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# Hemodynamic changes with placement of wrung-out topical 1: 1000 epinephrine nasal pledgets before and during endoscopic sinonasal surgery

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# Objectives

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To evaluate how intraoperative placement of endonasal topical 1:1000 epinephrine can affect hemodynamic parameters in the setting of various sinus and nasal pathologies.

Gather parameters in real-time directly after administration of epinephrine, which can better predict events when using topical vasoconstrictors.

# Background

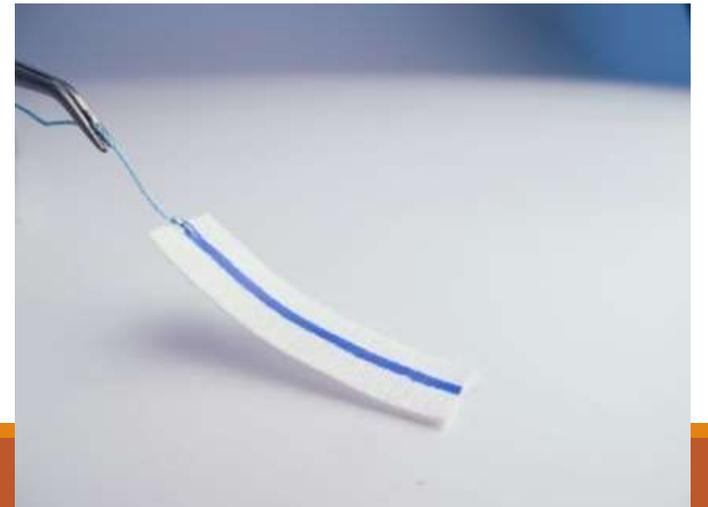
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Intranasal topical 1:1000 epinephrine has been used safely and effectively for obtaining hemostasis during endoscopic sinonasal surgery. <sup>1-6</sup>

Recent prospective studies assessing hemodynamic changes after intranasal topical epinephrine application have used completely soaked cottonoid pledgets, and have only assessed for hemodynamic changes after induction, before performing any surgery. <sup>5,6</sup>

- One previous study by Yim et al. observed significant elevations in BP with the use of 12mL of topical 1:1000 contained in 6 pledgets after induction in 6 out of 26 patients, with some requiring vasodilation from anesthesia. <sup>6</sup>

This study can determine whether intranasal application of topical 1:1000 epinephrine with wrung-out cottonoid pledgets can provoke significant hemodynamic parameter changes both before and after varying degrees of endoscopic sinonasal surgery.



# Methods and Demographics

- n=22
- Mean time between preoperative and intraoperative measurements:  $94.7 \pm 49.5$  mins
- Measurements were taken at time intervals after topical epinephrine placement and 2 minutes after the removal of the pledgets



- Heart rate, blood pressure (systolic, diastolic, and mean arterial pressure), and electrocardiography changes were recorded at these time marks.
- A paired, two-tailed student's t-test was used to compare the mean blood pressures and heart rates to the baseline 0' mean.

