

- 1st Choice:
  - Probe: Short Axis
  - Needle: In-Plane (most common for RA)

- 2nd Choice:
  - Probe: Short Axis
  - Needle: Out of Plane
  - Ideal for CPNB but difficult in some situations (C-POP)

- 3rd choice:
  - Probe: Long Axis
  - Needle: In-plane (Vasc access)

**Color Doppler**

- Helpful for identification of Artery/Vein in area
  - Artery- pulsatile, noncompressible
  - Vein- larger, compressible

- Catheter confirmation agitated saline/LA

**CPNB Pumps**

- Elastomeric/Spring loaded Pumps
  - On-Q; Accufusor; Baxter
  - Select-a-flow 2-14ml/hr
  - On-Demand 5ml/dose available
  - Both Select-a-flow and On-Demand
  - Easy, disposable, no alarms
  - 110-130%/flow rate 1-8 hrs
  - No refill of pump

- Electronic (batteries)
  - Ambit (Stryker)
  - Programmable, non-disposable
  - Higher volumes
  - More complex for patients

- Electronic "epidural" pumps for inpts

- Pharmacopeia, chap 797, ISO 5.
  - Min risk level; clean air hood; extensive requirements

**CPNBs Solutions, Rates**

- Local Anesthetics
  - Bupivacaine
    - 0.125%
    - mass (dose) prob more significant
    - Ropivacaine
      - 0.2% (potency)
      - Expensive ($8 vs $110)
    - Reduce for severe hepatorenal dz
    - No adjuncts useful
    - Serum levels 0.5-1.8ug/ml

- Rates:
  - PCA setting ideal comp to set basal rate
  - < LA dose, > pump duration, > pt satisfaction
  - 2-14 ml/hr
  - PCA setting: 2-5 ml/30-60min
  - Multiple catheters:
    - Ex: Fem/Sci
    - Max:
      - 20ml/h total for both
      - 10ml/hr each frequent
    - Bupivacaine max 0.5mg/kg/hr
Patient Education

- Reasonable expectations
- Prevent Disconnects, Leaking
- Patient Handout, Brochure
- Adjusting pump (analgesia w/o motor block)
- Protecting limb, Avoiding falls (slings, crutches, knee immobilizers)
- Exchange Phone #s
- Clean and Dry
- Observe for signs of infections
- Plan for Breakthrough Pain
- Plan for Removing Catheter

Continuous Peripheral Nerve Catheters (CPNB)

- Trauma/ Amputations:
- Extensive military use
- Burns, dressing changes
- Age: >12 yo in our practice
- Home:
  - Independent, able to care for self
  - Compliant, available for f/u

Indications:

- Trauma/ Amputations:
- Extensive military use
- Burns, dressing changes
- Age: >12 yo in our practice
- Home:
  - Independent, able to care for self
  - Compliant, available for f/u

Contraindications

- Allergy
- Patient Refusal
- Infection at site

Anticoagulation considerations:
- Avoid deep catheters with anticoagulation (esp LPB)
- Most CPNB acceptable with standard DVT prophylaxis

Acute Compartment Syndrome concerns – relative
- Avoid dense, long-acting blocks
- CPNB will dilute LA may be acceptable R/B (Mannion)
- Wounded warrior diagnosed with ACS even w/ CPNB (also Walker, 2012, RAPM)
- Inability to care for catheter (Home use)
- Lack of Availability for follow-up

Limitations

- Poor Reimbursement
- Increased Cost
  - Needle/Cath $30
  - Pump $250
- Increased Time
  - Place (15 min)
  - Pump setup (15 min)
  - Pt Education (15 min)
- Increased Liability
  - Infections
  - Poor analgesia (plan for breakthrough pain)

Billing for CPNB Codes & RVUs

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<tr>
<th>Block</th>
<th>Code</th>
<th>ASA Unit Worth</th>
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<tr>
<td>Brachial Plexus</td>
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<td>13</td>
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<td>Sciatic</td>
<td>64446</td>
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<td>Paravertebral</td>
<td>64520-22</td>
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</tbody>
</table>

Law changed 2009; CMS "unbundled" CPNB charge; new RVU roughly 10.

