Neurologic Complications following Regional Anesthesia in Obstetrics

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Neurologic Complications

- Immediate
  - Motor block, unexpectedly high block, prolonged block, seizures
- Prolonged or delayed
Etiology

- Obstetric etiology
- Traumatic nerve injury
- Spinal Origin
  - Spinal cord compression
  - Hematoma
  - Abscess
- Meningitis
  - Bacterial
  - Chemical

- Relation to the local anesthetic
  - Transient Neurologic Symptoms (TNS)
  - Cauda equina syndrome
- Cerebral origin
  - Headache and decreased ICP
Obstetric Anesthesia Claims

- 1990 to present, claims for maternal nerve injury—greater than 20% (89)
- Radiculopathy – 54% (48/89)
- Spinal cord injury – 18% (16/89)
  - Paraplegia in 10/16

Arendt, Current Opinion in Anesth, 2009
Peripheral nerve injuries
- Cephalo-pelvic disproportion
- Difficult labor
- Instrumental delivery

These nerve injuries have to be ruled out before considering an anesthetic implication.

Trauma to the lumbosacral trunk
- Commonest peripheral nerve lesions of child birth.
- Postpartum foot drop may result from fetal brow compression of the lumbosacral trunk.
**Obstetric Etiologies**

- **In-correct or prolonged positioning**
  - Compression of
    - Lateral cutaneous nerve
    - Common peroneal nerve.

- **Abnormal presentation**
  - Macrosomia or prolonged labor
    - Post-partum femoral
    - Obturator neuropathy.
Obstetric Etiologies Evaluation

- Review anesthesia record
  - Pain or paresthesias before delivery
  - Stirrups time
  - Fetal birth weight
  - Length of labor
  - Forceps use

- Mapping sensory and motor deficits

- Neurology consult and EMG for prognosis
Obstetric Etiologies: Management

- Foot-drop splint – ambulatory patients
- Foot pushboard at night
- Spontaneous recovery depending on nerve damage
Pressure Subjected Peripheral Nerves In Pelvis

Diagram showing the obturator nerve, femoral nerve, and lateral femoral cutaneous nerve in the pelvis.
### Distribution of Nerve Injuries in Laboring Parturients

<table>
<thead>
<tr>
<th>Nerve Injury</th>
<th>Total New</th>
<th>Preexisting</th>
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<tbody>
<tr>
<td>Lateral femoral</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>cutaneous</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>Femoral</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Common Peroneal†</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Lumbosacral plexus</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Sciatic</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Obturator</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Radicular</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>63</strong></td>
<td><strong>10</strong></td>
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</table>

Wong, Ob & Gyn, 2003
<table>
<thead>
<tr>
<th>Analgesia Technique</th>
<th># Deliveries</th>
<th># ND</th>
<th>Incidence of ND</th>
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<tbody>
<tr>
<td>None</td>
<td>8198</td>
<td>2</td>
<td>1 / 4099</td>
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<tr>
<td>Inhalational Analgesia</td>
<td>4766</td>
<td>3</td>
<td>1 / 1589</td>
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<tr>
<td>Epidural</td>
<td>9403</td>
<td>34</td>
<td>1 / 277</td>
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<tr>
<td>General Anesthesia</td>
<td>864</td>
<td>3</td>
<td>1 / 288</td>
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<tr>
<td>Other</td>
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<td>3</td>
<td>1 / 199</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>23,827</strong></td>
<td><strong>45</strong></td>
<td><strong>1 / 530</strong></td>
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</tbody>
</table>

Identification of Lumbar Interspinous Space

- Ultrasound vs palpation
  - 121 obstetric pts
  - Agreed 55%
  - Ultrasound usually higher than palpation
  - One or two spaces higher than intended

Whitty, IARS, 2008
Identification of Lumbar Interspinous Space

- Van Gessell et al
  - 59% dural punctures 1-2 spaces higher than assumed

- Broadbent et al
  - Experienced anesthetists
  - 85% of observations space was 1-4 segments higher
Complications of Epidural Obstetric Analgesia

- Intravascular injection  1:5,000
- Intrathecal injection      1:2,900
- Subdural injection        1:4,200
- High or total spinal       1:16,200

Jenkins, IJOA, 2005
Event Rates for Complications

Epidural hematoma 1:168,000
Deep epidural infection 1:145,000
Persistent neurologic injury 1:240,000
Transient neurologic injury 1:6,700

Ruppen, Anesthesiology, 2006
Epidural Catheter-Induced Traumatic Radiculopathy

- 7 cases during 12 month period – Yoshii, Reg Anesth, 1994
- 24-44% transient paresthesias
- Stiffer nylon catheter greater incidence than polyurethane
- Open end (single pore) greater than closed end catheters
Traumatic Nerve Injury

