



You ask ... We answer

Obstetric Anesthesia Panel 2024  
 Joy Hawkins, MD  
 Rachel Kacmar, MD



Clinical Updates	CLINICAL CONUNDRUMS
<u>TXA</u>	<u>Thrombocytopenia In Pregnancy</u>
<u>Transfusion in OB Anesthesia</u>	<u>Troubleshooting Epidurals</u>
<u>Post-dural Puncture Headache</u>	<u>Hypotension Prevention</u>
<u>Post-Cesarean Analgesia</u>	<u>NPO Status on L&amp;D</u>
<u>Neuraxial Technique Decisions</u>	<u>Sugammadex</u>

Obstetric Anesthesia Panel 2024

Joy Hawkins, MD  
 Rachel Kacmar, MD

No disclosures for all faculty.

A 30 y/o G2P1 is undergoing an emergency CD for placental abruption and abnormal FHR. There is brisk bleeding following delivery with an EBL of 1700 and ongoing bleeding. You decide to give 1 gm tranexemic acid (TXA). What is **NOT true** regarding the use of TXA in PPH Protocols?

- A. NO increased risk of a thromboembolic event
- B. Decreased risk of death due to bleeding in low-middle resource countries
- C. Cost - effective in routine use in the US
- D. Should be given following all deliveries as hemorrhage PROPHYLAXIS
- E. Should be included in all PPH Protocols as a TREATMENT option

**Table 1 Maternal mortality rate (MMR) related to postpartum haemorrhage in three European countries and in the study by the WOMAN Trial Collaborators**

Countries	MMR/100000 births
WOMAN Trial <sup>2</sup>	16 (tranexamic group) 19 (control group)
United Kingdom 2012–2014 <sup>6</sup>	0.56
Netherlands 1993–2005 <sup>7</sup>	0.7
France 2010–2012 <sup>8</sup>	1.2

The effect of tranexamic acid on blood loss and maternal outcome in the treatment of persistent postpartum hemorrhage: A nationwide retrospective cohort study. *PLOS ONE* 2017

**NO significant difference in composite morbidity/ mortality**  
 Adjusted OR 0.92 (95% CI 0.66 - 1.27)

- 1260 women with persistent PPH
- TXA early (within 3 hours of diagnosis)
  - TXA late or no TXA

Any TXA is helpful but **EARLY IS BETTER**

**TABLE 2 Cost savings, laparotomies averted, and maternal deaths averted in the United States per year<sup>a</sup>**

Strategy	Cost savings (2018 USD)	Laparotomies averted	Deaths averted
No TXA	0	0	0
Any TXA	11,308,283	334	9
TXA in 3 h	30,100,508	1258	14

TXA, tranexamic acid.  
<sup>a</sup> Assuming 4 million births and 3% rate of postpartum hemorrhage.  
 Sudhof et al. Cost-effectiveness of tranexamic acid. *Am J Obstet Gynecol* 2019;221:275.e1-12

**Tranexamic acid in the routine treatment of postpartum hemorrhage in the United States: a cost-effectiveness analysis**  
 Lauren S. Sudhof, MD; Scott A. Shankar, DO; M; Brent D. Emerson, MD, MPH

"...routine TXA administration in the treatment of major obstetric hemorrhage in the United States is expected to result in **substantial cost savings** and **reduction in maternal morbidity and bleeding-related mortality**"

Am J Obstet Gynecol 2019;221:275.e1-12

### Prophylactic TXA?

- ▶ TRANexamic Acid for Preventing postpartum hemorrhage
  - ▶ TRAAP 1 (vaginal deliveries, 2018)
  - ▶ TRAAP 2 (cesarean deliveries, 2021)

**Take home → NO Evidence to support routine use of PROPHYLACTIC Tranexamic Acid use in OB patients**

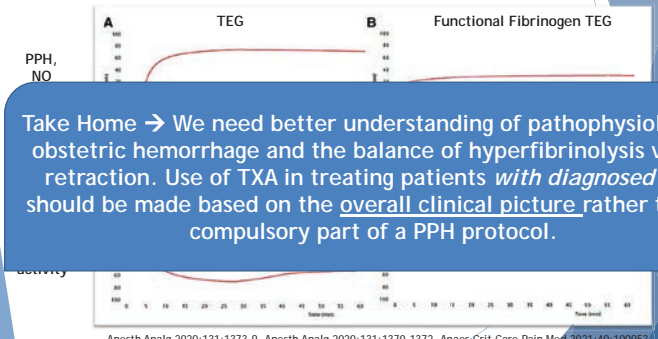
...placebo group and TXA group (ONLY ~100 mL - 680 v - 780

N Engl J Med 2018;379(8):731-742. N Engl J Med 2021;384(17):1623-. Anaesth Crit Care Pain Med 2021;40:100953.

BUT...are we really dealing with *hyperfibrinolysis* in PPH?

ORIGINAL CLINICAL RESEARCH REPORT  
**Thromboelastographic Assessment of Fibrinolytic Activity in Postpartum Hemorrhage: A Retrospective Single-Center Observational Study**

David E. Arnolds, MD, PhD,\* and Barbara M. Scavone, MD\*†



Take Home → We need better understanding of pathophysiology of obstetric hemorrhage and the balance of hyperfibrinolysis v. clot retraction. Use of TXA in treating patients *with diagnosed PPH* should be made based on the overall clinical picture rather than a compulsory part of a PPH protocol.

Anesth Analg 2020;131:1373-9

Anesth Analg 2020;131:1373-9, Anesth Analg 2020;131:1370-1372, Anaes Crit Care Pain Med 2021;40:100953

Which of the following is TRUE regarding transfusion for obstetric hemorrhage?

