

Recommendations for surgical safety checklist use in Canadian children's hospitals

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Background: There is ample evidence that avoidable harm occurs in patients, including children, who undergo surgical procedures. Among a number of harm mitigation strategies, the use of surgical safety checklists (SSC) is now a required organizational practice for accreditation in all North American hospitals. Although much has been written about the effects of SSC on outcomes of adult surgical patients, there is a paucity of literature on the use and role of the SSC as an enabler of safe surgery for children.

Methods: The Pediatric Surgical Chiefs of Canada (PSCC) advocates on behalf of all Canadian children undergoing surgical procedures. We undertook a survey of the use of SSC in Canadian children's hospitals to understand the variability of implementation of the SSC and understand its role as both a measure and driver of patient safety and to make specific recommendations (based on survey results and evidence) for standardized use of the SSC in Canadian children's hospitals.

Results: Survey responses were received from all 15 children's hospitals and demonstrated significant variability in how the checklist is executed, how compliance is measured and reported, and whether or not use of the checklist resulted in specific instances of error prevention over a 12-month observation period. There was near unanimous agreement that use of the SSC contributed positively to the safety culture of the operating room.

Conclusion: Based on the survey results, the PSCC have made 5 recommendations regarding the use of the SSC in Canadian children's hospitals.

Contexte : Il a été prouvé maintes fois que les patients, y compris les enfants, sur qui des interventions chirurgicales sont pratiquées peuvent subir des méfaits évitables. Les normes d'agrément exigent dorénavant de tous les hôpitaux d'Amérique du Nord qu'ils utilisent une liste de contrôle de la sécurité chirurgicale, l'une des stratégies susceptibles de réduire ces méfaits. Si de nombreux articles portent sur l'efficacité d'une telle liste lors d'interventions chirurgicales sur des patients adultes, peu d'études ont été publiées sur l'utilisation et le rôle de ces listes dans le contexte de la sécurité des interventions chirurgicales effectuées sur des enfants.

Méthodes : L'organisme Pediatric Surgical Chiefs of Canada (PSCC) représente tous les enfants canadiens qui subissent des interventions chirurgicales. Nous avons mené un sondage auprès des hôpitaux canadiens pour enfants pour déterminer le degré de mise en œuvre de la liste de contrôle d'un endroit à l'autre, pour comprendre son rôle dans l'évaluation et l'amélioration de la sécurité des patients et pour formuler des recommandations précises (d'après les données probantes et les résultats obtenus) afin d'en normaliser l'utilisation dans les hôpitaux pour enfants du Canada.

Résultats : Les 15 hôpitaux pour enfants ont tous répondu à notre sondage. Leurs réponses étaient très variées en ce qui concerne la mise en œuvre de la liste de contrôle, la façon dont ils évaluent et documentent le respect de la liste et l'efficacité de celle-ci à prévenir des erreurs concrètes pendant la période de 12 mois à l'étude. Les répondants ont indiqué presque à l'unanimité que la liste de contrôle favorisait grandement une culture de sécurité en salle d'opération.

Conclusion : À partir de ces résultats, le PSCC a formulé 5 recommandations concernant l'utilisation de la liste de contrôle dans les hôpitaux pour enfants du Canada.

Awareness of the risk of preventable harm faced by hospitalized patients during the provision of health care was brought to the forefront with the publication of *To err is human: building a safer healthcare system* by the Institute of Medicine in 1999.¹ Preventable harm associated with inpatient adult surgical care is most recognizable as death, or as a major complication; the rate of perioperative death directly due to inpatient surgery has been estimated at 0.4%–0.8%, and the rate of major complications has been estimated at 3%–17%.^{2,3} Studies of human factors in the complex and often chaotic environment of modern day operating rooms (ORs) have suggested that teamwork and communication failures are the principle determinants of these adverse events⁴ and that efforts to improve the quality of communication in the OR could and should lead to improved outcomes for patients. A publication by the World Health Organization’s (WHO) Safe Surgery Saves Lives Study Group, which described the global utility of a surgical safety checklist (SSC) in reducing morbidity and mortality of adult patients undergoing surgery,⁵ has resulted in widespread adoption of surgical checklists in hospitals throughout the developed and developing world.

