UPMC LIFE CHANGING MEDICINE

Complications of Obstetrical Anesthesia

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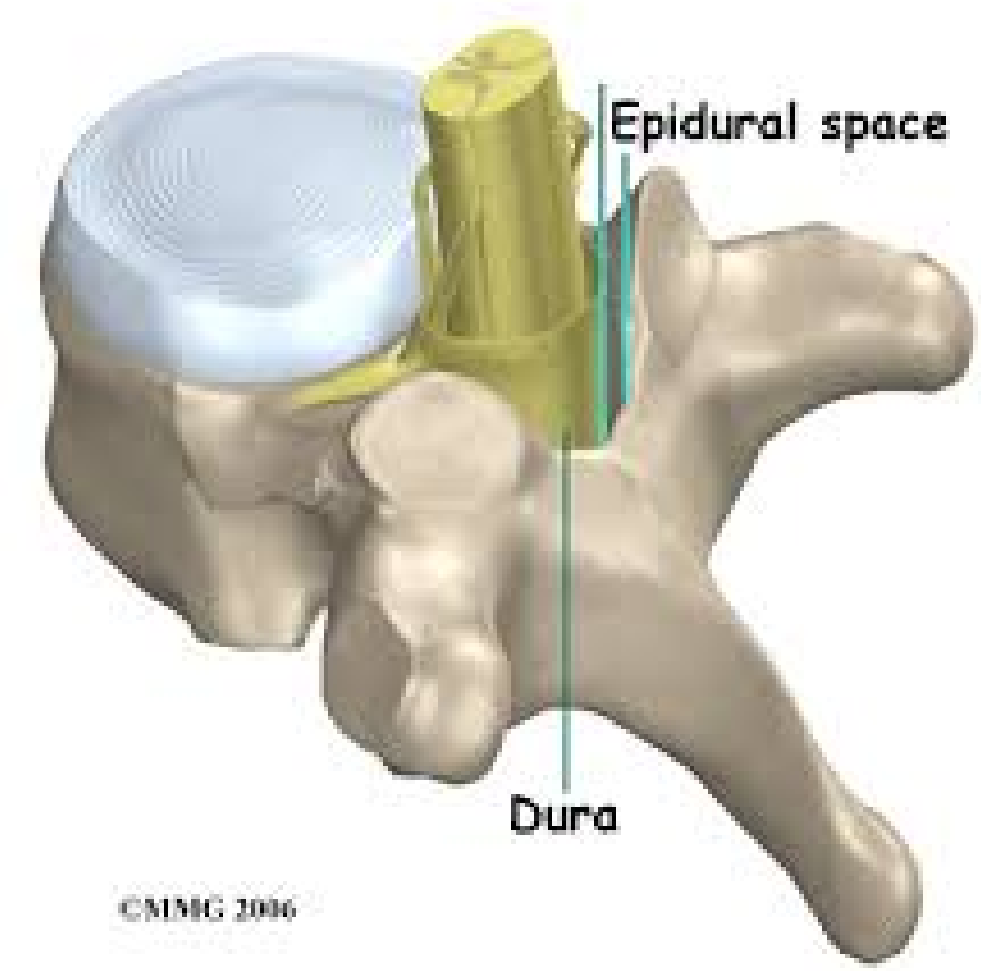
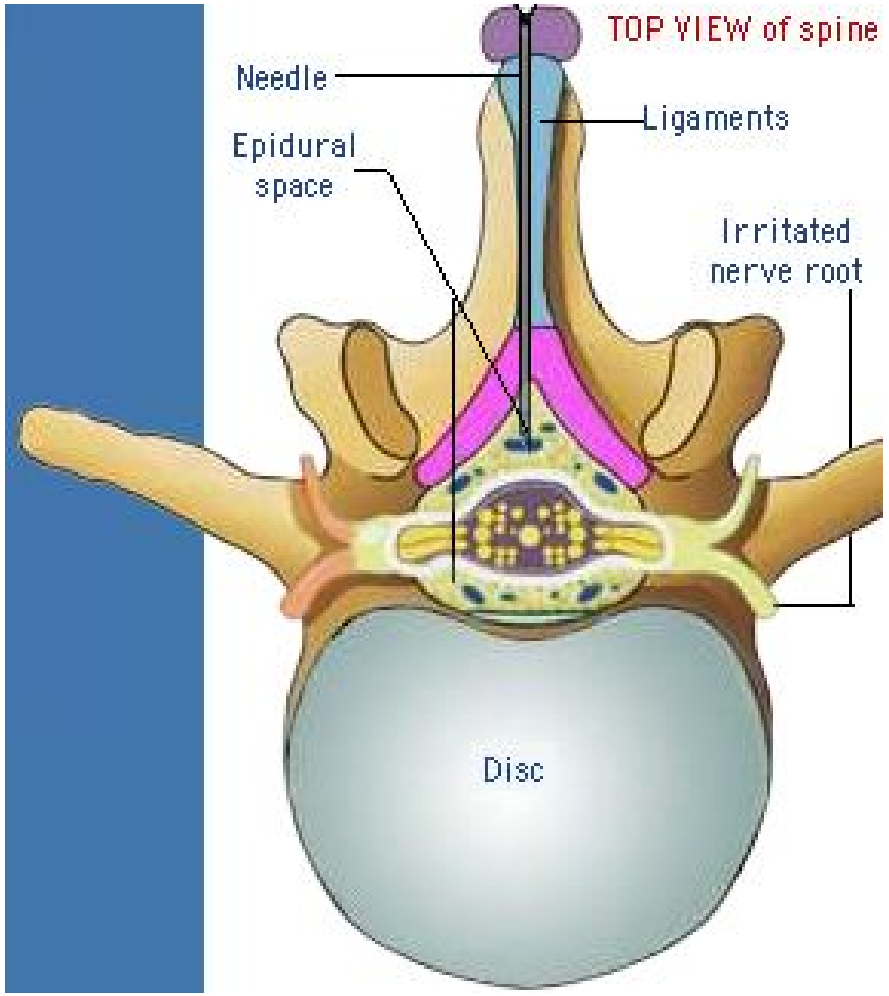
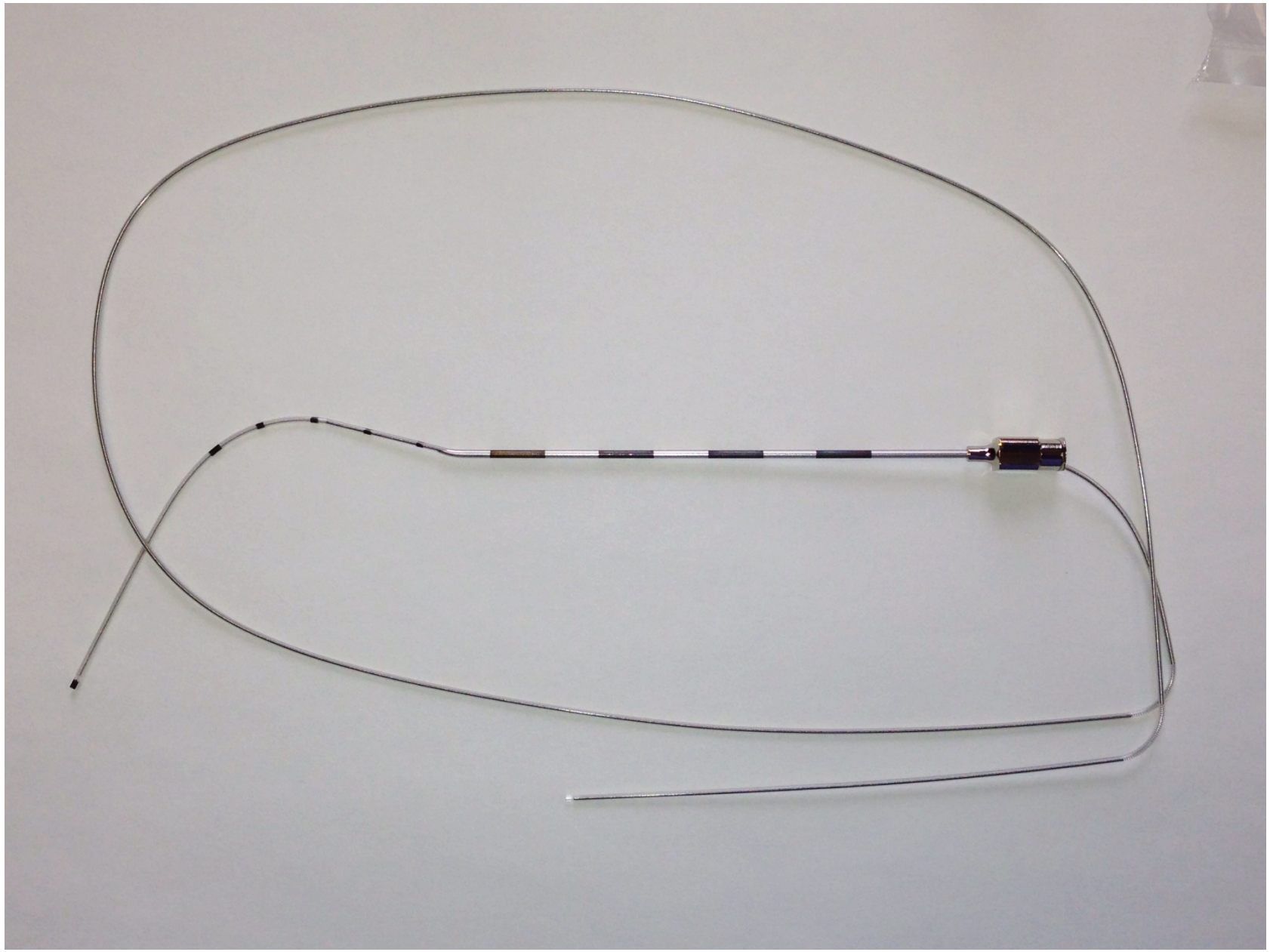
Obstetrical Analgesia and Anesthesia