- A. A trauma-based strategy of 1 PRBC: 1FFP should be used
- B. Platelets should be given early in transfusion protocols
- C. Transfusion should be goal-directed based on laboratory and clinical indication
- D. Fibrinogen repletion should be considered at a threshold of < 100 mg/dL in a bleeding parturient

**Blood Product Transfusion**



▶ Goal-directed transfusion of RPBC and FFP (*NOT 1:1*)

• Platelet transfusion is RARELY needed

AGGRESSIVE treatment of hypofibrinogenemia (< 200 mg/dL with continued bleeding)

**MTP:**

- 6 U PRBC
- 4 - 6 U FFP
- +/- 1 pooled PLT

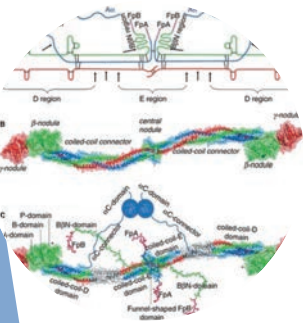


Adv Anesth 2017;35:65-93, Anesth Analg 2017;124:216-32, Transfusion 2020;60:897-907, JAMA Netw Open 2020;3:2017200

**Fibrinogen**

- ▶ Serum concentration < 200 mg/dL has 100% PPV for progression to severe PPH
- ▶ Options:
  - ▶ FFP
  - ▶ Cryoprecipitate
  - ▶ Fibrinogen concentration

2 gram dose raises serum fibrinogen ~ 100 mg/dL



**Point of care testing**

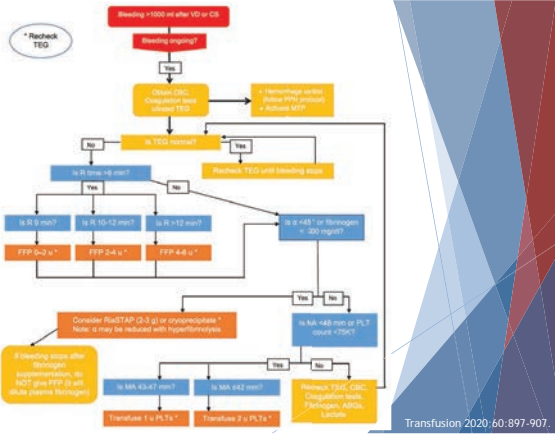
- ▶ Rapid laboratory analysis is the most important thing
- ▶ POC testing for hematocrit/hemoglobin can be helpful for early recognition and timely treatment of PPH
- ▶ TEG/ ROTEM can help guide resuscitation and transfusion



SOAP COE 2019. (soap.org). Anaesthesia 2019; epub ahead of print, Adv Anesth 2017;35(1):65-93, Transfusion 2020;60:897-907

Adv Anesth 2017;35:65-93, Br J Anaesth 2012;109(6):851-63, Semin Perinatol 2018;43:22-26, Transfusion 2020;60:897-907, Anesth Analg

Stanford  
TEG-based  
Goal-Directed  
Transfusion  
Guide



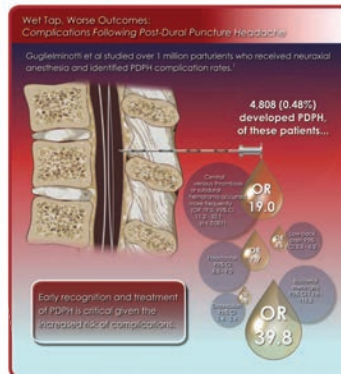
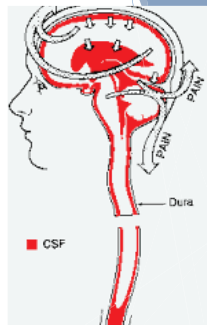
Which of the following is NOT a potential outcome following accidental dural puncture with a 18G Tuohy needle during a neuraxial procedure?

- A. Acute post-dural puncture headache (50-80% risk)
- B. Chronic headache syndrome
- C. Chronic back pain (increased risk)
- D. Increased risk of postpartum depression/ PTSD
- E. All of the above are potential outcomes

Postdural Puncture Headache (PDPH)

International Headache Society Definition:

Any headache that develops within 5 days of dural puncture and is not better accounted for by any other cause.



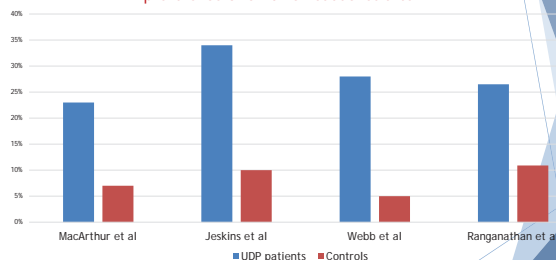
Severe sequelae of PDPH

- o OR 39.8: Bacterial meningitis
- o OR 19: Central venous sinus thrombosis or subdural hematoma
  - o Venous sinus thrombosis aOR 11.4
  - o Subdural hematoma aOR 76.7
- o OR 7.7: Persistent headache
- o OR 4.6: Persistent low back pain
- o OR 1.9: Depression

Guglielminotti J, Landau R, Li G. Major Neurologic Complications Associated With Postdural Puncture Headache in Obstetrics: A Retrospective Cohort Study. Anesth Analg. 2019 Nov;129(5):1328-1336

