Technical Challenges in the Conduct of CPB

There are significant technical challenges that accompany cardiopulmonary bypass (CPB) for cardiac surgery. The traditional goals of CPB are adequate tissue perfusion, organ (brain, heart and kidney) protection as discussed by other panelists, surgeon visibility and no exposure to allogeneic blood products.

Routine technical challenges may be further exasperated by ambitious caregivers who continue to redesign traditional CPB equipment and techniques in the quest to improve, streamline and minimize cardiac surgery procedures and consequences with desire for smaller incisions, less invasive approach, shorter hospital length of stay, and no sternotomy.

The technical challenges that accompany CPB may be listed and your team response to the common challenges may be prospectively planned and practiced. Techniques to study and plan for technical challenges are the Failure Mode and Effect Analysis (FMEA) and authoring evidence-based clinical procedure guidelines to include clinical notes on how to troubleshoot common technical problems for the procedure.

From retrospective surveys and prospective variance reporting, technical challenges during the conduct of CPB have been identified in several categories: inadequate anticoagulation and coagulation disturbances, hemodilution with edema, hypoperfusion, hypotension (low SVR or vasoplegia), inadequate venous return, failure to wean, poor cerebral perfusion, inadequate myocardial protection, inadequate tissue oxygenation, electrical and other equipment-related failures, extended aortic cross-clamping and CPB times, and perfusionist fatigue. Technical challenges during CPB may be described with six sigma statistics. For example, in one recent prospective study 87:1,000 CPB patients met the criteria for vasoplegia at a high rate equal to about 2.8 sigma.

The use of miniature circuits during minimally invasive cardiac surgical procedures has added another dimension of technical challenges. Options for circuit arterial blood patient return and cannulation options for venous return are unique for minimally invasive procedures. Hybrid ascending aorta, aortic arch and descending aortic aneurysm or dissection repairs present unique perfusion-related challenges that require team communication and troubleshooting in a culture of committed safety. Multiple reoperation procedures present unique vascular access challenges that potentially affect end-organ perfusion.

The types of technical challenges and technical incidents that occur during CPB vary with the type of surgical facility and the type of procedures performed at the facility.

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Reference


