Team Approach

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Case Vignette

It is approaching the end of the day shift when a nurse informs the intensive care doctor about an excessive loss in the chest drains of a patient that was admitted to the intensive care unit 45 minutes earlier following aortic valve surgery. The unit intensive care doctor, who is busy attending to another patient, instructs the nurse to contact the cardiothoracic surgical registrar (trainee surgical doctor). Instead of calling the registrar who assisted with the case, the nurse contacts the on-call registrar. The on-call registrar is informed that during surgery, there were some concerns raised that the patient was excessively "oozy" despite normal coagulation. This fact was not documented in the surgical operation notes. The on-call registrar assumes that the operating registrar knows about the problem and is at the bed side. The case remains unattended for a further 25 min before the surgical registrar arrives. At this point the chest drain output has increased to an alarming level. The nurse in-charge of the shift escalates the matter to the senior surgeon but there is a confusion about which consultant is on-call and during this delay and the distraction of discussions, the patient progresses to have a cardiac arrest which requires emergency resternotomy.

Why Is It Important?

Cardiac surgery has always required the collaboration of experts, but regardless of this longstanding use of teams, outcomes are not always favorable. It is unreasonable to assume that all adverse outcomes are preventable, but the majority of clinical staff will recognize that avoidable harm does occur.

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The United Kingdom Department of Health's "*An Organisation with a Memory*" published in 2000 [1] and the US Institute of Medicine's report "*To Err Is Human*" published in 1999 [2] both highlighted the frequency with which failures in teamworking and non-technical skills led to adverse outcomes and near misses. Both these national publications have raised awareness internationally of the need for a better understanding, and improved training, in system design and non-technical skills as a method of reducing harm and improving quality. This chapter will discuss the definition of teamwork in the context of adult cardiac surgery and outline the wider topics of system ergonomics and non-technical skills. It will discuss practical ways to improve outcomes through specific interventions to enhance teamworking in your own environment.

Definition of Teamwork

Salas et al. define teamwork as "*a distinguishable set of two or more people who interact, dynamically, independently, and adaptively toward a common and valued goal, who have each been assigned specific roles or functions to perform, and who have a limited lifespan of membership*" [3]. The importance of this definition is twofold: firstly, that the team members must interact and communicate with each other, and secondly that they must share and believe in a common goal.

Contemplate the typical make up of a cardiac surgical team. The knowledge and skills of this team are vast, and it becomes easy to see how having a shared mental model becomes very difficult. The overall goal of a positive patient outcome is likely to be shared, but when specific aims are identified, not everyone's targets are aligned. Consider the common scenario of fluid balance in the post-operative patient. The intensivist may feel that the patient is hypovolemic and requires fluid to optimize cardiac output, while the cardiac surgeon may wish to increase the inotropes to help improve myocardial function. Neither strategy is wrong because fluid management in this patient population can be extremely difficult, and both members want the best for the patient, yet without a shared mental model, conflict arises. This is where non-technical skills really come into play, and it is helpful to look at models of teamworking to understand how to get the performance outcomes desired. Team briefings, handovers, and verbalization of decision-making processes are particularly useful methods of establishing a shared mental model. Rhona Flin, in her seminal text on non-technical skills, "*Safety at the Sharp End*" describes four elements of teamworking: support others, manage conflicts, exchange information, and coordinate activities (Fig. 1.1) [4].

These four elements are the processes that lead to performance outputs, but there are many factors that influence them, for example, leadership, individual attitudes and biases, team structure, culture, available resources, environment, and norms (comfortable unconscious ways of working).

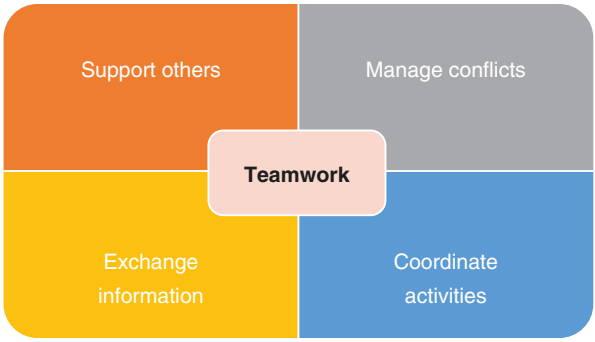

Fig. 1.1 Elements of teamworking

Supporting Others

Team members must pay attention to the workload of others in their team and support them by recognizing cognitive overload and offloading their colleagues when appropriate. Cognitive overload is often sighted as a causative factor in critical incident analysis. It is important to remember that people become overloaded at different levels and in different circumstances. Fatigue, stress, and hunger all affect our ability to work efficiently. It is part of the team's function to identify cognitive overload and allocate adequate resources to optimize performance.