There is evidence of the vulnerability of children to comparable harm. A recent study of adverse events in 3700 children admitted in Canadian hospitals reported a 9.2% rate of adverse events, of which 45% were deemed to be preventable.⁶ Among children experiencing an adverse event, surgery was the most common contributing factor, and event rates were highest within tertiary referral pediatric centres. Any strategy targeting unsafe care for hospitalized children must focus on risk reduction in the operating room and perioperative care areas.

Recently, concerns have been raised regarding the implementation fidelity of SSC. A study of Ontario hospitals failed to show any reduction in mortality or morbidity in surgical patients following the implementation of the SSC.⁷ Among a number of possible explanations for the SSC’s apparent failure to achieve its expected and desired effect is the robustness of the framework used for implementation.⁸ Implementation without careful attention given to stakeholder engagement and education (the “why”), without clear guidelines or recommendations for checklist format (the “what”), and without formal team training or guidelines for compliance measurement (the “how”) may at least in part, explain the phenomenon observed in the Ontario hospitals report.

The goal of the present study was to obtain a snapshot of surgical checklist use in all 15 Canadian hospitals that provide tertiary subspecialty surgical care for children to understand how the checklist has been implemented and used, how compliance is measured and reported, and the perceived value in preventing errors

and contributing positively to a culture of safety in the pediatric OR. Using these data as justification to optimize implementation fidelity, the Pediatric Surgical Chiefs of Canada (PSCC) have made recommendations for standardized use of a pediatric SSC in support of safe and high-quality surgical care for children.

METHODS

Setting

We surveyed all children’s hospitals in Canada ($n = 15$) that provide subspecialty children’s surgery with full-time availability of fellowship-trained pediatric anesthesiologists. These include 9 “free-standing” children’s hospitals and 6 children’s hospitals that have some shared services with an adjacent general hospital.

Survey tool

The questionnaire (Appendix 1, available at cansurg.ca) was developed collaboratively by the PSCC. The questions sought to determine the attributes of the surgical checklist in use at each children’s hospital: its structure, details of how the checklist is executed, how compliance is measured and reported, the role of the SSC in performance measurement and improvement, and stakeholder (physician, parent) assessment of the value of the checklist and its impact on the safety culture of the OR.

RESULTS

All 15 questionnaires were returned, yielding a complete representation of the use of surgical checklists in Canadian children’s hospitals. The survey permitted free text comments, some of which are excerpted below. The aggregate data were distributed in electronic format, and presented and discussed at the annual general meeting of the PSCC.

Surgical checklist structure

All 15 children’s hospitals reported using the same 3-phase communication structure described in the original WHO SSC. In all hospitals, the WHO checklist has been modified to meet the needs of the local environment.

Sign in

The sign in, performed immediately after the child is brought into the OR (often in the company of a parent), but before administration of anesthesia, consists of a team discussion verifying the patient’s identification, weight, and presence of allergies; the planned operative procedure (site and side); and confirmation of surgical site marking, if indicated.

Time out

The time out, performed after administration of anesthesia, but just before the surgical incision, verifies the patient's identification; the planned procedure (site and side); the need for and time of administration of prophylactic antibiotics; and whether special equipment, implants, or blood are required and immediately available.

Sign out

The sign out, performed at the end of the operation, confirms the operative procedure performed, whether final counts (sponge, needle, instruments) were correct, whether any surgical specimens were submitted, and the estimated blood loss for the procedure. Note may be made of any communication, equipment or process failures, and required remediation steps.

Huddle

In addition to the sign in, time out and sign out phases, 6 of 15 (40%) hospitals use a morning "huddle" (also referred to as the "7:35 huddle"). The huddle is a meeting among the anesthesiology, nursing and surgery staff that occurs 10 minutes before the first case of an elective surgical slate. The discussion is usually led by the surgeon and anesthesiologist and includes a brief oral confirmation of all the scheduled cases, equipment or blood product requirements, need for antibiotic prophylaxis, and the potential for any specific anesthesia needs (e.g., epidural anesthesia). One respondent explained, "the huddle gets everyone on the same page and reminds us of our shared responsibility to ensure that all patients have a safe procedure."

