

Episode 176: Barbiturates and Bier Blocks

On this episode: Dr. Jed Wolpaw With Dr. Gillian Isaac

In this 176th episode I welcome Dr. Gillian Isaac back to the show to discuss another 2 ABA key words. This time we discuss Barbiturates and Bier Blocks. I also take a moment up front to share some thoughts on the horrible tragedy of George Floyd's death at the hands of the police and the importance of acknowledging white privilege and fighting for the fact that Black Lives Matter.

[All keywords covered](#)

Questions & Notes

Click → jump to answers/notes.

BARBITURATES

BRIEF OVERVIEW OF THIOPENTAL

KEY POINT 1: MECHANISM OF ACTION, PHARMACOKINETICS

Awakening after a single dose of thiopental is caused by redistribution from the brain primarily to which of the following sites?

- (A) Fat
- (B) Heart
- (C) Liver
- (D) Lung
- (E) Skeletal muscle

Which of the following is associated with ↑ duration of clinical narcosis following infusion of total dose 10mg /kg thiopental over 3 hrs?

- (A) alcoholism in remission
- (B) asthma
- (C) fever?
- (D) obesity
- (E) use of appetite suppressants

Compared with thiopental, methohexital is characterized by:

- (A) better absorption after rectal administration
- (B) greater protein binding
- (C) greater hepatic clearance
- (D) larger volume of distribution
- (E) more complete biotransformation

The duration of action of an induction dose of thiopental is determined primarily by its

- (A) rate of elimination
- (B) rate of metabolism
- (C) redistribution from brain to fat
- (D) redistribution from brain to muscle
- (E) hepatic extraction

Each of the following affects the induction dose of thiopental EXCEPT

- (A) acute ethanol intoxication
 - (B) chronic use of barbiturates
-

- (C) intravascular volume
- (D) rate of hepatic extraction of thiopental
- (E) serum albumin concentration

Which of the following statements about thiopental is true?

- (A) Rapid uptake into maternal tissues limits its transfer to the fetus
- (B) Its short duration of action is due to its extensive binding to plasma proteins
- (C) Accumulation in fat leads to acute tolerance
- (D) Alkalinity of solution causes respiratory depression
- (E) Uptake into brain is slowed by respiratory acidosis

A healthy, but obese, 110-kg woman is scheduled for gastric stapling. Compared with that required at her ideal weight, the dose of thiopental required for anesthetic induction would likely be increased because of changes in?

- (A) blood volume
- (B) muscle mass
- (C) circulation time
- (D) body fat
- (E) metabolic rate

KEY POINT 2: CLINICAL USE, SIDE EFFECTS

Pain after 8ml inject of thiopental 2.5% through right radial catheter. Hand remains pink. Most appropriate next step?

- (A) Inject lidocaine into catheter
- (B) Inject nitroglycerin into catheter
- (C) Inject papaverine into catheter
- (D) R stellate ganglion block
- (E) No intervention

Which of following barb-protection from cerebral ischemia is true?

- (A) May be achieved w/ dose low enough to avoid cardiovascular effects
- (B) Linear dose related
- (C) Improve neuro outcome following card arrest
- (D) Most useful for patients with focal ischemia
- (E) Unrelated to EEG activity

Most likely to increase duration of seizure following ECT using barb and sux for GA?

- a) admin atropine
- b) change to benzodiazepine for induction
- c) change to etomidate
- d) add phenytoin to preop med (anti-seizure medication)
- e) decrease barb used (some data to show low dose might ..)

KEY POINT 3 = PHARMACOKINETICS, PHARMACODYNAMICS, ORGAN SYSTEM EFFECTS

CNS EFFECTS

RESPIRATORY EFFECTS

Middle aged 70kg for elective craniotomy for brain tumor. Preop: alert, papilledema present. Induced w/ thiopental 300mg, sux 100mg → intubate → immediate bucking occurs. Best immediate mgt?