Education of team members is a vital part of providing support. Adequate training in interpretation of routine lab and point of care blood results, resuscitation, and efficient preparation of patients for theater will enhance the care that the bleeding post-cardiac surgery patient receives. Prompt and effective resolution to coagulation problems and optimization of physiology will reduce secondary organ dysfunction.

Social support is also vital to effective teamwork. Individual personalities and attitudes need to be compatible to help develop working relationships, and team members must be open and tolerant of others viewpoints and previous experiences. An open culture and integrity among members will vastly improve the team's performance. Members must take ownership of their tasks and support others in completing theirs. Team members must ensure their own competence to undertake their role; otherwise, credibility is lost and conflict may arise. It was Belbin's conclusion in 1970's that it was the non-technical skills and behaviors that affected outcomes far more than the knowledge or intellect of the team [5]. Belbin went on to describe the nine team roles, which must be fulfilled in order for a team to be successful. Equally the balance of roles was found to be important, with too many members in one role and insufficient of another resulting in less successful teams. The fundamental idea that Belbin highlights is that it is as crucial to understand the strengths and weaknesses of other team members as it is to understand your own and facilitate discussion about it.

Managing Conflict

Perhaps counterintuitively, conflict among team members is vital to ensure creativity and optimum team performance, but this conflict must be managed. Conflict occurs because one section of a team holds behavioral preferences or attitudes which are incompatible with another, or because a mutually desired resource is limited. It is important for individuals to consider the knowledge, skills, and previous experience of other team members prior to embarking on a decision. A useful skill when making complex team decisions is to ask the rest of the team to give reasons why following a particular course or action is not a good idea. As an example, the cardiac surgeon wishing to take a bleeding post-operative patient back to theater for re-exploration could ask, "Give me two reasons why I should NOT take this patient back to theater?" The team is then empowered to offer their mental model of the situation. These perceptions will often deliver new information or a different perspective that had not been anticipated previously, which may or may not influence the situation. Most importantly it also allows the verbalization of the decision-making process, thereby enhancing the whole team's understanding of the situation. In this example team members may announce a newly received abnormal blood result that could be corrected (such as a coagulation deficit or heparin rebound) or ask if administration of an antifibrinolytic has been considered.

Members of any cardiac surgical team will possess overlapping skills and responsibilities, and this can often be a source of conflict. This concept of role blurring, as described by Marino [6, 7], can lead to team member disengagement and bitterness. Providing an opportunity to clarify expectations and renegotiate roles will help reduce this conflict. Junior staff should have a low threshold to raise concerns or discuss arising conflict with senior members of the team. Explicit trigger points and clear escalation pathways are helpful in facilitating this. Senior members of the team should have a willingness to seek external expert help for difficult decisions in complex patients, for example, through second opinions or involvement of other specialties such as hematology. Specialist involvement becomes even more important in patients that have non-cardiac comorbidity.

Dealing with conflict can be difficult. In 1979 Rahim and Bonoma elaborated on 5 previously identified conflict management strategies (Fig. 1.2) [8]. They highlighted the importance of the difference of conflict resolution versus conflict management: Conflict resolution implies elimination of the conflict, whereas conflict management infers that a negotiated and shared understanding is the aim of the conflict handling process. Conflict management, therefore, aims to utilize arising conflict to improve the team's performance rather than eliminate the creativity that conflict can provide to a team.

