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Individually Optimized Hemodynamic Therapy Reduces Complications and Length of Stay in the Intensive Care Unit

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Introduction

This study investigates whether goal-directed hemodynamic therapy, based on the combination of functional and volumetric hemodynamic parameters, improves outcome in patients with cardiac surgery. It demonstrates for the first time that a goal-directed hemodynamic therapy initialized immediately before surgery and continued throughout ICU treatment using CI, SVV, and an individualized optGEDI as primary targets led to a clinically significant reduction in postoperative complications.

Summary

- In specialized centers, mortality after elective cardiac surgery is known to be low. However, postoperative complications, such as bleeding, cardiovascular, gastrointestinal, or renal impairment, neurological deficits, infections, or disturbances in wound healing often cause protracted need for intensive care treatment and hospital stay.
- There is an increasing evidence of early optimization of cardiac output, and thus organ blood flow contributes to a reduction in postoperative complications. A concept based on preload and cardiac output optimization commenced during cardiac surgery reduces vasopressor and catecholamine support, and patients meet ICU discharge criteria earlier and ICU discharge time was reduced.
- In high-risk surgical patients, hemodynamic optimization oriented on goals to maintain and improve tissue oxygenation improves outcome. SVV was used to optimize cardiac preload: volume loading was performed as long as SVV remained more than 10%.
- If CI was less than 2.0 l·min−1·m−2 after preload optimization, catecholamine support with epinephrine was initiated. Heart rate (HR) was kept between 50 and 110 beats/min by epicardial pacing, pharmacological intervention, and increase in hemoglobin concentration or deepening of anesthesia when necessary.
- Overall, less postoperative complications were observed in the SG compared with the CG (40 vs. 63; P = 0.004).
- Patients in the SG reached the predefined criteria for ICU discharge faster (14.9 ± 6.3 [14.0] h vs. 24.0 ± 28.6 [17.0] h in the CG; P < 0.001) and were also discharged earlier from ICU (SG, 42.0 ± 18.7 [39.0] h vs. CG, 62.9 ± 58.2 [44.0] h; P = 0.018.

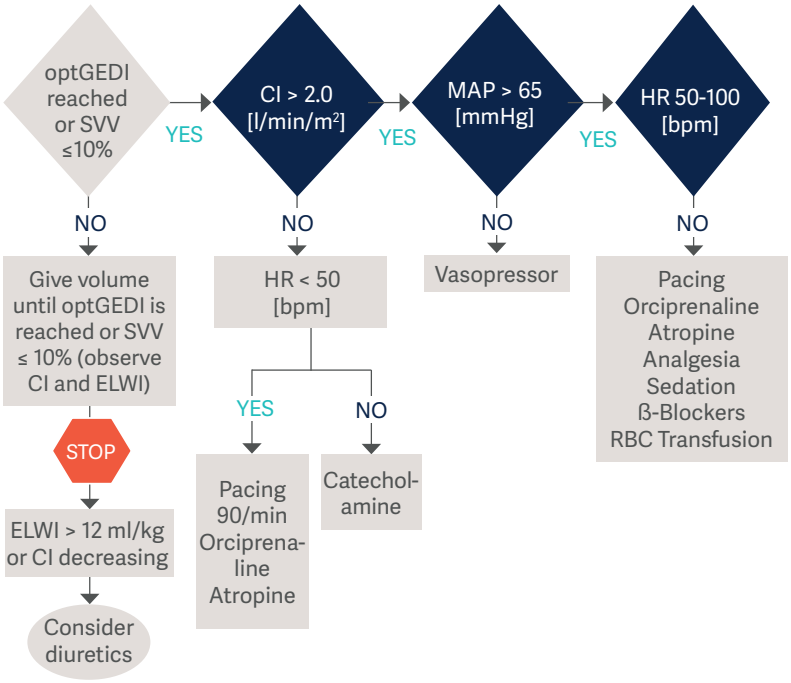

Figure 1. Hemodynamic algorithm for patients of the study group.

CI =	cardiac index;
ELWI =	extravascular volume index;
HR =	heart rate;
MAP =	mean arterial pressure;
optGEDI =	optimal global end-diastolic volume index;
RBC =	erythrocyte concentrate;
SVV =	stroke volume variation.

Discussion

A statistically significant effect in achieving ICU and hospital discharge criteria, and time to real ICU discharge was observed in the per protocol and ITT collective. Both from perioperative and intensive care medicine it becomes obvious that the implementation of a treatment algorithm and early follow-up of adequate goals lead to improvement of care.

Key takeaways:

- The fundamental cornerstone of hemodynamic optimization represents optimization of cardiac preload. So-called functional parameters of preload, SVV, or pulse pressure variation, allow individual titration of the patients' optimal preload.
- Combining the use of a functional parameter of volume responsiveness (SVV) during the perioperative phase of preload optimization, and postoperatively by using the patients' individualized optGEDI, leads to improved hemodynamics and results in less postoperative complications, facilitating earlier discharge from the ICU.

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