Complications of Neuraxial Anesthesia – "*An Ounce of Prevention is Worth a Pound of Cure*"

Brian J Kasson CRNA MHS
Faculty/Clinical Instructor
Nurse Anesthesia Program
Northern Kentucky University
Staff Nurse Anesthetist
The Christ Hospital
Cincinnati, OH

Conflict of Interest Disclosure Statement

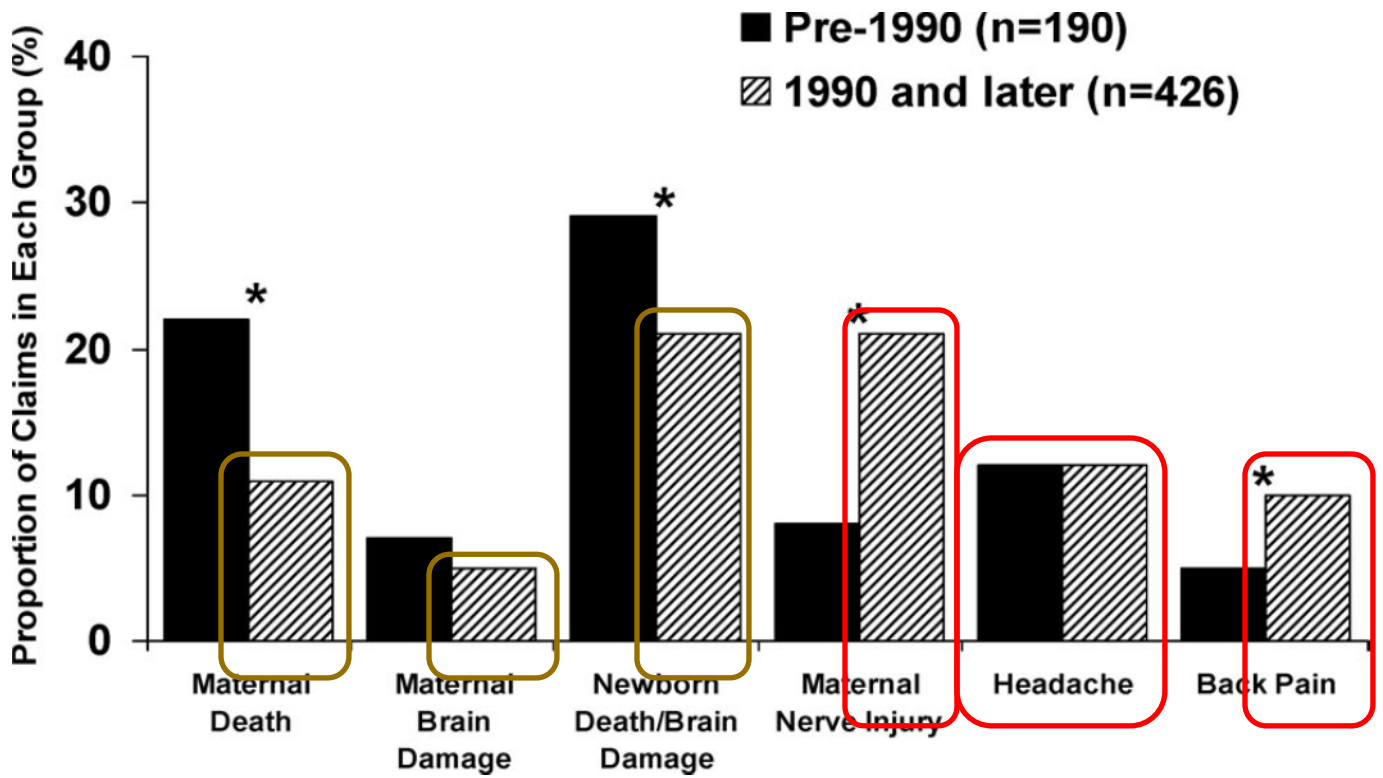
I have no financial relationships with any commercial interest related to the content of this activity.

Anesthesiology 2009; 110:131–9

Liability Associated with Obstetric Anesthesia

A Closed Claims Analysis

Joanna M. Davies, F.R.C.A., Karen L. Posner, Ph.D.,† Lorri A. Lee, M.D.,‡ Frederick W. Cheney, M.D.,§ Karen B. Domino, M.D., M.P.H.‖*



Median payment decreased - 455K to 222K

Post Dural Puncture Headache (PDPH)

- ***Postural component***
- Frontal and/or occipital
- Typically bilateral
- Associated symptoms:
  - Nausea (60%)
  - Ocular/auditory changes (13%)
    - CN palsy (VI)

http://ihsclassification.org/en/02_klassifikation/03_teil2/07.02.01_nonvascular.html

PDPH - Etiology

- Results from CSF leaking from a dural opening
- Normal - 150 ml total – 75 above/75 below
- In *volunteers* – removal of 10% (ie - 15 ml) results in a PDPH

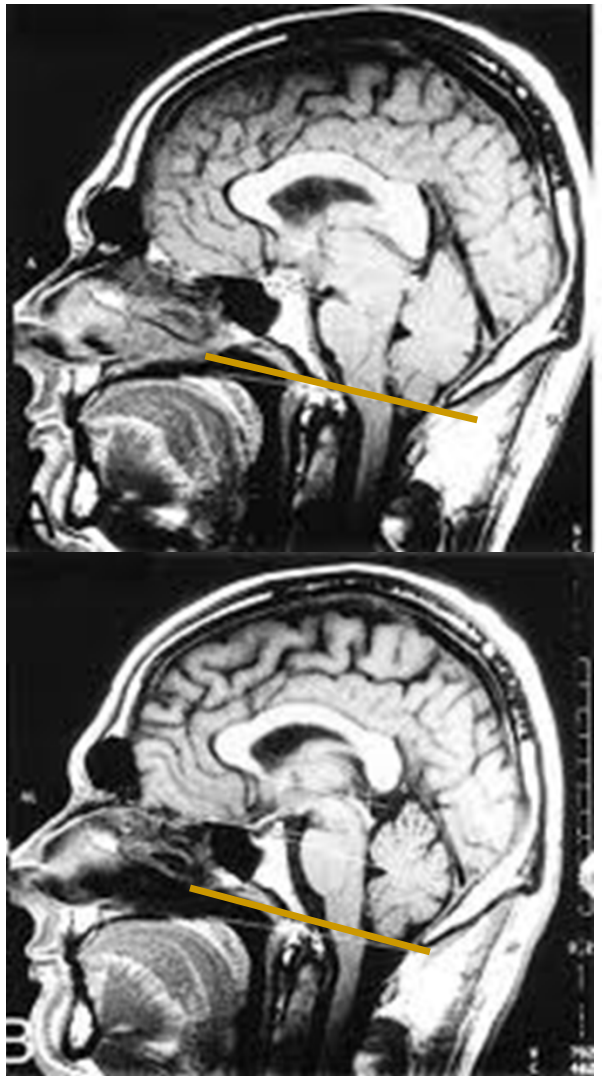
Kunkle EC et al. Experimental studies on HA: analysis of the HA associated with changes in intracranial pressure. Arch Neural Psych 1943;49:323-58

PDPH - MRI

- diffuse edema of the meninges
- cerebral venous dilation
- subdural fluid collections
- enlargement of the pituitary gland
- ***downward displacement of the brain – mechanical traction on CN & pain structures***

HOB ↑

supine



Pannullo SC, et al. MRI changes in intracranial hypotension. Neurology 1993;43:919-926