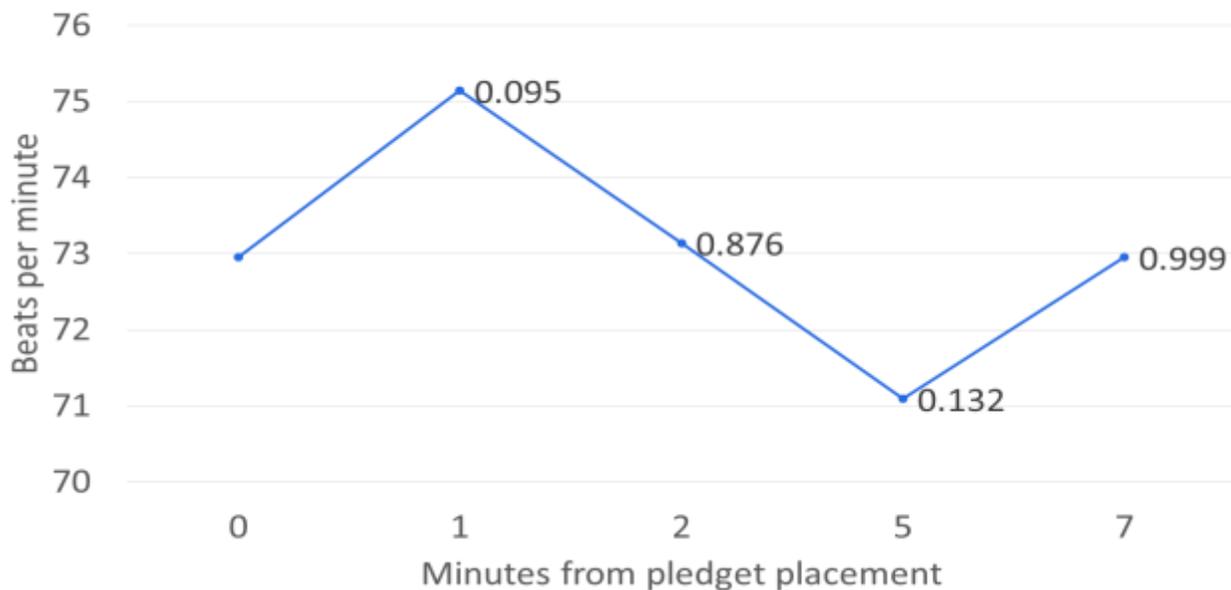
	Group	Frequency	%
Gender	Male	12	54.5
	Female	10	45.5
Pathology	Chronic Rhinosinusitis without nasal polyps	8	36.4
	Chronic Rhinosinusitis with nasal polyps	5	22.7
	Sinus neoplasm	5	22.7
	Skull base neoplasm	2	9.1
	Fungal ball	1	4.5
	Deflected nasal septum/ inferior turbinate hypertrophy	1	4.5
Number of pledgets after induction, before surgery	2 (unilateral)	2	9.1
	4 (bilateral)	20	90.9
Number of pledgets placed	2	2	9.1
	3	2	9.1
Intraoperatively	4	7	31.8
	5	2	9.1
	6	8	36.4
	8	1	4.5

# Results

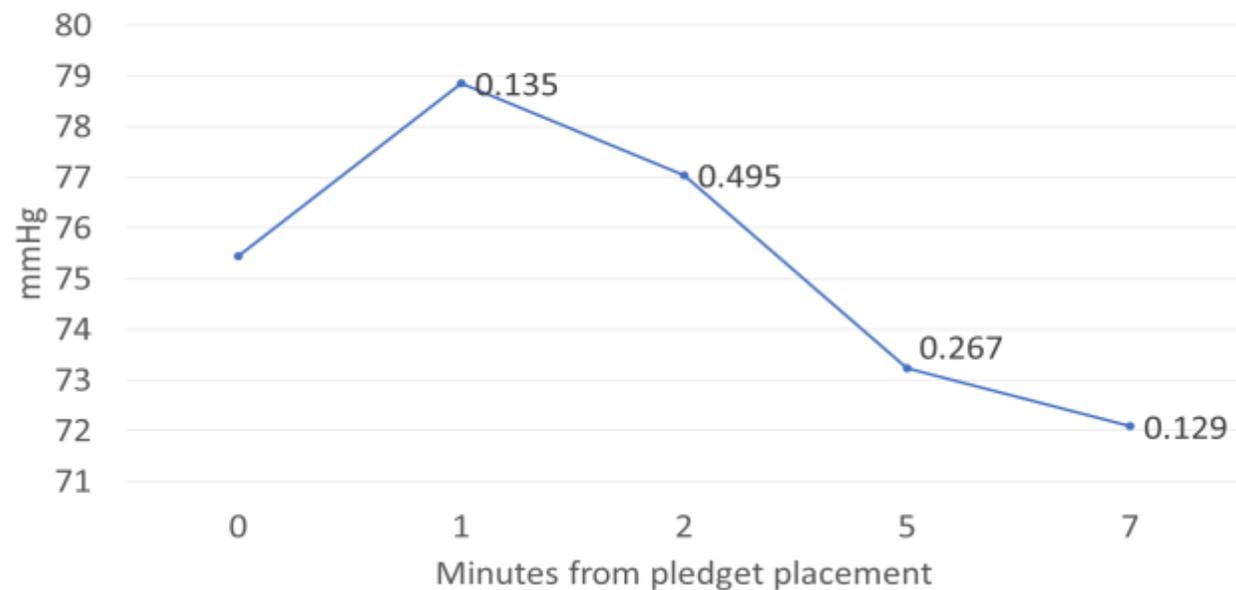
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1. After induction, before any sinonasal surgery was performed, wrung-out epinephrine-saturated pledgets caused no significant hemodynamic changes.
2. After varying degrees of sinonasal surgery, there were no significant elevations in heart rate or blood pressure, and no electrocardiographic abnormalities for any of the patients.
3. Interestingly, intra-operative systolic, diastolic, and mean arterial pressures actually decreased within 2 minutes of epinephrine pledget placement ( $p < 0.05$ ).