Executing the SSC

There is considerable variation across Canadian Children's Hospitals as to how the individual disciplines (i.e., anesthesiology, nursing and surgery) participate in the surgical checklist. In 5 of 15 hospitals, the attending anesthesiologist and surgeon and a member of the nursing team are required to be present for all 3 phases, while in another 7 hospitals, the roles of the anesthesiologist and surgeon may be represented by residents or fellows, provided they are familiar with the patient and the planned procedure.

There is also variability in how the elements of the checklist are discussed and who leads each step. For example, in 3 hospitals, all 3 phases follow a fixed script that is read aloud. However, in 4 hospitals, the surgical checklist consists of free-flowing conversation at each stage, whereas in the remaining 5 hospitals, a partially scripted checklist is used. There are no set requirements for who leads the performance of the checklist at any of the hospitals. Introduction of the members of the team was part of the time out phase in the WHO SSC. This

step is often omitted if the team members know each other. One respondent explained, "we use a white board with everyone's name written on it."

Eight of 15 Canadian children's hospitals use a modified surgical checklist for anesthesia or sedation procedures performed outside the OR.

Measuring and reporting compliance

Surgical checklist compliance is tracked in 14 of 15 (93%) Canadian children's hospitals. In more than half of hospitals, compliance is recorded manually on the OR record, which subsequently gets uploaded into a hospital information system. Other means of measuring compliance include periodic OR record or direct observer audits. In 7 of 15 children's hospitals (representing British Columbia, Alberta and Ontario) SSC compliance is identified as a quality indicator with mandatory reporting to the hospital executive, Board of Directors and the Ministry of Health. In 13 hospitals SSC compliance is reported internally to clinical leadership and the hospital executive. In 7 of 15 hospitals a quality improvement project targeting improved compliance with the SSC had been undertaken in the 12 months preceding the survey. One respondent explained, "we've tried to increase compliance to as close to 100% as possible by presenting our data at Department of Surgery rounds and divisional monthly meetings, and at our perioperative nurses' weekly education conference."

Value proposition and the SSC

The contribution of the surgical checklist to the safety and quality of surgical encounters at each of the 15 hospitals was assessed from a number of perspectives. One was the value (perceived by the OR team) of having parents as observers during the sign in phase for their children in those children's hospitals that permit parental presence at administration of anesthesia (12 of 15 hospitals). The perception in 6 of these 12 hospitals (50%) was that parental presence added value, while the remainder felt there was little or no added value. One respondent explained, "the view of value of parental presence is mixed. We have researchers looking specifically at this question. They have not demonstrated significant benefit, but there is perception of benefit in select cases."

Another "value" question asked whether or not the SSC had identified and prevented any errors ("near misses") within the previous 12 months. Six of 15 (40%) hospitals reported having 1 or more errors identified by the surgical checklist; 5 potential "never events" (i.e., wrong side, wrong procedure, wrong patient) were identified and prevented. One respondent commented, "the SSCL prevented at least 1 wrong side cochlear implant

operation.” Other errors recognized included 4 patients who did not have the side or site of surgery marked (despite a policy that requires this), and 1 patient each for whom equipment deficiencies or a failure to administer prophylactic antibiotics was realized. However, at least 1 “never event” did occur, despite an appropriately executed checklist. One respondent commented, “despite an SSC being properly completed, we did have an occurrence of a wrong-sided incision in 1 case.”

Surgeons in chief were asked to assess whether OR efficiency had improved, diminished or remained unchanged since implementation of the surgical checklist. Four of 15 felt it had improved, while the remainder felt that it had diminished ($n = 3$) or had no effect ($n = 8$). Finally, the last question inquired about the impact of the SSC on the safety culture in the OR. In the majority of children’s hospitals (13 of 15), the perception of the surgeons in chief was that the checklist had a positive influence on the safety culture, but there was still a need for constant vigilance. One respondent commented, “we are still having some trouble instituting all aspects of the SSCL with emergency cases after regular OR hours and we need to instill a culture of safety for all cases at all times.”