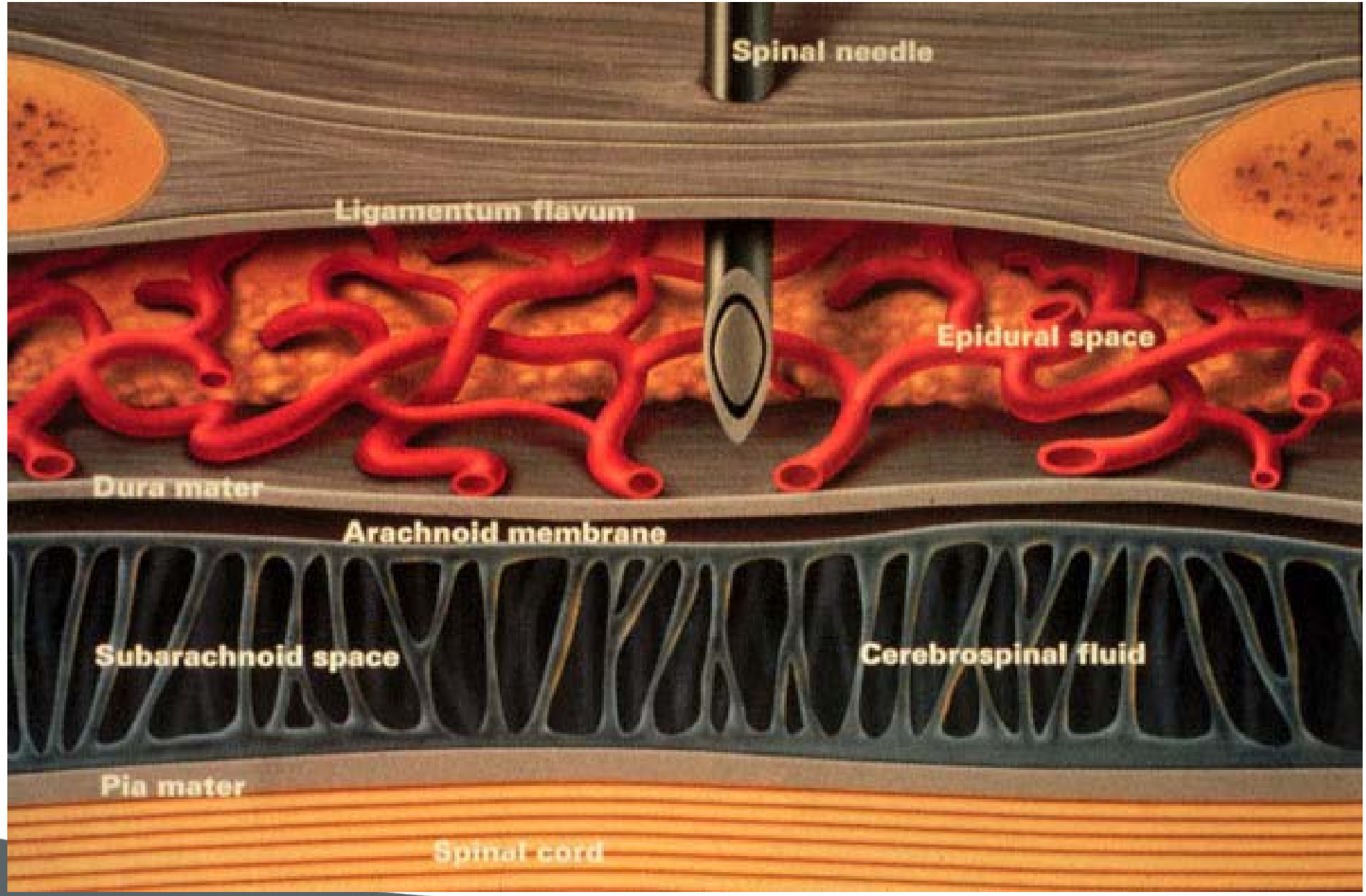
- Spinal Anesthesia
  - Generally used for elective cesarean sections
  - Single shot Bupivacaine (12 mg) injected into the intrathecal space + morphine
  - Most common side effect is hypotension
  - Goal is to provide anesthesia from T4 caudally.

- Epidural Anesthesia
  - Used for labor analgesia
  - Catheter threaded for continuous analgesia over prolonged period
  - Can be used for cesarean section by changing the concentration of local anesthetic
  - Lidocaine 2% + epinephrine 20 mL (400 mg)


Epidural space
Dura
©MMG 2006


TOP VIEW of spine
Needle
Ligaments
Epidural space
Irritated nerve root
Disc




Spinal needle
Ligamentum flavum
Epidural space
Dura mater
Arachnoid membrane
Subarachnoid space
Cerebrospinal fluid
Pia mater
Spinal cord

