Making Labor Epidural Analgesia Better: A Quality Improvement Project Part II

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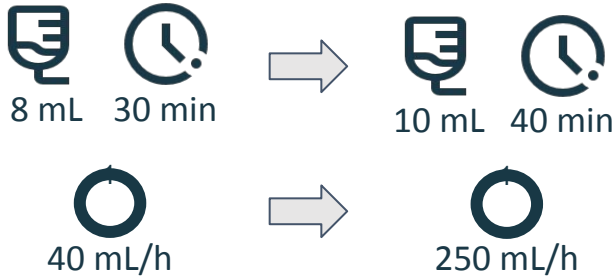
BACKGROUND

- Systemic evaluations suggest that the optimal Programmed Intermittent Bolus (PIEB) regimen is **10 mL boluses given every 40 minutes** [1-3]
- **Increased bulk flow rate** may provide more effective pain relief by improving the distribution of anesthetic [4-6]
- Our preliminary data showed that increasing bolus volume and dosing interval—without changing total anesthetic dose—did not reduce provider interventions but may improve anesthesia quality, as fewer required concentration increases

1 Anesth Analg 2011; 112: 904
2 Anesth Analg 2017; 124: 537
3 Anaesthesia 2018; 73: 459
4 Korean J Anesthesiol. 2024 ;77:106
5 J Clin Anesth. 2016 PMID: 27687462.
6 Anesthesiology. 2018;128:745

AIM

PIEB settings at Boston Medical Center:



↑ analgesia quality?

measured by need for provider interventions

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METHODS

	PIEB 0.0625% bupivacaine with 2 µg/mL fentanyl	Patient- Administered Boluses
Group A (Before Intervention) Mar 2023 Jun 2023	8 mL 30 min 40 mL/h	8 mL 15 min 32 mL
Group B (Intervention 1) Sep 2023 Apr 2024 Sep 2024	10 mL 40 min 40 mL/h	10 mL 20 min 30 mL
Group C (Interventions 1+2) Jul 2024 Nov 2024	10 mL 40 min 250 mL/h	10 mL 20 min 30 mL

Laboring Patients

Urban Safety Net Hospital

Mar 2023 – Nov 2024

Per Anesthesiologist Preference

Technique
- Epidural
- Dural Puncture Epidural (DPE)
- Combined Spinal Epidural (CSE)

Analgesia Induction
- Intrathecal or Epidural Bupivacaine
- Epidural Fentanyl
- Epidural Lidocaine with Epinephrine

Data Extracted from Electronic Medical Records

Demographics

Provider Interventions
- Rescue Bolus
- C-Section
- Increased Concentration
- Epidural Replacement

Time from Induction to Intervention or Delivery

Primary Outcome

Time to:
- Rescue Bolus
- C-Section
- Delivery

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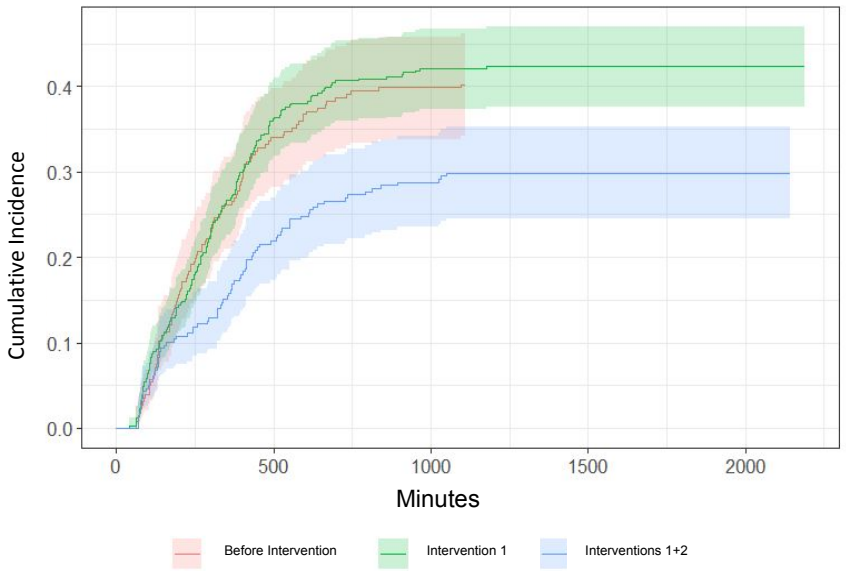
RESULTS

Cumulative Incidence Function of Rescue Bolus For Each Treatment Group with 95% Confidence Band



	Group A N=256	Group B N=423	Group C N=278	p-value
Outcomes, n (%)				
No Provider Intervention	153 (59.8)	244 (57.7)	193 (69.4)	0.004
Neck/Back Pain	0* (0.0)	8* (1.9)	9 (3.2)	0.112*
Epidural Replacement	15 (5.9)	26 (6.1)	21 (7.6)	0.684
↑ Infusion Concentration	17 (6.6)	8 (1.9)	6 (2.2)	0.002
Cumulative Incidence Function, % (95% CI)				
Rescue Bolus at 8 Hours	33% (95% CI: [27%, 39%])	35% (95% CI: [30%, 39%])	22% (95% CI: [17%, 27%])	0.002

Fine-Gray Hazards Model	**Hazards Ratio**	**(95% CI)**	**p-value**
Group A (8 mL q 30 min @ 40 mL/h)	-	-	-
Group B (10 mL q 40min @ 40 mL/h)	1.06	(0.83, 1.35)	0.6
Group C (10 mL q 40min @ 250mL/h)	0.68	(0.51, 0.90)	0.008

*Data Not Available for June 2023 and September 2023

- There is a **statistically significant difference in probability of needing a rescue bolus** among the three groups (p = 0.002), **specifically in Group C (Interventions 1+2)** compared to Group A (Before Intervention) and Group B (Intervention 1) (p=0.008).
- Changing bolus volume to **10 mL q 40 min** had a **significant effect on need to increase concentration**, but **potentially negative effect on need to rescue bolus.**

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CONCLUSION

- At our institution, increasing bolus volume and prolonging dosing interval (10 mL every 40 minutes) **with** increased bulk flow rate (250 mL/h) significantly **decreased the need for provider intervention**, as measured by incidence of rescue bolus.

- Increasing bolus volume and prolonging dosing interval **improved the quality of analgesia**, as measured by **need to increase concentration**, but potentially had a **negative effect on need to rescue bolus**.

- Next step is to study the **isolated effect of increased bulk flow rate (250 mL/h)** with original bolus volume and dosing interval (8 mL every 30 minutes).