DISCUSSION

The use of a surgical checklist or some other standardized communication tool to facilitate team-based collaboration and critical task completion leading to early recognition of “near misses” and prevention or early recognition of complications represents one of the most important changes in surgical care over the past decade. Borrowed from other high-risk industries, such as aviation,⁹ and used successfully for error reduction in other complex patient care environments, including intensive care units,^{10,11} procedural checklists permit structuring of the communication of critical information. Explicit information sharing among all team members across nonhierarchical disciplines encourages cross-checking for accuracy and supplements traditional paths of communication within disciplines (e.g., nurse to nurse, surgeon to surgical resident). Prior to the development of the WHO SSC, the Joint Commission developed a *Universal protocol for preventing wrong site, wrong procedure, wrong person surgery*.¹² This protocol, which became a U.S. hospital accreditation criterion in 2008, mandates a preoperative verification process, unambiguous surgical site marking, and a surgical pause or “time out” to be performed immediately before the start of the procedure. Another type of procedural checklist shown to be successful in reducing postoperative morbidity and mortality is the Surgical Patient Safety System (SURPASS), which utilizes a comprehensive, multidisciplinary SSC that follows the patient from admission to surgery to discharge.¹³ This checklist incorporates existing protocols

and checks to create a comprehensive framework for the surgical pathway and minimize errors during transfers from one stage of the pathway to the next.

Although use of an SSC is an accreditation requirement in Canadian hospitals,¹⁴ there are no standards for compliance documentation or reporting. Within the province of British Columbia, for example, surgical checklist compliance is a mandatory performance measurement reported to the Ministry of Health, with a minimum expectation threshold of 80%.¹⁵ However, the definitions of whether the checklist was used for a given surgical encounter vary among hospitals, ranging from a qualitative “yes” or “no” to a 9-point (3 disciplines present for all 3 phases) quantitative score for which all 9 “ticks” are necessary to achieve compliance. There is also variation in how the data are collected, ranging from third party observation^{13,16,17} to surgical record audits^{18,19} to self reporting.²⁰ These factors all serve to confound the reliability of compliance data and may contribute to the phenomenon of very high rates of checklist compliance (> 95%) without evidence of improvement in outcome following checklist implementation.⁷ An emerging theme in checklists as process improvement tools is the importance of “implementation fidelity” and the need to measure not only adherence to the tool, but also the support domains (e.g., education, resourcing, role of “champions,” staff engagement, incentives, safety culture) that would be expected to influence checklist adherence.^{8,21}

Children’s hospitals differ from hospitals for adults or community hospitals that treat adults and some children owing to their focus on delivering health services that are unique to the clinical, developmental and psychosocial needs of children and their families. In comparison to adults, the experiences of children undergoing surgery can vary dramatically based on the child’s age, developmental stage and health status; therefore, it is reasonable to assume that some modifications of a checklist that was developed primarily for use in adults might be necessary. With few exceptions, children undergoing surgery are more likely to be healthy, more likely to undergo an outpatient surgical procedure and more likely to be accompanied to the OR by a parent who will be present during anesthetic induction. Although rates of postoperative adverse events (mortality and morbidity) are lower in children than in adults,²² children do experience life-threatening complications after surgery and are not immune to “never events.”^{23–25}

Given that children appear to have an equivalent vulnerability to surgical harm, there is surprisingly little information on how surgical checklists have been implemented in tertiary care children’s hospitals. Reports from 2 American children’s hospitals describe the adaptation of the original WHO SSC to a 3-phase procedural checklist with some customization of steps to match the unique attributes of the procedures (e.g., a modified

checklist for short procedures) or the surgical team (e.g., large posters in every OR that the team could view simultaneously).^{26,27} A large Canadian children's hospital described the addition of a "7:35 huddle" — a meeting of the surgical team before the start of an elective slate where all the day's cases were briefly discussed to enable team preparedness.²⁸

Draft recommendations arising from the PSCC's discussion of aggregate survey data were modified until unanimous consensus was reached. In recognition of the need for an SSC that meets the unique needs of children and families, the PSCC makes the following observations and recommendations.

