TOTAL SPINAL





Anesthesia Complications

- Total Spinal vs BJR

TOTAL SPINAL

- **LOC & respiratory arrest caused by brainstem dysfunction from LAs**
  - Can begin with slurred speech & SpO_2 desaturation
  - LOC requires immediate airway securement with ventilatory and hemodynamic support.



EDUCATION: ORIGINAL INVESTIGATIONS IN EDUCATION

Serious Complications Related to Obstetric Anesthesia

The Serious Complication Repository Project of the Society for Obstetric Anesthesia and Perinatology

D'Angelo, Robert M.D.; Smiley, Richard M. M.D., Ph.D.; Riley, Edward T. M.D.; Segal, Scott M.D., M.H.C.M.

Author Information

Anesthesiology 120(6):p 1505-1512, June 2014. | *DOI:* 10.1097/ALN.0000000000000253

Table 7. Characteristics Associated with High Neuraxial Anesthetics

Variable	Number
Total high neuraxial anesthetics	58
Associated technique	
Spinal	23 (40%)
Epidural	21 (36%)
Unrecognized spinal catheter	14 (24%)
Occurred in labor suite	13
During cesarean delivery	1
Risk factors	38/44 (86%)
Obesity	18
Spinal technique after failed epidural anesthesia	12
Height <60 inches	4
Epidural after wet tap	3
Spinal deformity	1

1. D'Angelo et al. *Anesthesiology*. 2014

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- Collected data 2004-2009 on ~257,000 pregnant women given neuraxial or GA across 30 institutions
- Serious anesthesia-related complications reported in 85 (1 in 3,000) women

- Most common serious complications were:
  - **High neuraxial block**
  - **Respiratory arrest in labor suite**
  - **Unrecognized spinal catheter**

1. D'Angelo et al. *Anesthesiology*. 2014

EDUCATION: ORIGINAL INVESTIGATIONS IN EDUCATION

Serious Complications Related to Obstetric Anesthesia

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- Most common serious complication reported: **high neuraxial block necessitating intubation**
  - 1 : 4,336 regional anesthetics
    - ➢ Importance of readily available emergency airway equipment in OB.

- In addition, **CAUTION with spinal anesthesia after failed epidural anesthetic in women with anticipated difficult airway.**

> 25% of total high neuraxial blocks occurred in this specific context

implying the incidence may be relatively high.

1. D'Angelo et al. *Anesthesiology*. 2014

Anyone about to place a full-dose spinal for c/s after a recently dosed epidural



- "The literature" suggests biphasic absorption of epidural fluid with initial $t^1/_2$ 7-9 min, followed by a $t^1/_2$ 82-362 min, with majority of clearance in 30-60 min. [2]

- Maximal dural sac compression in first 5 min, with gradual restoration over 30-60 min
  - Complete resolution usually by 24h (~ 93% of cases on f/u MRI) [2]

    - *IMHO If unable to wait 30-60 min after epidural bolus, or unable to replace epidural, a controlled intubation is safer than a spinal.*

2. Higuchi et al. *Anesthesiology*. 2005

HIGH-LEVEL BLOCK

No airway compromise, but may cause pt anxiety, MAY progress to total spinal, or may illicit BJR

- Upper extremity weakness
  - **Ability to squeeze hands/thumb strength rules out block higher than C6**
    - Challenge her to a thumb war

- Hoarse voice/whisper
  - *2/2 lack of adequate air excursion from blockade of diaphragm motor innervation*
    - *May need intubation*

- Feeling of heaviness in chest "can't take a deep breath."

- HOTN & bradycardia possible from T1-T4 cardiac accelerator fiber blockade
  - N/V from HOTN:
    - Reduced brainstem perfusion, splanchnic circulation vasoconstriction

- Significant anxiety & restlessness

- **Symptom management & monitoring for possible progression to LOC/total spinal.**
  - **Shrugging shoulders (C4), Phonating (C1-3 larynx) (C3-5 diaphragm) rules out total spinal**
    - Keep mom talking to assess for neuro changes & apnea while you treat HOTN +/- bradycardia.
      - Consider elevating HOB/ramping if possible. NOT full reverse trend.

- ✓ **SEMI FOWLERS 45º** to reduce further LA cephalad spread, and to improve respiratory mechanics
- ✓ Pressor gtts: phenylephrine, norepi, or whatever is needed.
- ✓ O_2 support as needed
- ✓ Monitor for progression or regression.