- Motor Root Injury
  - Lower Motor Neuron Paralysis

- Sensory Root Injury
  - Painful paresthesias

- Peripheral Nerve Injury
  - Intrinsic Maternal Palsy from Positioning

- Segmental Distribution
  - Cord or Root injury

Peripheral Distribution

Segmental Distribution
Conus Medullaris Injury

- 7 pts injury with spinal and CSE
- Persistent neurologic sequelae
- MRI -spinal cord injury
- Pain, sensory deficit, foot drop, & bladder dysfunction

Reynolds, Anesthesia, 2001
Word of Caution

Pencil-point spinal needles must be advanced further than cutting needles before the orifice is within the subarachnoid space, at which point the tip may impinge on the spinal cord.
Traumatic Nerve Injury - Evaluation

- Thorough History & Physical Examination
- Review
  - Anesthesia Record
  - Paresthesias
  - Pre-existing Neurologic disease
- Early Neurology consultation
- EMG, Nerve conduction studies
Minor Neurologic Injury
- Observation
- Recovery within a few days to a few months

Major Neurologic Injury
- Follow Recommendations of Neurology and Physiotherapy
Epidural Hematoma

- Incidence 0.2-3.7:100,000 obstetric epidurals
- Features:
  - Severe backache
  - Neurologic deficit
  - Tenderness
  - Unexplained fever
Epidural Hematoma

LMWH and Obstetric neuraxial blocks
- No reported cases

If platelet count 80-100 epidural placed
- 66% academic practitioners
- 55% private practitioners

Loo, IJOA, 2000

Epidural Hematoma

Evaluation and Treatment

- History & Physical examination
- Verify Coagulation profile and Platelet count
- Early Neuro-surgical Consultation
- MRI of Spine
- CT or Myelography if MRI is unavailable
- Spinal cord decompression (within 8hr)
Epidural Abscess

- Severe Back Pain
- Local Tenderness
- Fever with Chills
- Leucocytosis
- Paresthesias
- Urinary Retention
- Irreversible Paraplegia
Risk Factors for Epidural Abscess

- Prolonged catheterization 1-4 days
- Venous trauma or difficult insertion
- Opioid without local anesthetic
- Diabetes or immunosuppression
- Body fluids in bed
- Poor aseptic technique
Epidural Abscess

- Evaluation
- History & Physical Examination
- Labs – WBC count and differential
- Early Neuro-surgical Consult
- Myelogram, CT Scan
- MRI – gadolinium enhancement
Epidural Abscess

◆ Treatment:

➢ Antibiotics

➢ Percutaneous needle drainage - *Tabo, Anesthesiology, 1994*

➢ Emergent laminectomy and drainage under direct vision
Bacterial Meningitis

- Fever, headache, photophobia
- Confusion, drowsiness, vomiting
- Neck stiffness, elevated WBC
- Positive kernig’s sign
Bacterial Meningitis - Risk Factors

- Entry point-blood borne or dural puncture
- Streptococcus viridans
- No face mask
- Vaginal infection
- Bacteremia
- Epidural blood patch

Reynolds, Neurologic complications, 701
Case Reports of Meningitis in OB Patients

<table>
<thead>
<tr>
<th></th>
<th>Labor</th>
<th>Cesarean Section</th>
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<tr>
<td></td>
<td>Spinal</td>
<td>Spinal</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>CSE</td>
<td>Epidural</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Unintentional dural puncture</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Uncomplicated epidural</td>
<td>6</td>
</tr>
</tbody>
</table>

Reynolds, Neurologic complications, 701
Routine epidural turns deadly - April 2, 2003

- Julie LeMoult
- Strep Meningoencephalitis
Aseptic Meningitis

- Fever, headache, nuchal rigidity, and photophobia
- Onset 24hr after dural puncture
- CSF
  - Opalescent and sterile
  - Variety of white cells in increased number
- Treatment
  - Symptomatic
  - Empiric Antibiotics
  - Usually subsides without sequelae - few days
**Bacterial Meningitis**

- **Management**

- **CSF analysis & Microscopy**
  - Increased CSF pressure
  - Increased Protein and WBC
  - Decreased Glucose

- **Appropriate Antibiotics**
Ischemia

- Pressure on blood vessels
  - Dual blood supply to the terminal part of spinal cord
  - Major supply – artery of Adamkiewicz
  - Minor supply - iliolumbar and lateral sacral arteries
Anterior Spinal Artery Syndrome

- Causes - severe arterial hypotension
- Necrosis of the anterior two thirds of the spinal cord below the lesion

