

## Short Commentary

# OR and ICU Teams “Running in Parallel” at the End of Surgery to Improve Handoffs

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Handoffs immediately following cardiothoracic surgery (CTS) involve the transfer of the patient and patient information between the teams working in the operating room (OR) and the intensive care unit (ICU) [1]. This process is important for patient safety yet it is often characterized by poor communication and teamwork [2,3]. OR-ICU handoffs that are weak increase the risk for incorrect treatment plans, diagnostic delays, and morbidity [4,5]. The main mechanism through which poor handoffs cause these problems is by hindering the process of situational awareness. Situational awareness is critical for safety in the face of any potentially hazardous activity but often misunderstood. The concept is best explained using a metaphor. Imagine that you are alone and walking in the woods on a beautiful sunny day. You have a map which indicates that there is a lake off the trail you are taking so you decide to veer off the beaten path. The weather is perfect with occasional bright beams of sunlight peaking through the dense forest. There are no bugs or any other wildlife to bother you other than an amazing golden eagle flying in the trees above. You continue to walk towards where you think the lake is while keeping your attention towards the incredible bird in the sky. Eventually, it flies out of view. Now you look down and start to realize that you are a considerable distance away from the trail you left and there is no lake in sight. On your left and right, in front and behind, for as far as you can see are nothing but trees. It is hard to recall exactly from which direction you have been walking. You are undeniably lost in the woods. Any experienced cardiac surgical team has had the analogous situation happen in the ICU after a patient hand-off. Consider the team that has just finished a challenging heart operation in which the patient developed a new heart block being treated by temporary epicardial pacing. The case was full of crucial steps and key moments in which everyone had to be at maximal concentration in order to complete their tasks successfully. Once the case was over, there is a tremendous relief among team members that the patient escaped without harm. As per the routine, the surgeon leaves the OR and the anesthesiologist gets the lines and tubes ready for transfer to the ICU. Others in this room read the cues as if they were in a beautiful sunny forest with no bugs where nothing bad could happen. Then, right after transfer to the ICU, the arterial line shows a flat line. The first and most obvious reaction is to think the arterial line is not working. It is. No reasonable explanations come to mind how such a sharp downward turn of events could happen. At this moment, the team starts CPR and

has become lost in the woods. No one employs the simple solution: reconnect the dislodged pacemaker cable. In both scenarios, the culprit was losing situational awareness. This means that perceptions about what was going on did not line up with reality. The reality is that almost all major problems are preceded by warning signs. If there was a lake just a few hundred yards off of the trail, it would not have been hard to find the way back. But there was neither a lake where it was expected nor sufficient awareness of the direction that was being taken to be able to get back easily. Similarly, if anyone in the OR team had maintained continued vigilance about the predictable problems that occur with pacing during transport, they would have picked up on several (probably not so subtle) signs that the patient was headed towards a crash.

Getting lost occurs the way that Ernest Hemingway describes going bankrupt: gradually, then suddenly (“A Sun Also Rises”). The trick in the ICU is to prevent problems or to steer things back on track during the gradual stage before it's too late. A more accurate map, GPS device and/or compass are to the hiker are what better processes for the ICU-OR handoff are to the cardiac surgical team. Several groups have targeted the OR-ICU handoff using various techniques including standardized checklists and structured protocols to improve communication and facilitate the required tasks. Interventions have been modeled after pit stops in a Formula 1 race [1] or on checklists based on process improvement techniques from the finance industry [3]. They have led to improvements in handoff effectiveness, as measured by decreased technical errors, fewer interruptions, and improvements in communication. Some showed clinical outcomes such as reductions in postoperative hemodynamic and respiratory complications and earlier extubation times [6,7]. Many of these positive results have not been reproduced at other institutions. An unstated assumption of current thinking about the OR-ICU handoff is that it must fit within the limited time that the two teams are together in the ICU after transporting the patient out of the OR, which at our institution is usually <10 minutes. This approach overlooks the fact that the final part of surgery (e.g. while weaning cardiopulmonary bypass and securing hemostasis) often predicts the patient's early course in the ICU but can be hard to appreciate without first-hand observation. In addition, an increasing number of teams have adopted the OR checklist protocol mandated by the World Health Organization (WHO) which includes a debrief at the end of the case while still in

the OR to review intraoperative events. The rationale for this debrief is to improve situational awareness about those key events and predict how that might influence the postoperative course. For these reasons, a handoff limited only to the ICU and not in the OR represents a lost opportunity to gain better situational awareness and improve patient outcomes. Our institution tested a novel handoff method between the OR and ICU teams: face-to-face while the patient was still in the OR [1]. We asked the ICU team members to be present in the OR with approximately 30 minutes remaining in a surgical case. Once in the OR, the ICU nurse and intensivist would receive a handoff from the circulating nurse and then directly seek out relevant information in real time during their 30-minute observation period (e.g. findings of the intraoperative echo, responses to inotropes/vasopressors, cerebral oximetry tracing during the case, amount of blood products given, need for pacing). Finally, the ICU nurse and intensivist would participate in the end-of-case debrief discussions with the surgeons, anesthesiologists, perfusionists, and OR staff and then help transport the patient to the ICU.

Our rationale for proposing this protocol is best explained using the metaphor of a relay race. An OR-ICU handoff that happens face-to-face only in the ICU – the status quo method – is analogous to a relay race with the sprinters coming to a complete stop prior to passing the baton. Indeed, prior authors have used the model of a Formula 1 pit crew to illustrate the need for a quick and abrupt stop prior to the handoff. Our novel method is more consistent with what is done in an actual relay race. The transition includes a period of “running in parallel” that hopefully enables the sprinter receiving the baton to reach full speed more efficiently. High reliability organizations (i.e. the crews in nuclear power plants, airplanes and aircraft carriers) are faced with situations every day that despite everyone’s best efforts can suddenly get out of control. For these teams, 99% prevention is not enough. Their survival depends on well-established plans for resolving the other 1% of the cases. Fortunately, others that have gotten lost in the woods have come up with effective strategies that can be taught and learned. Experienced hikers that get lost know that staying frozen in your tracks is not usually an effective way to get out of trouble. Often

the best way to tell where you are is to start walking somewhere else, ideally the high ground. From that vantage point it is easier to pick up on important landmarks that let you know where you are. If this is not helpful, a good general rule is to start moving downhill while keeping careful attention to the exact path that is taken. The surgical team that gets lost is also helped by having clear protocols ahead of time for what to do and who is responsible for doing it. Our novel handoff structure better enables the team to stake out “high ground” by sharing all the complex, time-sensitive information that is critical for decision making on arrival to the ICU. These data enable the ICU team to walk downhill by agreeing to a tentative diagnosis about what happened even as further diagnostic testing is being obtained. They carefully mark their trail by re-evaluating their initial diagnosis based on how the patient responds to specific treatments. In the end, changing old habits is hard. However, we hope that improving our handoffs will build the type of program where we would allow our patients to have surgery.

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