- a) Admin sux 100mg iv
- b) Fentanyl 500mcg iv
- c) Hyperventilate with isoflurane 2%
- d) Admin thiopental 400mg IV
- e) Hyperventilate + admin lido 1mg/kg

50M for emergent crani for evacuation of epidural hematoma. GCS 6. HR 54, BP 190/110. Most appropriate initial management?

- a) atropine

- b) mannitol
- c) nimodipine
- d) nitroprusside
- e) thiopental

70kg 46M undergo clipping of cerebral aneurysm w/ N2O , opioid relaxant anesthesia. as surgeon about to enter dura, it's noted to be tense and bulging. HR 100, MAP 90. PaO2 120, PaCO2 23, pH 7.5.

What should be done immediately?

- a) hyperventilate to PaCO2 15-20
- b) admin furosemide 20mg IV
- c) admin mannitol 0.5mg/kg
- d) admin thiopental 250 increments
- e) add halothane to deepen

During crani for supratentorial tumor, 28M receives N2O, O2, isoflurane. Vent controlled to maintain PACO2 25. Nasopharyngeal temperature 35.8. On opening dura, surgeon notes dura bulging . Most appropriate management ?

- a) ↓ iso conc.
- b) hyperventilate further
- c) stop N2O
- d) thiopental
- e) muscle relaxant

Depression of cerebral O2 requirement below level required to create isoelectric EEG can be achieved by:

- a) admin isoflurane
- b) admin nimodipine
- c) barb-coma
- d) hyperventilate
- e) hypothermia

HOW TO PERFORM?

MOA

Surgery cancelled after 10 min of IVRA with 50ml 0.5% lido. To terminate anesthesia safely, what is most appropriate timing for deflating tourniquet?

- a) immediate after benzo admin
- b) immediate after ephedrine
- c) immediately, followed by inflation/deflation
- d) in no less than 20 min after initial injection
- e) in no less than 45 min after initial injection

Primary determinant of duration of IVRA?

- a) tourniquet duration
- b) capacitance of venous system of extremities
- c) local anesthetic agent injected
- d) volume of solution
- e) method of exsanguinating

Which of following is true about bier block?

- a) useful for postop pain
- b) can be used for extremity surgery 2-3hr
- c) bupivacaine is an alternative choice
- d) lido most commonly used

All acceptable agents to use of bier block, except

- a) 0.5% lido
- b) 0.5% bupi
- c) 0.25% bupi
- d) 0.5% prilocaine

KEY POINT 2: CONTRAINDICATIONS

55kg man scheduled for hand surgery with IVRA w/ 0.5% lido 15 ml. Which of following is true?

- a) contraindicated in sickle cell disease
- b) mottling of skin after injection indicates abandonment of technique
- c) tourniquet discomfort is indication to inject more local
- d) bupivacaine 0.5% can be substituted to prolong anesthesia
- e) epi 1:400,000 should be added to prolong

KEY POINT 3: COMPLICATIONS

Tourniquet with dual bladder used for IVRA for UE. At what point should distal tourniquet be inflated?

- a) during injection of local anesthetic
- b) after patient complains of tourniquet pain
- c) co-inflation with proximal tourniquet
- d) after proximal tourniquet deflated
- e) prior to exsanguination

Which of following s/sx of lidocaine toxicity from high levels following IVRA?

- a) shivering
- b) nystagmus
- c) lightheadedness, dizziness
- d) tonic-clonic seizures

WHAT ARE YOU DOING TO TAKE MIND OFF STRESSFUL TIME?

We would like to take a moment to acknowledge the horror that happened to Floyd and many others. How to communicate this adequately? How to support you? If struggling with your own experience, please reach out to support.

“When I am overcome with sadness with the fact that human beings can treat each other this way, I find some solace and hope that there is incredible wonder and caring and joy in the world. (eg seeing colleagues go above and beyond.) Shows much to be cherished in humanity.”