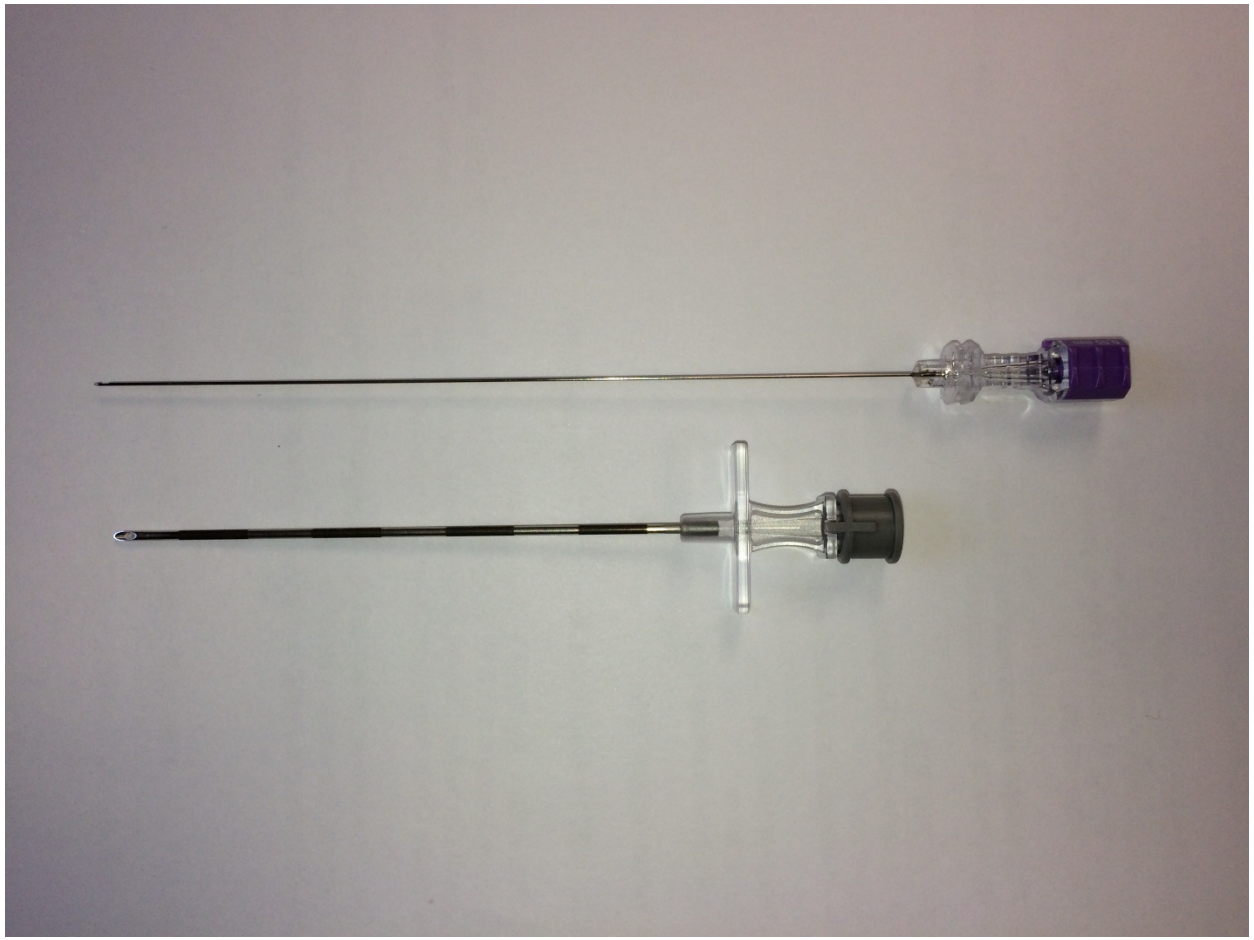
Test Dose (3 mL of 1.5% Lidocaine with Epinephrine)

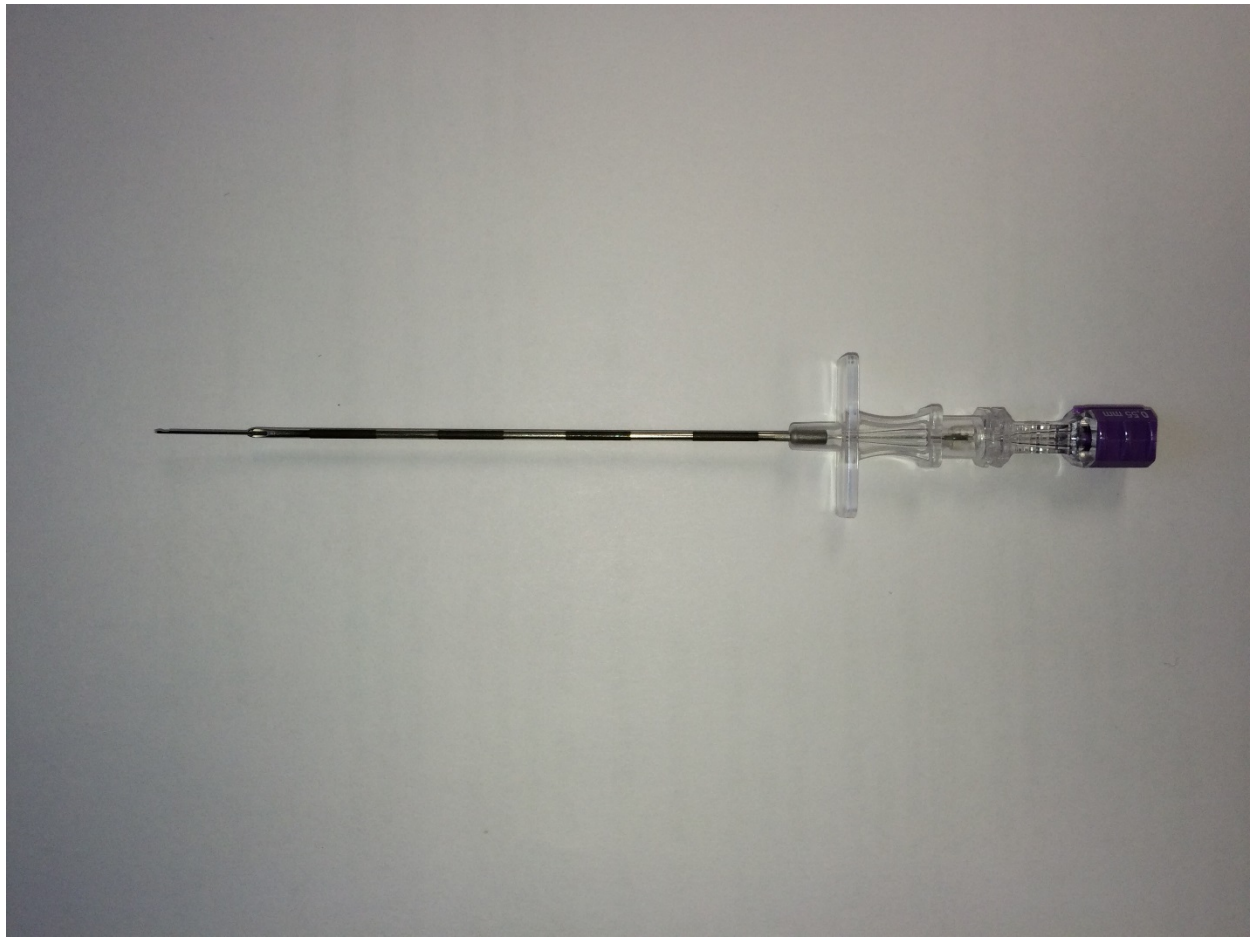
- Inadvertent subarachnoid catheter placement
- Intravenous catheter

Epidural Dosing

- Bolus-Bupivacaine 0.083% 10 mL + Fentanyl 100 mcg
- Maintenance: Bupivacaine 0.083% with Fentanyl 2 mcg/mL
- Patient Controlled Epidural Administration
- “Crazy Eights”
  - 8 ml/hr infusion
  - 8 ml bolus
  - lockout of 8 minutes
  - 24 mL one-hour maximum

Combined Spinal Epidural





Complications following Regional Anesthesia

- Local anesthetic toxicity
- Total spinal
- Postdural puncture headache
- Epidural hematoma
- Nerve palsy

Case 1

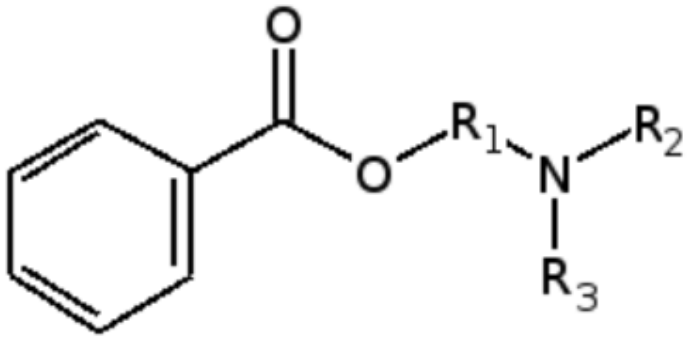
An 18 year old woman in the active stage of labor has an epidural that was just placed for labor analgesia. Shortly thereafter, she is rushed to the operating room for a cesarean section. During transport, 10 mL of Lidocaine 2% is administered followed shortly by complaints of lip numbness and she becomes very apprehensive. Another 10 mL is given and the patient seizes. Is this eclampsia or is their another cause?

