Original Article

Implementation of Surgical Safety Checklist Reduces Morbidity in a Tertiary Care Hospital

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Abstract

Background: Surgery is an essential part of health care. Adverse events can occur in surgical care but more than half of these are avoidable. A number of checklists have been developed to reduce these adverse events; the WHO surgical safety checklist has shown better outcome improvements than previous checklists. This study was designed to apply WHO surgical safety checklist in operation theaters of a tertiary care hospital to measure baseline surgical safety protocols and outcome measurements.

Methodology: This was a prospective interventional study conducted in three phases. First phase was base line data collection, implementation of surgical safety checklist during second phase and post-implementation data collection in last phase. A total of 613 patients were included, consisting of 303 during pre-implementation and 310 in post-implementation. Duration of each phase was 3 months. Primary end points were discharge from hospital, 25 days or death.

Results: The rate of post-operative infection fell from 33.7% to 16.2% ($p < 0.001$). Average hospital stay was reduced from 7.8 days to 6.5 days ($p < 0.001$). Use of non-sterilize instruments reduced from 38% to 0% ($p < .001$).

Conclusion: Implementation of the checklist was associated with improvement in adherence to surgical safety protocols and decrease morbidity in surgical patients. It was also associated with shorter hospital stay and early patient return to work.

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Introduction

Hospitals are considered to be safe, error – free places but adverse events do occur in hospitals and almost two – third of these events is associated with surgical care.[1] Data suggest that at least half of all surgical complications are avoidable.[2,3] Several interventions have been proposed to improve patient safety and improving quality of team work in operating room.[4] A number of surgical checklists have been developed to preventable surgical adverse events.[4-8] The Safe Surgery Saves Lives Group at the World Health Organization (WHO) recently published result of introducing a peri-operative surgical safety checklist.[5] The use of this checklist was associated with about 40% reduction in major complications and mortality reduction by 47%. Several studies have shown that majority of surgical errors about halt to two – third occur before or after surgery, making it likely that a more substantial improvement in safety could be achieved by targeting

the entire surgical pathway.[9-11] Routine surgery requires a complex coordination of surgeons, anesthetists, nurses and support staff to provide timely and effective care; heightened patient acuity and time pressure increase the potential for critical errors and omissions in established standards of care.

In situations requiring emergency intervention, however there is concern that use of a checklist will interrupt workflow and delay therapeutic care in ways that increase risk to patients. There are two ways to see this problem, one is delay in care and therapeutic intervention, second is adherence to checklists will improve compliance with basic standards of care and improve outcome following surgery.

The World Health Organization (WHO) launched the Safe Surgery Saves Lives campaign in January 2007 to improve consistency of surgical care and adherence to safety practices. The WHO Surgical Safety Checklist is a time efficient tools to help operating room staff improve teamwork and communication.[5] It consists of a series of checks that occur before the delivery of anesthesia, before first incision is made, and before the patient leaves the operating room.

With evidence that systemic use of checklists can result in decreased rates of surgical complication and catheter – related blood stream infections, the use of this type of intervention is gaining acceptance.[12,13]

In industrialized countries death rate after inpatient surgery is 0.4 to 0.8% while rate of major complications of 3 to 17%.[16,17] These rates are likely to be higher in developing countries.[14-17]

We hypothesized that implementation of this checklist will bring a significant reduction in complications and deaths.

Methodology

Study Design

We conducted a prospective study of pre-intervention and post intervention periods at one surgical unit of the largest hospital in the Country. This institution was selected on basis of its position, role as referral hospital, diversity and number of cases received. This study was aimed to act as validation of surgical safety checklist in healthcare setup of Pakistan and for purpose of implementation in other hospitals. This study was lead by two principle investigators and study supervisor were responsible for data collection and training of the surgical team. The investigators were responsible for taking permission and communication with hospital administration regarding change in surgical suite working policies.