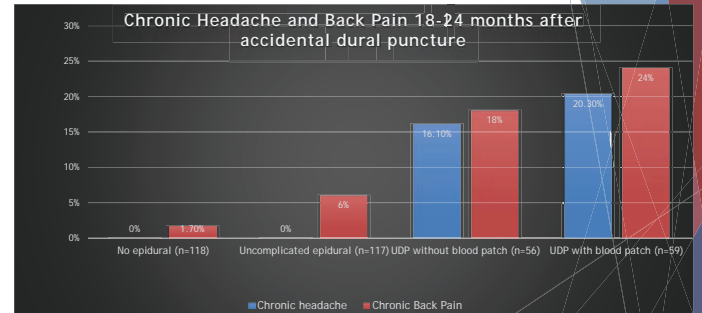
Chronic headache after accidental dural puncture

Results of Retrospective Studies: Significantly higher prevalence of chronic headaches after ADP



1. MacArthur C, Lewis M, Knox E.G. Accidental dural puncture in obstetric patients and long terms symptoms. BMJ 1999; 306: 883.  
 2. Jeskins G.D, Moore P.A.S., Cooper G. M., et al. Long-term morbidity following dural puncture in an obstetric population. UOa. 2001 Jan; 16(1): 17-24  
 3. Webb CA, Wecker PD, Zhang L., et al. Unintentional dural puncture with a Tuohy needle increases risk of chronic headache. Anesth Analg 2012; 115:124-132  
 4. Ranganathan P, Goffeiz C, Phelps AL., et al. Chronic headache and backache are long-term sequelae of unintentional dural puncture in the obstetric population. J Clin Anesth 2015; 27:201-206

Chronic headache after accidental dural puncture



Binyamin Y, Heesen P, et al. Chronic pain in parturients with an accidental dural puncture: A case-controlled prospective observational study. Acta Anaesthesiol Scand. 2021 Aug;65(7):959-966

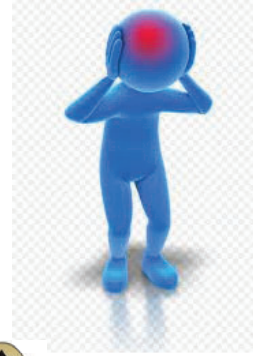
## Chronic psychological outcomes after ADP

Table 3 Postpartum outcomes since the index labour

	PDPH (n = 132)	No PDPH (n = 276)	95% CI for the difference between the groups	P
Postpartum depression	67/128 (52.3)	31/276 (11.2)	0.315 to 0.502	<0.0001
Possible PTSD	17/132 (12.8)	1/276 (0.4)	0.076 to 0.195	<0.0001
PTSD scores	7 [0 to 20.5; 0 to 77]	0 [0 to 0; 0 to 39]		<0.0001
LEC Score	0 [0 to 5; 0 to 65]	0 [0 to 0; 0 to 48]		0.345
Antidepressant medication after labour	9/130 (6.8)	11/276 (3.9)	-0.015 to 0.089	0.202
Current antidepressant medication	7/130 (5.3)	10/276 (3.6)	-0.023 to 0.073	0.408
Planned future epidural use*	37/89 (41.6)	169/219 (86.3)	-0.0225 to 0.0732	<0.0001
Breastfeeding initiation	74/126 (54.5)	212/276 (76.8)	0.331 to 0.552	<0.0001*
Breastfeeding duration (months)	1.5 [0 to 6; 0 to 75]	3.5 [1 to 8; 0 to 60]		0.005
Current headache	42/128 (32.8)	42/276 (15.2)	0.085 to 0.266	<0.0001
Current backache	58/129 (43.9)	58/275 (21.0)	0.141 to 0.335	<0.0001
Owestry score	0 [0 to 10; 0 to 34]	0 [0 to 2; 0 to 45]		<0.0001

Data are n (%), median (IQR; Range). LEC, Life Event Score; PTSD, posttraumatic stress disorder. \*Among women who responded to the question.

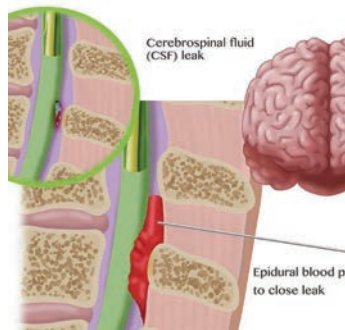
Orbach-Zinger S, Eidelman LA, et al. Long-term psychological and physical outcomes of women after postdural puncture headache: A retrospective cohort study. *Eur J Anaesthesiol* 2021;38:130-137.



How do we best treat women with APD and PDPH?

## Epidural Blood Patch (EBP)

- ▶ “Gold Standard” therapy for PDPH
- ▶ High success rate for initial resolution of symptoms from PDPH



Cephalgia 2013; 33(9): 629-808. *Semin Perinatol* 2014; 38: 386-94. ASA Committee on OB Anes 2021. *Br J Anaesth*. 1993;71:182-188. *Anesth Analg* 2010;113(1):126-33. *UGA* 2015;22:303-9. *UGA* 2014;23:171-4. *UGA* 2014;23:166-79.

### Key Points

- PDPH needs to be evaluated and diagnosed when symptomatic
- Mild symptoms may be managed conservatively whereas with severe symptoms, an EBP should be offered
- A second EBP may be offered if the clinical history is clearly UDP related; other causes of HA need to be considered in the differential diagnosis
- Post discharge, a telephone follow-up is essential with appropriate documentation in the medical record
- PDPH education should be provided to the parturient along with long-term follow-up for those with persistent headache

GUIDELINES, STATEMENTS, CLINICAL RESOURCES

### Statement on Post-Dural Puncture Headache Management

Committee of Origin: Obstetric Anesthesia

(Approved by the ASA House of Delegates on October 13, 2021)

<https://www.asahq.org/standards-and-guidelines/statement-on-post-dural-puncture-headache-management>

Which of the following is likely to provide the MOST successful post-cesarean analgesia?