Local anesthetic systemic toxicity (LAST)

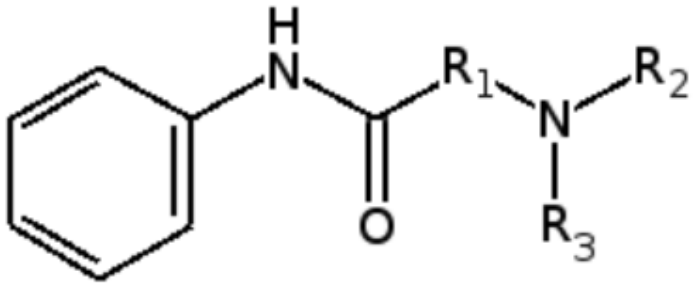
Esters

metabolized by plasma esterases

1. Cocaine
2. Procaine
3. Chloroprocaine
4. Tetracaine



Aminoester



Aminoamide

Amides

Hepatic metabolism

1. Lidocaine
2. Bupivacaine
3. Ropivacaine
4. Etidocaine
5. Mepivacaine

SYSTEMIC TOXICITY OF LOCAL ANESTHETICS

- Auditory changes, circumoral numbness, metallic taste
- Agitation
- Seizures
- CNS depression (coma, respiratory arrest).
- Cardiac excitation (hypertension, tachycardia, ventricular
- arrhythmias).
- Cardiac depression (bradycardia, asystole, decreased contractility, and hypotension).

As dose increases

Treatment of LAST

1. Stop administration of the local anesthetic

2. Hyperventilate the patient (Elevated CO_2 lowers the seizure threshold)

3. Consider propofol administration for seizure management

4. Cardiopulmonary bypass

5. Intralipid administration
   - Administer 1.5 mL/kg as an initial bolus; the bolus can be repeated 1- 2 times for persistent asystole.

   - Start an infusion at 0.25 mL/kg/min for 30-60 minutes; increase infusion rate up to 0.50 mL/kg/min for refractory hypotension.

Case 2

A 25 year old has requested a labor epidural. Following placement, a test dose is given which is immediately followed by 10 mL of 0.25% Bupivacaine solution. Shortly thereafter, the patient states that her pain is gone and that you are a god. However, she also mentions that she can’t move her legs. She then complains that she is having trouble breathing.

Total Spinal

Factors influencing spinal spread

- Agent
- Dose
- Volume
- Baricity
  - Specific gravity relative to CSF

Baricity of Local Anesthetics

- Isobaric – Stays where you put it
- LA has the same density or specific gravity as CSF (1.003-1.008) – Normal Saline

- Hypobaric – "Floats" up – Lighter than CSF
- LA has a density or specific gravity that is less than CSF (<1.003) – Sterile Water

- Hyperbaric – Settles to Dependent aspect of the subarachnoid space – Heavier than CSF
- LA has a density or specific gravity that is greater than CSF (>1.008) - Dextrose

Management of the Total Spinal Anesthetic

1. Cardiovascular support
2. Respiratory support
3. Patience

Closed Claims Database

Table 5. Causes of Maternal Death/Permanent Brain Damage (n = 69) 1990 or Later

	Overall (n = 69), %	General Anesthesia (n = 28), %	Regional Anesthesia (n = 41), %
High neuraxial block	15 (22)	0 (0)	15 (37)
Maternal hemorrhage	11 (16)	8 (29)	3 (7)
Embolic events	8 (12)	2 (7)	6 (15)
Difficult intubation	7 (10)	7 (25)	0 (0)
Preeclampsia/HELLP syndrome	5 (7)	3 (11)	2 (5)
Medication	5 (7)	0 (0)	5 (12)
Inadequate oxygenation/ventilation	3 (4)	1 (4)	2 (5)
Aspiration of gastric contents	2 (3)	1 (4)	1 (2)
Neuraxial cardiac arrest	2 (3)	0 (0)	2 (5)
Hypertensive intracranial hemorrhage	2 (3)	1 (4)	1 (2)
Central venous catheter	1 (1)	1 (4)	0 (0)
Chorioamnionitis/ARDS	1 (1)	1 (4)	0 (0)
Airway obstruction	1 (1)	1 (4)	0 (0)
Other/unknown	6 (9)	2 (7)	4 (10)

Percentages do not sum to 100% due to rounding error.

ARDS = adult respiratory distress syndrome; HELLP = hemolysis, elevated liver enzymes, low platelet count.

Davies JM et al. Anesthesiology 2009;110:131

Post-dural puncture headache

Risk Factors for Post-Dural Puncture Headache

- Beveled (Quincke) needle
- Larger gauge needle
- Female gender
- Pregnancy
- Younger age

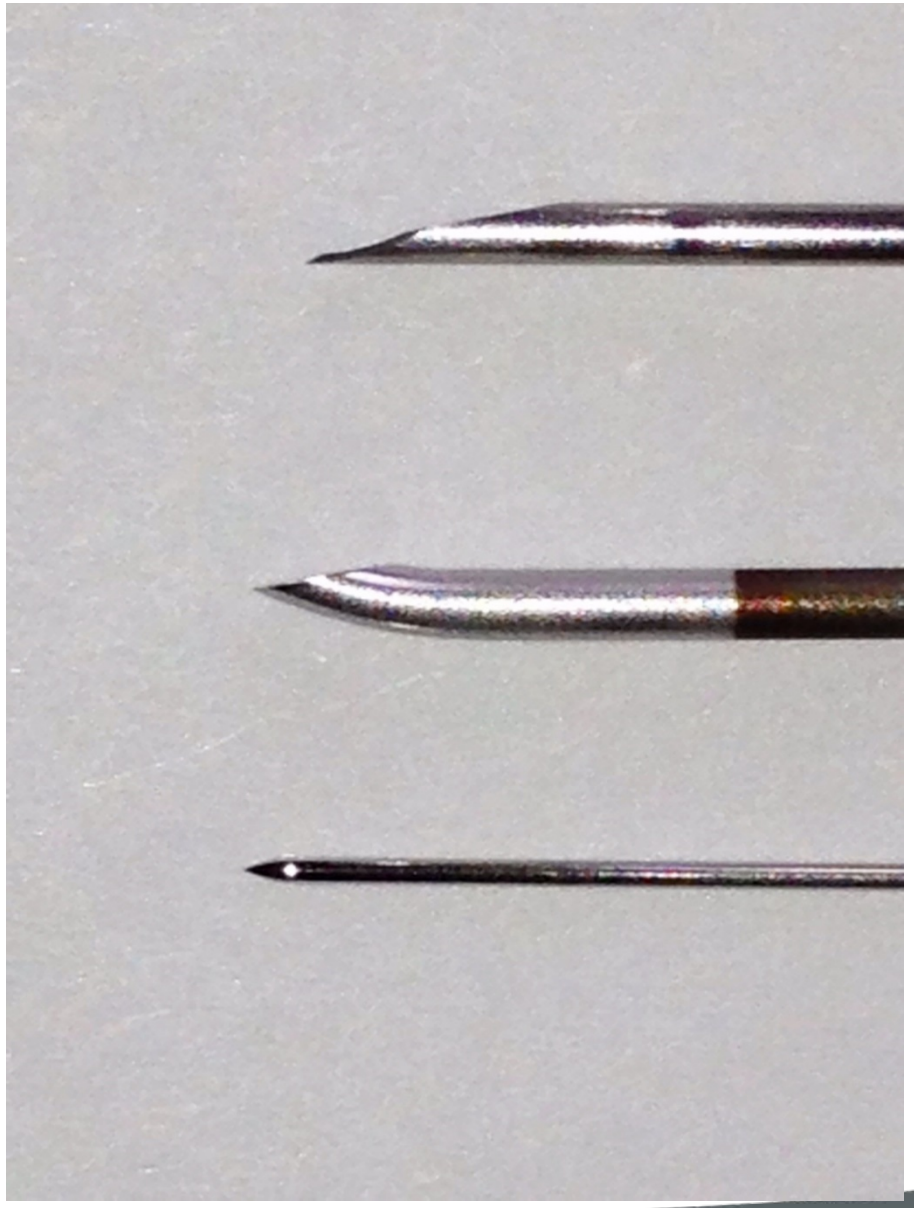


Table 3. Postdural Puncture Headache and Epidural Blood Patch Statistics

Variable	Totals	Percentage	Incidence (95% CI)
Known dural punctures*	115,070		
Total neuraxial anesthetics†	237,437		
No. of postdural puncture headaches	1,647	0.7% of all neuraxial anesthetics	1:144‡ (1:137, 1:151)
No. of epidural blood patches	917	55.7% of postdural puncture headaches	
Repeat epidural blood patches	98	10.7% of epidural blood patches	

* Includes spinal, combined spinal epidural, and continuous spinal anesthetics. The incidence of "wet tap" or dural puncture with the epidural needle was not tracked in the database. † The total neuraxial anesthetics listed above are from institutions that provided statistics on postdural puncture headache and epidural blood patch. Not all institutions tracked these variables as part of quality assurance. ‡ The risk of postdural puncture headache from all neuraxial anesthetic techniques, including epidural anesthesia.