1 surgical suite consisting of 4 surgical rooms was identified as study suite. Patient who were at least 12 years of age and were undergoing non-cardiac, non-obstetric surgeries were included in the study. Ethical approval was obtained from Ethical Review Committee of King Edward Medical University. This committee waived the requirement for written informed consent form patients.

The checklist is divided in different parts that corresponds to the stages of care in the surgical pathway (preoperative, operative, recovery or intensive care and post-operative), and it is multidisciplinary – the ward doctor, nurse, surgeon, anesthesiologist and operating assistant are all responsible for completion of parts of the checklist. Items on the checklist include an accounting of all necessary equipment and materials, the marking of the patient's operative site, the hand-off of postoperative instructions and the provision of medication prescription to the patient at discharge, among other things. The effects of the checklist on patient outcomes were studied in a controlled, multicenter, prospective study comparing outcomes before and after implementation of the intervention from May 2011 to Jan 2012. The amount of time required to implement the checklist was estimated at 3 months. The baseline measurement period was three months. Complications were documented in all patients who underwent elective general surgery and were discharged during this period. Patients who underwent emergency surgical procedure, discharged without any surgical intervention and patients who were discharged less than 24 hours were excluded. After implementation of the checklist during a three month period, a post implementation of the checklist was conducted for next three months. All patients with a minimum hospital stay of 24 hours who underwent general surgery were included in the post-implementation period, not just the patients whose checklist has been completed.

Because this was an observational study in which quality – improvement was assessed with the use of outcome measures that are routinely collected, the requirement for formal informed consent was waived.

Intervention

The intervention included a two-step checklist implementation program. Base line data was collected from May 2011 to Jul 2011 and analyzed to identify deficiencies in surgical care. During the next three months

surgical team was trained to rectify these deficiencies. WHO Surgical Safety Checklist was implemented in Oct 2011. Post implementation data collection resumed in Nov 2011 through Jan 2012.

Data Collection

Data on demographics, co-morbid factors, length of stay, number and types of surgical procedures was collected from hospital records and patient files. Outcome data was collected from patient examination and patient files. Data collectors followed patients post-operatively until discharge, 25 days or death whichever occurred first. Statistical analysis was done on SPSS version 17.

Results

A total of 613 patients were included in the study. These consist of 303 patients before intervention and 310 patients after the intervention. Male patients comprised about 51.2% of the total. About three – quarter of patients were within age range of 20 – 50 years. Rate of adherence to safety protocols which included patient, surgical site and procedure identity before first incision improved after the implementation of WHO Surgical Safety Checklist. Similarly sponge, instrument and needle count was improved both before and after surgery, once surgical safety checklist was introduced. In pre-intervention phase of the study antibiotic was administered in 54% cases which increased to 91% after the implementation ($p < 0.001$). The timing of antibiotic was most appropriate in post-intervention phase (within last 60 minutes before the first incision). Post implementation wound infection fell from 33.7% at baseline to 16.2% ($p < 0.001$). A reduction of surgical wound infection to about half which is directly linked to postoperative hospital stay, morbidity and mortality. Hospital stay after the implementation was reduced from an average of 7.8days at baseline to an average 6.5 days ($p < 0.001$). This short hospital stay can be attributed to the improvement in outcome as well as a factor which reduces complication on its own.

Table 1: Measurement of Safety Protocols.

Safety Protocol	Pre-intervention (n = 303)		Post-intervention (n = 310)		P value
	Number	%age	Number	%age	
Use of sterile instruments	188	62	310	100	< .001
Administration of appropriate antibiotics	114	37.6	282	91	< .001
Confirmation of patient identity	214	70.6	285	91.9	< .001
Pre-operative instrument, sponge and needle count	196	64.7	261	84.2	< .001
Post-operative items count	188	62	260	84	< .001

Table 2: Comparison of Hospital stay.

Duration of Stay (Days)	Pre-intervention (n = 303)		Post-intervention (n = 310)	
	Number	%age	Number	%age
1 – 3	26	8.6	109	35.2
4 – 5	147	48.5	97	31.3
6 – 10	69	22.8	52	16.8
11 – 15	23	7.6	27	8.7
16 – 20	24	7.9	10	3.2
More than 20	14	4.6	15	4.8

Table 3: Comparison of wound outcome.