- IV PCA
- Neuraxial long-acting opioid + oral oxycodone
- Neuraxial long-acting opioid + multimodal analgesia regimen
- TAP/ QL/ other truncal block

## Post-Cesarean Analgesia - do's and don'ts

YES PLEASE!	If you feel like it...	No Thanks
Neuraxial long-acting opioid (morphine or hydromorphone)	Truncal blocks (TAP, QL and ESP essentially equivalent)	Gabapentinoids (sedating and limited analgesic benefit)
Scheduled NSAIDs and acetaminophen (TOGETHER)	Wound infusion catheter (e.g. On-Q pump)	
IV dexamethasone 8-10 mg intraoperatively	Lidocaine patch (breakthrough pain)	
PRN oral opioids (e.g. oxycodone; limit # pills at discharge)	TENS device	



Which of the following should provide LEAST risk for failed neuraxial and BEST quality labor analgesia?

- A. Traditional epidural → continuous epidural infusion
- B. Traditional epidural → continuous infusion + PCEA
- C. DPE → continuous infusion + PCEA
- D. DPE → PIEB + PCEA

DPE (and CSE) are superior to "traditional" epidural

Numerous and repeated studies have shown that compared to epidural, DPE (and CSE) technique are associated with:

- Faster onset of analgesia
- Decreased local anesthetic needed for initial analgesia
- Decreased need for manual epidural boluses
- Decreased rate of catheter replacement
- Decreased rate of catheter failure
- NO difference in need for GA for C/D
- NO difference in rate of PDPH/ need for blood patch



### Effective Dose of Bupivacaine: Dural Puncture Epidural Versus Conventional Epidural Techniques

In labor analgesia, the dural puncture epidural (DPE) technique has distinct physiological advantages over the conventional epidural (EPL) technique

Randomized administration of bupivacaine to healthy pregnant women in labor using DPE or EPL techniques (N = 100)

Monitoring of effects post bupivacaine administration

- Effective dosage 90 (ED90) determination via biased-coin sequential allocation method
- Sensory/motor blockade
- Maternal or fetal side effects

ED90 of bupivacaine (n = 95)

With DPE	29.30 mg	35% reduction in bupivacaine dose with the DPE technique
With EPL	45.25 mg	

The DPE technique requires a lower dose of bupivacaine to achieve initial ED90 analgesia compared to the EPL technique

However, it is not known whether initial analgesia can be established with a lower dose of bupivacaine using DPE technique, as compared to the EPL technique

Labor Analgesia Initiation With Dural Puncture Epidural (DPE) versus Conventional Epidural Techniques: A Randomized Biased-Coin Sequential Allocation Trial to Determine the Effective Dose (ED90) of Bupivacaine. Hareida et al. (2023). Copyright © 2023 International Anesthesiology Research Society.

Programmed Intermittent Epidural Bolus aka...PIEB

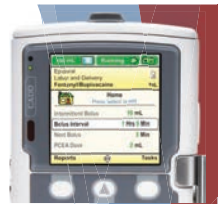
- ▶ NC
- ▶ Bu
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Continuous Infusion



Intermittent Infusion



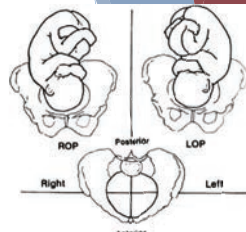
ius

Anesth Analg 2011;112(4):904-911. UOJ 2016;25:37-44. UOJ 2016;26:32-38. Anesth Analg 1999;89(2):534. Brit J Anaesth



Obstetric outcomes

- ▶ PCEA + PIEB →
  - ▶ SHORTER 2<sup>nd</sup> stage compared to continuous epidural infusion
  - ▶ NO change in maternal mechanics of the second stage of labor (v. PCEA alone)
  - ▶ IMPROVED analgesia at full cervical dilation (versus PCEA alone)



What are the ideal settings for an IEB strategy?

- ▶ It probably depends on your exact epidural solution and patient population
  - ▶ Bupivacaine v. Ropivacaine
  - ▶ Concentration of LA
  - ▶ Adjuncts (e.g. fentanyl 2 mcg/mL)
- ▶ For Programmed IEB through the pump:
  - ▶ Higher volumes, longer intervals
- ▶ If you *don't* have PIEB-capable pumps, can try high volume PCEA without background continuous infusion
- ▶ Use fastest injection speed as allowed by pump/ tubing caliber for best spread



Eur J Anaesth 2019;36:755-62. Brit J Anaesth 2018;121(2):432-7. Curr Opin Anesthesiol 2019, 32:307-314.



A G2P0 at 39.5 wks EGA presents for elective IOL with a recent (2 weeks ago) platelet count of 90K and requests an epidural. Her PLT have been stable ~ 90-100K during most of the pregnancy. What is your likely plan for neuraxial analgesia?

- A. No epidural for her no matter what!
- B. Recheck PLT count, if > 70K proceed with epidural
- C. Recheck PLT count, if <100K do NOT proceed with epidural
- D. Rely only on TEG to guide epidural placement decisions



## What are our considerations?

- ▶ 3 main causes in pregnancy
  1. Gestational thrombocytopenia (MAJORITY of patients)
  2. Idiopathic thrombocytopenic purpura (ITP)
  3. Thrombocytopenia related to hypertensive disorders of pregnancy (including HELLP)
- ▶ Thrombocytopenia details to know
  - ▶ What is the platelet count *right now*?
  - ▶ What is the *trend* in platelet count?
  - ▶ Are the platelets functional or nonfunctional?



