Study looks to flag awareness in anaesthetized patients

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For every 1,000 patients undergoing surgery and receiving general anaesthesia, one or two will wake up during the procedure, unable to move, speak or otherwise indicate to doctors they are conscious and aware of what is happening.

Western researchers who have already established consciousness in individuals believed to be in an unresponsive vegetative state are now approaching anaesthetized patients with similar inferences, hoping to find ways to better detect surgical consciousness and minimize the harm of this nightmare, when it does occur.

Mackenzie Graham, a postdoctoral fellow with Western's Rotman Institute of Philosophy and the Brain and Mind Institute (BMI), recently published a paper with Lorina Naci, a former postdoctoral fellow with BMI, looking at possible methods of detecting consciousness in anaesthetized patients and ways to mitigate trauma and harm when they do wake during a surgical procedure, unable to communicate their consciousness to medical staff.

"With vegetative patients, the way we determine they are vegetative is with behavioural tests at the bedside. We see if they respond to stimuli. If they don't, they get a diagnosis as vegetative. But as (Western Psychology professor Adrian Owen's) research on vegetative patients has shown, 17-19 per cent who can't respond behaviourally at the bedside, can do mental imagery in fMRI," Graham said, noting this is one way researchers have been able to detect consciousness in vegetative patients.

Owen and Naci, now a professor of psychology at Trinity College, have likewise detected consciousness in vegetative patients by showing clips from a movie. While inside the fMRI scanner at Western's Centre for Functional and Metabolic Mapping, participants watched a short film by Alfred Hitchcock and saw that movie viewing elicited a common pattern of synchronized brain activity. A long-time unresponsive participant's brain response during the same movie strongly resembled that of the healthy participants, suggesting not only was he consciously aware, but also he understood the movie.

But these methods cannot be used to test consciousness in anaesthetized patients. These patients cannot demonstrate consciousness to medical staff and, when that awareness occurs in the middle of a surgical procedure, it can be a nightmare.

The parallel between vegetative patients and anaesthetized patients spurred his and Naci's recent work, Graham explained.

"There's a connection between anaesthetised patients and vegetative patients, namely that both of them are behaviourally unresponsive and appear to be unconscious, but in both cases, they may not be," he said.

"Anaesthesia patients don't move; we presume they are unconscious, but as many as 1-in-1,000, or more, are actually aware when they are receiving anaesthesia," he added.

Graham and Naci set out to explore methods that could detect consciousness in those undergoing surgery with a general anaesthetic, hoping also to extrapolate some lessons they learned from vegetative patients about minimizing harm, only in an anaesthesia context, Graham explained.

There are monitors that measure brain activity of anaesthetized patients,

much like an fMRI is used to measure the brain activity of a vegetative patient. These monitors translate how deeply a patient is anaesthetized into a single number, ranging from 100 (wide awake) to 0 (no brain activity whatsoever). The "sweet spot" for anaesthesia is between 40-60, Graham said.

But these monitors and the data they provide are not well-researched. There are large studies that indicate patients report awareness even in this "sweet spot."

"Anaesthesia awareness is hard to detect because patients usually are paralyzed, so they can't move. Brain monitors aren't 100 per cent. What can we do to minimize harm in patients who do experience awareness, given that we can't prevent it totally?" Graham asked.

Their paper emphasises a need for appropriate pain management – a lesson taken from previous studies with vegetative patients. There is also a need for patient communication, when awareness is suspected.

"Rather than just addressing the problem, talking the patients through what's going on when they wake up might manage distress. They are confused; they don't know what's going on and they might be trying to signal they are awake but might not succeed. There's a lot of research to indicate that pain and level of distress these patients experience is tied to long-term negative sequoia, like post-traumatic stress disorder," he explained.

"Managing anxiety levels in patients while this is happening can help reduce the harm – while it's happening and long term. Because we've learned that patient communication is important in the vegetative context, even though they don't look aware or they're not responding, communicating with them could be very beneficial. The same thing is true in the anaesthesia context. We're just applying what we've already

learned to a different population."

But the question of detecting consciousness in anaesthetized patients remains, Graham added. Because brain monitors aren't dependable indicators, and anesthetized patients can't watch movies, he and Naci have partnered on a yet-to-be-published study looking at the possibility of using audio stories to detect consciousness.

Naci has already tested audio-only stories on vegetative patients to determine how brain networks are engaged by the story. The goal is to find a common neural code – a signature – that signals awareness. If this works, surgery patients could wear an EEG hairnet and headphones, and a monitor could indicate the presence of higher level thought or information processing when awareness is present under anaesthesia.

Provided by University of Western Ontario

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