Wound Condition	Pre-intervention Number (n = 303)	%age	Post-intervention Number (n = 310)	%age
Good healing	204	67.3	263	84.8
Superficial incision SSI*	52	17.2	36	11.6
Deep incision SSI	24	7.9	9	2.7
Organ or space SSI	11	3.6	1	0.3
Wound Disruption	12	4	2	0.6
*SSI = surgical site infection				

Discussion

This study demonstrated that training and use of the WHO Surgical Safety Checklist is associated with less complications. Improvement in outcome appears to be multifactorial. Adherence to safety protocols and pre-operative team briefing improves communication and decrease complications.[7] A study published in 2008 showed there are considerable discrepancies in organization and safety culture between nurses, anesthesiologist and surgeons.[18] The per-operative communication gap can easily be broken by team briefing. Retained foreign objects during surgery not only increase risk of infection but also cause malpractice claims. Sponge is the most common retained object and mostly occurs because of incorrect sponge count.[19,20] The risk of retained foreign object is significantly increased with unplanned change in surgical procedure.[21] Rate of post-operative infection was reduced to more than half which is mostly due to optimal administration of antibiotics. Surgical site infection rate was reduced to 16.2% which is less than global Surgical Site infection rate.[22] A study published in 2011 concluded that implementation of WHO Surgical Safety checklist improved perception of team work and safety climate among surgical team.[23] Surgical safety checklist has improved outcome in other specialties including Gynecology and Obstetrics practice.[24]

Recommendation

The authors recommend implementation of WHO Surgical Safety Checklist in all surgical specialties across the country. From the introduction of WHO Surgical Safety Checklist in 2009, more than 4000 hospitals are currently using surgical Safety Checklist.[25]

References

1. de Vries EN, Ramrattan MA, Smorenburg SM, Gouma DJ, Boermeester MA. The incidence and nature of in – hospital adverse events: a systematic review. Qual Saf Health Care. 2008; 17 (3): 216-23. Epub 2008/06/04.
2. Gawande AA, Thomas EJ, Zinner MJ, Brennan TA. The incidence and nature of surgical adverse events in Colorado and Utah in 1992. Surgery. 1999; 126 (1): 66-75. Epub 1999/07/27.
3. Kable AK, Gibberd RW, Spigelman AD. Adverse events in surgical patients in Australia. Int J Qual Health Care. 2002; 14 (4): 269-76. Epub 2002/08/31.
4. Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AH, Dellinger EP, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. N Engl J Med. 2009; 360 (5): 491-9. Epub 2009/01/16.
5. Makary MA, Holzmueller CG, Thompson D, Rowen L, Heitmiller ES, Maley WR, et al. Operating room briefings: working on the same page. Jt Comm J Qual Patient Saf. 2006; 32 (6): 351-5. Epub 2006/06/17.
6. Lingard L, Regehr G, Orser B, Reznick R, Baker GR, Doran D, et al. Evaluation of a preoperative checklist and team briefing among surgeons, nurses, and anesthesiologists to reduce failures in communication. Arch Surg. 2008; 143 (1): 12-7; discussion 8. Epub 2008/01/23.
7. Paige JT, Aaron DL, Yang T, Howell DS, Hilton CW, Cohn I, Jr., et al. Implementation of a preoperative briefing protocol improves accuracy of teamwork assessment in the operating room. Am Surg. 2008; 74 (9): 817-23. Epub 2008/09/24.
8. Verdaasdonk EG, Stassen LP, Widhiasmara PP, Dankelman J. Requirements for the design and implementation of checklists for surgical processes. Surg Endosc. 2009; 23 (4): 715-26. Epub 2008/07/19.
9. Greenberg CC, Regenbogen SE, Studdert DM, Lipsitz SR, Rogers SO, Zinner MJ, et al. Patterns of communication breakdowns resulting in injury to surgical patients. J Am Coll Surg. 2007; 204 (4): 533-40. Epub 2007/03/27.