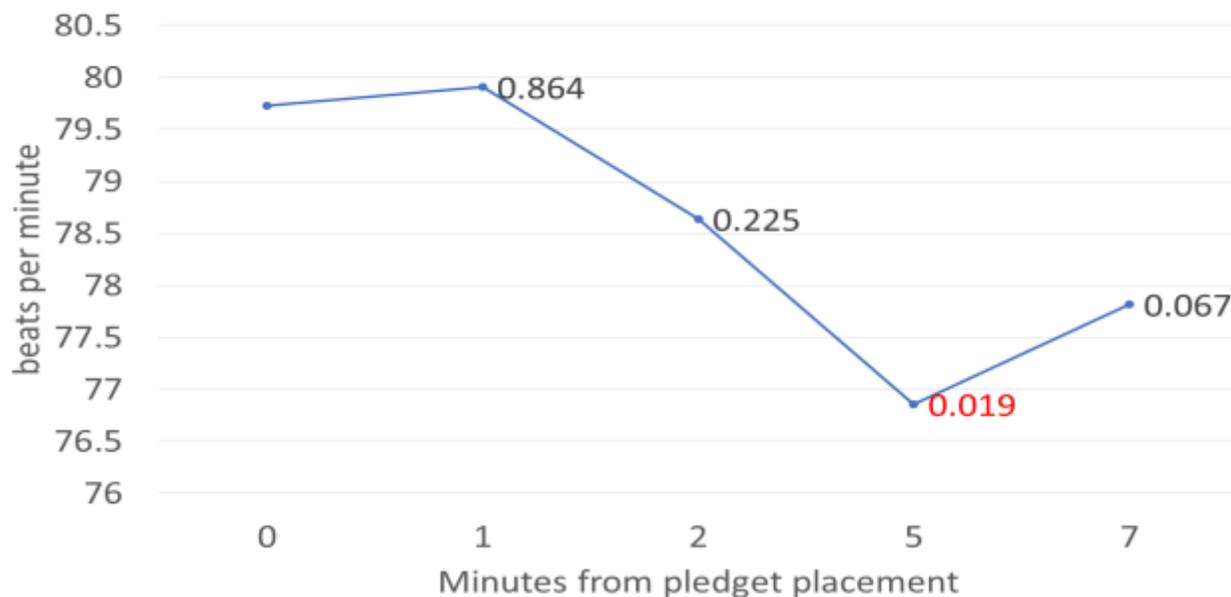
### Pre-operative Heart Rate



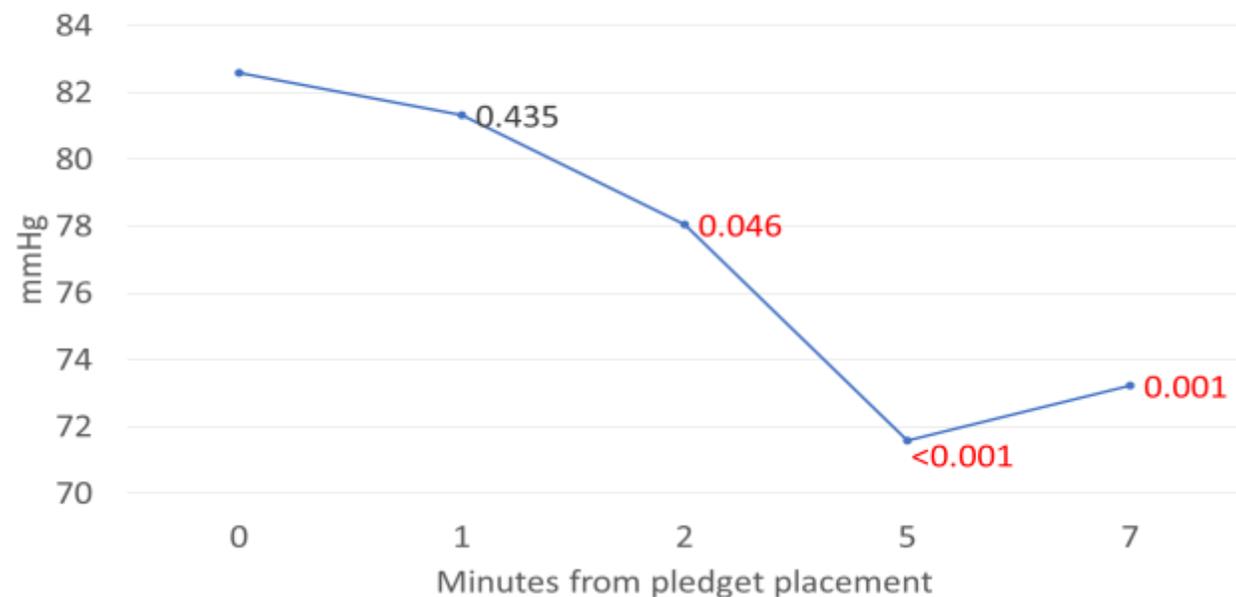
