The Ryder Cognitive Aid Checklist for Trauma Anesthesia

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Despite mixed results regarding the clinical utility of checklists, the anesthesia community is increasingly interested in advancing research around this important topic. Although several checklists have been developed to address routine perioperative care, few checklists in the anesthesia literature specifically target the management of trauma patients. We adapted a recently published "trauma and emergency checklist" for the initial phase of resuscitation and anesthesia of critically ill trauma patients into an applicable perioperative cognitive aid in the form of a pictogram that can be downloaded by the medical community. *The Ryder Cognitive Aid Checklist for Trauma Anesthesia* is a letter-sized, full-color document consisting of 2 pages and 5 sections. This cognitive aid describes the essential steps to be performed: before patient arrival to the hospital, on patient arrival to the hospital, during the initial assessment and management, during the resuscitation phase, and for postoperative care. A brief online survey is also presented to obtain feedback for improvement of this tool. The variability in utility of cognitive aids may be because of the specific clinical task being performed, the skill level of the individuals using the cognitive aid, overall quality of the cognitive aid, or organizational challenges. Once optimized, future research should be focused at ensuring successful implementation and customization of this tool. (Anesth Analg 2016;122:1484–7)

Checklists contain a series of sequential tasks that are important to accomplish under specific complex circumstances. Their value has been described for many decades in high-risk industries such as aviation, spaceflight, and nuclear power, and checklists are now increasingly common in clinical practice as a strategy to improve patient care and safety. Awareness of checklists, and their dissemination, has grown exponentially in recent years. In his book, *The Checklist Manifesto: How to Get Things Right*, Gawande[1] asserts the following about checklists: "...they provide reminders of only the most critical and important steps—the ones that even the highly skilled professional using them could miss. Good checklists are, above all, practical." To achieve this goal, the concept and application of medical cognitive aids have been described by Marshall[2] as "tools created to guide users while they are performing a task, or group of tasks, with the goal of reducing errors and omissions and increasing the speed and fluidity of performance." Likewise, *The Cognitive Aids in Medicine Group at Stanford* describes medical cognitive aids as "structured pieces of information designed to enhance cognition and adherence to medical best practices."[3] In fact, multiple studies have suggested that perioperative checklists improve outcomes, especially in the setting of highly stressful crisis scenarios. In a 2009 multicenter trial of >7000 patients undergoing noncardiac surgery, the World Health Organization surgical safety checklist reduced perioperative mortality from 1.5% before checklist implementation to 0.8% after implementation with a similar decline in inpatient complications from 11% to 7%.[4] Other recent systematic reviews and meta-analysis have shown comparable benefits.[5,6] In a recent prospective interventional study, Tscholl et al.[7] found that the implementation of an anesthesia preinduction checklist was associated with enhanced team communication, increased awareness of critical clinical information, and improved safety perception.

However, not all studies find benefit in clinical checklists. A recent Canadian study examined population-based administrative health data and found no significant improvements in operative mortality after introduction of a surgical safety checklist.[8] Similarly, Reames et al.[9,10] examined the implementation of a checklist-based intervention in a large population of Medicare patients and did not show improved outcomes or decreased costs.

Despite such mixed evidence, the anesthesia community is clearly interested in the design, implementation, and successful utilization of checklists. This interest is reflected in recent newsletter issues from The Anesthesia Patient Safety Foundation and the American Society of Anesthesiologists.[11–13] Simulation studies and anecdotes suggest that a checklist may be particularly useful during an emergency[14,15] but also have relevance during routine care.[16,17]

Cognitive aids offer an appealing vehicle for improving checklist compliance. However, their utility in emergencies has

