

Blood Pressure Management Analysis on ICU and Surgical Patients Receiving Vasopressor Therapy

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Background: Blood pressure management in the operating room and intensive care unit often requires vasopressor therapy, especially in high-risk surgical cases and critically ill patients. The current standard in vasopressor therapy is to manually titrate to a target mean arterial pressure, which can vary among different institutions. Ideally, changes in vasopressor infusion rates quickly follow changes in blood pressure. While too low of a blood pressure risks hypoperfusion and ischemia from too low driving pressure, too high of a blood pressure also risks ischemic injury via blood flow redistribution away from the visceral organs. In the ideal scenario, vasopressor infusions would be maintained at the minimum level sufficient to prevent hypotension. Few studies, if any, have examined blood pressure management under vasopressor infusion in a large sample of surgical and ICU patients receiving vasopressor therapy, however.

Methods: The data used in this study was obtained from two centers: Erasme Hospital in Brussels, Belgium and University of California, Irvine Medical Center (UCIMC) in Orange, California. At Erasme Hospital, 516 surgical patients were included in the data set. At UCIMC, 18,138 ICU visits were included. 1,302,221 minutes of ICU MAP data were included in the data set. At Erasme Hospital, patients on norepinephrine infusions with valid mean arterial blood pressure values (defined as values between 40 mmHg and 140 mmHg) were included. Norepinephrine was primarily used for blood pressure management at Erasme Hospital and therefore we did not examine blood pressure in the surgical setting during any other vasopressor. For the purpose of this analysis, the ideal MAP was considered to be 60-80 mmHg. The target MAPs in both data sets were unknown. We examined blood pressure during which vasopressors were used and also throughout the entire case/stay.

Results: Table 1. Surgical Patients from Erasme Hospital and ICU Visits from UCIMC

		Whole case	Under norepinephrine	Under phenylephrine
Surgical Patients from Erasme	Average MAP (mmHg)	76.17	75.08	
	Standard Deviation MAP (mmHg)	11.70	10.60	
	% time [60-80]	53.28	55.64	
	% time < 60 mmHg	11.18	10.65	
	% time > 80 mmHg	35.46	33.47	
ICU Visits from	Average MAP (mmHg)	84.54	76.90	79.90

UCIMC	Standard Deviation MAP (mmHg)	20.44	18.91	20.23
	% time [60-80]	34.65	53.24	46.32
	% time < 60 mmHg	6.60	10.63	9.46
	% time > 80 mmHg	58.75	36.13	44.22

Conclusion: These findings indicate a similar trend in blood pressure management under vasopressor infusion between an intensive care unit in the United States and an operating room setting in Europe. In both settings, patients spend significant time (>30%) with a MAP > 80 mmHg, and non-trivial time with MAP below 60 (about 10%). Given the growing evidence in the last few years that cumulative hypotension time contributes to worsened outcomes (1) and the substantial time in over-treatment, from this data, it is clear that there is room for improvement in accurate titration.

References:

1. Walsh M, Devereaux PJ, Garg AX, et al. Relationship between intraoperative mean arterial pressure and clinical outcomes after noncardiac surgery: toward an empirical definition of hypotension. *Anesthesiology*. 2013;119(3):507-15.