Cause of Postpartum Headache

- 95 women with H/A > 24 hrs (2000-2005@ UCMC) Mean onset H/A~3.4 days

- Cause:

Tension – type	n=37	47%
Preeclampsia/eclampsia	n=23	24%
Spinal headache	n=15	16%
Migraine	n=10	11%
Cerebral venous thrombosis	n=3	3%
Subarachnoid hemorrhage	n=1	1%

Stella CL et al. *Am J Obstet & Gynecol*. April 2007

PDPH - Risk factors

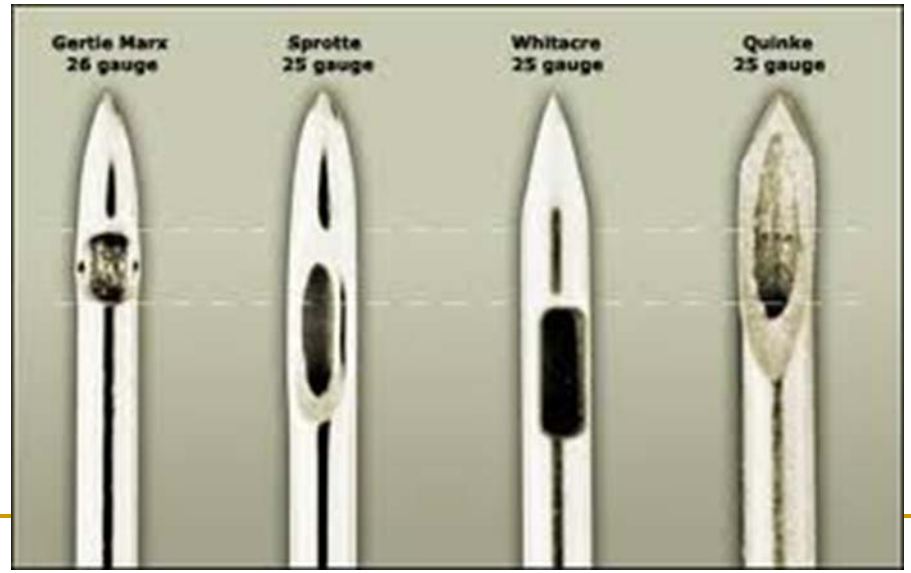
- Age – rarely see <10 y.o. and > ~ 70 y.o.
- Gender – F > M
- Pregnant > non-pregnant
- BMI – non-obese > obese
- Size and configuration of needle

Differential Diagnosis

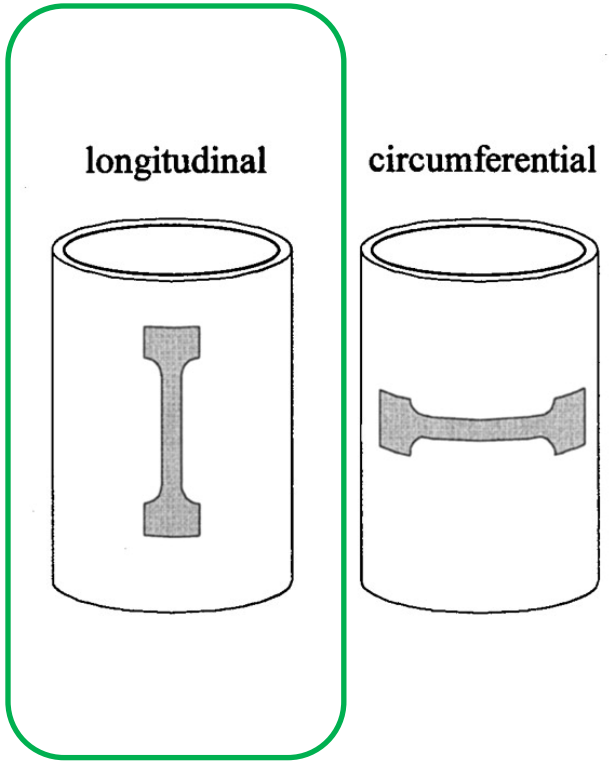
Meningitis	• Fever • Leukocytosis • Nuchal rigidity • Lethargy • Altered mental status
Delayed Onset Preeclampsia	• Hypertension/proteinuria
Intracranial Pathology	• Space occupying lesion • Subdural hematoma • Subarachnoid hemorrhage • Cortical vein thrombosis • Pseudotumor cerebri

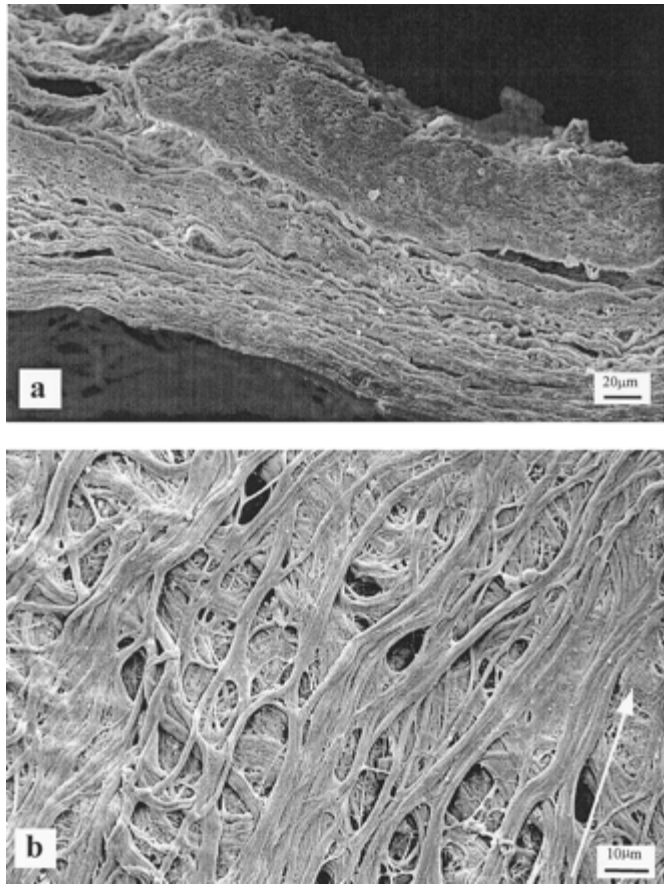
Spinal Needle – Structure and Size

- Needle tip configuration
- ↓ needle size - ↓ incidence of PDPH
  - Much less a factor with pencil point
  - PDPH rate is same 22g – 24g Sprotte



Dural anatomy





Runza M, et al. Anesth Analg 1999;88:1317-21

Epidural Needle - Accidental dural puncture

115 accidental dural punctures were randomized to 3 groups:

a. Immediately resite epidural catheter
b. Pass an intrathecal cath with removal at delivery
c. Pass an intrathecal cath with removal at 24 hours

Ayad S, et al. Reg Anes Pain Med 2003;28:512-15

Epidural Needle - Accidental dural puncture

Incidence of PDPHA:

a. 91% resite group

b. 51% remove at delivery group

c. 6% remove at 24 hr group

Infectious complications
Medication errors

Ayad S, et al. Reg Anes Pain Med 2003;28:512-15

Converting to spinal after accidental dural puncture ***did not*** ↓HA or EBP

- 1/3 of *re-site* patients received another ADP!!