D'Angelo R et al. Anesthesiology 2014;120:1505

Post-dural Puncture Headache

- Midline frontal and/or occipital. Not lateralized!
- May extend into neck (stiff neck)
- Worse with upright posture (usually immediate onset, may be delayed 20 minutes)
- Relief with flat posture (usually immediate).
- May be associated with diplopia (abducens palsy) and muffled hearing or tinnitus.
- Thought to be benign

PDPH etiology

- Traditional theory: loss of CSF leads to brain “settling down” in skull, with resultant traction on dura and nerves

- Vasodilation theory: loss of CSF leads to translocation of CSF to lumbar area with upright posture. Volume in skull must remain constant, hence→ vasodilation + HA.

- Therapeutic efficacy of caffeine and vasoconstrictors supports vasodilation theory

Management of the PDPH

- Conservative therapy vs. Blood patch
- Conservative therapy: NSAIDs, other oral analgesics, caffeine, fluids, gabapentin.
- Epidural blood patch (EBP): 10-30 mL of patient's blood injected into epidural space.
- EBP complications: back pain (common), leg paresthesias, theoretical risk of epidural abscess.

But is it really PDPH?

- The key question: Could it be something else?
- If you Rx PDPH and it is something else you incur two problems: unnecessary treatment risk AND missed Dx.
- It could be: lactation HA, migraine, subdural hematoma, brain tumor, AVM, cortical vein thrombosis, dural sinus thrombosis, etc.

CASE REPORT

Subdural Hematoma Associated With Labor Epidural Analgesia
A Case Series

Grace Lim, MD, Jamie M. Zorn, MD,* Yuanxu J. Dong, MD,*
Joseph S. DeRenzo, MD,* and Jonathan H. Waters, MD*†*

1. Between 2008 and 2015, 42,969 epidurals were placed with 437 dural punctures (1.0%).
2. 11 subdural hematomas found on postpartum imaging
3. Subdural hematoma rate following epidural – 1:3900
4. Rate of subdural hematoma 1:87 recognized dural punctures

Lim et al. Regional Anesthesia & Pain Medicine. 41(5):628-31, 2016

Post dural puncture headache (PDPH)

- Third most common cause of lawsuit in OB anesthesia.

- Can be disabling and distressing, particularly for a mother trying to take care of a newborn and a household.

Case 3

45 y.o. G1P0 presented to labor & delivery at 2 pm at 40.1 weeks gestation for induction of labor. An epidural was placed uneventfully on first attempt at L4-5 level without paresthesia, blood or CSF being noted. Test dose was negative. The patient subsequently reported her pain as 0/10 over the course of the night. By noon, the patient reported sharp pain and pressure in her perineum with contractions and reported pain as 8/10. The epidural was redosed with a higher concentration of bupivacaine 0.25%. (12 hours after placement) The patient gave birth to an 8 lb baby at 11:50 pm (time 24 hours) after pushing for 3 hours and suffering from a shoulder dystocia. Prior to delivery, the patient was again redosed with 0.25% bupivacaine. At 2 am (time 26 hours) the patient complained of dull pain in both of her legs. Upon evaluation, the patient was found to not have normal movement of her legs and feet. At 10 am (time 34 hours), the relief anesthesiologist visited the patient again where he found that there was still some numbness in her right foot but that she could move her entire leg with motor strength of 4/5 but that she had minimal movement of her left leg though he noted some improvement in her ability to wiggle her toes. The patient had no pain at this time.

Epidural Hematoma

Predisposing Factors

- Thrombocytopenia
- Preeclampsia/Eclampsia/HELLP
- Inherited clotting dysfunction
- Anticoagulation
- Coagulopathy (abruption, hemorrhage)

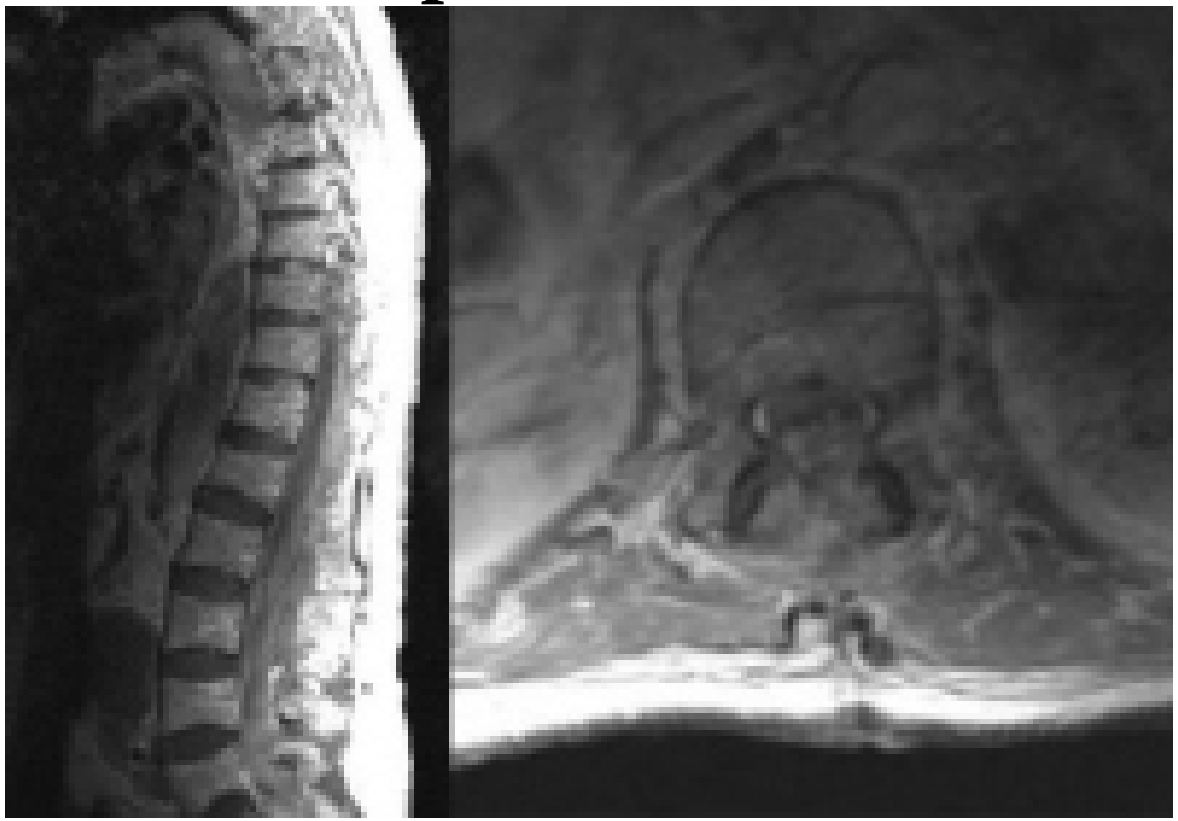
Table 1. Case Series Without Spinal Hematoma Complications After Epidural and Subarachnoid Anesthesia

Authors and references	Year	No. of cases
After epidural anesthesia		
Waldman (13)	1989	790
Vaes et al. (14)	1988	19,047
Crawford (15)	1985	26,490
Moore et al. (16)	1978	11,080
Holdcroft and Morgan (17)	1976	1000
Dawkins[a] (18)	1969	3998
Moore et al. (19)	1968	7286
Lund (20)	1966	150,000
Hellmann (21)	1965	26,127
Eisen et al. (22)	1960	9532
Bonica et al. (23)	1957	3637
After subarachnoid anesthesia		
Kortum et al. (24)	1979	2592
Bergmann (25)	1977	10,000
Philips et al. (26)	1969	10,440
Moore and Bridenbaugh (27)	1966	11,574
Sadove et al. (28)	1961	20,000
Vandam and Dripps (29)	1960	10,098
Brown (30)	1952	600

[a] Dawkins series originally contains 4000 patients including two cases of epidural hematoma.

