Impact of modified quality control checklist on protocol adherence and outcomes in a post-surgical Intensive Care Unit

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ABSTRACT

Background and Aims: Quality improvement (QI) is the sum of all activities that create desired changes in the quality. An effective QI system results in a stepwise increase in quality of care. The efficiency of any health-care unit is judged by its quality indicators. We aimed to evaluate the impact of QI initiatives on outcomes in a surgical Intensive Care Unit (ICU). Methods: This was an observational study carried out using a compliance checklist, developed from the combination of the World Health Organization surgery checklist and Society for Healthcare Epidemiology of America guidelines for the prevention of infections. A total of 170 patients were prospectively evaluated for adherence to the checklist and occurrence of infections. This was compared with a random retrospective analysis of 170 patients who had undergone similar surgeries in the previous 3 months. Results: Introduction and supervised documentation of comprehensive checklist brought out significant improvement in the documentation of quality indicators (98% vs. 32%) in the prospective samples. There was no difference in mortality, health-care-related infection rates or length of ICU stay. Conclusion: The introduction of comprehensive surgical checklist improved documentation of parameters for quality control but did not decrease the rates of infection in comparison to the control sample.

Key words: Line care-bundles, quality control, surgery, surgical site infection

INTRODUCTION

Quality improvement (QI) consists of systematic and continuous actions that lead to measurable improvement in health-care services and the health status of targeted patient groups. The efficiency of any health-care unit is judged by its quality indicators.[1] The Institute of Medicine defines quality in health care as a direct correlation between the level of improved health services and the desired health outcomes of individuals and populations.[2] The impact of improvement in quality control manifests in composite outcomes of surgical patients and hence attention to basic care will provide the desired positive impact on patients.

The assessment of outcomes in surgery represents a quality assurance of patient care.[3] Catheter-related blood steam infections occurring in the Intensive Care Unit (ICU) are a source of the economic drain and poor patient outcomes.[4] Strict adherence to infection control protocols and to line care bundles are recommended to reduce infections in post-surgical settings. Monitoring of quality indicators provides an institution an opportunity to improve its quality of care through standardisation of processes, procedures and treatment protocols.

We hypothesised that the adherence to standards of care could reduce infectious complications after major

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surgery. We enhanced the surveillance to adherence in bundle care and line insertion and emphasised on team discussions before surgery as part of surgical checklist protocols. The outcomes on infections were closely followed in the ICU until shift to the wards. Besides infectious outcomes, we looked at composite outcomes that included mortality, the length of ICU stay (LOICU), ventilator-associated pneumonia (VAP) readmission to the ICU within 24 h, re-intubation within 24 h, needle stick injuries, bedsores and iatrogenic pneumothorax.

The primary aim of this study was to evaluate the impact of quality improvement initiatives using a comprehensive surgical checklist derived from standard surgical and line care bundles on outcomes in patients undergoing abdominal surgery. The secondary outcomes were the LOICU stay and hospital-related infection rates.

**METHODS**

This was an observational study carried out using a compliance checklist, developed from the combination of the World Health Organization (WHO) surgery checklist and Society for Healthcare Epidemiology of America guidelines for the prevention of infections.

The sample size was derived using Slovin's formula applied to the number of cases performed each year. One hundred and seventy prospective samples of surgical patients were included for the adherence to infection control protocols and outcomes. This was compared to infection rates and outcomes in 170 retrospective patients selected by random number sampling excluding emergency surgeries or surgeries <4 h duration. The calculation was derived from Slovin's formula, \[ n = \frac{N(1 + N e^2)}{e^2} \] where \( N \) represented the number of surgeries performed the previous year and \( e \) the confidence interval (CI). Using a value of \( N = 1300 \) and 95% CI, \( (e = 0.05) \) the sample size was calculated as 340 patients. The study was undertaken between April and July 2015, and the tool was an assessment of adherence to standards and bundles in care of surgical patients.

A training programme was initiated which was divided into induction training and in-service training. The induction training was provided for newcomers, both doctors and nurses who were educated on key performance indicators (KPI), QI programmes and standard operation plans including surgical safety checklists. The in-service programme was training provided for preceptors in the theatres and ICUs. They were taught to regularly monitor KPI and evaluate compliance and to undertake corrective or preventive actions appropriately. The teaching programme was carried out between the 3rd week and the end of March 2015 before the implementation of the new protocol that began from April 2015.

The study was carried out in the gastrointestinal surgical and urology units of a tertiary care referral hospital after obtaining local ethics committee approval and informed consent. All patients undergoing major abdominal surgery defined as surgery lasting more than 4 h were included in this study. Minor surgeries and emergency surgeries were not included. To obtain the association between the groups and different categorical variables Chi-square test was applied. To compare the mean differences of numerical variables between groups independent two-sample \( t \)-test was applied.