5. Jacobs, D. *High or Total Spinal Anesthesia*; NYSORA. 2022

Bezold-Jarisch Reflex

BJR TRIGGER:

✓ Reduced preload from neuraxial sympathectomy
- can be exacerbated by aortocaval compression
  - ➢ Induces vigorous contraction of empty LV. (baroreceptive reflex)

PATHWAY:

➢ Afferent vagal C-fibers originating in LV inferoposterior wall
- ➢ mechanoreceptors detecting: strong LV contractions

➢ Synapses in nucleus tractus solitarius/solitarii
- Receives all visceral afferent input, controls autonomic reflexes/homeostasis
- Located in **medulla**

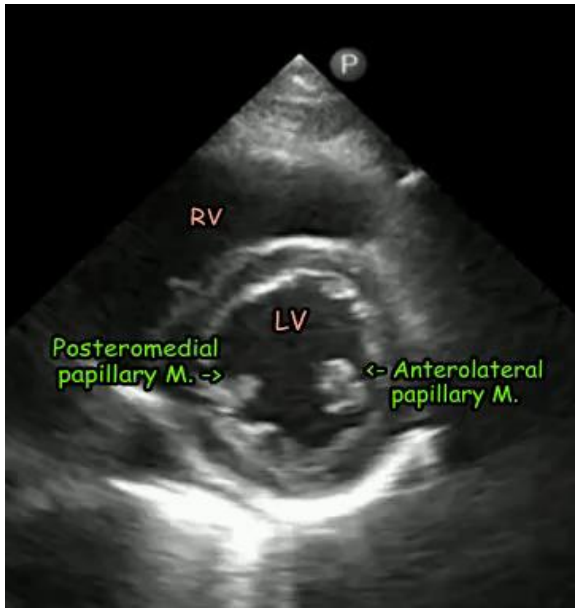
➢ Medulla tells central CV control to activate PNS and inhibit SNS
- ➢ because "ventricle is under stress, so let's reduce CV stress."
  - ➢ Medulla is "helping"

RESULT:

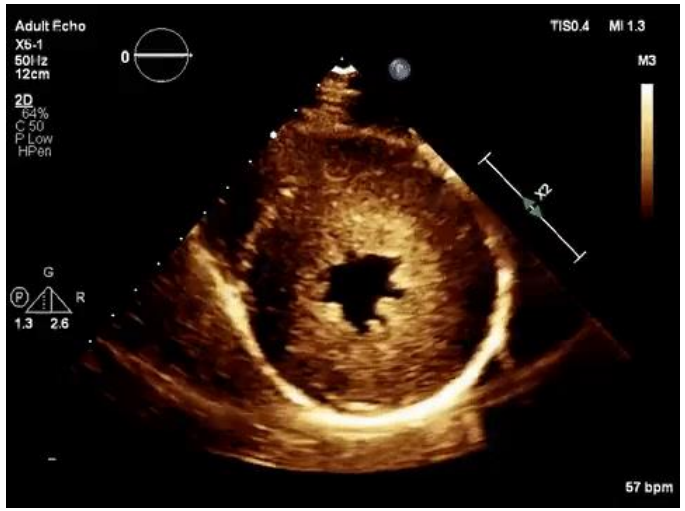
✓ **Severe bradycardia, vasodilation & hypotension, bradypnea/apnea → LOC & arrest**