Transf Med Rev 2018; epub.

## "What is your platelet threshold?"



Transf Med Rev 2018; epub. BJA 2015;115(S2):i175-88. J Perinat Med 2015; 43:61-6.

Obstetric Anesthesiology  
SPECIAL ARTICLE

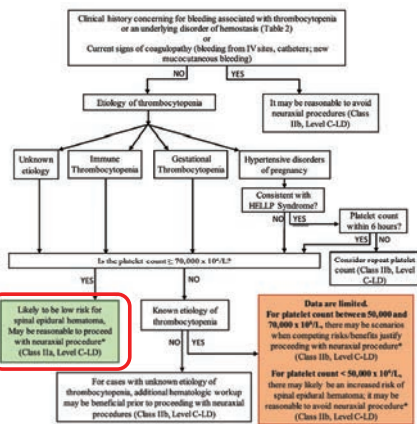
**The Society for Obstetric Anesthesia and Perinatology Interdisciplinary Consensus Statement on Neuraxial Procedures in Obstetric Patients With Thrombocytopenia**

Melissa E. Bauer, DO,\* Katherine Arendt, MD,† Yaakov Beilin, MD,‡ Terry Gernsheimer, MD,§ Juliana Perez Botero, MD,¶ Andra H. James, MD,¶ Edward Yagmour, MD,¶ Roulhac D. Toledano, MD, PhD,\*\* Mark Turrentine, MD,†† Timothy Houle, PhD,‡‡ Mark MacEachern, MLIS,§§ Hannah Madden, BS,‡‡ Anita Rajasekhar, MD, MS,‡‡ Scott Segal, MD,††† Christopher Wu, MD,‡‡ Jason F Cooper, MD, PhD,§ Ruth Landau, MD,\*\*\* and Lisa Leffert, MD‡‡

**Endorsed by the American Society of Regional Anesthesia and Pain Medicine (ASRA), American College of Obstetricians and Gynecologists (ACOG), and the Society for Maternal-Fetal Medicine (SMFM).**



Anesth Analg 2021;132:1531-44.



Anesth Analg 2021;132:1531-44.

A 35 y/o G1P0 is at 6 cm cervical dilation and is having pain during contractions. You placed her epidural about 8 hours ago when she was 3 cm (easy placement).

What is your initial plan to treat her pain?

- A. Nothing - tough it out
- B. Volume! (10-15 mL 0.125% bupivacaine)
- C. Density (0.25% bupivacaine +/- opioid)
- D. Replace epidural

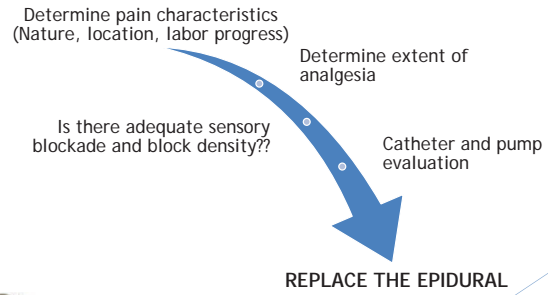


## Breakthrough Pain

Maternal Risk Factors	Obstetric Risk Factors
Obesity	Nulliparity
Structural back abnormalities	Increased fetal weight
Chronic low back pain	Abnormal fetal position
Opioid tolerance	Induction/ augmentation of labor
Increasing age	Epidural request at cervical dilation > 7 cm
	Prolonged/ rapid labor progression

Curr Opin Anesthesiol 2019, 32:307-314

## Stepwise Approach to Breakthrough Pain



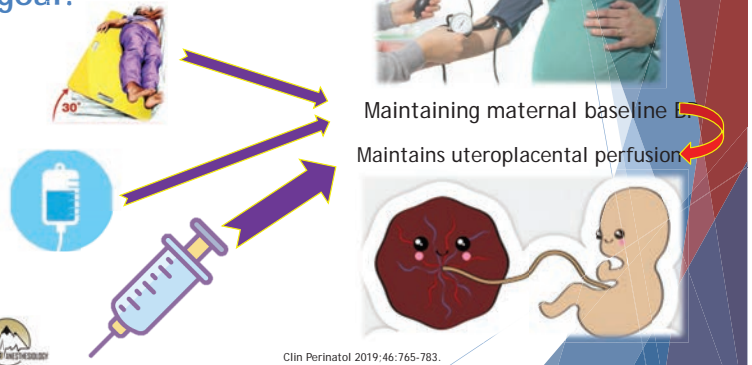
Curr Opin Anesthesiol 2019, 32:307-314

What is the most effective way to prevent hypotension following spinal for cesarean delivery?

- A. 2L crystalloid preload
- B. 30-degree LUD
- C. Ephedrine boluses
- D. Phenylephrine boluses
- E. Phenylephrine infusion
- F. Norepinephrine infusion

Who routinely uses a phenylephrine infusion following spinal for cesarean delivery

What's the goal?



Clin Perinatol 2019;46:765-783.

Old doctrine →



Current recommended practice →



- Easier titration
- Less maternal nausea/vomiting
- Less placental transfer

Clin Perinatol 2019;46:765-783. IJOA 2019;37:16-28.

## Embrace phenylephrine infusions!

- ▶ Either weight-based or non-weight based
- ▶ Titrate rate prn for relative hypo- or hypertension

- 50 mcg/min
- 0.54 mcg/kg/hr

Still OK to add ephedrine boluses for hypotension + bradycardia

Adv Anesthesia 2019;37:207-228. Clin Perinatol 2019;46:765-783. Anesth Analg 2019; epub ahead of print.