Thank you for providing that hope and being the people you are.

Please take a moment for George Floyd and others

Barbiturates

7:44

- What's tested?
- PK is big one, relationship b/w CMRO₂ and CBF

Brief overview of thiopental

8:14

- One of earliest demonstrated us was in 1930s
- Was go to OB induction drug in 2009!
- 2011 stopped production in the US
- Two types
 - o OXY (methohexital used for electroconvulsive therapy)
 - o THIO (pental)

Key point 1: Mechanism of action, pharmacokinetics

9:21

- GABA-receptor agonist
- If bolus → CNS → rapid redistribution (thus termination of action) after single dose. Then slowly metabolized by liver
- Thiopental: 12hr elimination t_{1/2}, which is 10x longer than prop
- Long context-sensitive half-time
- Methohexital: elimination t_{1/2} = 4hrs because more extracted from liver

11:00

Awakening after a single dose of thiopental is caused by redistribution from the brain primarily to which of the following sites?

- (A) Fat
- (B) Heart
- (C) Liver
- (D) Lung
- (E) Skeletal muscle

- Approach: clearly not C or D. Leaves us with A or E. E prob better perfused than fat.
- Highly vascularized skeletal muscle, then fat.. then liver over time
- Answer: E

12:11

Which of the following is associated with ↑ duration of clinical narcosis following infusion of total dose 10mg /kg thiopental over 3 hrs?

- (A) alcoholism in remission
- (B) asthma
- (C) fever?
- (D) obesity
- (E) use of appetite suppressants

- Infusion → longer duration of action, think of obesity (D)
- A - trick to thinking liver is ok.

13:29

Compared with thiopental, methohexital is characterized by:

- (A) better absorption after rectal administration
- (B) greater protein binding
- (C) greater hepatic clearance
- (D) larger volume of distribution
- (E) more complete biotransformation

- Answer: C

14:15

The duration of action of an induction dose of thiopental is determined primarily by its

- (A) rate of elimination
- (B) rate of metabolism
- (C) redistribution from brain to fat
- (D) redistribution from brain to muscle
- (E) hepatic extraction

- Brain to muscle - memorize fact
- Answer: C

14:40

Each of the following affects the induction dose of thiopental EXCEPT

- (A) acute ethanol intoxication
- (B) chronic use of barbiturates
- (C) intravascular volume
- (D) rate of hepatic extraction of thiopental
- (E) serum albumin concentration

- This is similar to a question about MAC
- a) sleepier = reduce
- b) chronic is opposite
- c) volume will affect (dilution)
- e) assume albumin tends to bind.
- Answer: D

16:22

Which of the following statements about thiopental is true?

- (A) Rapid uptake into maternal tissues limits its transfer to the fetus
- (B) Its short duration of action is due to its extensive binding to plasma proteins
- (C) Accumulation in fat leads to acute tolerance
- (D) Alkalinity of solution causes respiratory depression
- (E) Uptake into brain is slowed by respiratory acidosis

- Even if not sure about placental transfer, talked about rapid uptake by muscles so might limit transfer
- Similar to propofol
- If add acidity, will precipitate
- Answer: A

17:30

A healthy, but obese, 110-kg woman is scheduled for gastric stapling. Compared with that required at her ideal weight, the dose of thiopental required for anesthetic induction would likely be increased because of changes in?

- (A) blood volume
- (B) muscle mass
- (C) circulation time
- (D) body fat
- (E) metabolic rate

- Only factors that affect effect on brain is blood volume (A)

Key Point 2: Clinical use, side effects

18:26

- Induction of GA
- Methohexital: ECT
- Thiopental: barbiturate-coma (focal and incomplete ischemia, not global)
- Thiopental - tissue necrosis
- Contraindicated population: Acute Intermittent Porphyria

19:50

Pain after 8ml inject of thiopental 2.5% through right radial catheter. Hand remains pink. Most appropriate next step?