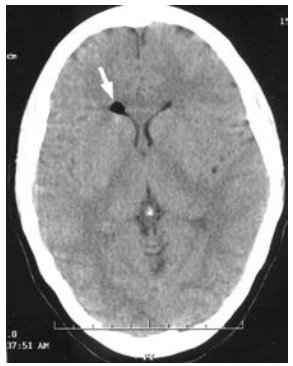
Leave the catheter in SAB space:

↓ chance of a 2nd ADP and provides rapid analgesia

IJOA 2012;21:7-16

Loss of resistance technique - AIR

- 3730 epidurals used LORT with air or saline
- If dural puncture occurred (~100) – a CT was done
  - 67% HA in air group
  - 10% HA in saline group



supraspinal intrathecal air bubbles were found in 78% of those with PDPH

Aida S, et al. Anesth Analg 1998;88:76-81

Epidural Blood Patch

EPIDURAL BLOOD PATCH

- Efficacy
  - –Single patch = 75-90% within 48h
- Technique
  - –At or below lowest dural rent
  - –15 – 20 mL or until discomfort
  - –Supine x 2h
  - –Stool softeners

Reconsider Dx after 2 failed blood patches

Society for Obstetric Anesthesia and Perinatology

Section Editor: Cynthia A. Wong

The Volume of Blood for Epidural Blood Patch in Obstetrics: A Randomized, Blinded Clinical Trial

Michael J. Paech, DM,* Dorota A. Doherty, PhD,†‡ Tracey Christmas, FRCA,§ Cynthia A. Wong, MD,‖ and Epidural Blood Patch Trial Group

15 v 20 v 30 ml volume

20 ml more effective than 10 ml or even 30 ml

EBP- Timing

- 71% failure rate when EBP < 24 hr after dural puncture
- 4% failure rate when EBP > 24 hr after dural puncture

Optimal timing of EBP appears to be > 24 hr in a symptomatic patient

Loeser EA, et al. Time vs. success rate for epidural blood patch. Anesth 1978;49:147-8

Treatment

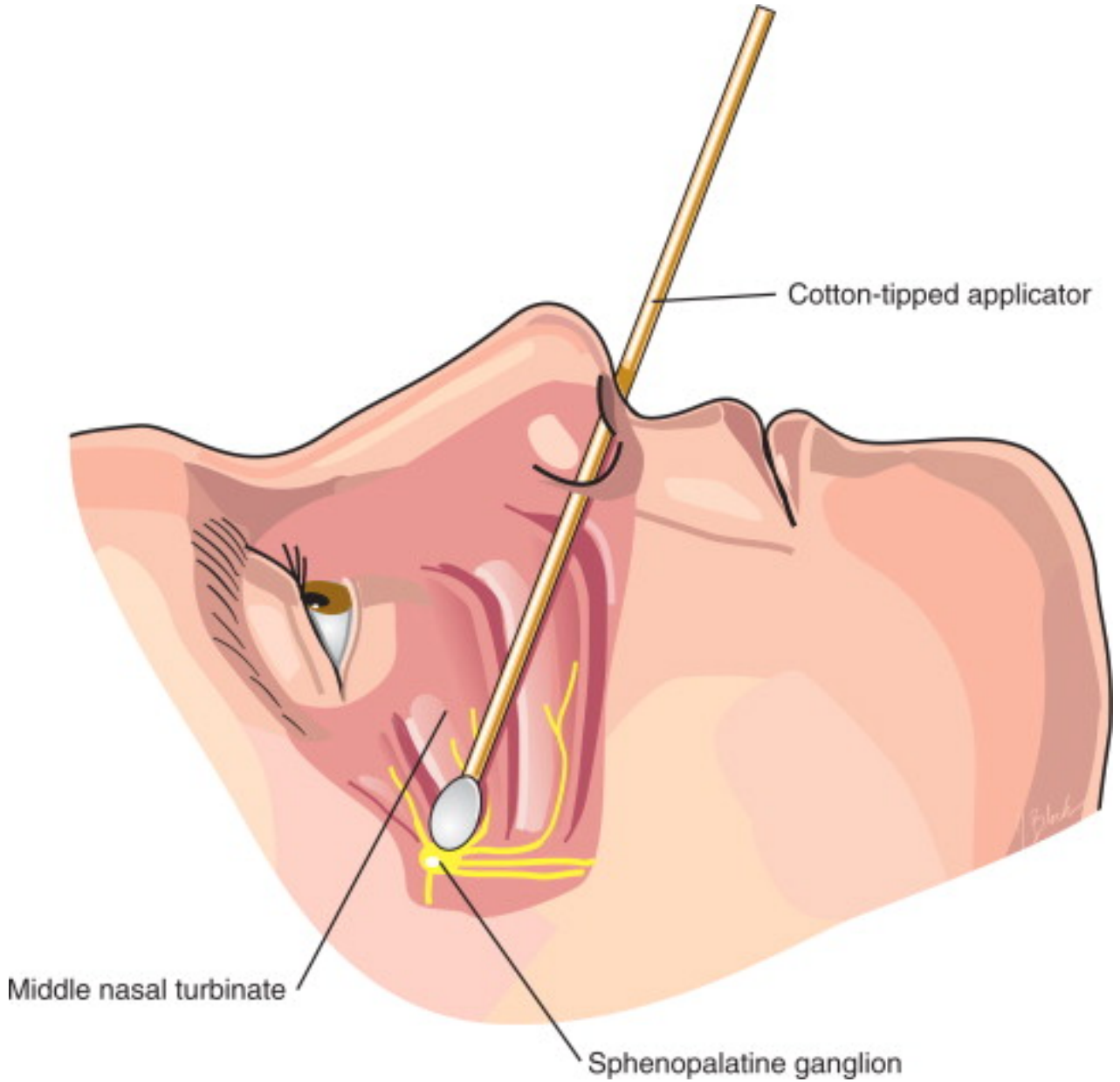
Conservative 0-24 hr

- Bed rest – prone position
- Oral analgesics
- Aggressive hydration
- Caffeine
- Observe for s&s infection, neuro deficits, extreme neck stiffness, HTN

Invasive > 24 hr

- Epidural blood patch
- Sphenopalatine ganglion block (SPG)
  - Symp, parasymp, and somatic sensory nerves
  - Blocks parasymp outlflow – stops cerebral vasodilation

Gaiser RR. ASA Review Course Lecture 2007. Anaesthesia 2008;63:847
Anaesthesia, 2009;64: 574–575. AA 2017;124:1219-28


Cotton-tipped applicator
Middle nasal turbinate
Sphenopalatine ganglion

Peripheral Nerve Injury

- Most common neurologic complication after labor
- Incidence 1:100-1:3000
- Associated with
  - Nulliparity
  - Prolonged labor
  - CPD
  - Non-vertex fetal presentations
  - Instrumented delivery

IJOA 2002;11:85-90
Obstet Gynecol 2003;101:279-88

Obstetric Nerve Injury

- Compression / stretching of nerve
- Intra-pelvic
  - Gravid uterus – 3rd trimester
  - Fetal passage – during labor
- Extra-pelvic
  - 2nd stage - hip flexion – femoral n. compression
  - Hematoma