Vandermeulen EP. Anesth Analg 1994; 79: 1165-77.

Risk of Epidural Hematoma



Spontaneous spinal epidural hematoma affects 1 per 1,000,000 people annually

The incidence of epidural hematoma after epidural anesthesia is unknown; however, it is estimated to be 1 in 150,000 cases

Horlocker TT, Wedel DJ. Neurologic complications of spinal and epidural anesthesia. Reg Anesth Pain Med 2000; 25: 83-98.

Combined Use of Anticoagulants and Epidural/Subarachnoid Anesthesia

Table 6. Case Series with Combined Use of Anticoagulants and Epidrual/Subarachnoid Anesthesia—Absence of Spinal Hematoma Complication

Authors and references	Year	Technique	Clotting disorder and anticoagulant	No. of cases
CLASP (99)	1994	Epidural	Aspirin	1422
Horlocker et al. (100)	1994	Epidural/spinal	Antiplatelet drugs	386
Brent, in de Swiet and Redman (101)	1992	Epidural	Aspirin	2269
Liem et al. (102)	1992	Epidural	Systemic heparin	27
Schwander and Bachmann (103)	1991	Epidural/spinal	Unfractionated heparin	5528
Schwander and Bachmann (103)	1991	Epidural/spinal	LMWH	13,917
Horlocker et al. (104)	1990	Epidural/spinal	Antiplatelet drugs	391
Samama et al. (105)	1990	Epidural	Systemic LMWH	10
Blomberg et al. (106)	1989	Epidural	Systemic heparin	14
Joachimsson et al. (107)	1989	Epidural	Systemic heparin	16
Rosen and Rosen (108)	1989	Caudal/epidural	Systemic heparin	32
Vanstrum et al. (109)	1988	Spinal	Systemic heparin	1000
Baron et al. (110)	1987	Epidural	Systemic heparin	912
Casey et al. (111)	1987	Spinal	Systemic heparin	40
El-Baz and Goldin (112)	1987	Epidural	Systemic heparin	30
Waldman et al. (113)	1987	Caudal/epidural	Systemic heparin/thrombocytopenia/ vitamin-K antagonist	336
Aun et al. (114)	1985	Spinal	Systemic heparin	40
Benzon et al. (7)	1984	Epidural/spinal	Aspirin	246
Fredin et al. (115)	1984	Epidural	Unfractionated heparin/dextran 70	116
Jones et al. (116)	1984	Spinal	Systemic heparin	56
Odoom and Sih (117)	1983	Epidural	Vitamin-K antagonist/systemic heparin	1000
Ellison et al. (118)	1981	Epidural	Systemic heparin	700
Rao and El-Etr (119)	1981	Epidural/spinal	Systemic heparin	4011
Mathews and Abrams (120)	1980	Spinal	Systemic heparin	40
Cunningham et al. (121)	1980	Epidural	Systemic heparin	100
Lunn et al. (122)	1979	Epidural	Systemic heparin	16

LMWH, low molecular weight heparin.

Vandermeulen EP. Anesth Analg 1994; 79: 1165-77.

Anesthesiology 2004; 101:143–52

Injuries Associated with Regional Anesthesia in the 1980s and 1990s

A Closed Claims Analysis

Lorri A. Lee, M.D., Karen L. Posner, Ph.D.,† Karen B. Domino, M.D., M.P.H.,‡ Robert A. Caplan, M.D.,§ Frederick W. Cheney, M.D.‖*

Table 5. Injuries to the Neuraxis in Regional Anesthesia Claims, 1980–1999 (n = 84)

	Obstetric (n = 26), No. (% Cases)		Nonobstetric (n = 58), No. (% Cases)	No. Cases Permanent Neurologic Deficit/Total (OB + Non-OB) (% Cases‡)
Hematoma	3 (12)	*	33 (57)	32/36 (89)
Unknown	4 (15)		9 (16)	12/13 (92)
Anterior spinal artery syndrome	2 (8)		3 (5)	4/5 (80)
Meningitis	6 (23)	†	2 (3)§	1/8 (13)
Spinal cord infarct	2 (8)		3 (5)	5/5 (100)
Abscess	6 (23)	†	2 (3)	2/8 (25)
Herniated disc	2 (8)		3 (5)	1/5 (20)
Other causes‖	1 (4)		4 (7)	4/5 (80)

* $P \leq 0.01$ and † $P \leq 0.05$ for obstetric *vs.* nonobstetric regional claims. ‡ % cases refers to percent of cases for each type of neuraxial complication. § In one patient with meningitis and permanent nerve injury, osteomyelitis and abscess developed. ‖ Other causes include cervical fracture after fall from table, arachnoiditis, transverse myelitis, intrathecal catheter, and direct needle trauma without hematoma.

Non-OB = nonobstetric; OB = obstetric.

Risk of Lawsuit for Epidural Hematoma 1 out of 2.2 million blocks

Cause of Death	Lifetime Odds
Assault by Firearm	1-in-325
Fire or Smoke	1-in-1,116
Natural Forces (heat, cold, storms, quakes, etc.)	1-in-3,357
Electrocution*	1-in-5,000
Drowning	1-in-8,942
Air Travel Accident	1-in-20,000
Flood (included also in Natural Forces above)	1-in-30,000
Legal Execution	1-in-58,618
Tornado (included also in Natural Forces above)	1-in-60,000
Lightning Strike (included also in Natural Forces above)	1-in-83,930
Snake, Bee or other Venomous Bite or Sting*	1-in-100,000
Earthquake (included also in Natural Forces above)	1-in-131,890
Dog Attack	1-in-147,717
Asteroid Impact	1-in-200,000
Tsunami	1-in-500,000
Fireworks Discharge	1-in-615,488

Regional Anesthesia
Section Editor: **Terese T. Horlocker**

Neuraxial Techniques in Obstetric and Non-Obstetric Patients with Common Bleeding Diatheses

Stephen Choi, MD*

Richard Brull, MD, FRCPC*†

BACKGROUND: There are few data in the literature regarding the safety of neuraxial techniques in patients with the most common bleeding diatheses, including hemophilia, von Willebrand's disease (vWD), and idiopathic thrombocytopenic purpura (ITP). Neuraxial techniques are not widely used in these populations because of concerns of potential hemorrhagic and/or subsequent neurologic complications. In this article, we review the available literature describing neuraxial techniques in patients with hemophilia, vWD, or ITP with the aim to assist anesthesiologists considering neuraxial techniques in these populations.

"There is paucity of published data regarding the provision and safety of neuraxial techniques in patients with common bleeding diatheses"

"The minimum safe factor levels and platelet count for neuraxial techniques remain undefined in both the obstetric and general population

"Evidence based recommendations in the setting of hemophilia, vWD, or ITP, cannot be offered."

