CHEST

Editor's Note: Authors are invited to respond to Correspondence that cites their previously published work. Those responses appear after the related letter. In cases where there is no response, the author of the original article declined to respond or did not reply to our invitation.

Checklists for Safety During ICU Intubations

The Details Matter

To the Editor:

We read with interest the article by Janz et al,[1] in a recent issue of *CHEST* (April 2018), which showed that a preprocedural checklist did not reduce the incidence of hypoxemia, hypotension, or other life-threatening complications during endotracheal intubation of critically ill patients. We applaud their use of a multicenter, randomized study to advance our understanding of best airway practice, but feel compelled to identify several concerns that may explain why these findings are at odds with current guidelines and expert consensus.[2]

The majority of items selected for the checklist in the Janz et al[1] trial were performed in > 90% of ICU intubations, based on a survey of 21 experts. It is therefore not surprising that there was a high rate of compliance with these elements in both usual care and checklist arms, and no subsequent impact on outcomes. This study was performed at high-volume, academic centers by experienced teams that were supervised by a pulmonary/critical care or anesthesia attending physician. The greatest variations in checklist element performance were seen in airway assessment, IV access confirmation, and verbalization of an airway plan. Arguably these omissions, previously associated with adverse outcomes,[2] may result in greater harm in less resourced settings.

The 80% first-pass success rate and 16% to 26% incidence of severe hypoxemia and hypotension reported in this trial are consistent with previous ICU studies[3]—but are they acceptable outcomes if we aspire to zero harm? Recognizing the pragmatic nature of this study, we note that 56% of subjects received preoxygenation via a nonrebreather mask or nasal cannula. Both of these devices deliver less F_{IO_2} than a bag-valve mask, and cannot apply positive end-expiratory pressure (PEEP). Noninvasive ventilation reduces the frequency of severe hypoxemia during ICU intubation,[4] and PEEP increases the time to critical desaturation, especially in obese patients.[5] Early or preemptive vasopressor use has been shown to decrease the incidence of severe hypotension during intubation,[6] but was used only in 17% of subjects in the trial performed by Janz et al.[1] We wonder if a checklist that mandates noninvasive ventilation, using a bag-valve mask with PEEP, and encourages early vasopressor use may more effectively reduce severe hypoxemia and hypotension during ICU intubation.

The trial performed by Janz et al[1] therefore provides the beginning, rather than the end, of an important line of work to define the right elements and implementation strategy to improve the safety and success of ICU airway management. Checklists are effective in numerous other complex, high-risk activities, and ICU intubation is unlikely to be the exception to this rule.

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References

1. Janz DR, Semler MW, Joffe AM, et al; Check-UP Investigators; Pragmatic Critical Care Research Group. A multicenter randomized trial of a checklist for endotracheal intubation of critically ill adults. *Chest*. 2018;153(4):816-824.
2. Cook TM, Woodall N, Harper J, Benger J; Fourth National Audit Project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. 2. Intensive care and emergency departments. *Br J Anaesth*. 2011;106(5):632-642.
3. Simpson GD, Ross MJ, McKeown DW, Ray DC. Tracheal intubation in the critically ill: a multi-centre national study of practice and complications. *Br J Anaesth*. 2012;108(5):792-799.
4. Baillard C, Fosse JP, Sebbane M, et al. Noninvasive ventilation improves preoxygenation before intubation of hypoxic patients. *Am J Respir Crit Care Med*. 2006;174(2):171-177.

5. Gander S, Frascarolo P, Suter M, Spahn DR, Magnusson L. Positive end-expiratory pressure during induction of general anesthesia increases duration of nonhypoxic apnea in morbidly obese patients. *Anesth Analg*. 2005;100(2):580-584.

6. Jaber S, Jung B, Corne P, et al. An intervention to decrease complications related to endotracheal intubation in the intensive care unit: a prospective, multiple-center study. *Intensive Care Med*. 2010;36(2):248-255.

Response

To the Editor:

We appreciate the excellent analysis of our trial[1] by Drs Niven and Doerschug. In response, we agree. Our checklist intervention was created by asking airway experts what steps "do you almost always perform" prior to intubation, but also with recommendations from guidelines, previous checklists in published studies, simulating the checklist, observational data from previous ICU intubation trials,[2] and nonintrusive checklist items. Therefore, we expected these items to be performed at some baseline rate in usual care and the experiment to be the almost always, verbal performance of a preintubation checklist vs a lower rate of item performance. The checklist item most often omitted was the evaluation of a difficult airway (12% of intubations); however, this was commonly due to performing this in critically ill adults (limited time, evaluation items that require an awake patient). Mandating the always-vs-never performance of checklist items to address the above issues would not be feasible as part of a clinical trial.

We did not mandate noninvasive ventilation as this intervention has only been shown to decrease arterial desaturation in 53 patients with hypoxemia,[3] and more than 40% of patients in the current trial were intubated for reasons other than hypoxemia. We did not mandate the use of positive end-expiratory pressure as the evidence to support this practice is based on 30 patients undergoing elective surgery, which is a markedly different patient population compared with patients undergoing intubation in the ICU. Finally, we did not mandate vasopressors as the cited evidence is a before-and-after observation of multiple interventions that can affect blood pressure (intravenous fluids, vasopressors, drug selection)[4] rather than evidence that vasopressors cause a lower rate of severe hypotension. We agree that mandating any of these may have produced different results as it would have also created a different experiment.[5]

The setting in which checklist research occurs is likely crucial to the effect of this intervention, as reported in previous studies showing an effect of a checklist in low-resource settings and lack thereof in high-resource settings.[6] If readers of the Checklists and Upright Positioning in Endotracheal Intubation (Check-UP) Trial[1] are considering these results in a decision to use our checklist for ICU intubations, they should also consider how similar their clinical environment is compared with the current trial, how often these checklist items already occur in usual care, and whether they would have created a different checklist. Differences in any of these may create different results.

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References

1. Janz DR, Semler MW, Joffe AM, et al; Check-UP Investigators; Pragmatic Critical Care Research Group. A multicenter randomized trial of a checklist for endotracheal intubation of critically ill adults. *Chest*. 2018;153(4):816-824.

2. Janz DR, Semler MW, Lentz RJ, et al. Randomized trial of video laryngoscopy for endotracheal intubation of critically ill adults. *Crit Care Med*. 2016;44(11):1980-1987.

3. Baillard C, Fosse J-P, Sebbane M, et al. Noninvasive ventilation improves preoxygenation before intubation of hypoxic patients. *Am J Respir Crit Care Med*. 2006;174(2):171-177.

4. Jaber S, Jung B, Corne P, et al. An intervention to decrease complications related to endotracheal intubation in the intensive care unit: a prospective, multiple-center study. *Intensive Care Med*. 2010;36(2):248-255.

5. National Institutes of Health Clinical Center. Preventing cardiovascular collaPse with administration of fluid resuscitation before endotracheal intubation (PrePARE). NCT03026777. ClinicalTrials.gov. Bethesda, MD: National Institutes of Health; 2017. https://clinicaltrials.gov/ct2/show/NCT03026777. Updated January 30, 2018.

6. Reames BN, Krell RW, Campbell DA, Dimick JB. A checklist-based intervention to improve surgical outcomes in Michigan: evaluation of the Keystone Surgery program. *JAMA Surg*. 2015;150(3):208-215.