Muscle Nerve 2002;26:340-7

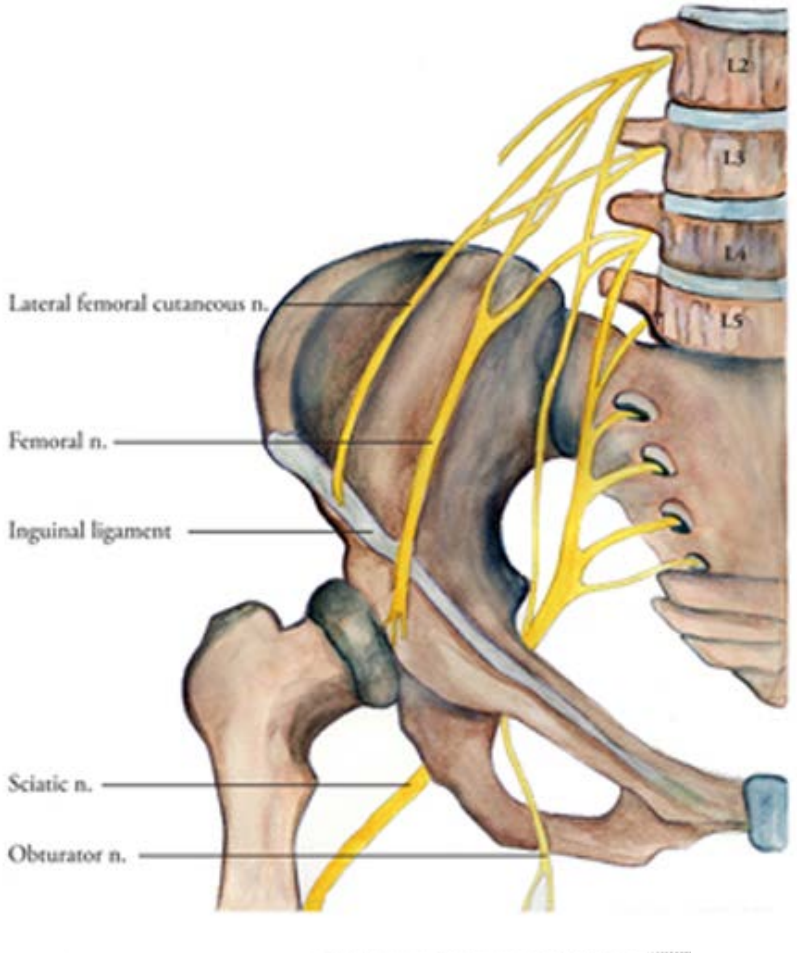
Anesthesia Related Neuropathy

- Direct
  - Needle trauma
  - Compression r/t hematoma or abscess
  - Injection of toxic substance
- Indirect
  - Positioning

Neurologic Deficits

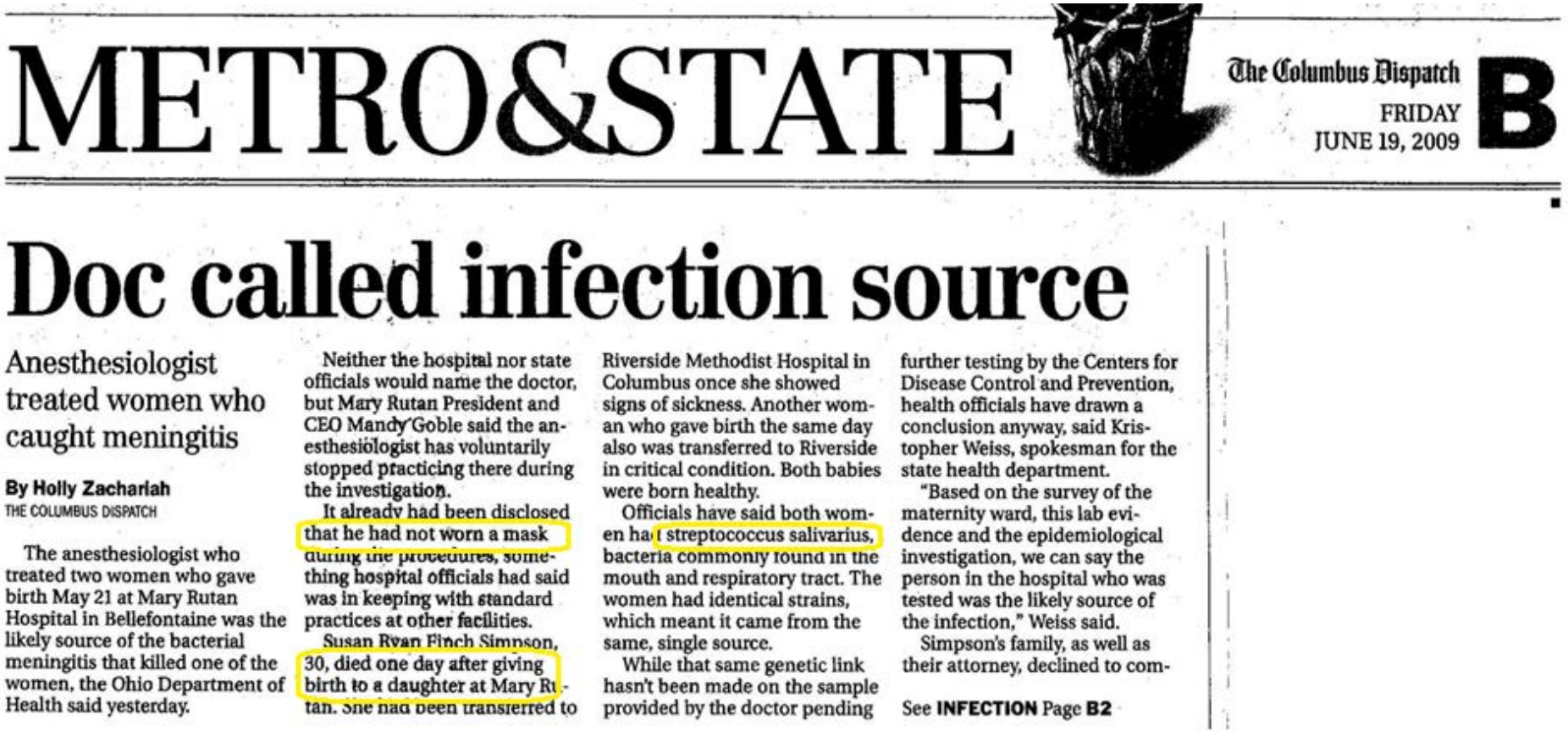
- *Peripheral (obstetrical)*
  - *Nerve root to ending*
  - *Usually unilateral*
  - *Single nerve distribution*
  - *Crosses a dermatome*

- *Central (anesthesia)*
  - *Spinal cord to nerve root*
  - *Usually bilateral*
  - *Dermatome distribution*
  - *Crosses a peripheral nerve*



Aseptic Technique

- Epic
  - Pa
- Rar



METRO&STATE

The Columbus Dispatch
FRIDAY
JUNE 19, 2009
B

Doc called infection source

Anesthesiologist treated women who caught meningitis

By Holly Zachariah
THE COLUMBUS DISPATCH

The anesthesiologist who treated two women who gave birth May 21 at Mary Rutan Hospital in Bellefontaine was the likely source of the bacterial meningitis that killed one of the women, the Ohio Department of Health said yesterday.

Neither the hospital nor state officials would name the doctor, but Mary Rutan President and CEO Mandy Goble said the anesthesiologist has voluntarily stopped practicing there during the investigation.

It already had been disclosed that he had not worn a mask during the procedures, something hospital officials had said was in keeping with standard practices at other facilities.

Susan Ryan Finch Simpson, 30, died one day after giving birth to a daughter at Mary Rutan. She had been transferred to Riverside Methodist Hospital in Columbus once she showed signs of sickness. Another woman who gave birth the same day also was transferred to Riverside in critical condition. Both babies were born healthy.

Officials have said both women had streptococcus salivarius, bacteria commonly found in the mouth and respiratory tract. The women had identical strains, which meant it came from the same, single source.

While that same genetic link hasn't been made on the sample provided by the doctor pending further testing by the Centers for Disease Control and Prevention, health officials have drawn a conclusion anyway, said Kristopher Weiss, spokesman for the state health department.

