

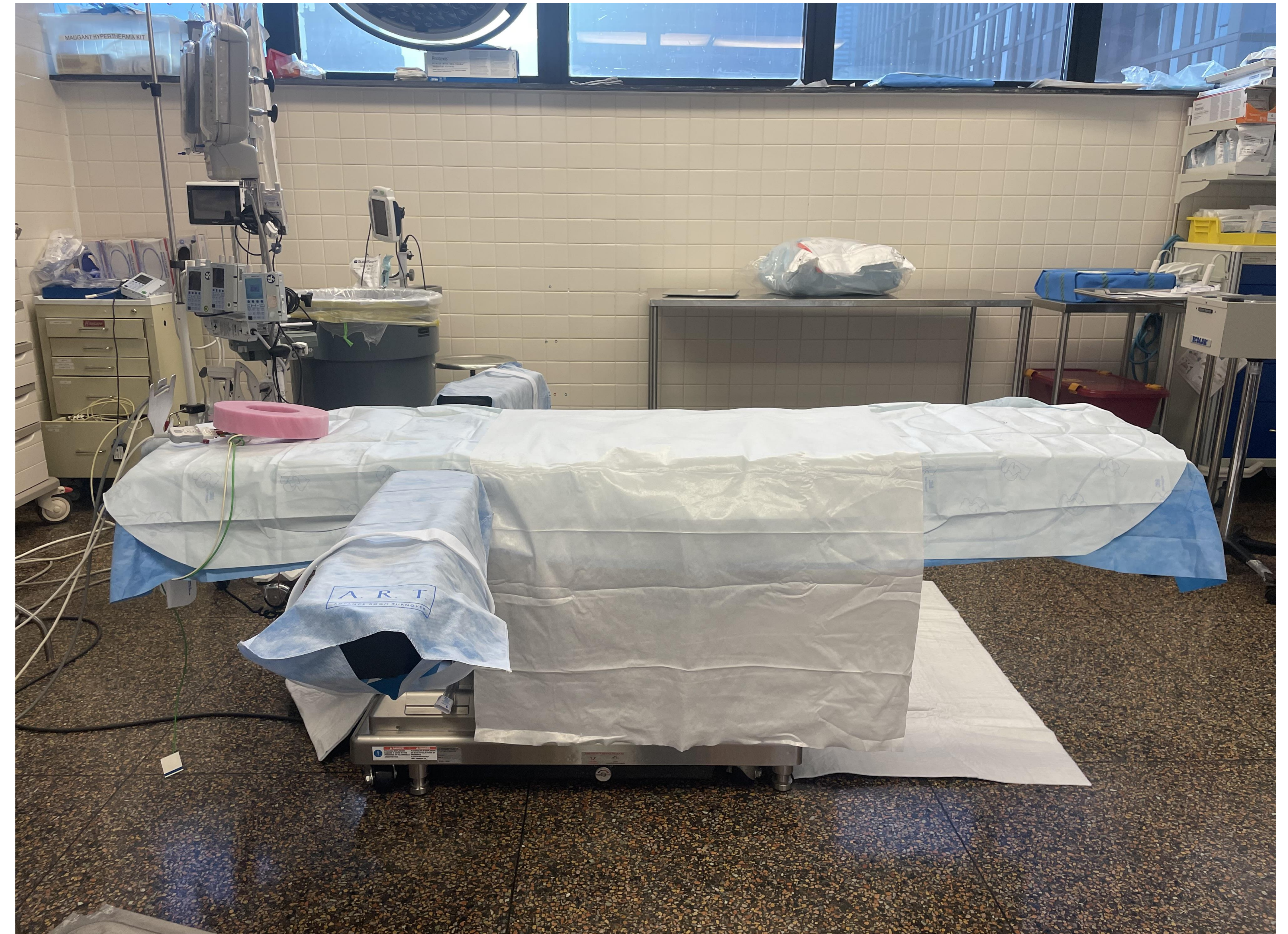
Minimizing Hypotension Following Spinal Anesthesia for Cesarean Section Using a Gradual Repositioning Technique

Natasha Sinai Hede, M.D.¹, ETTY Sims, M.D.¹, Jane Huffnagle, D.O.¹, Suzanne Huffnagle, D.O.¹, John Wenzel, M.D.¹, Garrett Gerney, M.D.¹, Marc Torjman, Ph.D.¹, Thomas Hurysz, M.D.², Maya Rosenberg, B.A.³

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1



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INTRODUCTION

The incidence of hypotension among parturients receiving spinal anesthesia for cesarean sections has been demonstrated to be as high as 71%¹ due to the sympathectomy caused by the local anesthetic. Treatment modalities include prophylactic intravenous fluid boluses, vasopressor administration, and left uterine displacement to prevent compression of the inferior vena cava and improve venous return^{2,3}. Hypoperfusion of the stomach due to hypotension commonly leads to the nausea and emesis associated with spinal anesthesia and can be prevented with maintaining a stable mean arterial pressure (MAP).