### Pre-operative MAP



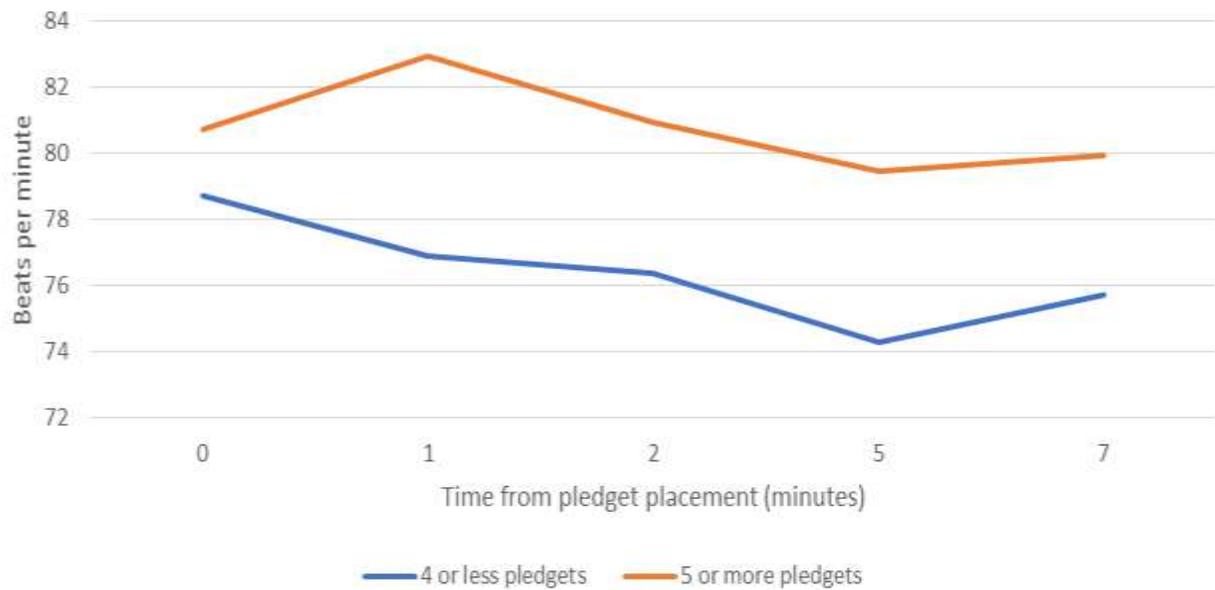
### Intra-operative Heart Rate