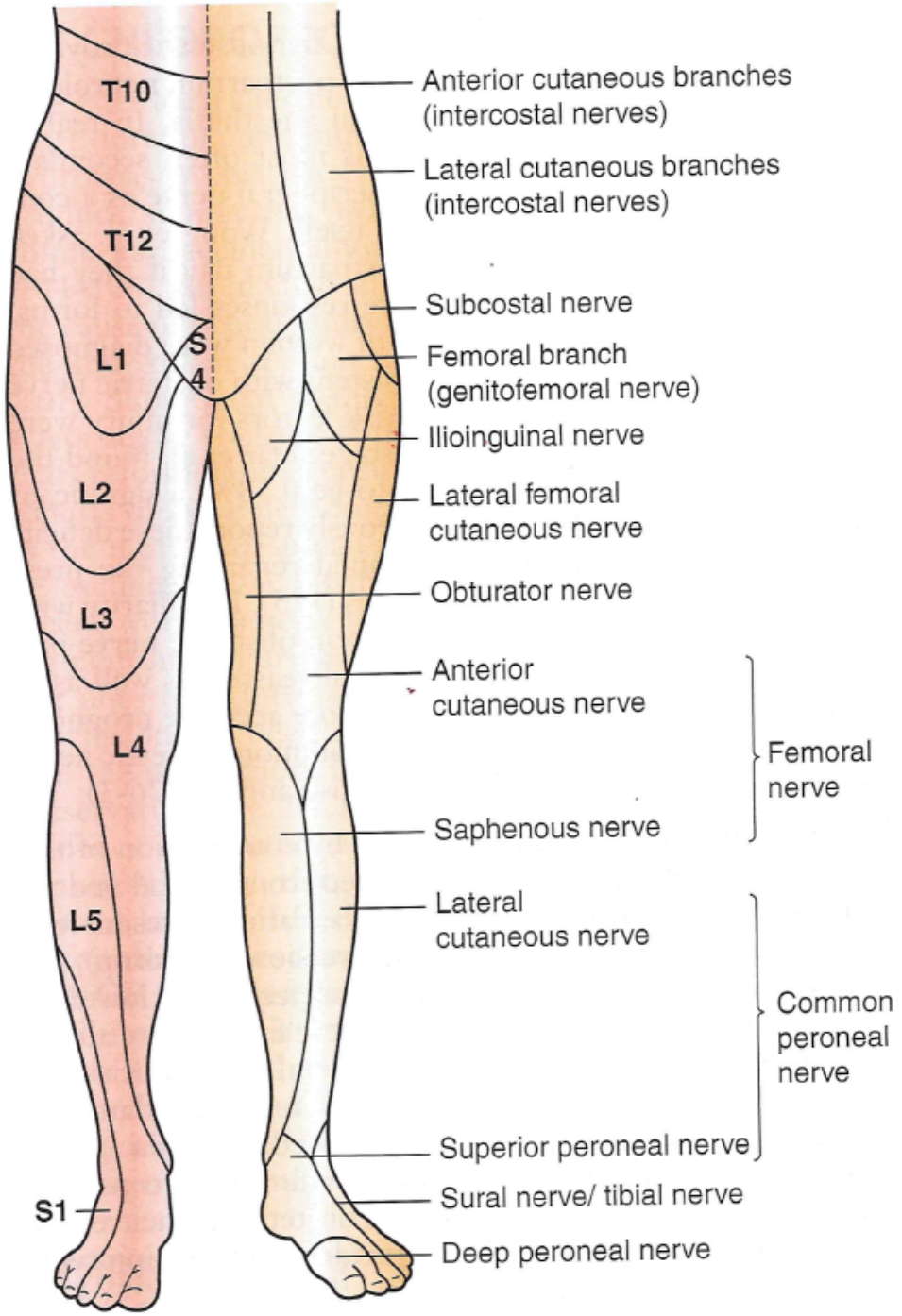
Choi S. Anesth Analg 2009;109:648-60

Obstetrical Nerve Injuries

- Lateral Femoral Cutaneous Neuropathy
- Femoral Neuropathy
- Fibular (Common Peroneal) Neuropathy
- Lumbosacral Plexopathy
- Obturator nerve injury
- Sciatic nerve injury

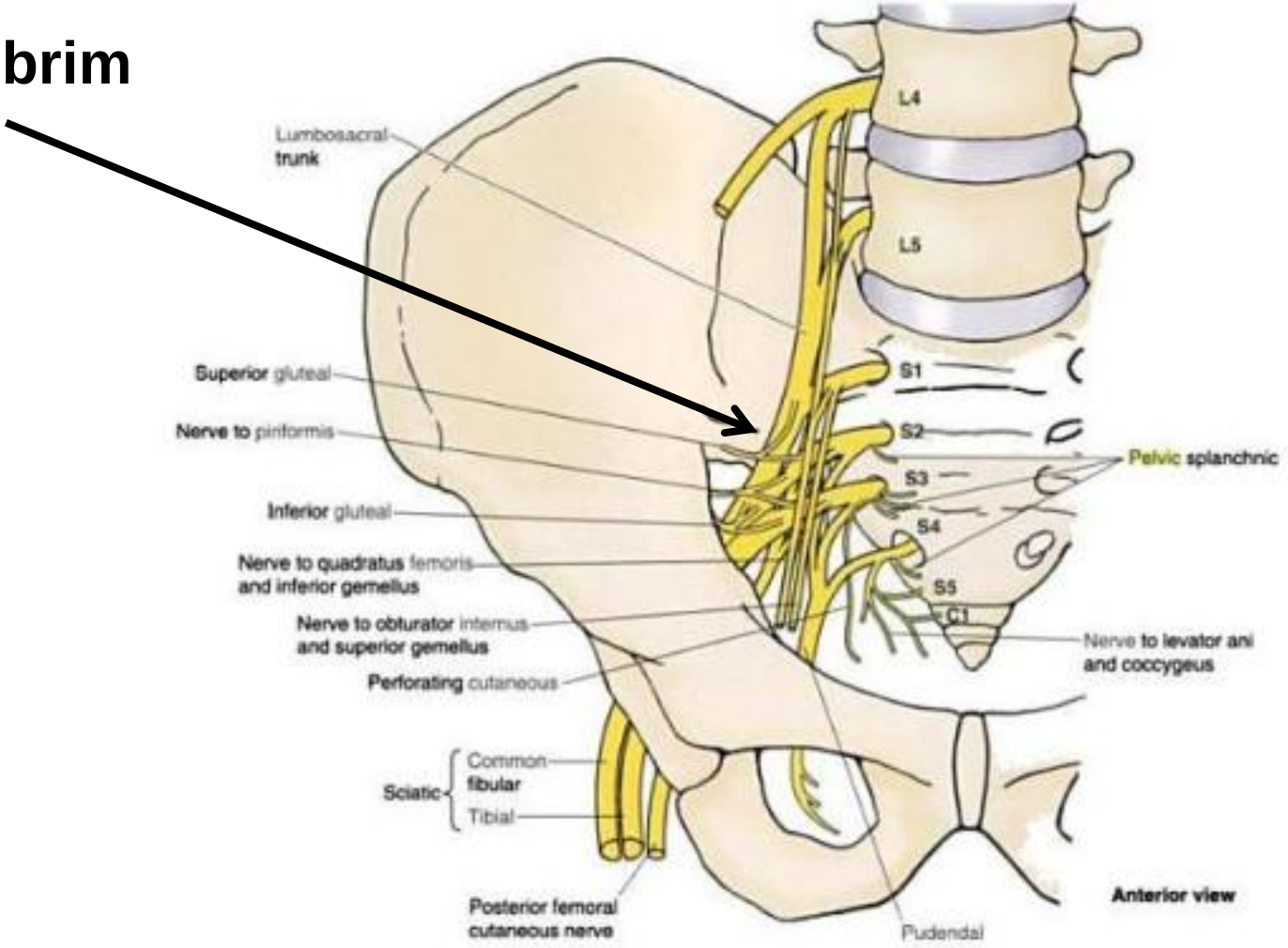
Obstetric palsy

- From nerve compression within the pelvis, by fetal head, forceps or retractors.
- Often blamed on neuraxial anesthesia.