4. Lacey JR, Dubowitz JA, Riedel B. *Anaesthesia Reports. 2022*

Normal

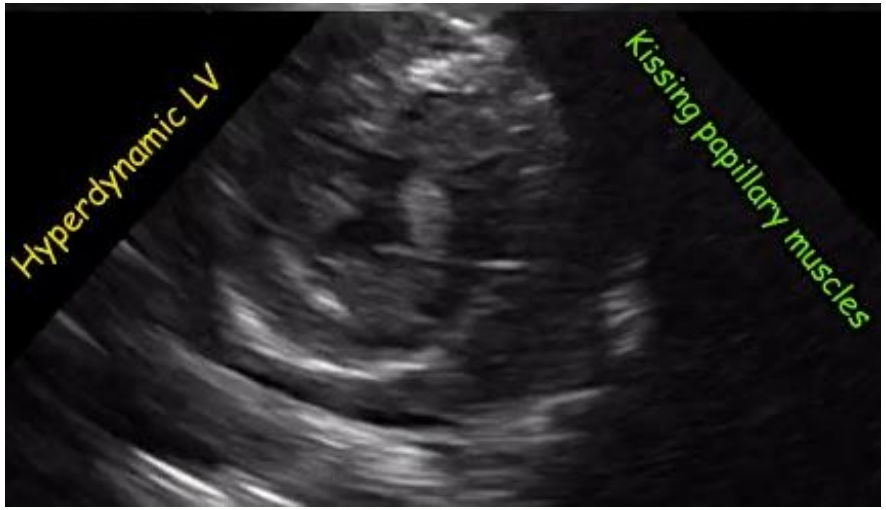


Severe LVH



- ✓ Chronic HTN
- ✓ HOCM
- ✓ Aortic Stenosis
- ✓ **Preeclampsia**
  - ✓ Esp. **early preE** (< 34 wks) – usually ++ severe

Hyperdynamic LV

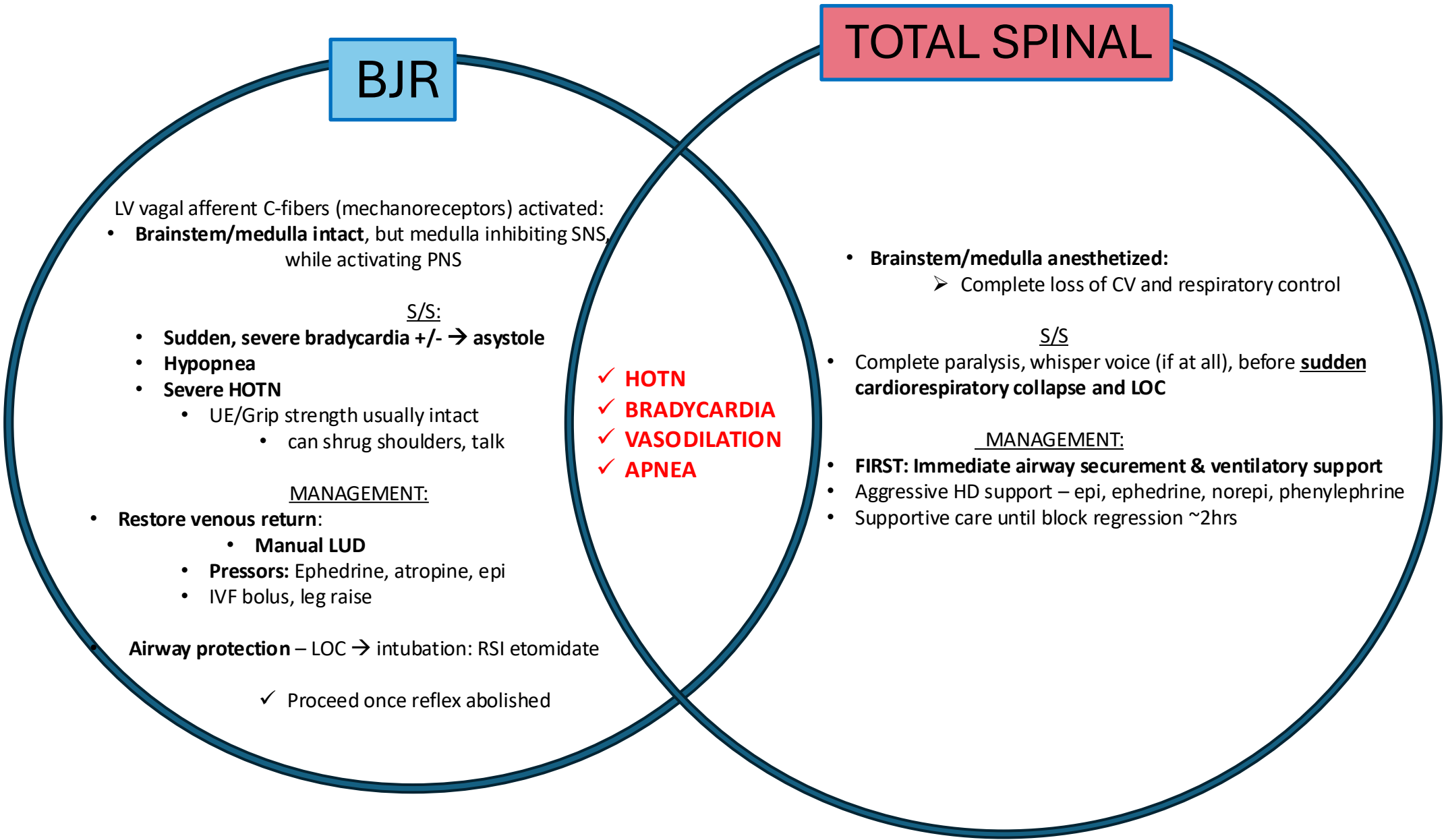


- ➢ LV cavity obliteration during systole
- ➢ Papillary muscles “kissing”
- ➢ Normal LV thickness in end-diastole (vs LVH)
- ➢ + clinical S/S