Managing conflict so that it is a healthy part of the cardiac surgery team requires team members to identify when conflict has arisen by understanding the relationship between their concern for others balanced against their own self-interest. Management of conflict is perhaps best understood through game theory modeling commonly used in economics and psychology. Zero-sum styles, where if someone takes more, someone else has to have an equal amount less (the total resource must

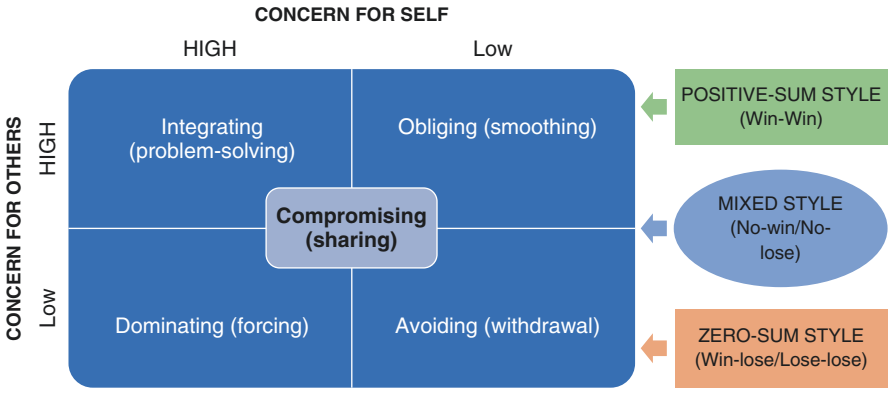

Fig. 1.2 Conflict management styles—replicated with permission from the publisher [8]

always add up to 1), are sometimes useful; for example, when you are certain the other party is incorrect in their assumptions or are unsure your own view point is correct (*forcing or withdrawing styles*). The withdrawing style can also be used when somebody wishes to sacrifice something now for a potential gain in the future. Non-zero sum styles are where both parties involved in the conflict can gain (*problem-solving or smoothing styles*) or where no one loses out (*sharing*).

The teams should have a working knowledge of these when there is a root cause analysis of a return to theater for bleeding to aid or enhance team performance. Such aspects are applicable to all morbidity and mortality analyses.

Exchanging Information

The exchange of information through both verbal and non-verbal means is a fundamental part of teamworking. Communication has the largest impact on clinical safety and outcomes of all the non-technical skills [1, 2, 9–11]. These aspects are demonstrated throughout the management of a patient undergoing cardiothoracic surgery.

Communication failure has been categorized by James Reason (most famous for his Swiss cheese model of organization accident causation) into system failures, message failures, and reception failures [12]. System failures occur when there is no communication between two parties, for example, someone who requires information is not on an e-mail distribution list or has no mobile phone reception. When a patient deteriorates in the night after cardiac surgery the on-call surgeon may be informed but the operating surgeon may be subject to a system failure of communication. In this instance it is possible the operating surgeon has a key piece of information that the on-call team taking the patient back to theater need in order to provide the best outcome. Clear escalation pathways should exist both to minimize conflict and appropriately communicated with all involved parties.

Message failures occur when the transmission is possible but where missing or incorrect information is sent, and *reception failures* occur when the message is misunderstood or do not arrive on time. These failures may be due to: cultural or language barriers, bias or previous experience affecting expectations, emotional state, fatigue and stress, cognitive workload, and physical barriers such as deafness or a noisy environment. Instructing colleagues to order investigations or blood products without explaining the rationale behind these decisions can lead to misinterpretation and message failure. Strong paths of communication from the laboratories and blood bank should be established to ensure rapid and effective communication during time critical bleeding emergencies. This may involve having the bed side presence of laboratory staff to ensure blood products are managed and replenished in a timely manner. Standard operating procedures for the availability, and timely delivery of blood products to the bedside should be robust to allow for times of extraordinary demand. Rhona Flinn describes several methods for improving communication within and between teams, namely, explicitness, timing, assertiveness, and active listening. Some examples are shown in Table 1.1 [4].

Coordination

Good coordination of a team requires three things: effective leadership, a comprehensive shared mental model, and effective communication.

