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Learning From Others: A Case Report from the Anesthesia Incident Reporting System

Case 2021-10: Situational Awareness

A 48-year-old man is undergoing primary resection of a large meningioma involving the anterior cranial fossa and possibly middle cranial fossa. At the teamsteps briefing, the surgeon mentions that he wants a lumbar spinal drain.

After an uneventful induction, the patient is placed left side down for placement of a lumbar CSF drain. After 30 minutes of failed attempts to insert the drain, the neurosurgery resident asks the attending anesthesiologist to assist. The anesthesiologist places the drain on the second attempt, using a right lateral approach at a level which he believes to be L4-5.

After return to the supine position and placement of Mayfield type pins and final positioning, the surgery proceeds. Ninety minutes into the procedure, the surgeon asks that 50 ml of CSF be drained. The anesthesiologist had tested the drainage system earlier. Now, CSF drained at the rate of 1 drop every "several" seconds. He makes a mental note to monitor this by watching the level drained in the appropriate chamber. At this point, the research nurse asks that "5 red top tubes be drawn." After doing this, the anesthesiologist gave the times to the nurse and caught up on charting. When he next directs attention to the draining CSF, which he forgot about, 200 ml of CSF were in the bag.

The surgeons were informed. After completion of surgery, the patient underwent a CT scan while still intubated. It showed no hematomas, fluid accumulations, or unexpected shifts of intracranial contents. The patient went to the ICU where he awoke and was extubated. Thirty minutes later, he demonstrated a normal neurologic exam for a worried surgeon. The patient recovered well.

The anesthesiologist presented the case at the departmental QA meeting. The consensus of the department was that the anesthesiologist was guilty of a failure of situational awareness.

The unintended, rapid loss of a significant fraction of a patient's CSF is the most feared complication of closed CSF spinal drainage. It can lead to anatomic injury, including shift of intracranial contents, especially the cerebellum (*Neurology* 2004;62:157). Intracranial hemorrhages can also happen. The pathophysiologic aspects of this mishap will have to wait for another discussion. The patient had a favorable outcome, but this cannot be considered a near-miss: the mistake absolutely reached the patient even though it did not cause significant harm.

This case has been chosen to further explore and understand human cognition. The reporting department, via its QA process, came to the conclusion that this was a lack of situational awareness. While this explanation implies the anesthesiologist became distracted, we believe the root cause is different. The department may have missed an opportunity to acknowledge the second victim, help this anesthesiologist learn from this case, and improve his or her practice. This is an excellent example of a human factors issue.

Prospective memory (PM) is defined as *the formation and implementation of future-intended actions*, such as remembering what needs to be done later (*Wiley Interdiscip Rev Cogn Sci* 2016;7:294-316). In this case, we have an excellent example of potential harm from failed prospective memory in which actual memory was irrelevant. A failure of memory would be if the doctor turned his attention to the patient a few minutes later, knew he had something to do but could not remember what. Had that been the problem, he could at least have done a survey of the patient and his issues and probably found the problem and rectified it.

The anesthesiologist did not monitor the patient wondering, "Now what was it I was supposed to be doing?" The second he or she turned attention to the drain, the anesthesiologist knew exactly what the issue was and likely experienced a "pit in the stomach" feeling, as we all would. The failure in this event emanated from attention dynamics, not memory.

In the context of clinical care, prospective memory typically involves a task. There are four components:

1. A task is planned
2. The task will be necessary in the future and cannot be done immediately
3. Other tasks and distractions will supervene as soon as the task is planned
4. There is nothing in the environment to remind the individual when the time to do the task is imminent.

Many of us would add a fifth requirement not often seen in the literature:

5. The individual has the belief that he or she will "remember" to do the task at the right time. If not, she would have set an alarm or a timer to trigger doing the task.

Are humans competent at tasks involving prospective memory? The fact that all of us can recall a personal failure of prospective memory indicates that we are not. There certainly are times when we very effectively complete tasks that require prospective memory, but we fail as often as we succeed. In humans, the study of cognitive bias shows that context is everything, and humans may not be well equipped to execute these tasks reliably (*Public Relations Review* 2007;33:135-9; *J Gerontol B Psychol Sci Soc Sci* 2002;57:P312-23; *European Journal of Social Psychology* 1990;20:311-35). That is a significant issue in a specialty that strives for "high reliability." If we accept that our cognitive processes do not ensure that we are competent at PM, the next question is: can we compensate?

The preventive strategies for failure of PM can be gleaned from the above definition. The first would relate to point #4, that nothing in the environment reminds you to do the task. A reminder can be set in the automated anesthesia record. The circulating nurse can be asked to check back if we accomplished the task by a certain time. Watches and smartphones can be set to remind us.

Here is an example: You are performing I.V. anesthesia with propofol and you decide based on decreasing arterial pressure and apnea that your patient has received more than enough propofol for adequate depth of anesthesia. You set the infusion at zero, fully expecting to turn it on after a short break. This is a failure of PM, but in this case, the "error" of not turning on the infusion will never reach the patient and will not cause harm. All I.V. pumps approved by the FDA will alarm when a previously running pump is set at zero for two minutes, a time period that almost always will not result in harm.

For point #5 – thinking we have an ability that we reliably do not – refers to the recommendations of the Institute of Medicine report, soon to be older than some of our residents. An important recommendation was to recognize where human weaknesses make safety episodes more likely to occur. The salient point is that one of the best ways to ensure that patient safety accidents repeat themselves is to address the error by saying "It's O.K., just be more careful next time." Almost always, the anesthesiologist was acting vigilantly and yet had an incident.

Regarding #3, you can't avoid distractions, especially in a busy OR. While reducing distractions may allow for a reduction in errors, and is an important intervention, one person's distraction is another's immediate need. Strategies to function in a distracting environment are necessary to avoid the error.

For point #2 – the task will be necessary but can't be done now – we can ask, "Can this be done now rather than later?" and execute on it immediately, but in many cases a delay is clinically necessary.

And finally, point #1. If someone is trying to give a task that meets the criteria for a PM error, and it's something anyone can do, ask that somebody else be assigned the task and explain why. That said, the other individual may be just as prone to distractions and forgetfulness as the first person. Therefore, focusing the other person on the task may be necessary: "Would you watch this CSF dripping and turn the stopcock to 'off' when the total drained reaches 50 ml? You can direct all your attention to this task, I will focus on the other tasks to prepare the patient for surgery." This is particularly helpful in a care team model.

Why did the department conclude that this error was a failure in situational awareness? It is understandable why they would have made this determination. Sarter and Woods define situational awareness as "the accessibility of a comprehensive and coherent situation representation which is continuously being updated in accordance with the results of recurrent situation assessments" (*Int J Aviat Psychol* 1991;1). Situational awareness is certainly a necessary skill in the OR and needs to be part of the training and education for our learners.

However, this was a lapse in prospective memory, and the methods to prevent this type of error are different than loss of situational awareness. Examples of how to prevent this error are: setting a timer, asking another person to focus on the trigger and task, or using the automated anesthesia record to prompt us.

Understanding when prospective memory will be required can help us avert the next potential disaster. The next time you think to yourself, "I need to remember to complete this task in the future," consider what might trigger you to do it and what will happen if you don't. After all, we are humans, held to an expectation of perfection – and that is not a realistic expectation at all. ■

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