CUTTING OFF THE LIZARD'S TAIL IN SURGERY

To the Editor:

We recently read with interest the article by Hickey and colleagues.¹

The aviation versus surgery debate is currently framed on the understanding, and possibly replication, of flight team dynamics that led to the outstanding record of safety currently enjoyed by commercial aviation (fatal accident rate of 0.06 per million flights or 1 fatal accident for every 16 million flights, well beyond 6 sigma²).

An aspect that is perhaps not fully appreciated in the current debate is the role of air traffic management (ATM) and the way it operates and contributes to safety. ATM operators face the critical task of managing the course of multiple aircrafts within an assigned sector, with the primary objective of avoiding mid-air collisions. The pilots are therefore relieved from this critical task. ATM vigilance requires variable degrees of mental workload. Variables affecting the workload are well understood and include (1) routine actions (eg, acknowledging aircraft entering and exiting the assigned air-space, issue course variations due to weather conditions or other phenomena) and (2) actions required to solve high-risk situations in which there is a potential risk of air collision, with the latter being the most dangerous in terms of outcome as well as the most resource-consuming for the operators. Sector capacities (ie, maximum allowed number of aircraft passing through a sector per hour) are not enough to ensure a sector is safely managed. As a matter of fact, workload is not experienced per hour by controllers. On the contrary, high-workload peaks manifest themselves in much smaller time frames. Therefore, defining a threshold for maximum ATM controller workload is essential to avoid cognitive overload, degradation of performance, and escalation of risk. A recent article by Obbens and Bezemer³ discussed the features of a new ATM Workload Model currently used at the Amsterdam Schiphol airport in The Netherlands. Workload modeling (based on Instantaneous Self-Assessment scores) determines a universal maximum workload threshold for operators of the concerned air traffic sectors, thus allowing for better decision making at the management level

(eg, how to staff sectors, how to manage the overall division of the air space). The benefits are better resource management, better traffic flow management, and improved safety.

A real-time workload monitoring of the surgeon and team members during complex procedural care would allow for better understanding of the complexities of the scenarios and thus provide a more solid ground for decisions concerning task prioritization.^{4,5} Pilots, air traffic controllers, and surgical teams all need to strategically reorganize their task list during periods of high cognitive load to maintain peak performance. They should be able to treat tasks like elastic springs, reduce the essential ones to the bare minimum, and completely omit those that they do not consider mission-critical, just as a lizard that “elects” to lose its tail when feeling threatened. This “task shedding” would allow members of the surgical team to get the job done when the task load suddenly increases and minimize potential for harm. Surgical teams should be trained on how to make these decisions under stress, something that, as pointed by Hickey and colleagues,¹ is not currently part of the standard training. Tools like air traffic control workload model may provide valuable information on how to succeed in this quest.

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WHEN AN ANALOGY HAS REACHED THE EXTENT OF ITS USEFULNESS

Reply to the Editor:

Zenati has suggested that the application of the lessons and techniques of aviation safety to the operating room has overlooked an important component of the safety culture in the airline industry, that of the role of air traffic management.¹ Although he is correct that this level of management was not discussed by Hickey and colleagues,² the notion that there is an operating room analogy for pilots being relieved of a critical task (managing the course of multiple aircraft within an assigned sector) is a stretch, unless Zenati is alluding to the situation in which a single surgeon is involved in multiple operations simultaneously. In contemplating the hundreds of steps of any cardiac surgical procedure, and the infinite anatomic variants that characterize surgical pediatric cardiac diagnoses in particular, it is difficult to think of an echelon of decision making that could be “shed” or assigned to someone other than the principal operator in real time. The situational awareness required in a pediatric cardiac surgical operating room has some similarities to that of a cockpit, but also critical differences. Although surgery task load evaluation is evolving and may lead to some helpful algorithms, virtually all the flow in the operating room must be planned and executed by the expert operating surgeon. One of the most important lessons imprinted by cardiac surgical mentors during the apprenticeship of congenital surgery fellowship is how to sequence surgery, creating a flow to the operation with natural phases, allowing intermittent pauses for rethinking and analyzing. Included in surgical flow is the concept that when there is an unexpected finding, a problem, or a challenge, a skilled surgeon must slow down and carefully analyze the situation, resisting an innate impulse to increase the speed of operating to solve the problem as quickly as possible. Although this may be an example of workload alteration to which Zenati was alluding, the more experienced the surgeon, the more he or she actually interacts with different components of the

operative environment (looking at monitors, hearing alarms, reminding other team members of potential upcoming challenges or tasks). This is actually the inverse of the “task shedding” that has been suggested.

The preoperative planning process may be an area in which advance decision making can relieve the intraoperative mental workload somewhat. In an analogy with aviation, the surgeon could, in effect, file a flight plan. For example, in our program (as in most), preoperative planning includes a full presentation of the case in a multidisciplinary conference 1 week before the scheduled operation. This case presentation allows full review of the clinical presentation and preoperative imaging and workup and hearty team debate and discussion, resulting in consensus regarding operative goals and risks. We have also adopted a new practice of disseminating a preoperative e-mail that is composed by the attending surgeon and distributed to all health care providers in the heart program. The preoperative e-mail outlines the salient preoperative anatomy, physiology, and comorbidities, followed by a reasonably detailed review of the planned perfusion and operative strategies. This practice has been shown to reduce crossclamp times, even in the hands of surgeons with significant personal operating experience (J. S. Tweddell, personal communication, June 2017), suggesting that there has been some streamlining of intraoperative decision making afforded during the process of composing the preoperative email. Further discussion of mitigating threats or errors in the operative context might be more helpfully conducted without adding to the already complex analogy with the aviation industry model.

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