## Norepinephrine...the new phenylephrine?

- ▶ Potency is 13-16:1 compared to phenylephrine
  - ▶ E.g. 100 mcg phenylephrine ≈ 6-8 mcg norepinephrine
- ▶ Versus phenylephrine:
  - ▶ Higher average heart rate
  - ▶ Significantly higher cardiac output
  - ▶ Lower systemic vascular resistance
  - ▶ Less placental transfer
- ▶ Concerns re: peripheral administration?
  - ▶ Probably equivalent safety compared to phenylephrine

Take home point →  
PROMISING, but not yet  
usual practice.

Adv Anesthesia 2019; 37: 207-228. Clin Perinatol 2019; 46: 765-783. Anesth Analg 2024.

A G2P1 at 38 weeks in labor (4 cm cervical dilation) with neuraxial labor analgesia requests to eat. Which of the following is FALSE?

- A. Delivery outcomes including duration of labor and C/D rate are improved when patients consume food during labor
- B. Gastric emptying during labor has been shown to be delayed up to 90% compared to non-pregnant and non-laboring women
- C. Women at term pregnancy may experience accelerated starvation and ketosis
- D. Certain classes of high-risk patients may require strict NPO status during the labor and delivery period

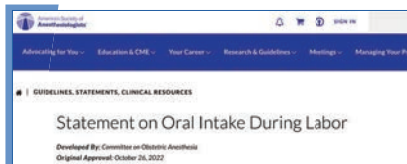


Table 1 - High Risk Conditions:

- GI Track Abnormality
- Disorders of Gastric Motility
- Difficult Airway
- Neurologic disorders/ mental status (Incl. IV Sedation)
- Obstetric Complications (Pre-E on Mag)
- Fetal conditions

### Committee Recommendations:

- Solid food during active labor should be avoided; clear liquids, especially electrolyte containing beverages should be encouraged.
- Regardless of labor course, patients with high-risk medical and pregnancy conditions (see Table 1) may require stricter limitations on the amount and type of clear liquids consumed.
- No recommendations can be made regarding the consumption of solid food during the pre-labor phase for a patient admitted for induction of labor. Shared decision making and informed consent on oral intake during the pre-labor time period are encouraged.
- Patients should NOT be denied neuraxial analgesia or anesthesia regardless of NPO status.

You are caring for a 32 y/o G2P1 with acute appendicitis undergoing laparoscopic appendectomy at 22 weeks EGA. Which of the following is true regarding use of sugammadex during pregnancy/ in lactating patients?

- A. Safe to use at anytime during pregnancy.
- B. Crosses the placenta at a high rate
- C. If used in lactating patients, "pump and dump" is advised
- D. Sugammadex binds progesterone and we lack robust data on safety during pregnancy

1. Avoid completely in early pregnancy as it binds progesterone.
2. Avoid or use with caution later in pregnancy.
3. It is safe to use when breastfeeding.
4. It is safe to use in patients of reproductive age IF they receive counseling to use additional nor hormonal contraception (e.g. condoms) for 7 days



2019 SOAP recommendation regarding use of sugammadex in pregnant and lactating patients

Obstetric Anesthesiology Anesth Analg 2020; 130: 1628

NARRATIVE REVIEW ARTICLE

## Sugammadex Administration in Pregnant Women and in Women of Reproductive Potential: A Narrative Review

Michael G. Richardson, MD, et al.

Is sugammadex safe to administer to pregnant women?

- Does it cross the placenta? *Probably not, but unknown.*
  - What are its fetal effects? *Completely unknown.*
  - What are its effects on the pregnancy continuing? *Unknown but its interaction with progesterone is concerning and there is no human data on safety.*
  - Amounts in breast milk should be very low and infant enteral absorption is very unlikely, *but unknown.*
- A case series of 25 pregnant patients who received intraoperative sugammadex found no pregnancy complications (A&A Case Reports 2021)



## Viscoelastic Tests - TEG and ROTEM

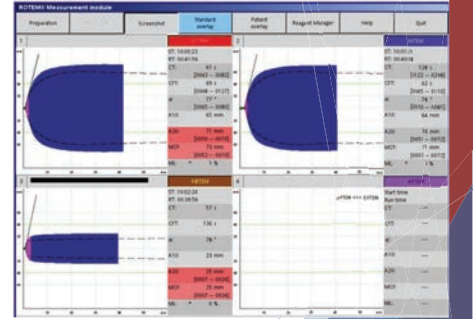
Component	Healthy parturient (term, predelivery)	Healthy parturient (term, postpartum)	Nonpregnant
<b>TEG</b>			
R time (min)	5.8-7.0	5.0-6.6	4-8
K time (min)	1.3-2.0	1.1-1.8	0-4
MA (mm)	72.0-75.4	72.7-76.4	54-72
Alpha-angle (degrees)	64.8-70.1	67.3-72.4	47-74
ly30 (%)	0.2-1.6 <sup>a</sup>	0.6-0.7	0-8
CI	1.2	1.8	-3 to 3
<b>ROTEM<sup>b</sup></b>			
CT (s)	45 (41-50)	45 (40-49)	31-66
CFT (s)	69 (62-81)	73 (63-86)	41-154
Alpha-angle (degrees)	77 (67-83)	76 (74-79)	63-83
MCF (mm)	71 (42-78)	71 (68-74)	42-78
ML (%)	7 (0-41)	8 (3-12)	0-44

- ▶ Thromboelastography (TEG)
- ▶ Thromboelastometry (ROTEM)

Adv Anesth 2017;35(1):65-93. Int J Gynaecol Obstet 2016;134(3):290-3. Br J Anaesth 2014;112(5):852-9. Anaesthesia 2012;67(7):741-7. Transfusion 20:60:897-907.

