

# Episode 132: Key Words Part 3: Spinals and Etomidate

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In this 132nd episode I welcome back Dr. Gillian Isaac to do more ABA keyword review. We review Spinals for the Basic Exam and Etomidate.

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## Spinal Anesthesia

- ABA Guidelines of what to know: indications, contraindications, sites of action, factors influencing onset, duration, termination of action, complications, physiological effects
- Highest yield: complications → most common and life/limb threatening, physiological effects
- Anatomy not listed on ABA guidelines, but is fair game question
- Most common question on anatomy: if doing spinal or epidural from midline approach, what tissues will you go through?
  - Answer: skin, subcutaneous tissue, supraspinous ligament, interspinous ligament, ligamentum flavum, epidural space
    - If doing spinal, also dura matter and arachnoid matter
    - Some questions will include posterior spinous ligament as distractor
- Question: which of the following is the correct order of anatomical structures encountered when using paramedian approach for lumbar spinal anesthesia
  - **A) ligamentum flavum, dura, arachnoid matter**
  - B) interspinous ligament, ligamentum flavum, dura, arachnoid matter
  - C) posterior longitudinal ligament, ligamentum flavum, dura, arachnoid matter
  - D) anterior longitudinal ligament, ligamentum flavum, dura, arachnoid matter
  - E) ligamentum flavum, dura, pia matter, arachnoid matter

## Block Height and Duration

- Block height determined by cephalad spread of local anesthetic in CSF
  - Factors suggested to affect spread:
    - Local anesthetic characteristics: baricity, dose, concentration, volume injected
    - Patient characteristics: age, height, weight, gender, pregnancy, position
    - Technique: site, speed, barbotage, direction of needle bevel, additions of vasoconstrictors
    - Most important is baricity and patient position (lateral vs. jack knife vs. prone vs. sitting)
  - Question: tingling of the 5<sup>th</sup> finger during spinal anesthesia is associated with anesthesia at which of the dermatomes?
    - A) C4
    - B) C6
    - **C) C8**
    - D) T2
    - E) T4
  - Regardless of what local is used, most patients sense onset within few minutes
    - Lidocaine → peak block height 10 to 15 minutes
    - Tetracaine and bupivacaine → peak block height 20 minutes
  - Question: which of the following neural functions demonstrates highest segmental block after spinal anesthesia?
    - **A) afferent sympathetic activity**
    - B) proprioception
    - C) sharp pain sensation
    - D) temperature sensation
    - E) touch sensation
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- Question: when performing a single shot spinal anesthetic, the level of block for motor, sensory, and sympathetic differs. Which of the following sequences is correct from the highest to the lowest section of the block?
    - A) sensory, sympathetic, motor
    - **B) sympathetic, sensory, motor**
    - C) sympathetic, motor, sensory
    - D) sensory, motor, sympathetic
  - Duration of block recedes cephalad to caudad
  - Duration mostly determined by local anesthetic
    - Bupivacaine → 90 to 140 minute two dermatome regression time
    - Chloroprocaine → 30 to 50 minute two dermatome regression time
  - Adding in adjuvant (eg. epinephrine) affects block height
  - Which of the following findings best represent complete resolution of spinal anesthesia?
    - A) ability to ambulate
    - **B) ability to urinate**
    - C) perianal pinprick sensation
    - D) pain at surgical site
    - E) proprioception of the big toe

## Spinal Effects - Cardiovascular

- Cardiovascular:
  - Hypotension → blockade of sympathetic efferent → arterial and venous dilation → drop in preload and afterload
  - Bradycardia → blockade of cardioaccelerator fibers from T1 to T4
- Question: 30 y.o. man receives spinal anesthesia to level of T4. 10 minutes later, HR and BP abruptly decrease to 30 bpm and 60/25mmHg, the most appropriate management is administration of which of the following drugs:
  - A) atropine
  - **B) epinephrine**
  - C) isoproterenol
  - D) metaraminol
  - E) phenylephrine

## Spinal Effects - Respiratory

- Respiratory:
    - Higher block can impair ventilatory function that require active exhalation → diaphragm working, but chest wall affected
    - ↓ expiratory reserve volume, peak expiratory flow, max minute ventilation
    - Tidal volume should remain the same
  - A lot of patients complain of dyspnea because chest wall is numb → no sensation that chest wall is moving
  - Question: healthy 24 y.o. woman is undergoing knee arthroscopy with spinal anesthesia to level of T4, which of the following findings is least likely
    - A) decreased HR
    - B) decreased hepatic blood flow
    - C) decreased MAP
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- **D) decreased tidal volume**
    - E) hyperperistalsis
  - Question: Which of the following is the most likely cause of dyspnea during spinal anesthesia with T3 sensory level block?
    - A) decreased abdominal muscle tone
    - **B) decreased afferent input from the thoracic wall**
    - C) increased dead space ventilation
    - D) increased intrapulmonary shunting
    - E) partial diaphragmatic paralysis
  - All GI organs derive sympathetic from T6 to L2 → if block these, then unopposed parasympathetic activity → secretions, sphincters relax, nausea, vomiting

## Spinal Complications – Post Dural Puncture Headache

- Post dural puncture headache → most common complication
- Risk factors: younger, female, pregnant, size of needle → smaller gauges ↓ risk
- Question: which of the following factors is the least important determinant of post dural puncture headache?
  - A) age of patient
  - B) gauge of needle
  - C) gender of patient
  - D) pregnancy
  - **E) time to ambulation**
- Question: 63 y.o. woman has knee surgery under spinal anesthesia. Two days later she complains of a severe headache. Pain intensity is not related to posture. The least likely cause of this headache is:
  - A) caffeine withdrawal
  - B) viral illness
  - C) migraine
  - **D) post dural puncture headache**