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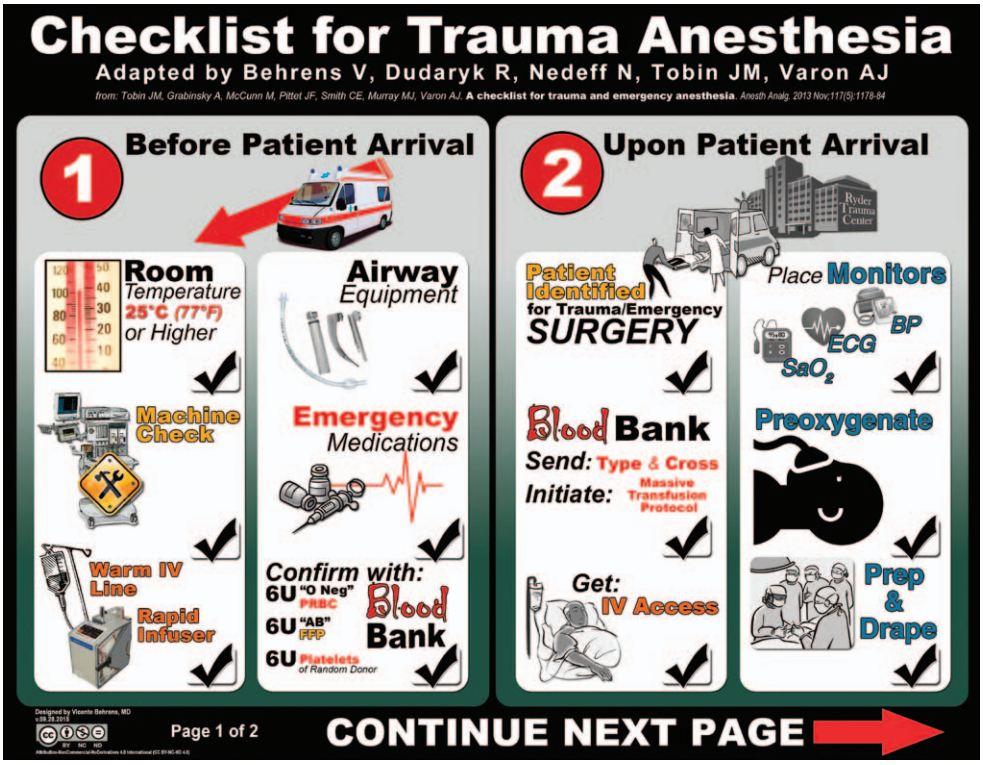

Figure 1. First page of *The Ryder Cognitive Aid Checklist for Trauma Anesthesia.*

also met with varied success. In a 2006 simulation study involving malignant hyperthermia, groups using cognitive aids had performed better than those that did not.[18] A 2013 review of cognitive aids in anesthetic emergencies reported that 10 of 23 studies evaluating cognitive aids in a simulated emergency noted improvement in performance. Interestingly, the remaining 13 investigations in that review reached diverse conclusions, from no improvement to worsened communication to mixed results.[2] Notably, however, many of the cognitive aids in those trials were generated by expert consensus, and one of the methods of evaluation was to use "anecdotal evidence only." Thus, the variability in usefulness of cognitive aids may be because of the specific clinical situation being addressed, the skill level of the individuals using the cognitive aid, the overall quality of the cognitive aid, or organizational challenges.[19,20]

Trauma remains the leading cause of death for individuals up to the age of 45 years, and anesthesiologists play an integral role in resuscitation of trauma victims.[21,22] Recently, Tobin et al.[23] proposed a standardized "trauma and emergency checklist" as a guide during the initial phase of resuscitation and anesthesia of critically ill trauma patients. This checklist reflected the latest evidence-based advances in resuscitation of trauma patients. Understanding that trauma emergencies are often complex and time-critical, the military provides evidence-based guidance in the form of clinical practice guidelines for management of combat trauma patients. The US Army Institute of Surgical Research's most recent revised Joint Theater Trauma System Clinical Practice Guideline on trauma anesthesia,[24] specifically in its Appendix A, shares many themes with the Tobin et al. article.[23]

The care of critically ill trauma patients involves a combination of high cognitive load, multitasking, simultaneous crisis scenarios, and participation of numerous clinicians. In addition, not all anesthesiologists have enough consistent exposure to trauma care for it to become second nature. To our knowledge, there are no pictographic cognitive aids in the anesthesia literature specifically targeted at the management of such trauma patients. Hence, we developed a cognitive aid in the form of a pictogram (Figs. 1 and 2; Supplemental Digital Content, http://links.lww.com/AA/B424) to familiarize anesthesiology trainees and anesthesiologists who do not frequently care for trauma patients with the resuscitative strategies integral to the management of these patients. We adapted the proposed checklist by Tobin et al.[23] into an applicable medical cognitive aid that could be made available online to the entire medical community under the Creative Commons License.[a]

The Ryder Cognitive Aid Checklist for Trauma Anesthesia is a letter-sized, full-color document consisting of 2 separate pages (Figs. 1 and 2). The first page is organized into 2 major sections. In section 1, the essential steps to be performed before patient arrival to the hospital are depicted: warming the operating room to ≥25°C (77°F), performing a thorough anesthesia machine check, preparing a fluid warmer on the IV line and having a rapid infuser available, verifying immediate availability of essential airway equipment and emergency medications, and confirming with the blood bank that 6 units of type O packed red blood cells, 6 units of type AB fresh-frozen plasma, and 6 units of random donor platelets are readily available. In section 2, the essential steps to be performed on patient arrival to the hospital are illustrated: the need for emergent and/or trauma surgery is determined, a blood sample for type

[a]Available at http://creativecommons.org/licenses/by-nc-nd/4.0/. Accessed September 27, 2015.