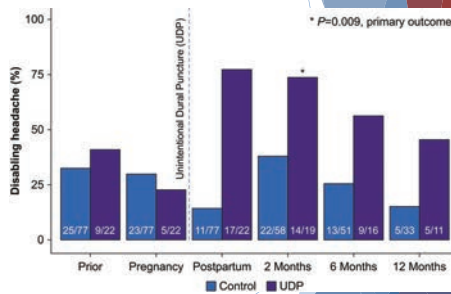
## Improved outcomes with TEG/ ROTEM- guided transfusion and resuscitation

- ▶ LOWER blood product transfusion rate
  - ▶ PRBC, FFP, and PLT
- ▶ LOWER rate of hysterectomy
- ▶ Decreased hospital LOS
- ▶ Decreased ICU admission
- ▶ Rapid prediction of hypofibrinogenemia and TCP



J Clin Anesth 2018;44:50-56. Br J Anaesth 2012;109(6):851-63. Transfusion 2020;60:897-907. Anesth Analg 2020;130(2):416-25.

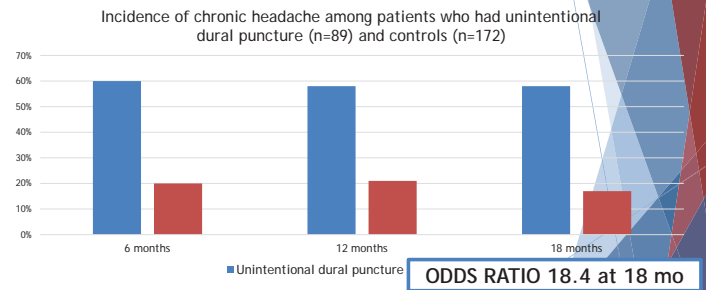
## Chronic headache after accidental dural puncture



2 mo → RR 1.9 (95% CI 1.2-2.9)  
6 mo → RR 2.2 (95% CI 1.1-4.0)

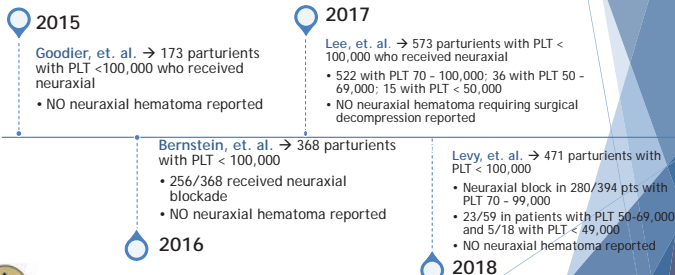
Ansari J, Barad M, Shafer S, Flood P. Chronic disabling postpartum headache after unintentional dural puncture during epidural anaesthesia: a prospective cohort study. BJA. 2021. epub July 8 2021

## Chronic headache after accidental dural puncture



Niraj G, Mushambi M, Gauthama P, Patil A, Kelkar A, Hart E, Nurmikko T. Accidental Dural Puncture Outcome Study Collaborative Group. Persistent headache and low back pain after accidental dural puncture in the obstetric population: a prospective, observational, multicentre cohort study. Anaesthesia. 2021 Aug;76(8):1068-1076.

## Retrospective Reviews essentially say the same thing...



UOA 2018;35:4-9. Anesthesiology 2017;126:1053-64. Anesth Analg 2015;121(4):988-91. Anesth Analg 2016;123(1):165-7.

What do we need to do?

Obstetric Anesthesiology

SPECIAL ARTICLE

## Society for Obstetric Anesthesia and Perinatology: Consensus Statement and Recommendations for Enhanced Recovery After Cesarean

Laurent Bollag, MD,\* Grace Lim, MD, MS,† Pervez Sultan, MBChB, FRCA,‡ Ashraf S. Habib, MBBCh, MSc, MHSc, FRCA,§ Ruth Landau, MD,|| Mark Zakowski, MD,¶ Mohamed Tiourine, MD,‡ Sumita Bhamhani, MD,\*\* and Brendan Carvalho, MBBCh, FRCA‡

## ERAC - Antepartum Management

- ▶ Education - 1:1 meeting with an RN at 32-34 weeks to provide a comprehensive education booklet that includes SSI prevention, breastfeeding education, and pain control.
- ▶ Encourage continued exercise during pregnancy.
- ▶ Discuss NPO guidelines and encourage clear fluid intake (e.g. Gatorade™) up to 2 hours before surgery.
- ▶ If anemic, optimize hemoglobin using PO iron or infusions.
- ▶ Call her the day before surgery to review the checklist

## ERAC - Intrapartum Management

- ▶ Optimize IV fluids (< 3L in routine case)
- ▶ Prevent/ treat hypotension (i.e. PPX vasopressor infusion)
- ▶ Maintain normothermia
- ▶ Timely antibiotic administration
- ▶ Intra/ post-op N/V prophylaxis and treatment
  - ▶ Prophylactic vasopressor infusion
  - ▶ Limit/ avoid uterine exteriorization
  - ▶ ≥ 2 prophylactic anti-emetics
- ▶ Initiate multimodal analgesia
- ▶ Promote skin-to-skin neonatal bonding

