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## Response by Petersen et al to Letter Regarding Article, “Decreases in Blood Pressure During Thrombectomy Are Associated With Larger Infarct Volumes and Worse Functional Outcome”

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### Keywords

Stroke; Blood Pressure; Thrombectomy; Brain Ischemia; Cerebrovascular Disease/Stroke; Ischemic Stroke; Revascularization

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We thank Samuels et. al. for their interest in our article and their comments regarding the benefits of local anesthesia (LA) over general anesthesia (GA) or conscious sedation (CS) for avoiding intraprocedural hypotensive episodes. To better elucidate these differences, we further analyzed the data in our initial study, both to characterize the timing of the intraprocedural decreases in blood pressure and the relationship between various types of sedation used in our study and functional outcome.<sup>1</sup>

Justly, Samuels et. al. pointed out in their letter that intraprocedural hypotensive episodes have been previously found to be associated with worse outcomes for patients receiving GA and CS.<sup>2,3</sup> These hypotensive episodes are thought to possibly be related to the agents administered in these types of sedation, and if true, these episodes should occur during the induction of anesthesia or conscious sedation. To better characterize the timing of blood pressure decreases in our original study, we reviewed images and procedural reports of each patient. We recorded the timing of specific procedural steps including arrival in angiography suite, groin puncture, first angiogram to visualize the intracranial occlusion, first pass with stent retriever, recanalization, catheter removal and procedure end. Maximum blood pressure drop (MAP) was assigned to one of three intra-procedure time intervals: interval 1 (arrival in angiography suite to groin puncture), interval 2 (groin puncture to first pass), and interval 3 (first pass to recanalization). While most patients experienced their maximum blood pressure reduction at the beginning of procedure at which time induction of GA or CS would occur (intervals 1 and 2; n=219; 71%), 29% occurred later in the procedure between first pass and recanalization. The mean MAP reduction in interval 1 was larger compared to interval 2&3 (32 vs. 23 and 26 mmHg, respectively, p=0.017). Decreases in MAP during all intervals were significantly associated with 90-day outcome (OR per 10 mmHg 1.29,

p=0.022; OR 1.16, p=0.022; and OR 1.33, p=0.01 for interval 1-3, respectively). We found no significant relation or interaction between timing of blood pressure reduction and outcome.

To evaluate the effects of anesthesia type on intraprocedural blood pressure decreases, we reviewed the anesthesia records of all patients in our cohort who underwent monitored anesthesia care at Yale-New Haven Hospital (n=176) and further separated by whether they received CS (n=135) or LA only (n=41). As expected blood pressure reductions were smaller among patients receiving LA compared to CS or GA (mean MAP 16 vs. 24 vs. 33 mmHg, respectively, p=0.02). Intraoperative blood pressure reduction was significantly associated with functional outcome at 3 months for both GA patients and those with conscious sedation (OR per 10 mmHg 1.24, 95%CI 1.05-1.46, p=0.013 and OR 1.22, 95%CI 1.03-1.45, p=0.02, respectively). The effect size for shifting towards a worse outcome on mRS with LA was similar compared to CS or GA, however, results were no longer statistically significant (OR per 10 mmHg 1.17, 95%CI 0.94-1.46, p=0.114). We cannot conclude whether this an underpowered result, and a definitive finding of a null result may require further study.

In summary, we found that the majority of the largest blood pressure reductions occurred at the beginning of the endovascular procedure and may be related to the induction of anesthesia conscious sedation. Regardless of when these drops occur or which form of procedural sedation/anesthesia was used, they associate with poor outcome suggesting that neither partial reperfusion nor anesthesia may protect against the detrimental effects of blood pressure reduction. The use of local anesthesia resulted in overall smaller intraprocedural blood pressure reductions. Thus, minimizing the use of CS or GA or using a rigorous blood pressure management protocol may help to minimize blood pressure reductions during induction and could potentially reduce the detrimental effects of blood pressure decrease prior to reperfusion. However, the substantial portion of patients who experienced their maximum decrease in blood pressure long after what would be the induction period of GA or CS suggests that decreases cannot be solely solved by refraining from the use of GA or CS and thus underline the importance of blood pressure management throughout the procedure. Finally, we very much agree that understanding the pathways that lead to outcome, as they relate to drops in blood pressure, is critical to inform the development of the most promising interventions.

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### Disclosures

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