Continuous Peripheral Blocks Codes - Daily Evaluation Charges

- Charge for Catheter placement and separate charges for inpatient evaluation and mgmt
- Total USB Billing - complicated
  - Procedure Fee
  - Facility Fee
  - USG Fee
- Daily Evaluation - Inpatient
  - Need 3 components (Hx/PE/plan and coordination)
  - Ave 15min at bedside
  - Use 99231 (Daily evaluation) code
  - 0.76 RVU
- Home CPNB services not billable essentially
  - If face to face, could use 99211-99215 codes
Other Billing Considerations:

- **Documentation requires:**
  - Type of Block/CPNB
  - Indication: 719.xx pain
  - Surgeon’s request for pain block/catheter
  - Description
  - Date
  - Anesthesiologist
  - USG guidance and picture in chart
  - Pre or postop: primary or postop analgesia.

Charge Modifiers

- **Modifier “51”**
  - Multiple blocks on the same extremity
  - Ex: Sciatic nerve catheter & single femoral block for ORIF

- **Modifier “50”**
  - Rare
  - Used for bilateral nerve blocks along with “59”

Upper Extremity Catheters - Interscalene

- Posterior vs Posterior-lateral vs Anterior
  - Boezza, N. Stm, 2002
  - Antonakakis, USG, 2009
- 35% of all CPNB in our ASC
- Total Shoulder Arthroplasty
- Proximal Humeral Fractures
- Open Shoulder Cases
- Clavicular ORIFs - Cervical plexus caths at C4

Upper Extremity - Suprascavicular or Infrascavicular CPNB

- Mid-Dist Humeral ORIF
- Major Elbow, Forearm, Hand Surgery
- Amputations
- Elbow Arthroplasty
- Burns
- Reimplantations:
  - Taaras, 1998, J Reconstruct Microsurg.
  - Most feel C-FNB gold standard
  - C-Adductor vs C-FNB Catheters
- Nearly equivalent analgesia
- Less Motor Block

Lower Extremity Catheters

- LPB
- TKA
- Fem/Fascia Iliaca
- Fem ORIF AKA/BKA (Fem/Sci)
- TIB Plt ORIF (Fem/Sci)
- Bums
- Saphenous/ Adductor
- May require post op placement
- Minimizes fall risk
- Add for major medial ankle surgery

Sciatic/ Popliteal CPNBs

- Calcaneal ORIF
- Ankle Reconstruction
- Ankle arthrodesis
- Dist Tib/fib ORIF
- Hallux Valgus Repair
- 55% of all Home CPNBs C-Popliteal at Nashville ASC

***Subgluteal most comfortable sciatic***

- Consider Tourniquet Location if primary
- Consider Surgical Prep if preop CPNB
- Couple with femoral or saphenous blocks usually
Continuous Peripheral Nerve Catheters: What is the Current Thinking?

CPNB for Thoracic / Abdominal Surgery

- C-PVB
  - Thoracotomy
  - VATS
  - Mult Rib Fractures
  - Mid-CAD
  - Major Breast Surgery

- C-TAP
  - Open Cholecystectomy
  - Laparotomy
  - Malchow, 2011
  - Avoided postop opiates
  - Hysterectomy
  - ICBG

C-PVB vs TEA for Thoracotomy

- Joshi, 2011, A&A.
- Grider, 2012 J Cardiothor Vasc Anesth

Analgesia:
- Equivalent analgesia with LA alone
- > analgesia with TEA-LA + opioid
- > Inc Spirometry with TEA-LA opioid
- TEA-opioid alone = systemic opiates

Side Effects:
- > Hypotension with TEA-LA alone
- > pruritis with TEA-LA + opioid (35%)
- > pulm complications with systemic opioids vs C-PVB or TEA

Post-Thoracotomy Pain Syndrome:
- 20% with TEA or C-PVB
- Up to 50% without Adv RA

References:
- Antonskalski. USG posterior ISB. RAPM. 2009; 34:64-68.

Conclusion

Continuous Peripheral Nerve Blocks
- Introduction
- Risks and Benefits
- Supplies, Techniques
- Indications, Limitations
- Specific Types

Questions and Answers?

“Prospect Group”