"Based on the survey of the maternity ward, this lab evidence and the epidemiological investigation, we can say the person in the hospital who was tested was the likely source of the infection," Weiss said.

Simpson's family, as well as their attorney, declined to com-

See **INFECTION** Page **B2**

Aseptic technique

- WASH HANDS FIRST
- Remove watch – rings less clear
- Insufficient data to recommend a sterile gown
- Mask is important - especially if operator is infected

Hebl J. The importance and implications of aseptic techniques during regional anesthesia. Reg Anesth 2006;31:311-323

Skin prep

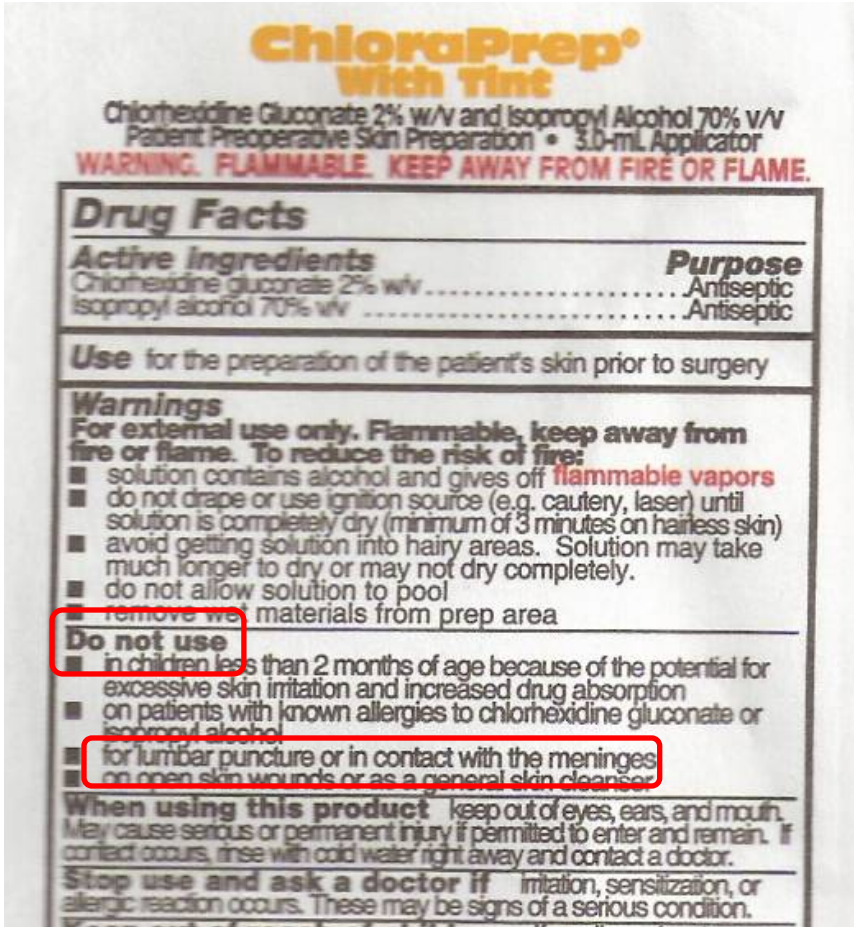
Consensus position of ASRA, ASA, and AANA:

"Chlorhexidine-based solutions should be considered the antiseptic of choice for regional anesthesia"

Reg Anesth 2006;31:311-323

Skin prep


APLICARE
3/4 FLUID OUNCE
POVIDONE-IODINE
SOLUTION
0.75 Fl. oz. (22.5 mL)
STERILE unless opened or damaged.
Drug Facts
Active Ingredient
Purpose
Use
Warnings
Reorder No. L-3001
Cat. No. 260415
Single Use • Applicator is STERILE if package is intact
ChloraPrep
With Tint
Chlorhexidine Gluconate 2% w/v and Isopropyl Alcohol 70% v/v
Patient Preoperative Skin Preparation • 3.0-mL Applicator
WARNING: FLAMMABLE. KEEP AWAY FROM FIRE OR FLAME.
Drug Facts
Active Ingredients
Purpose
Use for the preparation of the patient's skin prior to surgery
Warnings
Do not use
When using this product
Stop use and ask a doctor if
Directions
Other Information
Inactive Ingredients
Questions?


ChloraPrep
With Tint
Chlorhexidine Gluconate 2% w/v and Isopropyl Alcohol 70% v/v
Patient Preoperative Skin Preparation • 3.0-mL Applicator
WARNING: FLAMMABLE. KEEP AWAY FROM FIRE OR FLAME.
Drug Facts
Active Ingredients
Purpose
Chlorhexidine gluconate 2% w/v ..... Antiseptic
Isopropyl alcohol 70% v/v ..... Antiseptic
Use for the preparation of the patient's skin prior to surgery
Warnings
For external use only. Flammable, keep away from fire or flame. To reduce the risk of fire:
solution contains alcohol and gives off flammable vapors
do not drape or use ignition source (e.g. cautery, laser) until solution is completely dry (minimum of 3 minutes on hairless skin)
avoid getting solution into hairy areas. Solution may take much longer to dry or may not dry completely.
do not allow solution to pool
remove wet materials from prep area
Do not use
in children less than 2 months of age because of the potential for excessive skin irritation and increased drug absorption
on patients with known allergies to chlorhexidine gluconate or isopropyl alcohol
for lumbar puncture or in contact with the meninges
on open skin wounds or as a general skin cleanser
When using this product keep out of eyes, ears, and mouth. May cause serious or permanent injury if permitted to enter and remain. If contact occurs, rinse with cold water right away and contact a doctor.
Stop use and ask a doctor if irritation, sensitization, or allergic reaction occurs. These may be signs of a serious condition.

Neurologic Complications

- > 12,000 SABs from 2006-2010
- 57 neuro complications (0.46%)
- SAB - ? etiology in 5 complications (0.04%)

Normal neuro complication rate following SAB

Reg Anes Pain Med 2012;37(2):139-44

Chlorhexidine

- *“However, in the absence of clinical or ex- tended animal investigations examining the neuro- toxic potential of chlorhexidine, the FDA has chosen not to formally approve its use for skin antisepsis before lumbar puncture.”*

Reg Anesth Pain Med 2006;311-323

Obesity – Obstetrical Risk

	Morbidly Obese (%)	Control (%)
Vaginal delivery	38	76
Cesarean section	62	24
Labor requiring C/S	48	9
Emergency C/S	32	9
Operative time > 60 min	48	9
Prolonged delivery interval	25	4

Anesth Analg 1993;79:1210-8
Am J Obstet Gynecol 1994;170:560-5

Obesity – Risk for C/S

BMI	Rate (%)
<20	0
21-30	0.3
31-40	31.6
41-50	77.6
51-60	94.0
>60	97.5

Anesth Analg 1999;91:A1064

Recommendations for the Obese Parturient

1. Early consultation/exam and plan
2. Early initiation of neuraxial block
3. Anticipate difficult/prolonged labor
4. Likely C/S
5. Frequent block evaluation
6. Communication
7. ***+/- ultrasound assistance***

