Computer-assisted individualized hemodynamic management reduces intraoperative hypotension

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Video Abstract

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Abstract

A new study published in the journal Anesthesiology suggests that computer-assisted individualized hemodynamic management is a promising strategy to minimize hypotension during certain surgeries. Intraoperative hypotension is common but can increase the risk of postoperative complications. During surgery, individualized hemodynamic management can help mitigate hypotension and decrease such complications. In this strategy, clinicians use both intravenous fluids and vasopressors to maintain mean arterial pressure and blood volume near a patient's personalized baseline. Despite its reported success, this approach requires constant monitoring and adjustment, which can be particularly challenging during complex and prolonged surgeries. Automated systems that can deliver either vasopressors or fluids have recently been developed, but a single closed-loop system that can deliver both with minimal clinician intervention isn't yet available. To pave the way for such technology, researchers at a hospital in Bicêtre, France, designed a computer-assisted system with two main parts: one for closed-loop vasopressor administration and another for decision-supported fluid administration. The researchers then tested their system against traditional fluid and vasopressor management with respect to intraoperative hemodynamics and postoperative complications. The researchers randomized thirty-eight patients scheduled for elective intermediate- to high-risk abdominal or orthopedic surgery to either a computer-assisted goal-directed therapy group or a manually adjusted goal-directed therapy group and compared the outcomes. The same hemodynamic management protocol was used in both groups; only the presence of automation differed. Compared with the manual group, the computer-assisted group had significantly less hypotension, indicating better blood pressure management. This was likely due to the much higher number of vasopressor infusion rate modifications in this group. However, there was no difference in the postoperative complication rate between groups, likely because of the small sample size. Additionally, all flow-based hemodynamic variables were kept closer to the target value in the computer-assisted group than in the manual group. Finally, the mean stroke volume index and cardiac index were significantly greater in the computer-assisted group, further supporting the superior hemodynamic control of the computerized system. Notably, the computer-assisted surgeries were supervised by the principal investigator, and provider experience and type weren't controlled. Blood loss and aspirin use were greater in the computer-assisted group than in the manual group. Additionally, hypotension during anesthesia induction couldn't be assessed. Finally, the findings may not apply to types of surgeries beyond those examined. Despite these limitations, this study demonstrates that computer-assisted individualized hemodynamic management is superior to goal-directed manual adjustments in minimizing intraoperative hypotension. This work is yet another steppingstone in the development of automated systems to optimize patient management during surgery.