10. Griffen FD, Stephens LS, Alexander JB, Bailey HR, Maizel SE, Sutton BH, et al. The American College of Surgeons' closed claims study: new insights for improving care. J Am Coll Surg. 2007; 204 (4): 561-9. Epub 2007/03/27.
11. de Vries EN, Hollmann MW, Smorenburg SM, Gouma DJ, Boermeester MA. Development and validation of the Surgical Patient Safety System (SURPASS) checklist. Qual Saf Health Care. 2009; 18 (2): 121-6. Epub 2009/04/04.
12. Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, et al. An intervention to decrease catheter – related bloodstream infections in the ICU. N Engl J Med. 2006; 355 (26): 2725-32. Epub 2006/12/29.
13. DuBose JJ, Inaba K, Shiflett A, Trankiem C, Teixeira PG, Salim A, et al. Measurable outcomes of quality improvement in the trauma intensive care unit: the impact of a daily quality rounding checklist. J Trauma. 2008; 64 (1): 22-7; discussion 7-9. Epub 2008/01/12.
14. Bickler SW, Sanno – Duanda B. Epidemiology of paediatric surgical admissions to a government referral hospital in the Gambia. Bull World Health Organ. 2000; 78 (11): 1330-6. Epub 2001/01/06.
15. McConkey SJ. Case series of acute abdominal surgery in rural Sierra Leone. World J Surg. 2002; 26 (4): 509-13. Epub 2002/03/23.
16. Yii MK, Ng KJ. Risk – adjusted surgical audit with the POSSUM scoring system in a developing country. Physiological and Operative Severity Score for the Enumeration of Mortality and morbidity. Br J Surg. 2002; 89 (1): 110-3. Epub 2002/02/20.
17. Ouro – Bang'na Maman AF, Tomta K, Ahouangbevi S, Chobli M. Deaths associated with anaesthesia in Togo, West Africa. Trop Doct. 2005; 35 (4): 220-2. Epub 2005/12/16.
18. Mills P, Neily J, Dunn E. Teamwork and communication in surgical teams: implications for patient safety. J Am Coll Surg. 2008; 206 (1): 107-12. Epub 2007/12/25.
19. Wan W, Le T, Riskin L, Macario A. Improving safety in the operating room: a systematic literature review of retained surgical sponges. Curr Opin Anaesthesiol. 2009; 22 (2): 207-14. Epub 2009/04/25.
20. Cima RR, Kollengode A, Storsveen AS, Weisbrod CA, Deschamps C, Koch MB, et al. A multidisciplinary team approach to retained foreign objects. Jt Comm J Qual Patient Saf. 2009; 35 (3): 123-32. Epub 2009/03/31.
21. Couper RT. Risk factors for retained instruments and sponges after surgery. N Engl J Med. 2003; 348 (17): 1724-5. Epub 2003/04/25.
22. de Oliveira AC, Ciosak SI. [Surgical site infection in a university hospital: post-release surveillance and risk factors]. Revista da Escola de Enfermagem da U S P. 2007; 41 (2): 258-63. Epub 2007/08/29. Infeccao de sitio cirurgico em hospital universitario: vigilancia pos-alta e fatores de risco.
23. Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AH, Dellinger EP, et al. Changes in safety attitude and relationship to decreased postoperative morbidity and mortality following implementation of a checklist-based surgical safety intervention. BMJ Qual Saf. 20 (1): 102-7. Epub 2011/01/14.
24. Kearns RJ, Uppal V, Bonner J, Robertson J, Daniel M, McGrady EM. The introduction of a surgical safety checklist in a tertiary referral obstetric centre. BMJ Qual Saf. 20 (9): 818-22. Epub 2011/06/23.
25. World Health Organization, Patient Safety A World Alliance for Safer Health Care, Surgical Safety Web Map. 2012 [updated 3/26/2012; cited 2012 8/6/]; Available from: http://maps.cga.harvard.edu:8080/Hospital/.