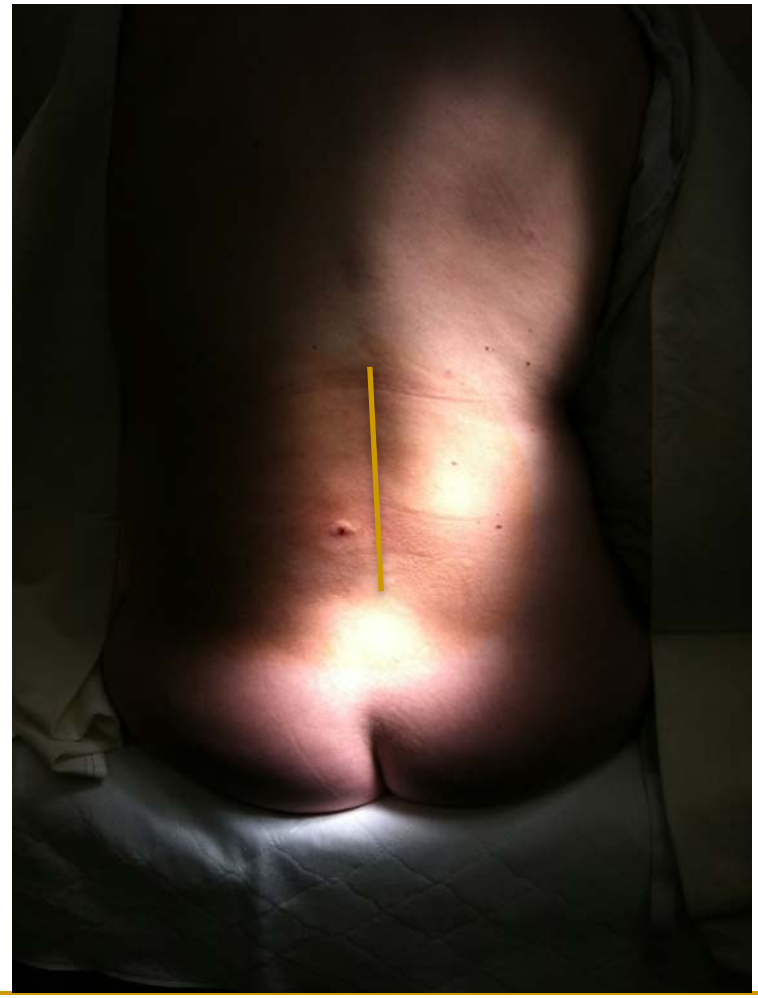
Anesth Analg. 2012;115(4):899–903

Anatomical Determinants
Patient Selection

- Difficult identification of landmarks
  - Scoliosis

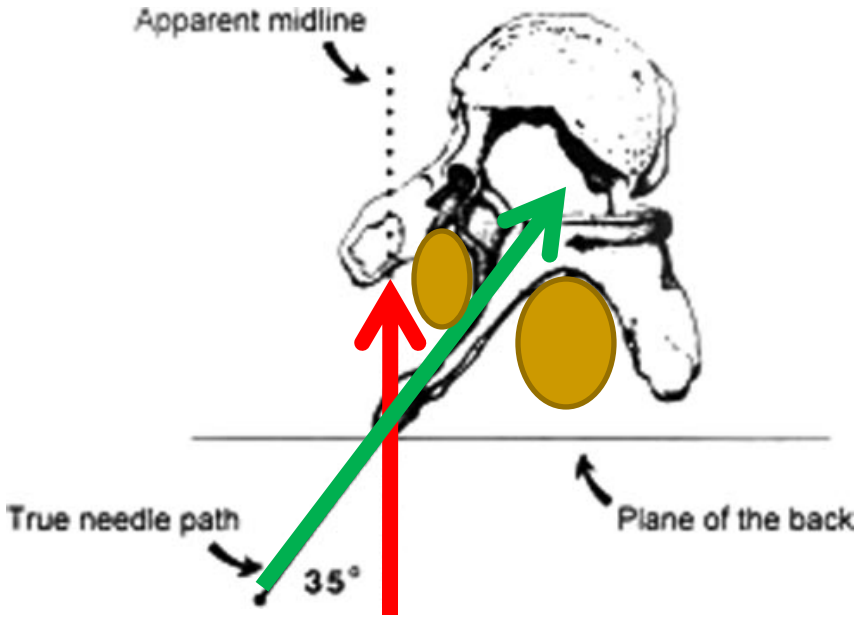
Not all are created equal

Scoliosis – Lateral Deformity



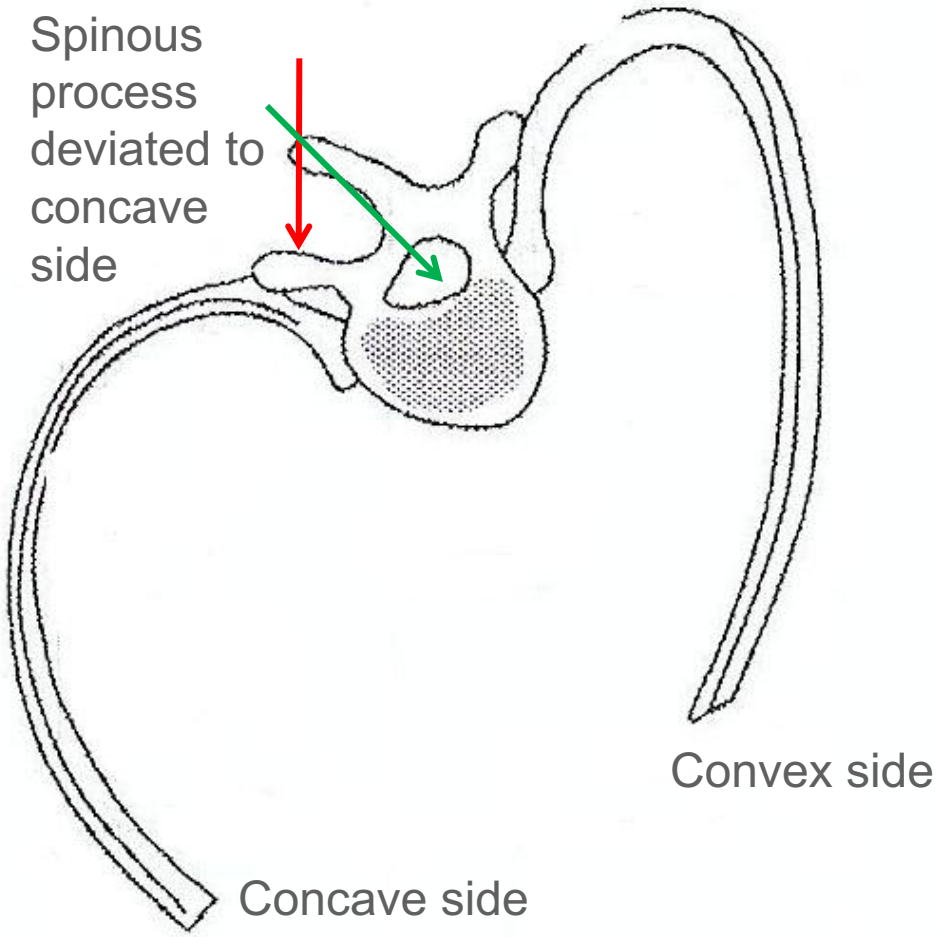
AA 2009;109:1930-4

Scoliosis – Rotational Defect



The needle should be directed toward the *convexity* of the scoliotic curve (hump) as it is advanced from the interspinous space