Position immediately following administration of spinal anesthesia has also shown to affect risk of hypotension. El-Hakeem et al. found that allowing parturients to sit upright for 5 minutes decreased incidence of hypotension and nausea, but also decreased intraoperative block height without affecting the overall success of the anesthetic³. Moore et al. further found that the average time requirement for parturients to remain upright to prevent hypotension in 50% of patients was 129 seconds⁴. Sahin et al. demonstrated maintaining patients in a left lateral position for 15 minutes showed a 50% decreased incidence of hypotension, as well as decreased nausea and vomiting and pressor requirement⁵. We hypothesize that the use of a slow repositioning technique in a parturient can prevent or reduce the effect of a rapid sympathectomy, thus decreasing the incidence of hypotension, nausea, and emesis commonly seen when placing women supine immediately following spinal blockade.

METHODS

After approval by the Thomas Jefferson University Hospital Institutional Review Board, eligible parturients were invited to participate in the study by TJUH anesthesia resident and attending physicians. Study participants provided written informed consent. Participants were 18-40 years of age, at term (> 37 weeks gestation), and undergoing elective cesarean section for uncomplicated pregnancy. Exclusion criteria included urgent or emergent cesarean section, patients planned for combined spinal-epidural technique, patients receiving medications for management of hypertension, and those who received same-day neuraxial analgesia for external cephalic version.

Patients were randomized and blinded to either control (immediate supine positioning) or experimental (gradual recline to supine) group. Prior to spinal administration, patients were given one liter of intravenous crystalloid fluid, as well as 30 mL sodium citrate solution. Spinals were administered via standard sterile technique with 0.13 mg hydromorphone, 15 mg hyperbaric bupivacaine (2 mL of 0.75% solution) and 10 mcg fentanyl. Patients in the control group were laid supine immediately and, per TJUH standard practice, started on a prophylactic phenylephrine infusion (0.5 mcg/kg/min). Patients in the experimental group were laid at an angle of 45° and gradually transitioned to supine over a period of 5 minutes. The prophylactic phenylephrine infusion was not started in this group. Both groups were placed in left uterine displacement using a soft wedge immediately after spinal placement and were monitored with ASA standard monitoring. Noninvasive blood pressures were measured over the first twenty minutes of the procedure every two minutes. Patients in both groups were treated with vasopressor boluses for mean arterial pressures less than 65 mmHg or systolic blood pressures below 80% of baseline pressure (measured prior to spinal administration). Total vasopressor requirements (both in bolus and infusion form) for this period were recorded, as was patient-reported nausea, vomiting, and treatment of these symptoms with antiemetic medications.

For patients in both groups, sensory blockade levels were measured at five and ten minutes following spinal administration using a gentle pinprick method. Blockade considered adequate for Cesarean was defined as a sensory blockade at least at the T5 level by 10 minutes following spinal.