- ✓ **Hypovolemia**
  - **Massive hemorrhage**
  - **Sympathectomy**
  - **Vasoplegia**
- ✓ **Distributive Shock**
  - **Sepsis**

https://www.renalfellow.org/2019/08/07/focused-cardiac-ultrasound-abnormalities-on-the-parasternal-short-axis-view/

BJR vs Total Spinal



LV vagal afferent C-fibers (mechanoreceptors) activated:

- **Brainstem/medulla intact**, but medulla inhibiting SNS, while activating PNS

S/S:

- **Sudden, severe bradycardia +/- → asystole**
- **Hypopnea**
- **Severe HOTN**
  - UE/Grip strength usually intact
    - can shrug shoulders, talk

MANAGEMENT:

- **Restore venous return**:
  - **Manual LUD**
  - **Pressors:** Ephedrine, atropine, epi
  - IVF bolus, leg raise
- **Airway protection** – LOC → intubation: RSI etomidate

✓ Proceed once reflex abolished

✓ **HOTN**
✓ **BRADYCARDIA**
✓ **VASODILATION**
✓ **APNEA**

- **Brainstem/medulla anesthetized:**
  - ➢ Complete loss of CV and respiratory control

S/S

- Complete paralysis, whisper voice (if at all), before **sudden cardiorespiratory collapse and LOC**

MANAGEMENT:

- **FIRST: Immediate airway securement & ventilatory support**
- Aggressive HD support – epi, ephedrine, norepi, phenylephrine
- Supportive care until block regression ~2hrs

BJR MANAGEMENT:

(same as total spinal, except pt should recover more quickly, without need for ICU care/maintained ETT until LA wears off as is may be needed for total spinal.)

- **CALL FOR HELP / CALL A CODE**
- If LOC w/ profound bradycardia & HOTN → Begin CPR immediately
  - **Manual LUD while flat & supine -** remove right hip bump/wedge if on OR table
  - Crash RCD

  - Arrest/LOC: significantly reduce induction dose
  - Suction – high aspiration risk

- **Hemodynamic support:**
  - ✓ **If HOTN severe: Epi** (can start with **~10 mcg** pushes *if no arrest*, up to 100mcg), Ephedrine, Norepi, Phenylephrine, Atropine(0.5mg)
    - Epi > Ephedrine – fast-onset & direct-acting
  - **IVF bolus 500-1L**
    - Careful in cardiac or PreE pt – risk of pulmonary edema

- **Restore venous return**:
  - **Manual LUD**
  - **Pressors:** Ephedrine, atropine, epi
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- **Airway protection** – LOC → intubation: RSI etomidate

✓ Proceed once reflex abolished

TOTAL SPINAL

Differential Diagnosis:

- Hemorrhage
- Vasovagal or BJR
- Aortocaval Compression
- L.A.S.T
- Embolism: AFE, PE, MI, VAE
- Eclampsia
- Sepsis

ANESTHESIA MANAGEMENT of TOTAL SPINAL

- **CALL FOR HELP / CALL A CODE**

- If LOC w/ profound bradycardia & HOTN → Begin CPR immediately
  - **Manual LUD while flat & supine -** remove right hip bump/wedge if on OR table
  - Crash RCD

- **Alirway securement**
  - Arrest/LOC: significantly reduce induction dose – maintain sedation until block wears off
  - Suction – high aspiration risk
  - If difficult airway, remember **Spont Vent will NOT return** – must secure airway.

- **Hemodynamic support:**
  - ✓ **If HOTN severe: Epi** (can start with **~10 mcg** pushes *if no arrest*, up to 100mcg), Ephedrine, Norepi, Phenylephrine, Atropine(0.5mg)
    - Epi > Ephedrine – fast-onset & direct-acting
  - **IVF bolus 500-1L**
    - Careful in cardiac or PreE pt – risk of pulmonary edema

Reverse trendelenburg DOES NOT prevent cephalad spread

- **May cause or accelerate CV collapse from venous pooling**
  - Consider semi-fowlers, raising back ONLY.