The comprehensive checklist [Figures 1-3] was provided to the anaesthesia team at the beginning of surgery and compliance to protocols entered by respective team members that included surgical and nursing teams and was endorsed by all three team members. In addition to noting the compliance, we also looked at the composite outcomes in the ICU as end points of infection control. All patients were followed until their discharge from the hospital.

**RESULTS**

The filled checklists and the data collected from the hospital information system medical records were analysed using simple percentage method.

We noted that, after the introduction of comprehensive checklist, there was a significant improvement in the documentation of QI parameters [Table 1] which included changes in the plan of anesthesia, difficulty in line insertion, and maintenance of sterility in the insertion of lines, plan for post-operative ventilation and serious adverse events as defined by the National Accreditation Board for Hospitals. There was a statistically significant increase in the documentation of each component of the WHO surgery checklist that defined the preparedness of the team for the proposed surgery in the prospective group compared to the retrospective group \( [P < 0.001, \text{Table 1}] \). Adherence to bundles of care and their documentation had significantly improved in the prospective samples but
this did not result in any change in the post-operative infection rates or mortality (Table 2). LOICU stay (as a reflection of infection rates) was similar between the two groups.

**DISCUSSION**

Centers for disease control (CDC) have introduced evidence based guidelines for improvement of patient care. A major contribution for spread of infection is related to hand hygiene and historically compliance is as low as 39%.[8] The CDC and WHO have emphasised the need for improved hand hygiene practices and introduced recommendations to improve compliance at all levels of health care providers.[9] Won and colleagues[10] in their study on hand hygiene demonstrated the positive impact of compliance programs on nosocomial infections. Nursing care is a crucial component in line-related infections, and there is growing evidence that
shortages amongst the nursing staff jeopardize the quality of patient care.\[11\]

Outcomes after surgery depend on the recovery, infections from indwelling lines and the surgical site. Surgical site infection (SSI) is one of the most dreaded post-operative complication and causes significant post-operative morbidity, mortality, prolongation of hospital stay and can also increase hospital costs.\[12,13\] Approximately, 160,000–300,000 SSIs occur each year in the US,\[14,15\] and up to 60% of have been estimated to be preventable by implementing evidence-based guidelines.\[16,17\] Catheter-related bloodstream infections (CRBSIs) and other post-operative complications are also found to be

| Table 1: Documentation of WHO checklist |
|---------------------------------------|
| WHO checklist elements                 | Documentation | Retrospective | Groups | Prospective | P     |
|                                       | n=170 | Percentage | n=170 | Percentage |       |
| Patient confirmation                  | No    | 93        | 54.7  | 1          | 0.6   | <0.001|
|                                       | Yes   | 77        | 45.3  | 169        | 99.4  | <0.001|
| Aspiration risk                      | No    | 32        | 18.8  | 0          | 0.0   | <0.001|
|                                       | Yes   | 138       | 81.2  | 170        | 100.0 | <0.001|
| Risk of blood loss                   | No    | 28        | 16.5  | 1          | 0.6   | <0.001|
|                                       | Yes   | 142       | 83.5  | 169        | 99.4  | <0.001|
| Anaesthesia safety check             | No    | 57        | 33.5  | 2          | 1.2   | <0.001|
|                                       | Yes   | 113       | 66.5  | 168        | 98.8  |       |
| Introduction of team                 | No    | 3         | 1.8   | 1          | 0.6   | 0.31139|
|                                       | Yes   | 167       | 98.2  | 169        | 99.4  |       |
| Site marking                         | No    | 5         | 2.9   | 11         | 6.5   | 0.09958|
|                                       | Yes   | 165       | 97.1  | 159        | 93.5  |       |
| Images displayed                     | No    | 163       | 95.9  | 29         | 17.1  | <0.001|
|                                       | Yes   | 7         | 4.1   | 141        | 82.9  |       |
| Critical events                      | No    | 145       | 85.3  | 13         | 7.6   | <0.001|
|                                       | Yes   | 25        | 14.7  | 157        | 92.4  |       |
| Antibiotic prophylaxis before 1 h of surgery | No  | 20        | 11.8  | 1          | 0.6   | <0.001|
|                                       | Yes   | 150       | 88.2  | 169        | 99.4  |       |
| Sterilisation indicators             | No    | 141       | 82.9  | 16         | 9.4   | <0.001|
|                                       | Yes   | 29        | 17.1  | 154        | 90.6  |       |
| Instrument counts                    | No    | 107       | 62.9  | 27         | 15.9  | <0.001|
|                                       | Yes   | 63        | 37.1  | 143        | 84.1  |       |
| Specimens identified                 | No    | 123       | 72.4  | 38         | 22.4  | <0.001|
|                                       | Yes   | 47        | 27.6  | 132        | 77.6  |       |
| Equipment problems                   | No    | 126       | 74.1  | 37         | 21.8  | <0.001|
|                                       | Yes   | 44        | 25.9  | 133        | 78.2  |       |
| Name of the antibiotic               | No    | 39        | 22.9  | 14         | 8.2   | <0.001|
|                                       | Yes   | 131       | 77.1  | 156        | 91.8  |       |
| Pre-operative bath                   | No    | 44        | 25.9  | 15         | 8.8   | <0.001|
|                                       | Yes   | 126       | 74.1  | 155        | 91.2  |       |
| Glucose level                        | No    | 119       | 70.0  | 53         | 31.2  | <0.001|
|                                       | Yes   | 51        | 30.0  | 117        | 68.8  |       |
| Body preparation                     | No    | 80        | 47.1  | 24         | 14.1  | <0.001|
|                                       | Yes   | 90        | 52.9  | 146        | 85.9  |       |