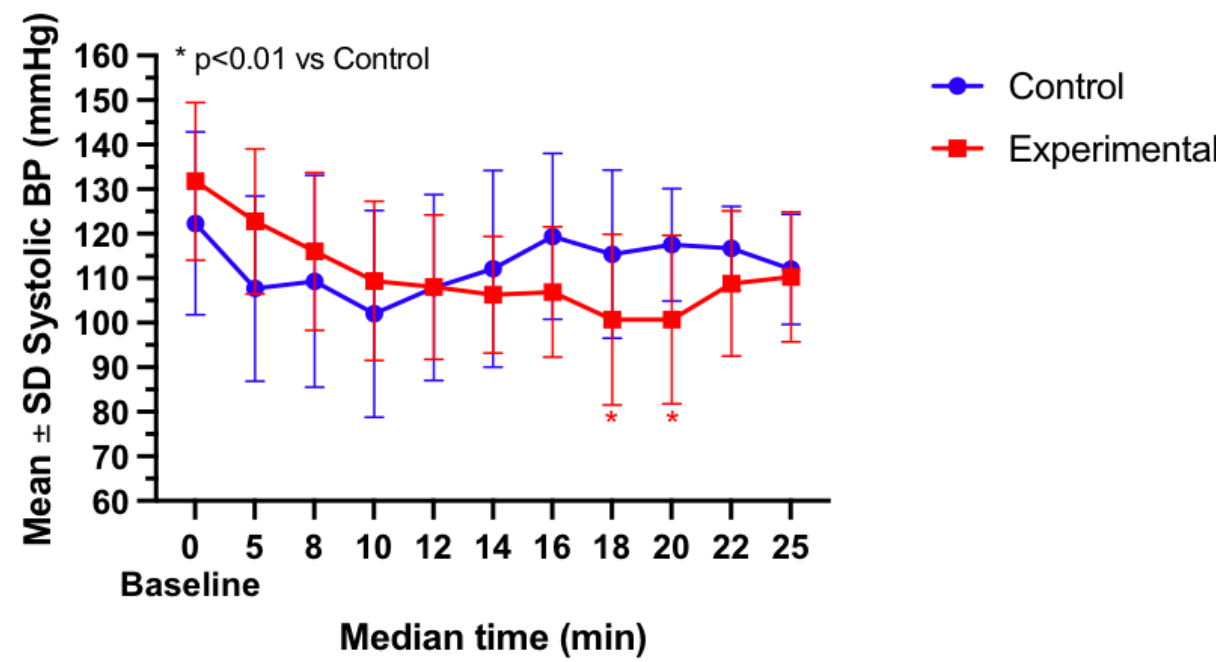
RESULTS

Of 38 patients, 100% achieved block height adequate for Cesarean section by 10 minutes after spinal placement.

We found a statistically significant (p = 0.005) difference in systolic blood pressure (SBP) demonstrating SBPs lower in the experimental group at minutes 14 and 16. At these times SBPs were maintained at a mean of 100.6 and 100.7 mmHg in the experimental group compared with means of 115 and 117 mmHg in the control group. There was no statistically significant difference in diastolic blood pressures (p = 0.933). There was a statistically significant (p < 0.001) difference in total phenylephrine usage via infusion at 20 minutes between the two groups with the mean lower in the experimental group (mean of 0.890 mg in the control group vs 0.012 in the experimental group). There was no statistically significant difference in total phenylephrine (p = 0.426) or ephedrine (p = 0.641) boluses between the two groups.

Of the 18 control group patients, 8 reported nausea while 4 experienced vomiting; of 20 experimental group patients, 7 reported nausea, while 1 experienced vomiting.

One patient experienced a failed spinal despite adequate sensory block and negative ‘Allis’ testing and was excluded from the study.



Vomiting	NO		YES		Total	
	N	%	N	%	N	%
Control	14	77.8%	4	22.2%	18	100.0%
Experimental	19	95.0%	1	5.0%	20	100.0%
Total	28	100.0%	5	100.0%	33	100.0%

12. Vomiting: p=0.117
Note: probably underpowered to show a statistically significant difference

DISCUSSION

Symptomatic hypotension due to spinal anesthesia is a ubiquitous issue in the delivery room that has numerous downstream effects on both mother and fetus. At baseline, the typical physiologic changes in the parturient include a decrease in systemic vascular resistance (SVR) and the tendency for supine hypotension due to aortocaval compression. Consequently, the uterus and placenta, which have little autoregulation, are susceptible to hemodynamic perturbations. An important implication of maternal hypotension (and the resulting placental hypoperfusion) is fetal acidosis, which can further result in altered hemodynamics, pharmacodynamics, and fetal distress. Methods for mitigating maternal hypotension have been extensively studied in the obstetric anesthesia community. Currently, treatment with prophylactic vasopressors (typically an infusion of phenylephrine) is considered a mainstay in many practices. Our study found that with a gradual recline technique, blood pressures were overall maintained at a similar level between the two groups while still achieving the necessary sensory block height needed for Cesarean section. The total vasopressor use in the control group was also significantly higher than that in the experimental group. Together, these findings imply that a gradual recline may attenuate the rapid rate of sympathectomy with supine positioning. The result is preservation of baseline blood pressures with a lesser vasopressor requirement. Regarding nausea and vomiting, a trend did appear between the two groups. 22.2% of the control group patients experienced vomiting compared with 5% of those in the experimental group. Of those who vomited, 80% were in the control group. Based on our current data, this may correlate with the more gradual decrease in blood pressure seen with the gradual recline technique within the first six to eight minutes after spinal placement. While the current data set was underpowered to adequately analyze the statistical significance of this finding, it will be further evaluated as we continue to enroll patients in this study.