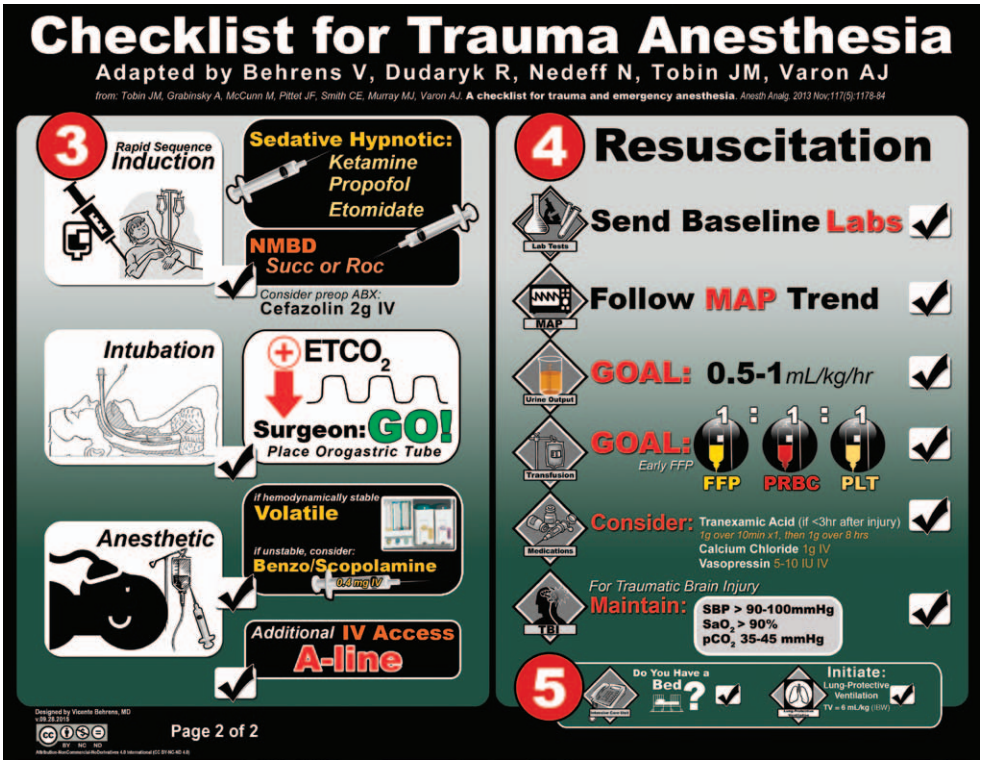

Figure 2. Second page of *The Ryder Cognitive Aid Checklist for Trauma Anesthesia.*

and crossmatch is sent, and the massive transfusion protocol is activated, vascular access is obtained, monitors are placed (oxygen saturation probe, blood pressure cuff, and electrocardiogram leads), and oxygen administration is performed during surgical preparation and draping. The second page is organized into 3 major sections: sections 3, 4, and 5. Section 3 starts with the medication options for rapid sequence induction and the appropriate preoperative antibiotic therapy followed by confirmation of orotracheal intubation and immediate communication with surgeons to proceed. The last steps in section 3 include placement of an oral gastric tube, selecting anesthetic technique according to hemodynamic status, and obtaining additional vascular access, including arterial line placement. Section 4 illustrates additional steps to be performed throughout resuscitation: sending baseline laboratories; following trends in mean arterial blood pressure; tracking urine output to a goal of 0.5 to 1 mL/kg/h; transfusing packed red blood cells, fresh-frozen plasma, and platelets in a 1:1:1 ratio; and considering the use of tranexamic acid if within 3 hours from injury, calcium chloride, and vasopressin. In case of traumatic brain injury, the goals are to maintain systolic blood pressure >90 to 100 mm Hg, oxygen saturation >90%, and a Pco_2 between 35 and 45 mm Hg. Section 5 corresponds to the essential steps to be performed for the postoperative plan, including contacting the intensive care unit and initiating lung-protective ventilation with tidal volumes of 6 mL/kg ideal body weight.

Prospective, randomized evaluation of cognitive aids would clearly more thoroughly assess the utility of our tool. In the absence of such rigorous evaluation, expert opinion and anecdotal experience offer a reasonable approach to reducing complex problems into simple stepwise solutions.[25,26] This cognitive aid offers a first step toward validation of the approach to trauma resuscitation. At the same time, it brings essential components of trauma care into anesthesia practice in a form that is easy to understand and follow. We hope that by sharing this tool with the global medical community and obtaining feedback, we can facilitate the widespread implementation of the trauma and emergency checklist, improve clinical outcomes, and encourage the design and development of other tailored medical cognitive aids. We encourage readers to download this cognitive aid and share their experience and comments with us through a brief online survey, which is hosted at http://tiny.cc/RyderSurvey2016; Accessed December 22, 2015.

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