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Enhancing surgical safety using digital multimedia technology

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Abstract

BACKGROUND: The purpose of this study was to examine whether incorporating digital and video multimedia components improved surgical time-out performance of a surgical safety checklist.

METHODS: A prospective pilot study was designed for implementation of a multimedia time-out, including a patient video. Perceptions of the staff participants were surveyed before and after intervention (Likert scale: 1, strongly disagree to 5, strongly agree).

RESULTS: Employee satisfaction was high for both time-out procedures. However, employees appreciated improved clarity of patient identification ($P < .05$) and operative laterality ($P < .05$) with the digital method. About 87% of the respondents preferred the digital version to the standard time-out (75% anesthesia, 89% surgeons, 93% nursing). Although the duration of time-outs increased (49 and 79 seconds for standard and digital time-outs, respectively, $P > .001$), there was significant improvement in performance of key safety elements.

CONCLUSION: The multimedia time-out allows improved participation by the surgical team and is preferred to a standard time-out process.

Wrong site surgery rates in this country are estimated to be between 1 in 15,500 to 30,000 operations.[1] Errors may result from misinformation or misperception of the patient's orientation. Past attempts at error prevention have been based on multiple independent checks such as marking the patient and the surgical time-out. Surgical safety programs including the time-out or "presurgical pause" have been widely adopted across the world and have subsequently been shown to be effective tools to reduce patient harm.[2–5] However, checklist tools only facilitate safety when they are used as intended and incorporated into an overarching paradigm shift toward a culture of safety.[3,6] We, and others, have reported that healthcare worker compliance and effective use are variable, with inconsistent performance occurring when such processes become a mundane exercise in "checking the box."[7–9] Shifting to a safety-centered culture is a tremendous challenge. Inattentiveness, environmental distractions, lack of leadership, and role confusion all form further barriers to successful and effective implementation.[10,11] A standard automated process may improve

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time-out performance and create a more attentive process for surgical team members.

Previous studies have demonstrated that a "whiteboard" or digital time-out increased compliance with sustained follow-up over a 9-month period.[12] We hypothesized that a multimedia (video)-based checklist would facilitate attentiveness, participation, and performance of the time-out. Furthermore, it would allow for indirect patient participation in the process which is a step that is missing in the standard time-out process. We therefore reformulated our multimedia time-out to include a patient video stating personal identifiers and location and laterality of surgery within the bounds of a digital standardized checklist. To evaluate the effectiveness and performance of the tool, we compared standard time-outs with time-outs incorporating our multimedia-based checklist. Additionally, we surveyed key participants in the time-out process regarding perceptions of safety and efficacy.

Patients and Methods

This study was designed for Scott & White Memorial Hospital in an effort to use innovation to improve patient safety and was supported by the institution in the form of an Innovations grant. Institutional Review Board approval was obtained for this prospective pilot study. A multimedia checklist was developed within our institution as an electronic surrogate to the current written formatted checklist. Key elements established by the WHO and adapted to our hospital system were kept identical between the old and new systems.[13]

Forty consecutive patients were consented for participation. Participating surgical teams enrolled patients for one entire operative day to ensure maximum exposure to the new process. Surgeons from the fields of general, colorectal, thoracic, orthopedic, gynecologic, and surgical oncology were included. All patients provided written informed consent before inclusion.

The institutional standard time-out currently encompasses four critical elements including the following: staff member introduction, patient identification (name, date of birth, medical record number), description and laterality (if any) of the procedure to be performed, and clarification of key patient safety components. The multimedia system included not only these four elements but was further enhanced with a patient video stating name, date of birth, surgical procedure and laterality, along with team member visualization of the signed consent (Demonstration Video).

Patient information, video, and consent image were input into the program preoperatively by a single investigator. Data were then linked to the patient through a near field communication sticker placed on the patient's wristband. This allowed data to be scanned into a secure server and transmitted to a wireless tablet. The tablet then streamed all the time-out components to the wall monitor present in the operating room (OR). The surgical team in its entirety was thus able to visualize all time-out components and follow along with all key steps as a group.

First, 40 case observations of the previously established time-out were conducted to gather baseline data on performance of key elements and duration of time-out. Thirteen key elements identified as necessary for a safe and thorough handoff (Table 1) and length of each time-out procedure were measured. Next, perceptions of the current process were gathered through anonymous surveying of OR nurses, scrub technicians, anesthetists, and surgeons. To do so, a 9-question satisfaction survey, modified from the validated safety attitudes questionnaire, was used and measured on a Likert scale (1, strongly disagree to 5, strongly agree).[3,14] OR teams were then educated on use of the multimedia checklist. Following implementation, 40 postintervention case observations were conducted based on the same 13 elements. OR staff members were then resurveyed postintervention regarding the new checklist.

Statistics were conducted using GraphPad InStat (GraphPad Software, Inc, La Jolla, CA). Observational data were compared using chi-square test. Survey responses without comparison are reported as percentages, "top box analysis," or mean ± standard deviation. Survey responses with comparison are reported as median response and

Table 1 Observation results comparing standard and multimedia time-outs

Essential components of the time-out	Standard (n = 40)	Multimedia (n = 40)	*P* value
Announce that the time-out started	39 (98%)	40 (100%)	1
Team members were quiet and attentive	31 (78%)	40 (100%)	<.01
Team members introduce themselves	22 (55%)	38 (95%)	<.0001
Patient identified by 2 identifiers	39 (98%)	39 (98%)	1
Patient wrist band checked	14 (35%)	40 (100%)	<.0001
Procedure stated	39 (98%)	40 (100%)	1
Confirm incision site	15 (38%)	40 (100%)	<.0001
Special surgical equipment discussed	13 (33%)	40 (100%)	<.001
Antibiotics given within 60 minutes	37 (93%)	40 (100%)	.24
Discuss anticipated critical operative events	19 (48%)	40 (100%)	<.001
Discuss any patient-specific concerns	28 (70%)	40 (100%)	<.001
Confirmation of sterility	29 (73%)	40 (100%)	<.001
Time-out was without interruption	39 (98%)	40 (100%)	1