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ORIGINAL ARTICLE

Checklists and multidisciplinary team performance during simulated obstetric hemorrhage

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ABSTRACT

Background: Checklists can optimize team performance during medical crises. However, there has been limited examination of checklist use during obstetric crises. In this simulation study we exposed multidisciplinary teams to checklist training to evaluate checklist use and team performance during a severe postpartum hemorrhage.

Methods: Fourteen multidisciplinary teams participated in a postpartum hemorrhage simulation occurring after vaginal delivery. Before participating, each team received checklist training. The primary study outcome was whether each team used the checklist during the simulation. Secondary outcomes were the times taken to activate our institution-specific massive transfusion protocol and commence red blood cell transfusion, and whether a designated checklist reader was used.

Results: The majority of teams (12/14 (86%)) used the checklist. Red blood cell transfusion was administered by all teams. The median [IQR] times taken to activate the massive transfusion protocol and transfuse red blood cells were 5 min 14 s [3:23–6:43] and 14 min 40 s [12:56–17:28], respectively. A designated checklist reader was used by 7/12 (58%) teams that used the checklist. Among teams that used a checklist with versus without a designated reader, we observed no differences in the times to activate the massive transfusion protocol or to commence red blood cell transfusion ($P>0.05$).

Conclusions: Although checklist training was effective in promoting checklist use, multidisciplinary teams varied in their scope of checklist use during a postpartum hemorrhage simulation. Future studies are required to determine whether structured checklist training can result in more standardized checklist use during a postpartum hemorrhage.

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Keywords: Checklist; Multidisciplinary; Obstetrics; Postpartum hemorrhage; Simulation

Introduction

Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality.^{1–3} Despite advances in medical and obstetric management, rates of PPH in the USA and other well-resourced countries have increased in recent years.^{4–6} Consequently, system-wide approaches and protocols have been recommended to improve how obstetric care providers identify and manage PPH.⁷

There is growing awareness of the importance of checklists for assisting providers during medical crises. Studies have shown that providers are more likely to adhere to recommended procedures during critical

phases of medical emergencies when using checklists or cognitive aids.^{8–12} Simulation training and checklist use offer the prospect of improving how multidisciplinary teams manage obstetric crises. However, the impact of checklists on multidisciplinary team performance during simulations of PPH has not been investigated.

In this prospective observational study, we exposed 14 multidisciplinary teams to checklist training to evaluate checklist use and team performance during a simulation of major PPH post-vaginal delivery.

Methods

This prospective observational study was approved as exempt by Stanford University Institutional Review Board. The study was performed on the labor and delivery unit at a tertiary obstetric center (Lucile Packard

Accepted August 2015

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Children's Hospital, Stanford, California) over a four-month period in 2013. Fourteen multidisciplinary teams were studied: each team consisted of seven to 10 participants which included two obstetricians (attendings, fellows, and residents), one anesthesiologist (resident), three to five labor and delivery nurses and one to two operating room (OR) technicians. The teams encountered the same scenario of a patient with atonic PPH following vaginal delivery. Participants were naïve to the scenario before performing each simulation.

For the design of the checklist the authors reviewed PPH guidelines from recognized obstetric bodies (American College of Obstetricians and Gynecologists (ACOG) and the Royal College of Obstetricians and Gynaecologists), relevant papers from the literature and our institutional PPH protocol.¹³⁻¹⁵ The final action items for the checklist were selected by consensus by all authors. The checklist was available for participants' use during simulations (Fig. 1). Fifteen key tasks were identified for inclusion on the PPH checklist which included clinical, communication, and systems-based aspects of management. The items were separated into three boxes to enable easier use of the checklist, which is a common

challenge in checklist design. At the time of the study PPH checklists were not being used for clinical care on our labor and delivery unit. Anesthesia residents had prior experience with checklists in other anesthesia domains; however, other participants had minimal or zero experience using checklists.

All 14 teams underwent standardized educational training immediately before each simulation. Each training session lasted 15 min and comprised two parts. Each simulation was overseen by an expert in obstetric simulation (GH, KD, SL) with at least 10 years of experience in simulation training. The first part was didactic training in which participants viewed a slide presentation with an oral presentation by an expert in obstetric simulation training (GH, SL). During the oral presentation, the benefits of using a checklist were discussed. It was explained to each team that a checklist could be used to initiate tasks (in a prospective manner) or verify task completion (in a retrospective manner). Teams were able to use either approach. Trainers advised teams to designate a participant to be a checklist reader who assisted the team leader by reading out-loud tasks on the checklist and verifying completion of each.⁹ The second part of the training session was hands-on checklist training. For training purposes, a checklist for managing shoulder dystocia was used which was formatted in a similar style to the PPH checklist.

The scenario consisted of a severe PPH (1500 mL blood loss) due to refractory uterine atony in a primiparous 18-year-old patient who had undergone a spontaneous vaginal delivery. The patient became tachycardic and hypotensive consistent with hemorrhagic shock. All simulations were performed on the labor and delivery unit. We used a hybrid mannequin (MamaNatalie Birthing Simulator; Laerdal, Wappingers Falls, NY, USA) for simulations in the labor room. A high-fidelity mannequin (NOELLE Maternal and Neonatal Birthing Simulator S550; Gaumard Scientific, Miami, FL, USA) was used for simulations in the OR. All simulations were videotaped. None of the teams received information about the PPH simulation before starting the simulation.

Before each simulation, instructors informed each team that a checklist would be available in the labor room. However, none of the teams received or viewed the actual PPH checklist before the simulation. After being introduced to the scenario, teams were expected to manage ongoing blood loss in a hemodynamically unstable patient. Key management tasks were: activation of the institutional massive transfusion protocol (MTP) and transfusion of red blood cells (RBC) via a rapid infuser (Belmont Rapid Infuser; Belmont Instrument Corp., Billerica, MA, USA). The simulation was stopped when each team completed all 15 tasks on the checklist, or when 20 min had elapsed (if <15 tasks were completed). During each simulation checklist use was not enforced and the

Checklist for Initial Management of PPH

<ul style="list-style-type: none"> • Uterine massage <input type="checkbox"/> • Pitocin - increase <input type="checkbox"/> • Fluids - aggressive resuscitation <input type="checkbox"/> • Oxygen - 10L/min non-rebreather face mask <input type="checkbox"/> • Vital signs - BP/HR/O₂ Sats/RR <input type="checkbox"/>
<ul style="list-style-type: none"> • PPH causes - atony/POC/lacs/inversion/coagulopathy <input type="checkbox"/> • Bladder - place Foley <input type="checkbox"/> • Uterotonics - methergine/hemabate/misoprostol (see over) <input type="checkbox"/> • Call - 2nd obstetrician + anesthesiologist + RSN <input type="checkbox"/>
<ul style="list-style-type: none"> • MTP - call Lead Tech (ext xxxx) + send runner <input type="checkbox"/> • IV - place 2nd large bore + set up Belmont <input type="checkbox"/> • Stat labs - CBC + coags <input type="checkbox"/> • Management plan - team discussion <input type="checkbox"/> • Consider OR - D&C, Bakri, B-Lynch <input type="checkbox"/> • Vasopressors - for BP control <input type="checkbox"/>

Fig. 1 Postpartum hemorrhage checklist used during the drill. BP: blood pressure; HR: heart rate; Sats: oxygen saturation; RR: respiratory rate; PPH: postpartum hemorrhage; POC: products of conception; RSN: resource staff nurse; MTP: massive transfusion protocol; IV: intravenous; CBC: complete blood count; OR: operating room; D+C: dilation and curettage

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