- (A) Inject lidocaine into catheter
- (B) Inject nitroglycerin into catheter
- (C) Inject papaverine into catheter
- (D) R stellate ganglion block
- (E) No intervention

- Not tissue injection since into artery, so not much can do other than watching for tissue necrosis.
- Diff. than extravasation of vein
- Answer: E

20:59

Which of following barb-protection from cerebral ischemia is true?

- (A) May be achieved w/ dose low enough to avoid cardiovascular effects
 - (B) Linear dose related
 - (C) Improve neuro outcome following card arrest
 - (D) Most useful for patients with focal ischemia
 - (E) Unrelated to EEG activity
- Dose will definitely have cardiovascular effects
 - Answer: D

22:00

Most likely to increase duration of seizure following ECT using barb and sux for GA?

- a) admin atropine
 - b) change to benzodiazepine for induction
 - c) change to etomidate
 - d) add phenytoin to preop med (anti-seizure medication)
 - e) decrease barb used (some data to show low dose might ..)
- Answer: E

Key point 3 = Pharmacokinetics, Pharmacodynamics, organ system effects

CNS effects

23:20

- CNS depressant, anti-convulsant, though some pro-convulsant properties
- Thiopental neuroprotective
- ↓ MRO₂, CBF, ICP
- EEG burst suppression

Cardiovascular effects

23:50

- ↓ MAP, venous tone, CO

Respiratory effects

23:58

- Dose-depend respiratory depression, no bronchodilation

24: 22

Middle aged 70kg for elective craniotomy for brain tumor. Preop: alert, papilledema present. Induced w/ thiopental 300mg, sux 100mg → intubate → immediate bucking occurs. Best immediate mgt?

- a) Admin sux 100mg iv
- b) Fentanyl 500mcg iv
- c) Hyperventilate with isoflurane 2%
- d) Admin thiopental 400mg IV
- e) Hyperventilate + admin lido 1mg/kg

- In general wouldn't give another dose of sux iso ICP. what can you do that's really fast to prevent ↑ ICP?
- B and C = not fast enough
- Basically can substitute thiopental with propofol
- Answer (D)

27:21

50M for emergent crani for evacuation of epidural hematoma. GCS 6. HR 54, BP 190/110. Most appropriate initial management?

- a) atropine
- b) mannitol
- c) nimodipine
- d) nitroprusside
- e) thiopental

- Don't want BP that high. Perfuse brain w/o ↑ CMRO₂. Give something to ↓ ICP quickly.
- Answer: (E)

29:01

70kg 46M undergo clipping of cerebral aneurysm w/ N₂O, opioid relaxant anesthesia. as surgeon about to enter dura, it's noted to be tense and bulging. HR 100, MAP 90. PaO₂ 120, PaCO₂ 23, pH 7.5. What should be done immediately?

- a) hyperventilate to PaCO₂ 15-20
- b) admin furosemide 20mg IV
- c) admin mannitol 0.5mg/kg
- d) admin thiopental 250 increments
- e) add halothane to deepen

- Want to drop BP fast, but not too fast (D)

30:03

During crani for supratentorial tumor, 28M receives N2O, O2, isoflurane. Vent controlled to maintain PACO2 25. Nasopharyngeal temperature 35.8. On opening dura, surgeon notes dura bulging . Most appropriate management ?

- a) ↓ iso conc.
- b) hyperventilate further
- c) stop N2O
- d) thiopental
- e) muscle relaxant
 - Thio similar to above
 - Answer: D

30:35

Depression of cerebral O2 requirement below level required to create isoelectric EEG can be achieved by:

- a) admin isoflurane
- b) admin nimodipine
- c) barb-coma
- d) hyperventilate
- e) hypothermia
 - Already at isoelectricEEG, so not A, C.
 - Hypotherm: (E)

Bier Blocks

32:04

- "Intervenous regional anesthesia" IV regional
- Mechanism, indication/contraindication, side effects
- Most likely asked: how to do? How does it work?
- Complications, limitations

33:25

- Invented in 1908 by Bier.
- Most commonly used for short duration procedure of UE distal to elbow
 - o eg carpel tunnel release, dupuytren contracture release, neuroma excision, fracture reduction

How to perform?

