The Use of Cognitive Aid Checklist Leading to Successful Treatment of Malignant Hyperthermia in an Infant Undergoing Cranioplasty

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To the Editor

The journal recently published several articles on implementing emergency manuals and the use of perioperative cognitive aids during emergencies to help translate best practices for patient care during acute events.[1–3] We describe a real life example of the benefits resulting from introduction of one such cognitive aid, *The Emergency Manual*[4,5] into each anesthesia workstation. Informed consent from the parents to publish this report was obtained.

Approximately 1 hour after inhalational induction in a 4-month-old boy undergoing cranioplasty, acute unexplained increases in heart rate (180/min), end-tidal carbon dioxide (62 mm·Hg), and patient temperature from 34°C to 38°C occurred over 5 minutes These physiologic changes were quickly noted as suspicious for malignant hyperthermia (MH), and the now readily available *The Emergency Manual* was referenced and utilized as a cognitive aid in quickly treating the patient. Dantrolene 2.5 mg/kg IV was administered, and the Malignant Hyperthermia Association of the United States hotline was concurrently contacted for assistance. Cooling measures were instituted, and blood samples were sent for arterial blood gases, lactate, and coagulation profile. The patient's heart rate and end-tidal carbon dioxide began to return toward normal after dantrolene administration. Twenty-four hours later, his trachea was extubated, and he was discharged from the pediatric intensive care unit on postoperative day 3.

Management of MH requires early diagnosis, rapid intervention, and smooth coordination of operating room personnel at the direction of the anesthesiologist to safeguard a favorable outcome. The MH section of *The Emergency Manual* assisted us in implementing the necessary steps to immediately manage the patient in this critical situation. This avoids the need for personnel to be dependent only on memory for management[6] and is much more effective in completing each of the steps in the least time possible. In our case, this occurred within the first 5 minutes of diagnosis. It was also clear to us that availability of *The Emergency Manual* assisted other operating room staff to work as a team during the management of this crisis. As the information was read aloud, a clear understanding of the management sequence including distribution of the workload and effective communication were established. The prompt diagnosis and rapid team intervention prevented a potentially fatal outcome.

This case illustrates the clinical advantage of using cognitive aids in the operating room, which has been proposed in simulation scenarios described by Marshall.[1]

This report was previously presented, in part, at the Malignant Hyperthermia Association of the U.S. conference in November, 2013.

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The Limitations of Crisis Checklists

To the Editor

In citing the well-known and very successful landing of flight 1549 on the Hudson River, Goldhaber-Fiebert and Howard[1] raise some important issues regarding the use of cognitive aids and checklists in time-sensitive crisis scenarios. An alternative perspective, however, is that the "dual engine restart" checklist proved a distraction (the aircraft was too low and the engines irreparably damaged), and the reason for the successful outcome was the pilot's training, experience, and safety awareness—an example no less valuable to anesthesiologists. The success of the Hudson River landing was more consistent with Klein's recognition-primed decision-making model mentioned later in the article; a process that "…allows difficult decisions in less than ideal circumstances."[2] In this instance, the Captain had very quickly assessed altitude, engine performance, airspeed, and landing opportunities—perhaps the only checklist benefit was to prevent or shorten the "startle" effect.[3]

Emergency manuals or cognitive aids can help improve performance[4] but concerns remain. An incorrect diagnosis can lead to the wrong checklist being used, and a disproportionate sense of urgency can result in fixation error. It is also reasonable to predict that specific checklists will not be a perfect fit for every clinical context and may actually distract from task prioritizing. Interestingly on flight 1549, the directive to seal doors and hatches for water landings was on a different checklist and not completed.[a]

[a]Air and Space SmithsonianInterview: Sully's Tale. Available at: http://www.airspacemag.com/flight-today/Sullys-Tale.html. Accessed November 11, 2013.

In aviation, the mantra "aviate, navigate, communicate" in response to sudden, adverse changes in conditions allows the pilot to direct attention to the most important issues first. In my institution, we have adapted this mantra to "call (for help), communicate (the problem), and delegate (tasks)," allowing the anesthesiologist to maintain focus on the patient.

Emergency manuals may prove their usefulness in anesthesia over time, but as Captain Sullenberger demonstrated, good training, clinical experience, and commitment to safety remain the core components of crisis management.

Conflicts of Interest: David Borshoff is the author of The Anesthetic Crisis Manual, North American Edition, Geoffrey Lighthall, ed. Published by Leeuwin Press, Australia.

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Emergency Manuals and Flight 1549

To the Editor

Goldhaber-Fiebert and Howard[1] cite the successful outcome of U.S. Airways Flight 1549 that landed on the Hudson River as an example of the effective use of an emergency manual by the crew of that aircraft. I disagree. Yes, the "dual engine failure" checklist and the emergency-landing checklist were surely consulted when both engines failed and could not be restarted. There is, however, no "recommended management action" in the emergency manual for where to crash-land an airplane. That lonely choice was the responsibility of the pilot in command, Captain Chesley Sullenberger.

In the case of Flight 1549, the passengers and crew aboard were fortunate to have an immensely experienced pilot whose long commercial aviation career was preceded by service in the U.S. Air Force flying combat missions during the Vietnam War. It was his experience, judgment, flying skill, and intuition that made possible the successful outcome that occurred that day. Had Captain Sullenberger attempted to reach another airport—he declined a suggestion to do so from air traffic control—he may well have come up short, resulting in substantial loss of life and property. Instead, he turned toward the Hudson. That decision, along with the gray-haired Sullenberger's superior piloting skills, is what brought the passengers of Flight 1549 back to earth safely, not the use of an emergency manual.

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In Response

It is gratifying to read Ranganathan et al.'s[1] description of a successful team effort in managing a malignant hyperthermia emergency, attributed in part to the use of a cognitive aid. The authors have quite rightly identified that improved coordination and reduced reliance on memory are important in enhancing the team's performance with an aid.

However, it is currently unclear from the literature to what extent existing cognitive aids support or hinder effective team behavior.[2] Factors such as the personnel available, time pressures, and noise during an anesthetic emergency must be taken into account in the design and implementation of new cognitive aids. Other key issues for consideration include how the aid is presented, the team's familiarity with the aid, the team's structure, and the ability to disseminate the information within the team.[3]

In the case described by Ranganathan et al.,[1] it appears that the team used a "reader" of the cognitive aid. This strategy has been suggested to enhance team performance by developing shared situation awareness and improved team communication.[4]

Clearly, it would be difficult and undesirable to test the designs and methods of use of cognitive aids on actual patients because of the risk of harm and the thankfully infrequent nature of these events. Immersive simulation studies using whole teams in actual or replicated clinical settings provide a potential solution and allow experimental control to test the appropriateness of design and method of use of cognitive aids. Nevertheless, reports of successful use are valuable sources of feedback and link these simulation studies to clinical practice.

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