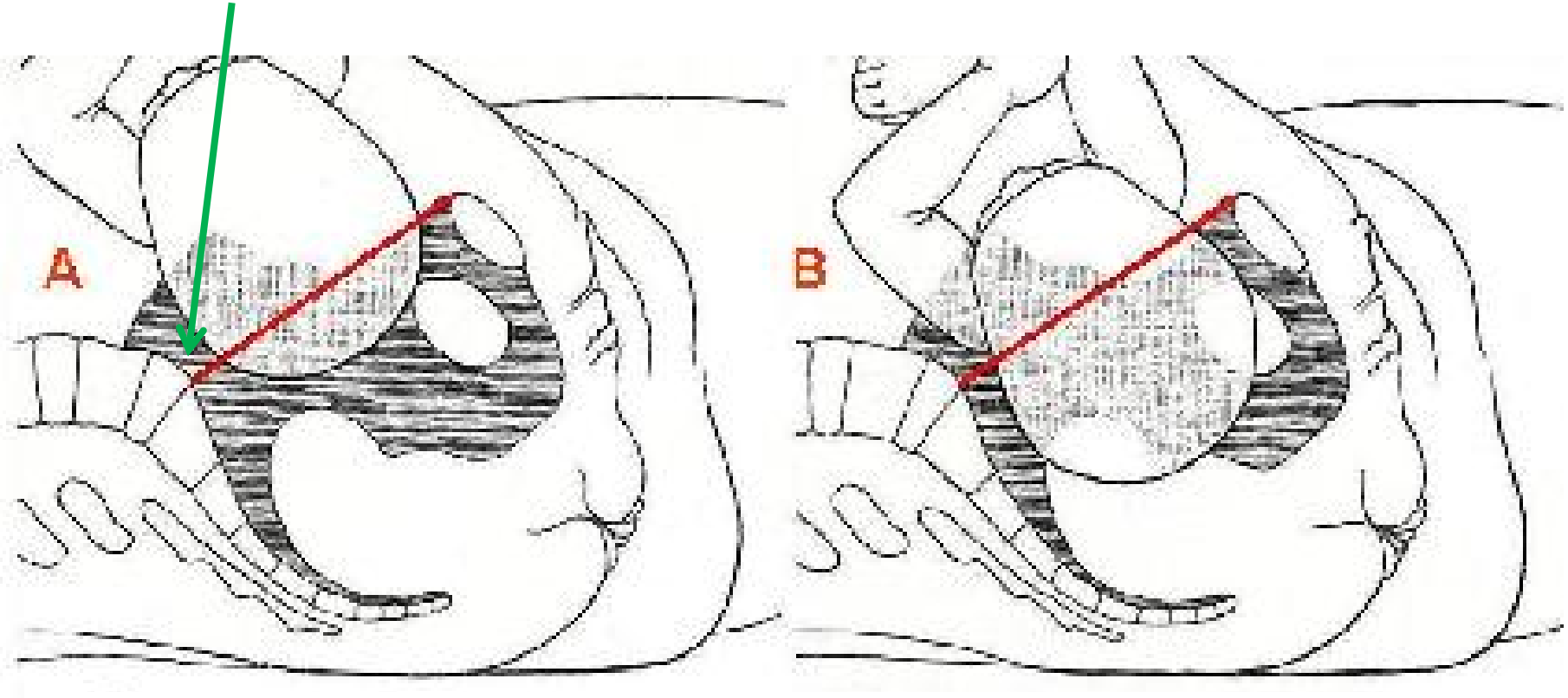

T10
T12
L1
S4
L2
L3
L4
L5
S1
Anterior cutaneous branches (intercostal nerves)
Lateral cutaneous branches (intercostal nerves)
Subcostal nerve
Femoral branch (genitofemoral nerve)
Ilioinguinal nerve
Lateral femoral cutaneous nerve
Obturator nerve
Anterior cutaneous nerve
Femoral nerve
Saphenous nerve
Lateral cutaneous nerve
Common peroneal nerve
Superior peroneal nerve
Sural nerve/ tibial nerve
Deep peroneal nerve

Peripheral nerves in the pelvis.

Pelvic brim



Pelvic brim is the red line.
Fetal head is “engaged” when biparietal diameter is below pelvic brim.
Fetal head or forceps can damage nerves (lumbosacral trunk or obturator) at **sacral promontory** portion of pelvic brim.

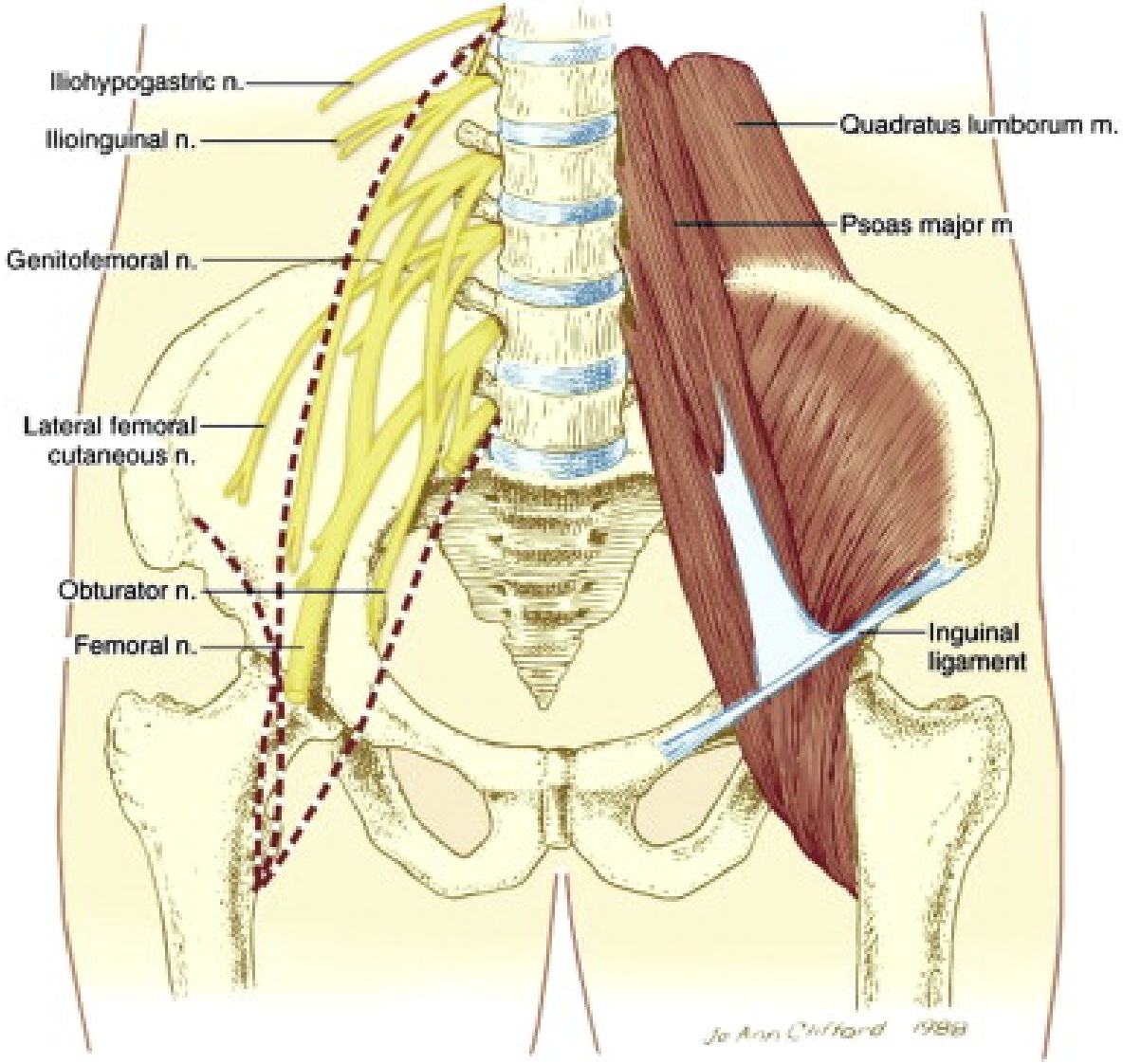


http://www.obstetricexcellence.com.au/questions-and-answers/engagement-of-the-foetal-head

Vulnerable nerves in pelvis:

Lateral femoral cutaneous (at inguinal ligament)

Lumbosacral trunk
Obturator
Femoral
Sciatic



Cited in Wong et al

https://quizlet.com/7190173/anesman6-positioning-flash-cards/

http://www.meditek.ca/yellofin-stirrups-guide/

http://littlewhitecoats.blogspot.com/2013/01/what-maneuvers-may-help-you-manage.html

Peripheral Neuropathy Syndromes in Obstetrics

- “Meralgia Paresthetica”– lateral femoral cutaneous nerve (pure sensory)– numbness of lateral thigh. Common in pregnancy.

- Femoral nerve damage from prolonged hip flexion→ weak quadriceps. Can’t straighten leg and climb stairs.

Peripheral Neuropathy Syndromes in Obstetrics

- Foot drop– Impaired foot dorsiflexion due to:
  - Common peroneal nerve at fibula (leg holders)
  - Lumbosacral trunk at pelvic brim (fetal head)

- Impaired dorsi- and plantar-flexion of foot and numbness below knee: Sciatic nerve damage. Pressure on buttock during long CS? Diabetic patient?

- Impaired adduction of thigh and inner thigh numbness– obturator palsy at pelvic brim


Steelers
Steelers