(nysora)



*Please watch Adam Sandler's **The Waterboy** to understand this reference if you were born after 1990..*

BJR

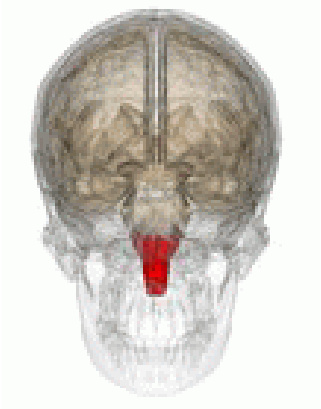
Medulla intact, mocking us



TOTAL SPINAL

Medulla gets taken out





Bezold-Jarisch Reflex



TOTAL SPINAL



More common in spinals w sudden preload drop, but this suspected BJR case happened w an epidural in place..

- Non-emergent c/s for failure to progress and Cat 2 tracing. Epidural in place, patchy block. Reportedly very difficult epidural placement.
- Prior VS: HR 80-90m BP 100-110/70-80s . PMH: term G1 P0, chronic HTN, OSA, morbid obesity
- (-) catheter aspiration prior to dosing, but noticed tachycardia ~120s and increased BP SBP 140s after pt moved onto OR bed after 5cc lido/epi… pt had patchy block and one LE with normal strength so she was able to mostly move herself – unsure if VS change was just bc pt was morbidly obese and moving herself, or if any LA w/ epi had gone IV - pt reported block feeling a little heavier which was reassuring, but still switched to chloroprocaine to reduce risk of LAST while determining if epidural was IV. Block density proceeded to increase in expected fashion w/o further concern for IV epidural.
- Over 10-15 min, some weakness in arms, but could still move arms, fingers, & shrug shoulders.
- Neo gtt running at 50mcg/min for chronic HTN, BP stable. (-) Allis test, adequate surgical block established.
- Pt c/o some chest wall numbness and SOB, SpO2> 95%, chest wall moving, verbal reassurance & continued to closely monitor. O2 NC for pt comfort.
- Pt's ++ body habitus prolonged prep time between dosed epidural and c/s start
- Pt HR dropped back to more normal range – tachycardia presumed to be from her moving herself onto the table.
- Pt then c/o "I can't breathe" (hypopnea) and HR began to **plummet** 70, 50, 30, 14 within about 15 seconds. at same time NIBP was cycling and failed to get a BP read. Pre-filled ephedrine syringe 20 mg immediately given, and atropine drawn up 0.4mg given immediately **– HR was 14 at this time.**
- Immediate return of HR and VS, but hypopnea persisted followed by apparent LOC → emergently intubated, stat C/S performed (large pannus made immediate delivery more challenging, but OBs went as fast as they could) Baby APGARs fine, no issues.
- Mom stable after ephedrine & atropine, immediate return of RR & Vt after succs wore off, stable for rest of case - ruled out total spinal for lack of ANY residual HD instability or resp paralysis. r/o LAST bc of rapid return of VS to meds – seemed more vagal. Extubated without incident. Post-op neuro checks and VS WNL, debriefed with pt and family on suspected BJR reflex. POD #1 follow-up normal, repeated thorough debrief w pt and family.
- I think the ephedrine & atropine got in just in time while she still had a minimal HR to perfuse anything, A few seconds later and we would have been coding her. Epi is also appropriate, and would have been the next thing I pushed, but ephedrine was already drawn up and right next to me so that was what I pushed 1st immediately. Atropine also was already out on top of the pyxis so it was a fast med to draw up – and I was suspecting this was BJR from the presentation.
- Mom was fine, meanwhile I was not fine - she gave me a heart attack and this case still haunts me.



References

1. D'Angelo R, Smiley RM, Riley ET, Segal S. Serious complications related to obstetric anesthesia: the serious complication repository project of the Society for Obstetric Anesthesia and Perinatology. *Anesthesiology*. 2014;120(6):1505-1512. doi:10.1097/ALN.0000000000000253
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4. Lacey JR, Dubowitz JA, Riedel B. Asystole following spinal anaesthesia: the hazards of intrinsic cardiac reflexes. *Anaesthesia Reports*2022;10(2). doi:10.1002/anr3.12198