Chapter 34
Teamwork in the Cardiac Surgical Operating Room

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Roles/Responsibilities of Cardiac OR Teams

Cardiac Surgery

The cardiac surgery team often includes 1 or 2 primary surgeons (also known as the "attending surgeon(s)") who are assisted by either 1 or 2 operators (known as the "first assistant" or "second assistant"). The primary surgeon is viewed as the "captain" of the team who is board certified in the field of cardiothoracic surgery. His/her main responsibilities include:

- To perform the highly specialized procedure based on his/her technical skills and experience (e.g., perform sternotomy, perform valve repair or replacement, perform the coronary bypass, etc.)
- To communicate effectively with the other OR teams during various aspects of the procedure as needed (e.g., obtaining surgical instruments, inquiring about patient anesthesia, understanding hemodynamics during cardiopulmonary bypass, requesting for surgical implants, etc.)
- To hold each member of the OR team accountable for their roles to ensure patient safety is upheld at all times (e.g., working with perfusion throughout cardiopulmonary bypass).
- To help facilitate patient transitions of care from the OR to the intensive care unit once the procedure is concluded.

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The first or second assistant can be a surgical fellow/resident in training (if at an academic center), or a specialized physician assistant who is trained to assist with various aspects of the procedure (e.g., harvesting of vein conduits for bypass, assisting with groin access for cardiopulmonary bypass). These individuals work closely with the primary surgeon and are familiar with the needs and preferences of the primary surgeon to ensure smooth conduct of the procedure.

Anesthesia

The anesthesia team often includes 1 or 2 primary anesthesiologists (also known as the "attending surgeon(s)") who are assisted by either a resident/fellow in training or nurse anesthetist. Their combined responsibilities include:

- To safely provide adequate anesthesia for the patient during the perioperative period.
- To perform key adjunct procedures (e.g., transesophageal echocardiography) that provide clinical insight and enhance clinical decision-making.
- To work closely with the cardiac surgeon and perfusion team during periods of high cognitive load (e.g., initiation of cardiopulmonary bypass, weaning off bypass, providing systemic heparinization and reversal, etc.)
- To supervise the bypass heart-lung machine to ensure adequate systemic ventilation.
- To assist with the delivery of drugs and medications that prevent arrythmia's or systemic hypotension.
- To assist with the transport of the cardiac surgical patient safely to the cardiac intensive care unit for post procedure recovery.

Perfusion

This team often includes 1 or 2 individuals whose primary responsibility is as follows

- To select patient-specific equipment that will support the cardiopulmonary needs of the patient.
- To operate the heart-lung machine during cardiac surgery that allows regulating blood flow and blood temperature during surgery.
- To coordinate with the cardiac surgery and anesthesia teams regarding the appropriate timing of initiation and weaning off cardiopulmonary bypass.
- To manage metabolic demands of the patient during surgery by analyzing the blood chemistry and making adjustments as needed.
- To deliver drugs (or "cardioplegia") used to arrest the heart to allow the cardiac surgeon to perform the procedure. This allows the surgeon to manage the physi-

ologic demands of the patient under the direction of the surgeon or anesthesiologist.

Nursing

The nursing team remains an essential component of the cardiac OR with several key roles

- To ensure the OR is set up appropriately for the cardiac procedure.
- To coordinate and obtain all surgical supplies (instruments, implants, imaging platforms) that will ensure the smooth conduct of the procedure.
- To assist in patient positioning and transfer to and from the OR table.

Scrub Person

The scrub person plays a huge role in ensuring the smooth conduct of the procedure. Their responsibility include:

- To ensure all surgical instruments are sterile and available for the cardiac surgery team based on a-priori specified surgeon preferences.
- To anticipate the needs of the surgeon during the procedure and provide the correct instruments in the timely fashion.
- Assist in patient positioning before and after the procedure.
- To ensure sterile procedures are followed at all times during the procedure.

Variations in Cognitive Load During Cardiac Surgery

In recent years, the role of human cognition in contributing to errors in complex environments is increasingly recognized across the various teams in the cardiac OR, which is a high-impact complex and dynamic healthcare environment where the majority of human errors leading to preventable patient harm can potentially occur [1]. Cognitive workload, or the level of measurable mental effort put forth by an individual in response to a mental task, varies substantially throughout a particular procedure and can impact the different teams differentially [2]. One recent study, for instance, investigated individual measures of cognitive load over time during cardiopulmonary bypass for various stakeholders (surgeon, anesthesiologist, and perfusionist) [2]. The study found that perceived cognitive load varied throughout the procedure. Furthermore, while on bypass, the anesthesiologists experienced significantly lower levels of perceived cognitive load than both surgeons and perfusionists. Correlational analyses also reveal that perceived cognitive load of both the surgeon

and the team had significant positive associations with bypass length and surgery length. Another novel preliminary study attempted to identify and capture dynamic changes in heart rate variability as a proxy for cognitive workload among perfusionists while operating the cardiopulmonary bypass pump during real-life cardiac surgery [3]. Cognitive workload was at its highest during the time between initiating bypass and clamping the aorta (preclamping phase during bypass), and decreased over the course of the bypass period [3].

The nature, timing, and extent of high cognitive load can also vary substantially across the different cardiac surgical procedures. Thus, the different teams have to mentally train and adopt to the various perioperative circumstances to ensure that patient safety is upheld and individual/team performance is not compromised during periods of cognitive overload. Likewise, the adoption of non-technical skills via simulation-based training to enhance surgical team performance is essential to improve patient safety in OR.

Impact of Preoperative Briefing ("Huddle")

Preoperative briefing or "huddle" remains an essential and proven framework that is designed to promote situation awareness, teamwork, and error prevention especially given the high acuity nature of cardiac surgery [4]. Implementation of surgical safety checklists during preoperative briefing also improves perceptions of surgical safety and facilitates a shared adoption of mental models to provide a safe environment to raise/highlight mutual awareness of any patient safety-related concerns [5]. The shared model also enables an individual to develop a higher level abstraction about the expertise and responsibilities of other team members prior to the surgical incision. This is particularly relevant in the context of high turnover of staff in the OR (e.g., different trainees, new nurses). Overall, this process enhances team closed-loop communication that is essential throughout the surgical procedure.

Promoting a Culture of Safety in the OR

Given the integrated nature of collaboration between the various teams in the cardiac OR, the importance of developing and maintaining a "culture of safety" cannot be over-emphasized given the strong correlation between patient safety climate and patient safety [4]. This concept is common to the commercial aviation industry which have consistently demonstrated the virtue of open communication, and root-cause analyses in a blame-free environment to prevent catastrophic failures [4, 6]. Each team member, rather than the surgeon alone, is expected to play a pivotal role in advocating for patient safety and reducing errors as the stakes are high even though the leadership style of the attending surgeon has a significant impact on the function of the entire OR. Ultimately, although variable, the behavior of the surgical team has a substantial impact on patient outcomes in the context of surgical safety.

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