CONCLUSIONS

Patients undergoing gradual recline after spinal anesthesia administration require overall less vasopressors to maintain relative normotension compared with those undergoing immediate supine positioning.

The gradual recline technique still allows for appropriate block height by 10 minutes after spinal administration.

A gradual recline technique demonstrates a trend towards a lesser incidence of vomiting compared with the immediate supine group.

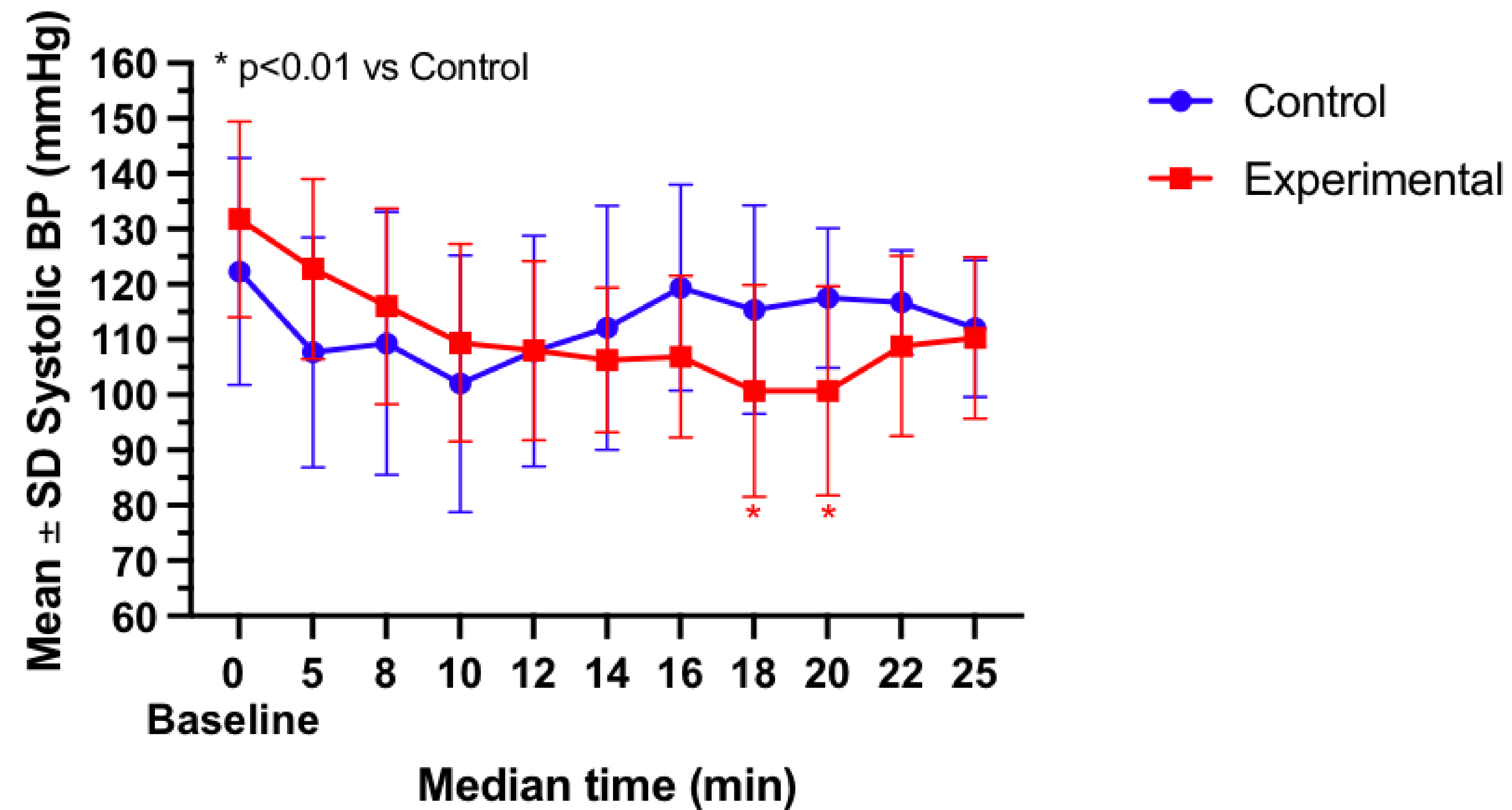
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