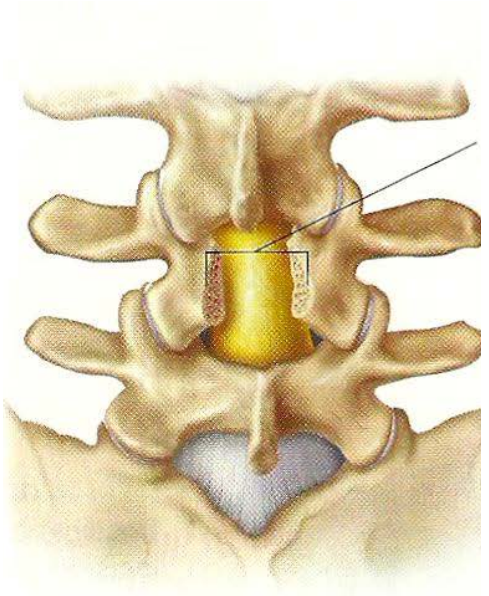
Rotational Deformity rib-hump schem

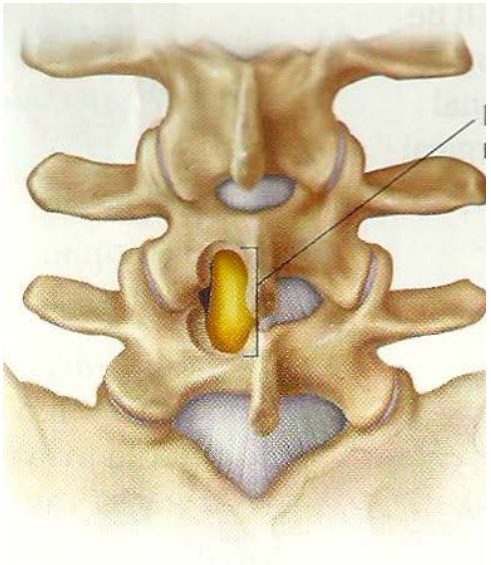


What about?
Previous spinal surgery

- Scar tissue
- Adhesions or obliteration of the epi space

can block spread or increase the risk of dural puncture

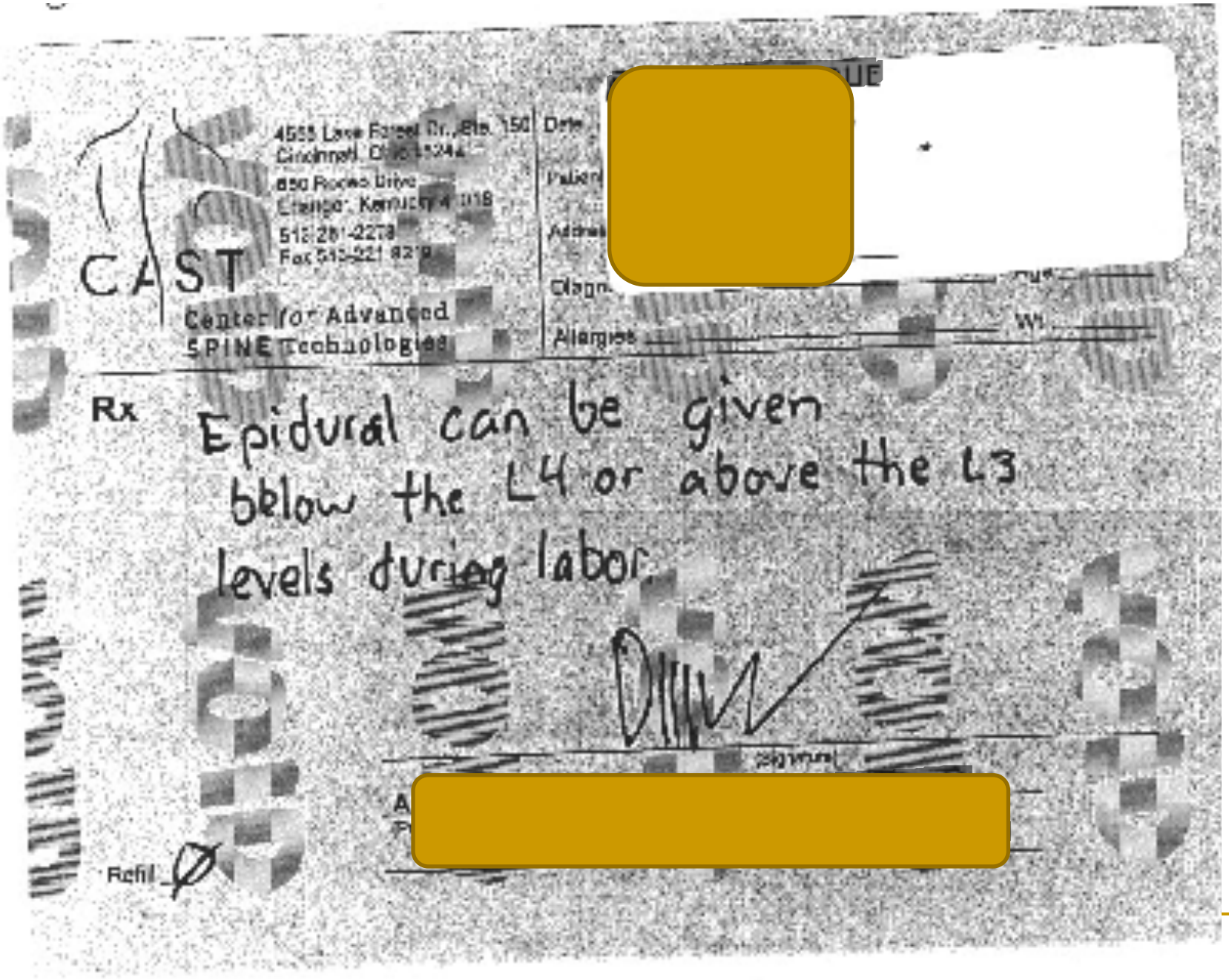




Spinal fusion and/or hardware

Consult early

- Careful examination of anatomy
- Look at radiological studies
- Obtain OP reports
- Neurological examination for persistent numbness, weakness, pain
- Documentation of pre-anesthetic interview- including risks, benefits, and alternatives
- Including, but not limited to:
  - Poor analgesia
  - Difficult, painful insertion
  - PDPH that is difficult or impossible to treat
- SAB may be preferable to an EPI


CAST
Center for Advanced
SPINE Technologies
Rx
Epidural can be given
bblow the L4 or above the L3
levels during labor.
Refil

Previous spinal surgery
What to do?

1. Place block above or below the surgical site
2. Place early to allow for increased pt cooperation and time to troubleshoot
3. CSA – place an intrathecal catheter with standard EPI equipment
4. Use multiple serial SAB's

OB CSAs – Intrathecal Macrocatheters

- 761 CSA placements 2001-2012
  - 653 after ADP
  - 108 intentional (obesity, difficult placement)