## Spinal Complications – Life Threatening

- Asystole → give epi
- High spinal (.01% risk) → hypotension, bradycardia, respiratory arrest because loose respiratory drive from brainstem
- Question: 19 y.o. man undergoing inguinal hernia repair is anesthetized with spinal block supplemented with midazolam and fentanyl. During the procedure, he has sudden loss of consciousness, profound hypotension, and bradycardia. Systolic BP is 40mmHg and HR is 30 bpm. CPR is started. The most appropriate next step is administration of:
  - A) atropine
  - B) ephedrine
  - **C) epinephrine**
  - D) naloxone

## Spinal Complications – Neurological Injury

- Most common is persistent paresthesia → 0.03% risk
  - More severe complications:
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- Cauda equina syndrome
    - Transient neurological syndrome → associated with lidocaine
  - Question: 65 y.o. man undergoes prostatectomy in lithotomy position under spinal anesthesia using bupivacaine 12 mg. Ten hours later, he reports his left foot is numb. Exam shows decreased pin prick sensation over the lateral dorsal aspect of the left foot. Dorsiflexion is limited. Which of the following is most likely?
    - A) cauda equina syndrome
    - **B) compression of common peroneal nerve**
    - C) compression of post tibial nerve
    - D) L5 nerve root damage
    - E) stretching of sciatic nerve
  - Question: common elements present in cauda equina syndrome after continuous spinal anesthesia
    - A) use of micro catheter
    - **B) maldistribution of local anesthetic** → high concentration in small area causes problems
    - C) administration of lidocaine
    - D) addition of epinephrine

## Etomidate Mechanism of Action

- Carboxylate imidazole-containing anesthetic → structurally unrelated to other IV anesthetic
- Works by acting on GABA receptors
- Question: which drug exerts its main CNS action by inhibiting the NMDA receptor?
  - A) propofol
  - B) midazolam
  - C) etomidate
  - **D) ketamine**

## Etomidate Complications

- The aqueous solution of etomidate is unstable at physiological pH → mixed with propylene glycol which has pH of 6.9 → higher incidence of pain on injection, venous irritation, and hemolysis
- Question: the most common reason for patients to rate anesthesia with etomidate unsatisfactory is:
  - **A) PONV** → etomidate is one of most nausea inducing drugs
  - B) pain on injection → could be pretty significant, but not what people dislike most
  - C) recall of intubation
  - D) post-operative hiccups → barbiturates cause this
- Standard induction dose: 0.1 to 0.2 mcg/kg

## Etomidate Causing Myoclonus

- Myoclonic movement during induction with etomidate → subcortical disinhibition and not due to seizure activity
    - Decrease frequency of myoclonus by giving opioid or benzo before administration
  - Question: compared with thiopental, etomidate causes:
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- A) greater histamine release → etomidate actually causes less histamine release so good for pt with asthma
  - B) greater myocardial depression → etomidate is hemodynamically stable so good for people with bad hearts
  - **C) greater myoclonic activity**
  - D) increased seizure activity
  - E) less nausea → more nausea than thiopental

## Pharmacokinetics of Etomidate

- Emergence time is dose dependent, but remains short even after repeated bolus or continuous infusions → context sensitive half-life does not go up
- Pharmacokinetics → described by three compartment open model
- High clearance rate due to extensive hydrolysis in liver resulting in an inactive metabolite

## Effects of Etomidate on CNS

- Decrease cerebral metabolic rate, decrease cerebral blood flow, decreases intracranial pressure → maintain adequate cerebral perfusion pressures because hemodynamically stable → not bad for neurosurgery
- Question: which of the following increases cerebral blood flow while decreasing cerebral metabolic rate?
  - A) etomidate
  - B) fentanyl
  - **C) isoflurane**
  - D) lidocaine
  - E) midazolam
- Question: Cerebral blood flow is decreased by each of the following except:
  - A) etomidate
  - B) midazolam
  - **C) NO**
  - D) increased minute ventilation
  - E) positive end expiratory pressure

## Effects of Etomidate on Adrenal Glands

- Etomidate has inhibitory effect on adrenal cortical synthetic function
    - [1984 NEJM Paper “Etomidate Inhibits Adrenocortical Function in Surgical Patients”](#)
  - Question: a single dose of etomidate for induction of anesthesia will cause
    - **A) adrenal cortical suppression** → but not clinically significant outside of severe sepsis/septic shock; lasts 5 to 8 hours
    - B) decreased skeletal muscle tone → etomidate increases
    - C) hypotension → should remain hemodynamically stable
    - D) increased airway activity → decreased airway activity because no histamine release
    - E) tachycardia → may still see from direct laryngoscopy, not from drug
  - Question: a patient being mechanically ventilated in the ICU requires wound debridement twice daily. Each of the following agents would be appropriate for induction of brief general anesthesia, except:
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- A) NO
  - **B) etomidate** → adrenal suppression will be clinically significant at this point
  - C) ketamine
  - D) methohexital
  - E) midazolam

## Other Effects of Etomidate

- Etomidate is induction agent of choice for patients with cardiorespiratory disease and where preservation of normal BP is crucial → used a lot in trauma
- Etomidate increases amplitude of SSEPs (somatosensory evoked potential) and has minimal increase on latency
- Etomidate associated with high PONV especially when used with opiates

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