- Features
  - loss of motor function
  - loss of pain and temperature
  - sparing of vibration and joint sensation
Cauda-Equina Syndrome

- Signs and symptoms
  - Bowel and bladder dysfunction
  - Motor and sensory deficit
  - Saddle sensory loss

- Etiology
  - Maldistribution
  - Excessive doses of 5% lidocaine

Loo, AAS, 1999;43:371-9
Cauda Equina Syndrome

- 6 Cases of CES reported to Swedish Pharmaceutical Insurance (1993-97)

- Recommendation
  - Hyperbaric lidocaine – no greater than 2%
  - Total dose limited to 60 mg

Loo, AAS, 1999;43:371-9
Transient Neurologic Symptoms (TNS)

- Lidocaine Spinal Anesthesia 16 - 40%
- Pain or Sensory abnormalities in the lower back, buttocks or lower extremities
- Starts within a day – Resolves over a week
- Risk Factors
  - Obesity
  - Lithotomy
  - Out patient status

- Tetracaine 1.6%
- Bupivacaine 1.3%
- Lidocaine 11.9%
TNS in Obstetric Patients

- Incidence very low
  - Cephalad spread of LA
  - Increased elasticity of musculoskeletal system due to relaxin potentially protective

Wong, Reg Anesth and Pain Medicine, 1999
**Transient Neurologic Symptoms (TNS)**

- **Dose and Lidocaine concentrations**
  - No effect on TNS

- **Management**
  - EMG, Nerve conduction studies, SSEP are Normal
  - NSAIDs and Oral Opioid analgesics
Inherited Neuropathy

- 28 yr s/p C/S under epidural-rt foot drop and lateral foot numbness
- L5 root injury and referred to neurology
- 5 months later seen in clinic after recovery
- 8 yr ago lt foot with similar symptoms
- Heriditary neuropathy with liability to pressure palsies (HNPP)
HNPP

- 16:100,000 population
- Autosomal dominant with variable penetrance
- Second or third decade
- Painless focal neuropathies at common entrapment sites after minor trauma or compression
- Resolve in days to months
Cranial Nerve Palsy with PDPH

- Abducent nerve most susceptible
- Facial nerve palsy
- Cranial nerve VIII dysfunction
  - Without blood patch risk for permanent tinnitus
- Visual field defects
- Trigeminal nerve disturbance - transient effect
  - High spinal block
Hearing Loss

- Dural puncture
  - 0.4%-9.1% transient decrease in low frequency
  - Unilateral
  - Perilymphatic pressure decreases in cochlear aqueduct
  - 14% parturients with spinal 24g Sprotte (Hussain, 1996, Otolaryngology)
  - Resolution after blood patch

Seminars of Perin, 2002, 154-68
Cranial Subdural Hematoma

- Reduced CSF pressure-rupture of bridging meningeal veins
- Reported after:
  - Dural puncture with epidural needle
  - Spinal needle
  - Myelography
  - Diagnostic lumbar puncture
Subdural Hematoma
# Frequency of Systemic Toxic Reactions

<table>
<thead>
<tr>
<th>Author</th>
<th>Epidural</th>
<th>STR</th>
<th>Rate</th>
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<tbody>
<tr>
<td><strong>Pre-1982 rate</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Blundell, 1955</td>
<td>790</td>
<td>87</td>
<td>110</td>
</tr>
<tr>
<td>Bonica, 1957</td>
<td>3,637</td>
<td>116</td>
<td>320</td>
</tr>
<tr>
<td>Moore, 1978</td>
<td>6,729</td>
<td>13</td>
<td>20</td>
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<tr>
<td>Kenepp, 1981</td>
<td>4,003</td>
<td>40</td>
<td>100</td>
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<tr>
<td><strong>Post-1982 rate</strong></td>
<td></td>
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</tr>
<tr>
<td>Tanake, 1993</td>
<td>17,439</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Brown, 1995</td>
<td>16,870</td>
<td>2</td>
<td>1.2</td>
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<tr>
<td>Auroy, 1997</td>
<td>30,413</td>
<td>4</td>
<td>1.3</td>
</tr>
</tbody>
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Rate = frequency per 10,000

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Regional Anesthesia and Pain Medicine, 2002, 556-561
Closed Claims Data Experience

- 1970s: IV Inj 5, Death 3, No Test 4
- 1980s: IV Inj 4, Death 2, No Test 2
- 1990s: IV Inj 3, Death 1, No Test 1

Mulroy, Regional Anesthesia and Pain Medicine, 2002, 556-561
Conclusion

- Close follow-up after neuraxial anesthesia
- Aseptic and meticulous technique
- Avoid upper lumbar interspace at all times
- Consult Neurology/Neurosurgery as needed