Hemoadsorption Is Safe During Cardiac Surgery – But Does It Improve Outcomes?

Matthew C. Henn, MD, and Marc R. Moon, MD

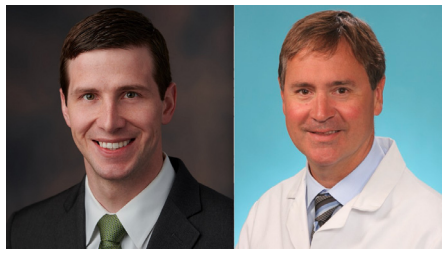
The Achilles heel of complex cardiac surgery has long been the deleterious effects of prolonged cardiopulmonary bypass characterized by the cascade of hemolysis, release of plasma-free hemoglobin, activation of inflammatory mediators, and end organ dysfunction. The holy grail of research in this subject would be to find something able to mitigate or eliminate the mediators responsible for these potentially catastrophic downstream effects of prolonged cardiopulmonary bypass. Gleason et al[1] have eloquently explored the use of hemoadsorption technology specifically designed to reduce plasma-free hemoglobin during prolonged cardiopulmonary bypass in a multicenter, randomized control trial.

The hemoadsorption technology called CytoSorb consists of a cartridge of highly porous polymer beads that absorb cytokines and is placed in parallel to the cardiopulmonary bypass circuit. While this technology has been approved in Europe and has been used in more than 4000 cardiac cases,[2–6] this is the first randomized, control trial evaluating the safety and performance of dual cartridges of CytoSorb when used intraoperatively during cardiopulmonary bypass in patients undergoing complex cardiac surgery. The main novelty of this study was the inclusion criteria targeting patients undergoing complex cardiac operations with expected cardiopulmonary bypass times of ≥3 hours. The principle findings of the study are that CytoSorb was safe and effective in reducing concentrations of plasma-free hemoglobin and activated complement in this population, which will certainly pave the way for future clinical studies aimed at the clinical significance of this finding and potential approval for clinical use in the United States.

The clear strengths of the study are the study design including the ideal study population who would potentially glean the most benefit from such technology and randomization, which virtually eliminated any selection bias. Further, the main objective of the study, which was to evaluate the safety of using dual cartridges, was clearly met by demonstrating no difference in major adverse events between the study population and control population.

Several serious limitations of the study are the limited ability to draw major, clinically significant conclusions. With a very small study population including only 23 patients in each arm, the study was not powered to detect clinical differences between populations. The study also included a wide variety of procedures across multiple institutions that have potentially significant variability in standard of care. Last, the study methodology limited the addition of CytoSorb to the circuit until 1 hour after the patient went on cardiopulmonary bypass. The study found that complement activated rapidly after the initiation of bypass, but CytoSorb contributed to significant reductions in activated complement. This suggests that potentially CytoSorb should be utilized at the outset of cardiopulmonary bypass and represents an area for future study.

Despite these limitations, the study clearly shows CytoSorb is safe during complex cardiac surgery and the authors should be commended on a well-designed and well-written manuscript. However, these results highlight the need for further study to determine if hemoadsorption during cardiopulmonary bypass results in better outcomes than the current standard of care.



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Central Message

Hemoadsorption during complex cardiac surgery is safe, but future studies are needed to assess its clinical utility and impact on outcomes.

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REFERENCES

1. Gleason T, Argenziano M, Bavaria J, et al: Hemoadsorption to reduce plasma free hemoglobin during cardiac surgery: Results of REFRESH I pilot study. Semin Thorac Surg 31:783–793, 2019
2. Bernardi M, Rinoesl H, Dragosits K, et al: Effect of hemoadsorption during cardiopulmonary bypass surgery—A blinded, randomized, controlled pilot

https://doi.org/10.1053/j.semtcvs.2019.05.017

study using a novel adsorbent. Crit Care 20:96, 2016. https://doi.org/10.1186/s13054-016-1270-0
3. Born F, Pichlmaier M, Peterss S, et al: Systemic inflammatory response syndrome in heart surgery: New possibilities for treatment through the use of a cytokine adsorber during ECC? Kardiotechnik 2:41–46, 2014
4. Baumann A, Buchwald D, Annecke T, et al: RECCAS—REmoval of Cytokines during CArdiac Surgery: Study protocol for a randomised controlled trial. Trials 17:137, 2016
5. Deppe A, Weber C, Choi Y, et al: Use of cytokine filters in cardiopulmonary bypass machines. (Einsatz eines Zytokinfilters in die Herz-Lungen-Maschine). Z Herz-Thorax-Gefäßchir 30:254–259, 2016
6. Traeger K, Skrabal C, Fischer G, et al: Hemoadsorption treatment of patients with acute infective endocarditis during surgery with cardiopulmonary bypass—A case series. Int J Artif Organs 40:240–249, 2017