Table 1.1 Methods for improving communication within and between teams, namely, explicitness, timing, assertiveness, and active listening

Method	Rationale	Examples
Explicitness	• Avoids ambiguity • Improves clarity	• Declare responsible individual to liaise with blood bank • Use a succinct message to avoid cognitive overload of receiver
Timing	• Avoids interruptions • Information is given at the relevant time • Reduces distraction and task interruption	• Ensure the surgeon is ready to listen by either waiting for a pause in concentration or draw their attention prior to delivering important information • Deliver the correct information as it is required, for example, state the ACT prior to cannulation of the aorta
Assertiveness	• Avoids passive communication approach • Helps overcome hierarchy	• Use a staged and proportional increase in verbal and non-verbal cues to ensure the message is received
Active listening	• Acknowledges understanding • Consolidates information received	• Avoid completing others sentences • Avoid interruptions during the WHO team brief • Ask questions to clarify ambiguity, for example, to ensure the correct replacement valve is chosen • Paraphrase information to demonstrate understanding

In 2017 the Faculty of Medical Leadership and Management published the *Leadership and Management Standards for Healthcare Teams*, which encompasses four main domains applicable to effective leadership and teamwork [13]. These four domains encompass culture, vision and strategy, management, and people and relationships. This document provides some fundamental principles about how to effectively coordinate a high functioning team and allow it to control variance, improve quality, and enhance the shared mental model. The faculty also produces a self-assessment tool for healthcare teams which allows teams to reflect on their collective performance and quickly identify areas of strength or improvement goals [14].

Leadership requires many skills including the use of assertiveness, providing and maintaining standards, planning and prioritization, and managing workload and resources [4]. Some decisions are rule-based and simple to implement, for example, delivering defibrillation. These rule-based decisions are useful for life-threatening emergencies, but under stress or unfamiliar circumstances can be incorrectly applied or fail to consider other factors which require thought and understanding. Junior rotational staff are likely to be familiar with the standard adult resuscitation guidelines but may not be aware of the alterations made to these guidelines in the management of the post-cardiac surgery patient. Training and education in cardiac advance life support for all staff will improve coordination among team members who, during an emergency, will have a common understanding of the management pathway. The common language used as part of adult cardiac life support training will allow rapid and coordinated escalation to resternotomy when required in an exsanguinating patient.

The majority of decisions that are made by teams, however, are not dire emergencies and there is usually a minimum of a few minutes to think. This is where models or tools can improve the decision-making process and facilitate the best choice of action with the resources and time available. One example of a decision-making tool for more complex decisions is t-DODAR (see Table 1.2), an

Table 1.2 The t-DODAR system, a decision-making tool for more complex decisions

	Task	Description
t	Time	Assess how much time is available to reach the decision
D	Diagnose	Consider possible diagnoses and avoid confirmation bias by asking the other team members what they feel the diagnosis is rather than asking for confirmation of your own diagnosis
O	Options	Consider the options available to manage the situation given the time and resources available and the diagnosis
D	Decide	The team leader needs to lead on making a decision and get agreement from the team. If agreement cannot be found the team leader is responsible for explaining their decision choice to the team. If the team feel the decision is dangerous they must clearly communicate this
A	Assign Tasks	Assign roles to team members to facilitate the plan that has been made
R	Review	Undertake frequent reviews until the task is complete to allow changes to be made to the plan and to maintain situational awareness

acronym taught to airline pilots, but applicable to cardiac surgery [15]. It provides a framework to help reduce cognitive biases and encourages a team approach to decision-making.

Within cardiac surgery the team leader will vary depending on the situation. In the theater environment the team leader is often a senior member of the nursing team, who has the expertise to coordinate the team's activities, liaise with external departments, and promote a positive culture within the operating theater. It is the team leader's role to help ensure a shared mental model. For example, during the World Health Organization's team brief they will need to collaborate with the whole team in order to ensure that the operating surgeon, anesthesiologist, perfusionist, and scrub team have the opportunity to vocalize their plans and any anticipated risks for the cases that day. It is vital to avoid planning, briefing, and checklists during periods of high stress and workload as the risks of error increase. It is also extremely difficult for the theater team to function effectively if the individual members do not understand why particular aspects of patient care might deviate from expectation. A team with a shared mental model will have a far better ability to adapt to unanticipated events, by behaving in a more appropriate and predictable fashion.

During critical incidents the leadership role may move toward another member of the team. For example, on intensive care it may be the consultant anesthesiologist or lead intensive care nurse. These individuals are likely to have better situational awareness and can help to reduce the surgeon and nursing team's cognitive load and allow then to focus on their allocated roles and tasks.

