

# Prophylactic Phenylephrine Infusion to Mitigate Intraoperative Hypotension after Spinal Anesthesia among Orthopedic Patients

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## Background

Intraoperative Hypotension (IOH) is common after spinal anesthesia (SA) and is associated with an increased risk of end organ damage.<sup>1, 2, 3</sup> The treatment regimen for IOH after SA varies in the orthopedic population. However, the current research literature suggests that a prophylactic infusion of phenylephrine significantly reduces the number of episodes and duration of hypotension.<sup>1</sup>

This EBP project aims to report the proportion of patients receiving prophylactic phenylephrine infusions and the incidence of hypotension following SA among orthopedic surgery patients at Providence Sacred Heart Medical Center (PSHMC) in Spokane, WA.

## Methods

- A retrospective, observational EBP project was conducted at PSHMC.
- Permission was obtained by PSHMC Clinical Innovation and Research Council and deemed exempt from human subjects research by the Providence Health Care Institutional Review Board.
- Patient data was securely extracted, deidentified, and stored in a HIPAA compliant REDCap database.
- Inclusion criteria: Adult patients ≥ 18 years old who received SA for non-emergent orthopedic surgery.
- Exclusions: Pediatric, obstetric, emergency surgery, and surgery lines other than orthopedic.
- IOH outcome determined by absolute mean arterial pressure (MAP) thresholds, as described in Wesselink et al. (2018) systematic review.<sup>4</sup>
- Descriptive analyses were conducted to examine baseline demographics and IOH treatment regimens utilized at PSHMC.
- Independent risk factors determined using binary logistic regression and time-to-event (MAP <60 mmHg) analyses determined using the Kaplan-Meier estimator ( $\alpha = 0.05$ ).

## Findings

**Table 1. Patient Demographic & Clinical Characteristics (n=3745)**

Variable	Value	Prophylactic Infusion* (n=593)	No Prophylactic Infusion (n=3153)	P value
Gender	Female	50% (n=296)	55% (n=1735)	0.02
	Male	50% (n=296)	45% (n=1418)	
Physical Status	I/II	66% (n=391)	71% (n=2239)	0.02
	III/IV	34% (n=201)	29% (n=914)	
Patient History	DM	15% (n=86)	15% (n=464)	0.91
	CKD	6% (n=35)	4% (n=134)	0.07
	CAD	13% (n=78)	9% (n=286)	<0.01
	PVD	10% (n=61)	8% (n=244)	0.04
	Stroke	10% (n=41)	8% (n=248)	0.43
Case Type	Knee (TKA)	53% (n=315)	59% (n=1847)	0.02
	Hip (THA)	46% (n=270)	39% (n=1238)	<0.01
	Other	1.0% (n=7)	2% (n=68)	0.12
	Age (years)	69 (±10)	66 (±10)	<0.01
BMI (kg/m <sup>2</sup> )	30 (±5)	30 (±5)	0.35	
Case Duration (mins)	141 [123-155]	141 [123-155]	0.46	

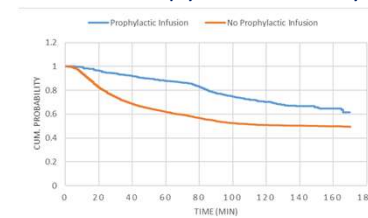
Prophylactic Infusion: Phenylephrine infusion started prior to first MAP <60mmHg; Continuous data presented as mean values (± standard deviation) or median [Interquartile Range]. Categorical data presented as a count and percent; BMI: Body Mass Index

**Table 2. Incidence of IOH Following SA Prophylactic Phenylephrine Infusion versus No Infusion**

MAP (mmHg)	Duration (mins)	IOH Incidence with and without Prophylaxis		Relative Risk of IOH No Prophylaxis		
		Prophylaxis	No Prophylaxis	RR	95% CI	P value
<65	≥ 20	20.3% (n=120)	42% (n=1309)	2.05	[1.74-2.42]	<0.001
	≥ 10	7.1% (n=42)	24% (n=768)	3.42	[2.55-4.62]	<0.001
<60	≥ 20	3.2% (n=19)	12.9% (n=406)	4.01	[2.55-6.30]	<0.001
	≥ 5	4.2% (n=25)	12.6% (n=398)	2.99	[2.01-4.43]	<0.001
<55	≥ 10	1.2% (n=7)	5.4% (n=170)	4.56	[2.15-9.70]	<0.001
	≥ 5	0.3% (n=2)	2.4% (n=76)	7.13	[1.76-29.0]	0.006
<50	≥ 10	0.2% (n=1)	0.8% (n=25)	4.70	[0.64-34.6]	0.13

Categorical data presented as a percentage of the total; RR: Relative Risk Ratio

**Figure 1. Time to First MAP <60mmHg With and without Prophylactic Infusion of Phenylephrine**



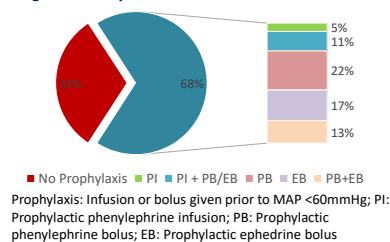
Cumulative survival (Kaplan-Meier) curves show the proportion of patients in each group without hypotension (MAP <60mmHg) over time ( $\alpha = 0.05$ )

**Table 3. Number of Patients at Risk of MAP <60mmHg over Time**

Time (min)	0	30	60	90	120	150	180
Prophylactic Infusion	100% (592)	91% (541)	85% (501)	75% (442)	68% (402)	65% (386)	64% (381)
No Prophylactic Infusion	100% (3153)	74% (2344)	62% (1953)	54% (1709)	51% (1612)	51% (1598)	50% (1592)

Prophylactic Infusion: Phenylephrine infusion started prior to first MAP <60mmHg; Percent (#patients) at risk.

**Figure 2. Analysis of IOH Treatment at PSHMC**



Prophylaxis: Infusion or bolus given prior to MAP <60mmHg; PI: Prophylactic phenylephrine infusion; PB: Prophylactic phenylephrine bolus; EB: Prophylactic ephedrine bolus

## Discussion

The primary objective of this observational EBP project of 3,745 patients was to measure the use of prophylactic phenylephrine infusions among orthopedic surgery patients at PSHMC. Overall, we found that 16% of patients received a prophylactic phenylephrine infusion. The median infusion start time for a prophylactic infusion was 19 minutes following SA [IQR 10-29]. Patients who did not receive a prophylactic phenylephrine infusion following SA had significantly increased risk of MAP <60mmHg for ≥ 10 minutes (RR 3.42, 2.55-4.62,  $p < 0.001$ ). The observed median time to the first MAP <60 mmHg was longer in patients who received prophylactic phenylephrine infusions (80 [41-99] vs 29 [16-57] minutes,  $p < 0.0001$ ). Patients who were male, advanced age, higher physical status scores and history of CVD were more likely to receive a prophylactic infusion.

This project is the first to establish the utilization rate of prophylactic phenylephrine infusions and the incidence of IOH after SA among orthopedic patients at a large academic health center. However, due to the lack of prospective studies, further investigation is warranted.

## References

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