## ERAC - Postpartum/ Postoperative Management

- ▶ Begin ice chips, gum in PACU -> food on postpartum unit.
- ▶ Begin scheduled multi-modal non-opioid analgesia.
- ▶ Oxycodone 5 mg is available for breakthrough pain.
- ▶ Encourage early mobilization after her spinal wears off.
- ▶ Remove the urinary catheter by 12 hours postop.
- ▶ Remove her IV 24 hours post-surgery (post-morphine).
- ▶ VTE prophylaxis. Lactation consult. Peds visit

## Multi-modal Analgesia Details

- ▶ Schedule NSAIDs: IV ketorolac 30 mg q 6 hours x 4, then ibuprofen 600 mg q 6 hrs. Give NSAIDs with acetaminophen!
- ▶ Schedule acetaminophen 1000 mg q hrs after preop dose.
- ▶ Oxycodone 5 mg PO q 4 hours only PRN for breakthrough.
- ▶ Gabapentinoids are sedating and have limited analgesic benefit, so no routine use, but may be appropriate in select patients.
- ▶ Pre-emptive or rescue truncal blocks as indicated: TAP, QL
- ▶ Local anesthetic wound infusion catheter

One of the obstetricians calls you about a patient in triage who is G1P0 at ~29 wks EGA with h/o Marfan syndrome with bicuspid valve, moderate aortic stenosis and LV EF 40% and presents with what seems to be early PTL. Which of the following is TRUE?

- Parturients with moderate to severe cardiovascular disease can safely deliver at any obstetric unit/ any hospital
- She has minimal risk for maternal mortality or severe morbidity
- Cardiac anesthesiologists may be helpful as part of a pregnancy heart team for care planning
- She and all parturients with cardiovascular disease should have scheduled C/D

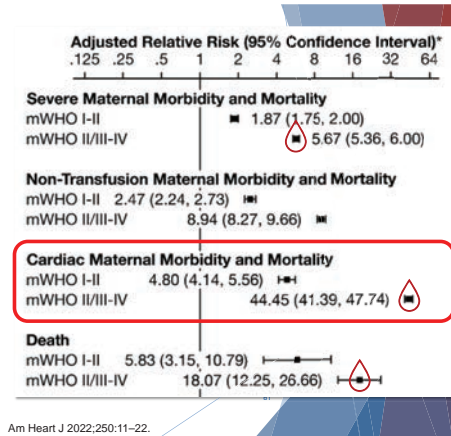


## Cardio-obstetrics

- ▶ Comprehensive and coordinated multidisciplinary care (ante-, intra- and postpartum) for women with known cardiac conditions or significant risk factors for cardiovascular disease

## Let's Review...

- ▶ Women with known mWHO class II/III-IV heart disease have increased risk for maternal morbidity and mortality



## Matching Patients with Resources

**Table 2. Maternal Levels of Care<sup>3</sup>**

Level	Title	Maternal Health	Hospital Capabilities	Anesthesia Staffing	Modified World Health Organization Patients*
Birth center	Birth center	Low risk	Not applicable	None	None
Level I	Basic care	Low to moderate risk	Limited obstetric ultrasound Blood bank	Anesthesia provider readily available at all times	Modified World Health Organization class I
Level II	Specialty care	Moderate to high risk	Computed tomography scanning/magnetic resonance imaging Maternal echocardiogram Nonobstetric ultrasound	Anesthesiologist readily available at all times	Modified World Health Organization class I or II
Level III	Subspecialty care	More complex maternal, obstetric and fetal conditions	Interventional radiology In-house capability of all blood components	Board-certified anesthesiologist physically present at all times	Modified World Health Organization class I or II, some III
Level IV	Regional perinatal health center	Most complex maternal conditions	ICU care with Maternal Fetal Medicine comanagement Cardiovascular surgery, ECMO, and transplant capabilities	Board-certified anesthesiologist with obstetric anesthesia fellowship or experience in obstetric anesthesia physically present at all times	Modified World Health Organization class I, II, III, or IV

Obstet Gynecol 2019;134(2):e41-55. JCVJ 2021;35:3483-3488. Anesthesiology 2021;135:164-83

## ANESTHESIOLOGY

### Obstetric Anesthesia and Heart Disease: Practical Clinical Considerations

Marie-Louise Meng, M.D., Katherine W. Arendt, M.D.  
ANESTHESIOLOGY 2021; 135:164-83

Circulation. February 2023;147:00-00.

#### AHA Scientific Statement

### Anesthetic Care of the Pregnant Patient With Cardiovascular Disease: A Scientific Statement From the American Heart Association

This statement is endorsed by the Society for Obstetric Anesthesia and Perinatology and the Society of Cardiovascular Anesthesiologists.

The American College of Obstetricians and Gynecologists supports the value of this clinical document as an educational tool, October 2022.

Marie-Louise Meng, MD, Chair; Katherine W. Arendt, MD, Jennifer M. Bangari, MD, Elise A. Brody, MD, Arthur J. Vaughn, MD, Allan S. Harned, MD, John Hens, MD, RN, C-OB, C-OBP, Benjamin Dwyer, MD, Leann S. Marks, MD, Wafa Khatib, MD, Chair, on behalf of the American Heart Association Council on Cardiovascular Surgery and Anesthesia, Council on Cardiovascular Clinical Care, Perioperative and Resuscitation, and Council on Population and Prevention.

This topic could be an entire talk(s) but these are 2 excellent very recent articles with guidance and recommendations for anesthetic care.

## FOCUSING ON THE PATIENT: IMPROVING INDIVIDUAL OUTCOMES & EXPERIENCES

Join us in May **IN DENVER** for more OB Anesthesia CME!

#SOAPAM2024