- No serious complications reported

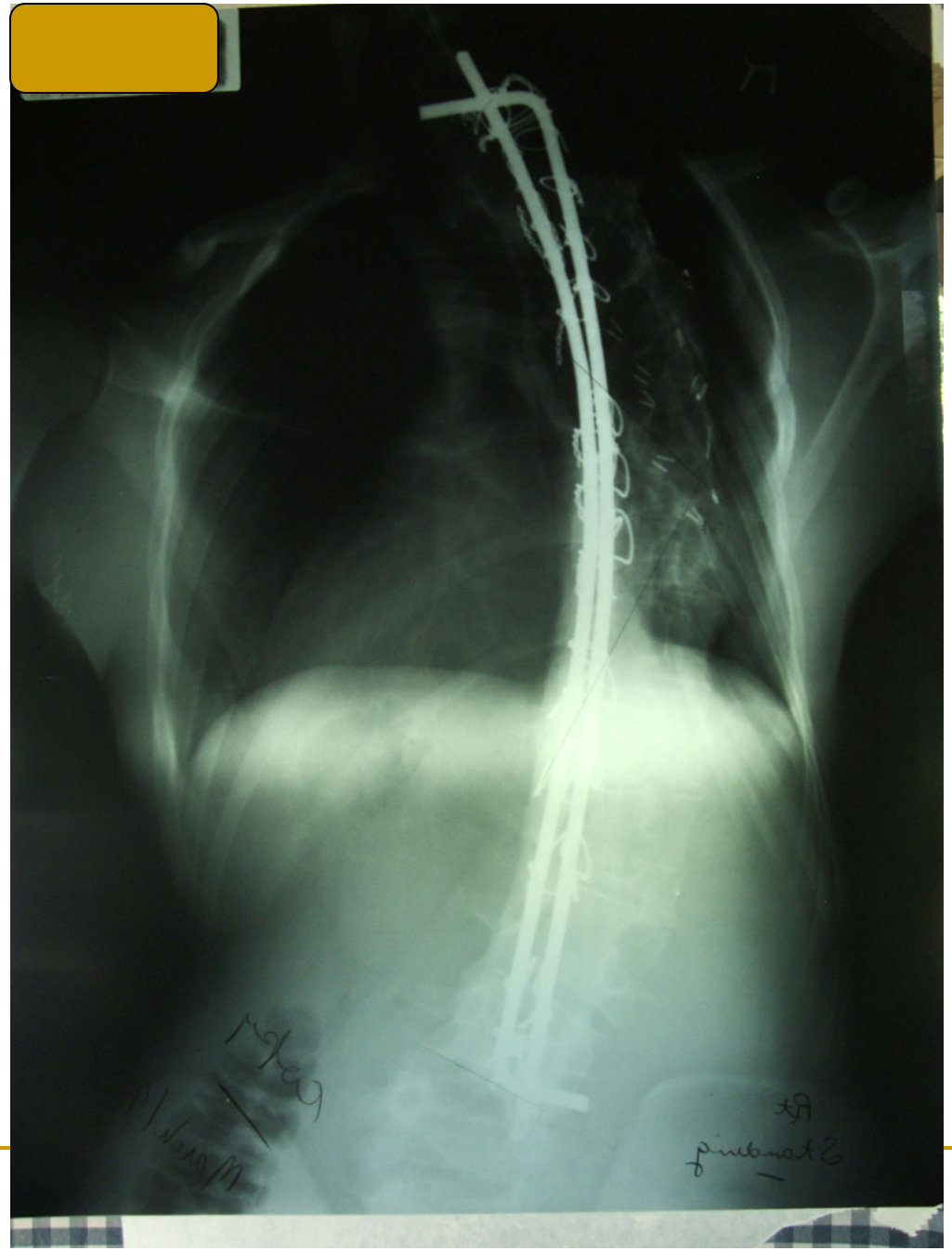
PDPH rate 41%

Spinal fusion and/or hardware

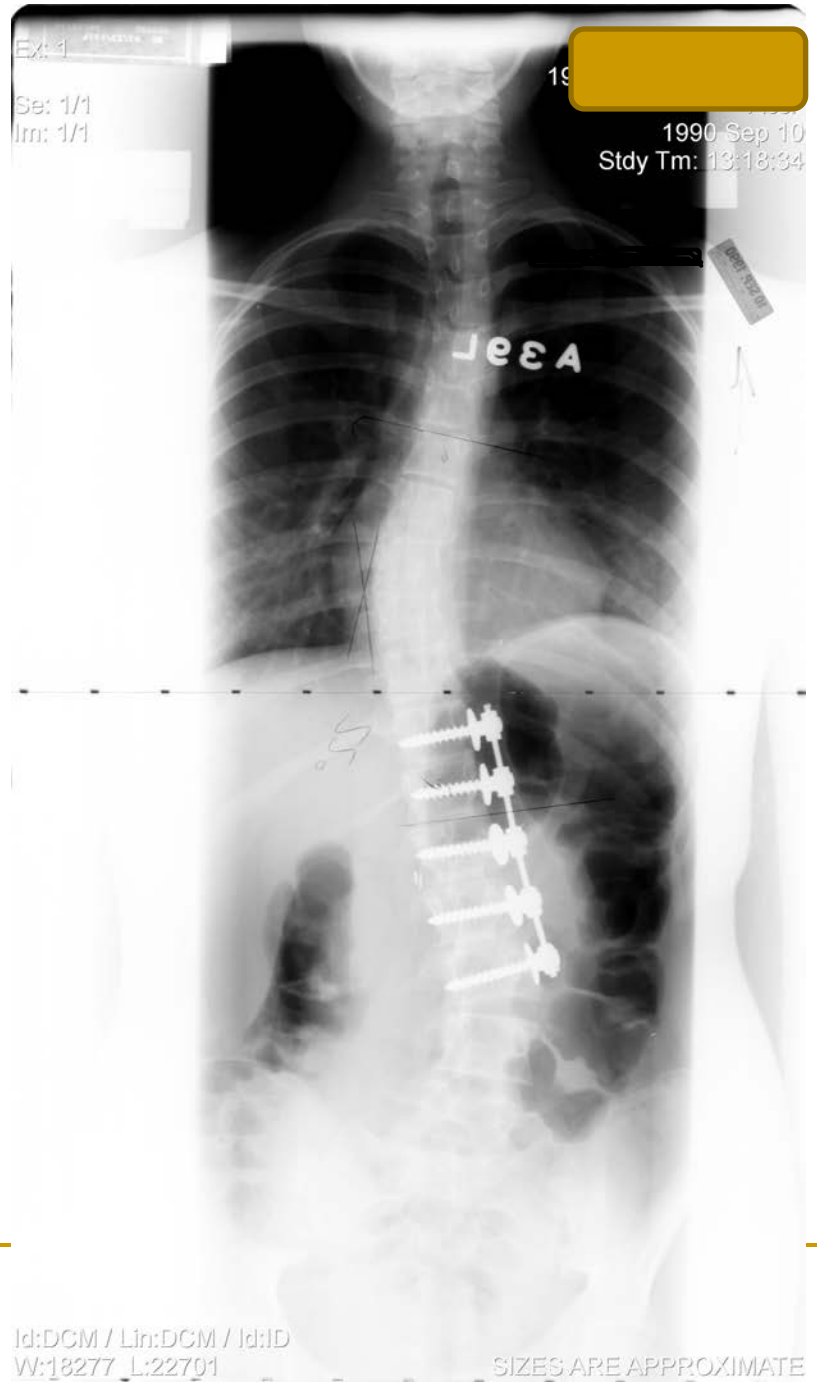
- Positioning both during and after the block may be difficult
- Performing the neuraxial anesthesia technique could be very difficult, or in some cases, technically impossible

Instruct the patient and staff to be meticulously careful when moving and positioning - so as not to aggravate a pre-existing injury

Reese C. et al. Spinal Anesthesia. In: *Clinical Techniques of Regional Anesthesia.* Park Ridge: AANA; 2007:19




Ex: 1
Se: 1/1
Im: 1/1
2003 Jan 10
Stdy Tm: 13:23:32
Id:DCM / Lin:DCM / Id:ID
W:22108 L:22359
SIZES ARE APPROXIMATE


Se: 1/1
Im: 1/1
1990 Sep 10
Stdy Tm: 13:18:34
Id:DCM / Lin:DCM / Id:ID
W:18277 L:22701
SIZES ARE APPROXIMATE

What about – Tattoos

- Avoid the tattoo if possible
- Contraindicated if the affected skin is still healing
- Ink fragments present in 22g needles

Reg Anesth Pain Med 2015;40:533-538


Questions?
bkassoncrna@gmail.com