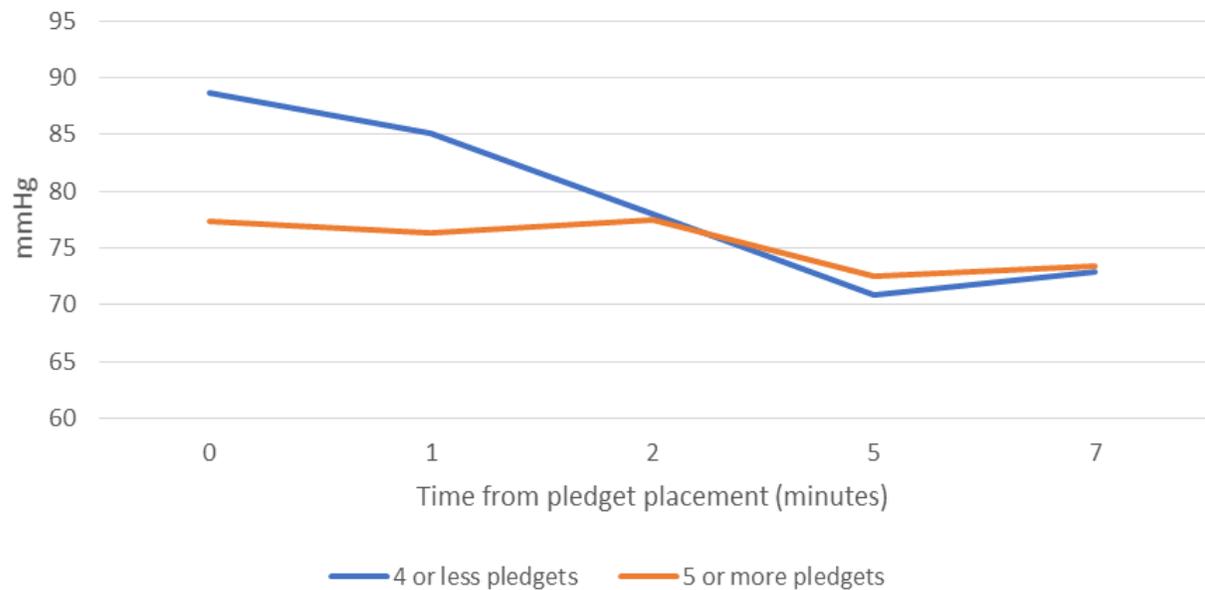
### Intra-operative MAP



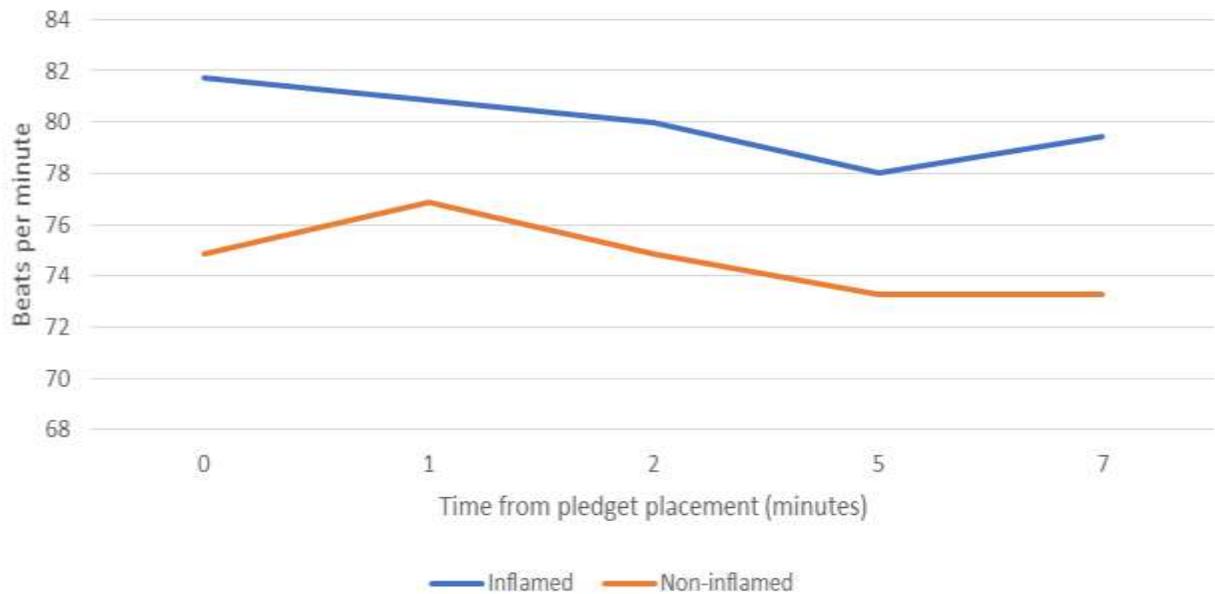
### Intraoperative HR