34:00

- Small IV distal as possible
- Elevate arm, exanguinate
- Tourniquet proximal to elbow and inflate ideally to 50-100 mmHg above systolic
- Lido 15-20 ml 2% through catheter.

MOA

34:49

- Diffusion of local anesthetic extravascular to block distal peripheral branches of nerve, different than supraclavicular where you're blocking the plexus

35:36

Surgery cancelled after 10 min of IVRA with 50ml 0.5% lido. To terminate anesthesia safely, what is most appropriate timing for deflating tourniquet?

- a) immediate after benzo admin
- b) immediate after ephedrine
- c) immediately, followed by inflation/deflation
- d) in no less than 20 min after initial injection
- e) in no less than 45 min after initial injection
 - 20 min, then de/inflate for slow release
 - After 45, can just release tourniquet

37:06

Primary determinant of duration of IVRA?

- a) tourniquet duration
- b) capacitance of venous system of extremities
- c) local anesthetic agent injected
- d) volume of solution
- e) method of exsanguinating
 - A because doesn't cover tourniquet pain, though can go around it by using 2 tourniquets
 - Arm safety time limit: ~1hr
 - Not perfusing! also bloodless surgery

38:51

Which of following is true about Bier block?

- a) useful for postop pain
- b) can be used for extremity surgery 2-3hr
- c) bupivacaine is an alternative choice
- d) lido most commonly used
 - Not A bc too short acting
 - Not B
 - Not C bc don't want it intravenous
 - Answer: D

39:37

All acceptable agents to use of Bier block, except

- a) 0.5% lido
- b) 0.5% bupi
- c) 0.25% bupi
- d) 0.5% prilocaine
 - Don't want to use bupivacaine bc strongly binds to Na (of heart)
 - Answer: B

Key point 2: Contraindications

40:07

- Relative:
 - o Inability to gain IV access
 - o Infection of site
 - o Severe peripheral vascular disease, already have ischemia
 - o Sick cell disease
 - o Venous disruption (AVF, shunt)
 - o Convincing hx of local anesthetic allergy

40:27

55kg man scheduled for hand surgery with IVRA w/ 0.5% lido 15 ml. Which of following is true?

- a) contraindicated in sickle cell disease
- b) mottling of skin after injection dictates abandonment of technique
- c) tourniquet discomfort is indication to inject more local
- d) bupivacaine 0.5% can be substituted to prolong anesthesia
- e) epi 1:400,000 should be added to prolong
 - Don't want E because will cause more vasoconstriction
 - Answer: A

Key point 3: complications

41:26

- Closed claims: only 3 of death / brain damage from Bier block
 - o Most common: Local Anesthetic Systemic Toxicity, and things associated with it
 - o Others: Nerve damage, compartment syndrome, skin discoloration/petechiae/thrombophlebitis
- Most common: tourniquet pain

42:21

Tourniquet with dual bladder used for IVRA for UE. At what point should distal tourniquet be inflated?

- a) during injection of local anesthetic
- b) after patient complains of tourniquet pain
- c) co-inflation with proximal tourniquet
- d) after proximal tourniquet deflated
- e) prior to exsanguination
 - Don't need at all unless tourniquet pain
 - Answer: B

43:11

Which of following s/sx of lidocaine toxicity from high levels following IVRA?

- a) shivering
- b) nystagmus
- c) lightheadedness, dizziness
- d) tonic-clonic seizures
 - Based on induction experience, C
 - Then tinnitus/perioral numbness → CNS effects → shivering → twitch → seizure

44:16

- Questions most about how to use safely, re: tourniquet, timing, contraindications, LAST

What are you doing to take mind off stressful time?

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