Improving Teamwork in Cardiac Surgery

James Reason classifies the factors leading to medical errors as: team factors, task factors, situational factors, and organization factors [16].

Team Factors

In healthcare teams often come together for only short periods of time. The team will be made up of individuals with very specific skill sets, performing a specific task, but the people performing these skills may vary from day-to-day. This has its own challenges, but having standardized ways of working, a robust education program and ensuring closed-loop communication will improve performance. The behaviors and attitudes that team members need to develop include adaptability, sharing situational awareness, coordination, and communication. Introducing briefings and simulations to prepare for common or serious cardiac surgical emergencies (for example, advanced cardiac life support, massive hemorrhage, expedient return to bypass or resternotomy) improves teamworking. Team members checking and communicating with each other during periods of high workload heightens alertness

Table 1.3 Situational awareness levels

Level	Description	Example
Perception	Perception of data and the environment	Looking at the monitor and noticing the blood pressure is very low and the chest drain output has been minimal for the past hour when previously it had been high
Comprehension	Comprehension of the meaning and significance of the data relevant to the situation	Recognizing that this could be cardiac tamponade and needs immediate action
Projection	Perception and anticipation of future states and events	Anticipate that the patient may require blood products or need to return to theater urgently

and improves situational awareness, ensuring not just perception, but comprehension and projection (Table 1.3).

Task Factors

Taskwork reflects the skills and behaviors that team members must have in order to complete their role. Recognizing and adjusting tasks that are susceptible to failure, misinterpretation, or repeated errors are crucial steps in mitigating risk. For example, instead of someone copying down blood tests results into the medical records, which is prone to transcription error, redesign the task to mitigate this. For instance, ensuring the order in which the tests are listed on the pro forma mimics the sequence of the results as shown on the screen or the development of an electronic system which would negate the need for transcription. This might be pertinent to the perfusionist or anesthesiologist documenting blood gas results in theater.

Cross training is also a useful way to promoting better teamworking. This is where a team member shadows or undertakes another team member's role to improve their understanding of others roles and responsibilities. For example, the critical care nurse may spend time in theater with the scrub nurse and surgeon to help understand the process of resternotomy.

Situational Factors

During his research Reason identified situational factors that most commonly led to error. These included unfamiliarity with the task, time limitation, poor human–system interface, misunderstanding of the task, and inadequate checking. Many of these can be avoided with engaged briefings, and adequate staffing and resources. Ensuring effective handover between shifts by reducing cognitive overload and utilizing electronic or written communication tools will benefit the team and the patient. Task training either through supervised activity or simulation should be offered to all those staff who may be working as part of the team to ensure familiarity with common and critical tasks. Other factors such as sleep disturbance, a hostile

environment (both psychologically such as aggression, and physically such as too hot), and boredom also contribute to an increase in risk. The case that comes out of theater shortly before a change of staff is particularly prone to adverse outcomes if handover is not robust.

Organizational Factors

The development of a positive culture for incident and excellence reporting will allow improved teamworking and should focus on learning from previous system failures and successes rather than apportioning blame to individuals. A contemporary, candid, and multidisciplinary clinical governance program will be fundamental to any cardiac surgery center looking to deliver safe and quality patient care. Encouraging the team to embrace diversity, listen to other's thoughts, and value different perspectives will all be developed through promoting an open organizational culture. Improvements in quality and safety through meaningful audit and quality improvement projects will enhance teamworking through development of team self-awareness and interdependence. Participation in research programs and collaborative working between local and national cardiac centers will lead to the sharing of best practice and the development of a dependable evidence base. Enrolment and contribution to national and international registries using appropriate quality indicators should allow early identification of deviations of practice, and rapid resolution of inadequate care, through support and collaboration.

Implications for Daily Practice

In summary, while the expert clinical knowledge and skills shared in this book are fundamental to the management of bleeding in the pre-, intra-, and peri-operative periods of cardiac surgery, the non-technical skills underpin the safe, efficient, and quality outcomes that we are all striving to achieve. Improving non-technical skills through effective quality improvement programs and by developing a positive culture to learn, we can develop cardiac services that we can be proud of.

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