vs Number of Pledgets



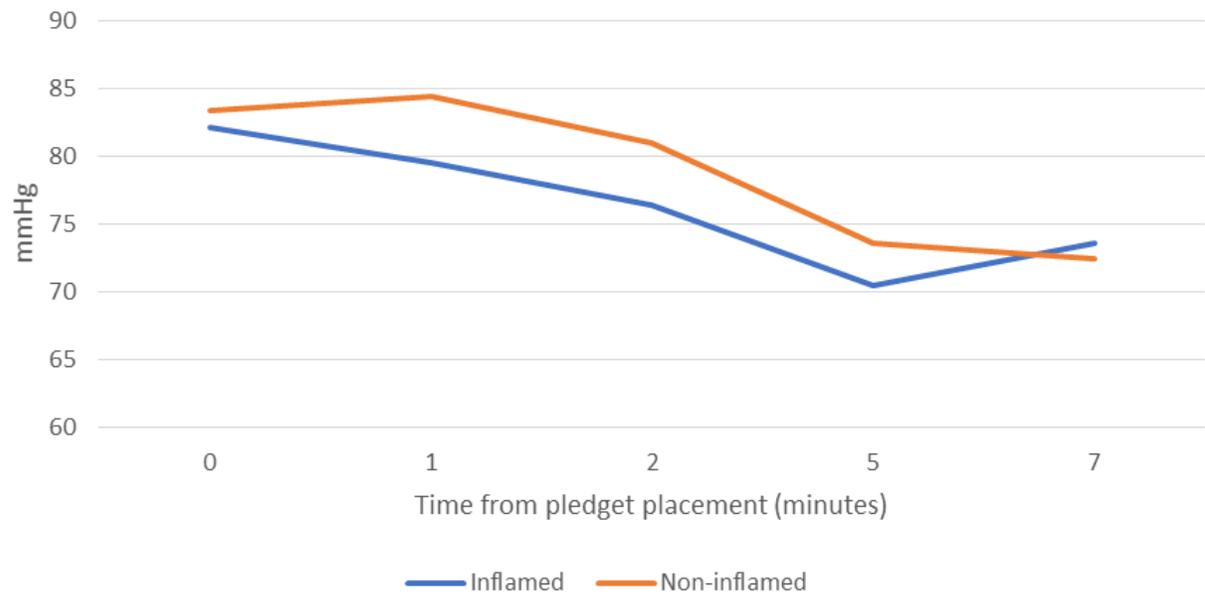
### Intraoperative MAP vs Number of Pledgets