Checklist implementation

Recommendation: Although all Canadian children's hospitals are currently using an SSC, change management must be undertaken with "implementation fidelity" as a primary objective. A poorly conceived change management strategy (i.e., without proper education, justification, adequate implementation resources, or perceived lack of clinical champions) may do more harm than good, and should be avoided. The surgeon in chief, in collaboration with a senior manager or director with oversight for perioperative services, should oversee any change implementation related to the SSC.

Checklist structure

Recommendation: Children's hospitals should use a surgical checklist adapted to the needs of patients and the surgical teams. A "7:35 huddle" adds an additional element of planning and instills a strong sense of shared responsibility for patient safety and should be officially considered part of the checklist. For slates of repetitive, short-duration "sided" procedures, the focus of the huddle should be on patient identification, confirmation of site and side, and plans for regional anesthesia, with complementary goals of room efficiency and patient safety. For longer, complex procedures, the huddle should include a specific discussion of personnel roles, special equipment, blood product or implant needs and any special requirements for tissue handling (e.g., frozen sections).

Executing the surgical checklist

Recommendation: All 3 disciplines (anesthesiology, nursing and surgery) must be present for all phases (including the 7:35 huddle), and the representative of the physician disciplines must be sufficiently experienced and know the individual patients and procedures well enough to be authoritative in these discussions (i.e., either the staff surgeon and anesthesiologist, or a subspecialty fel-

low). Team member introductions may be unnecessary when everyone knows one another (as in the context of dedicated specialty OR nursing teams), but is essential when new staff (nursing or physician) are present. There must be consistency in discipline representation between the 7:35 huddle and sign in for each case. Flexibility in who leads the oral communication of each phase is appropriate, and whether conversation is free-flowing or scripted should be decisions of the surgical teams, guided by preference and experience. Because the sign in phase will often be performed in the presence of a parent, consideration should be given to introductions, although this must not alter the intent of this step, which is identity and procedure verification for the child.

Use of the surgical checklist outside of the OR

Recommendation: The surgical checklist should be used for procedures requiring sedation or general anesthesia outside of the OR (e.g., cardiac catheterization or interventional radiology suites), and operational governance structures should make checklist compliance a requirement in any part of the hospital where procedural sedation or anesthesia is provided.

Measuring and reporting surgical checklist compliance

Recommendation: The process used for compliance documentation should have face validity, should be collected in real time (i.e., not subject to recall bias) and should not have unintended consequences (i.e., significantly disrupt workflow or be a source of distraction to the surgical team). Recording of compliance should be integrated in the operative record (electronically, where feasible), and should minimize extra work for nurses, who are already heavily burdened with documentation during and after surgery.

Ideally, the surgical checklist should be viewed as a safety conversation that occurs within an integrated, high-functioning team with surgical patient safety as a shared core value — not as a "tick box" exercise necessary to keep administrators happy. A critical determinant of success of the surgical checklist, or any other process improvement measure in the OR, is the response of the prevailing culture to its implementation.

Children's hospitals should have flexibility in how they interpret and document checklist compliance, but must be committed to validity and transparency. Checklist compliance should be reported internally as a perioperative services quality indicator, and noncompliance should be discernable at several levels, including the surgical specialty, the individual surgeon (or anesthesiologist), and even the room and slate, to enable data "drill downs" when undertaking performance improvement activities.

CONCLUSION

Many children experience preventable adverse events in Canadian children's hospitals, and the OR is a high-risk area for these events. A standardized, appropriately implemented surgical checklist that is sensitive to the unique needs of children and their families is an integral element within a comprehensive strategy targeting harm reduction in hospitalized children.

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