### Intraoperative HR vs Pathology Type



### Intraoperative MAP vs Pathology



# Discussion

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Normal Pharmacokinetics: half-life of epinephrine is around 1 minute and metabolized locally by adrenergic neuronal uptake and systemically by COMT and MAO in the liver. Normal resting physiologic levels are <115pg/mL. 7

Rate of absorption is variable depending on mode of administration and dosage, e.g. injection results in rapid elevation in systemic catecholamine levels with a higher peak plasma level, while topical application results in a slower elevation and a smaller peak plasma level. 8,9,10

This is the first study to our knowledge to evaluate topical epinephrine's hemodynamic effects *after* varying degrees of endoscopic sinonasal surgery had been performed.

- Could exposed vascular beds caused by surgical trauma and prolonged exposure with general anesthesia could alter the effect of topical 1:1000 epinephrine's systemic absorption?

Halogenated hydrocarbons found in general anesthesia, including sevoflurane and isoflurane used in our study, are known to sensitize the myocardium to the arrhythmogenic effects of elevated plasma epinephrine. 11, 12

# Discussion

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We used wrung out pledgets instead of soaking wet pledgets, which is recommended to lessen the risk of provoking an adverse cardiovascular event <sup>2</sup>

Between 2-8 pledgets were used intraoperatively. In a similar study, wrung out pledgets hold about 1mL, or 1mg each. <sup>6</sup> Hence, based on total dose, the topical dosage can potentially exceed the resuscitative dose of 1mg.

However, the overall minimal absorption and rapid metabolism can result in lower than expected plasma levels. A previous study has demonstrated that about a third of the dose contained in topical cocaine soaked pledgets was absorbed total, with 47% of that amount absorbing in 5 minutes and 70% absorbing by 10 minutes. <sup>13</sup>

To quantify this minimal absorption, Nakponetong et al. has described that the dose of intranasal epinephrine (administered by nasal spray) would need to be 20-fold higher to equally compare to the plasma epinephrine levels reached after intramuscular injection. <sup>14</sup>

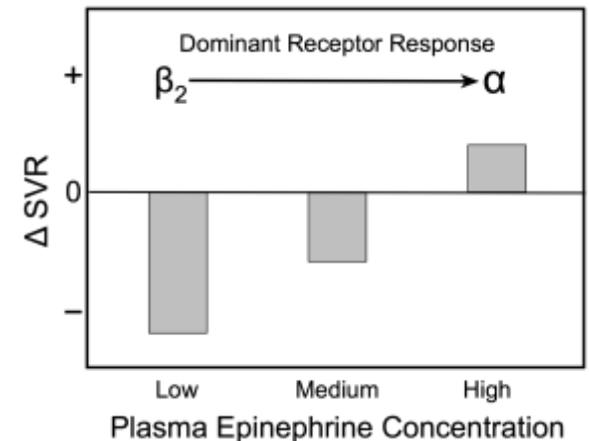
# Discussion

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Our data suggests a low systemic absorption. In fact, a transient decrease in the MAP was observed intraoperatively.

This decrease in blood pressure can be due to the vasodilatory effects of the sensitive  $\beta_2$  receptors in muscular vasculature, while a higher plasma level of epinephrine would preferentially activate  $\alpha_1$  receptors resulting in vasoconstriction, increasing the BP. <sup>15</sup>

- Our data also suggests that the number of pledgets used intraoperatively did not have a significant effect on hemodynamics or result in high blood pressure, although future studies should utilize a higher number of subjects to further determine hemodynamic changes in these different settings.
- Limitations to our study:
  - There was a low number of subjects (n=22). A higher number could offer more insight on how number of pledgets and sinonasal pathology can alter absorption and hemodynamics
  - Patients with cardiovascular comorbidities were not used in this study



# Conclusion

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Intranasal application of topical 1:1000 epinephrine via wrung-out cottonoid pledgets did not cause elevations in heart rate or blood pressure parameters, nor any cardiovascular events, before or during endoscopic sinonasal surgery.

Judicious use of 1:1000 epinephrine should be exercised on patients with cardiovascular morbidities.

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