WHO – World Health Organization

Figure 3: Modified quality control checklist page 5
high in the healthcare settings. A wound infection is the commonest and the most troublesome disorder of wound healing. Post-operative wound infections have been a problem since surgery was started as a treatment modality.\[^{19}\]

Specific interventions to reduce adverse post-operative events as per National Surgical Quality Improvement Programme included enforcement of protocols and adherence to the Institute for Healthcare Improvement ventilator bundles, including head of bed elevation, sedation holidays, encouraging early extubation and early institution of nutrition.\[^{19}\] A ‘bundle’ of ventilator care processes (peptic ulcer disease prophylaxis, deep vein thrombosis prophylaxis, elevation of the head of the bed and a sedation vacation) which may also reduce VAP rates can serve as a focus for improvement strategies in ICUs.\[^{20}\] However, scrupulous adherence in protocols and documentation are constantly needed to maintain standards of care.

A potentially preventable adverse outcome impacts the patient’s experience and increases the overall cost of treating the patient. We hoped that endorsing these guidelines could improve outcomes in our patients. Surprisingly, we did not find any significant differences in the infection rates. However, our study results revealed that supervised documentation of comprehensive checklist brought out significant improvement in the documentation of quality indicators in the prospective samples. We had defined positive blood culture with signs and symptoms of infection in the patient as blood stream infection. CRBSI was defined as growth of the same organism as the blood culture at least 2 h earlier and with greater numbers of colony forming units. VAP was defined by a positive culture in the bronchoalveolar lavage and radiological evidence of lung infiltrates. The CRBSI rate was 2.96/1000 catheter days in the prospective and 1.06/1000 catheter days in the retrospective samples while bloodstream infections at 6.5% in the prospective and 2.5% in the retrospective group were not significantly different. The CRBSI rate was within the lower limits of reported incidence in literature.\[^{21}\] Even though the time frame for both arms spanned across 6 months only, we felt that the patients in the prospective group could have been a sicker group than the retrospective patients. However, the differences in infection rates were not different statistically.
Measures to improve the quality of post-operative care and to reduce post-operative infections, the length of stay and other complications are to incorporate integrated inputs from nursing, anaesthetics and surgical teams during care, better communication among the surgical team, hospital-mandated use of a pre-operative surgical safety checklist and bundle adherence checklists.

An ideal situation demands the presence of a quality control team consisting of anaesthetists/intensivist, an infection control practitioner, nurse practitioner, surgeons, quality coordinators, pharmacist and nursing leaders. Monthly meetings including data reviews, critical incident reports on antibiotic usage and adherence to protocols on infection control are required.

Some of our patients discharged from the ICU had urine and bronchoalveolar lavage samples that were positive for organisms. In patient follow-up, we had excluded infection as a cause in patients who were asymptomatic and these patients were assigned to a group that could have contaminants or improper collection techniques.

The infection control practices in the ICUs play a vital role in the reduction of infections. Creation of awareness on the need for adherence to bundles of care must be addressed periodically. Periodical auditing of the documentation of various WHO surgery checklists and other checklists in the patient’s medical records should be carried out to continue the improvement in documentation. Timely updates of improvements in practices along with an internal assessment of individuals will ensure safety in the standard of nursing in the post-operative ICU. We documented a significant increase in awareness and compliance in the components of the mandated checklist with inputs from the anaesthesia, nursing and surgical teams. We had aimed to keep the rates of infection following line introduction to be minimal and implemented this after formal training of staff members on the recommended practices of the line care. We concluded that although documentation and awareness had improved with our intervention, we had probably established safe standards in line placements and did not have too much scope to improve.

The major limitation of this study was our failure to categorise patients according to their health profiles while comparing prospective and retrospective samples. This could have resulted in reducing the impact of supervised enforcement in perioperative care on outcomes in our patients.

**CONCLUSION**

The introduction of comprehensive surgical safety checklist improved documentation of quality care bundles but did not change the rates of infection or the ICU stay in patients undergoing abdominal surgery.

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**Conflicts of interest**

There are no conflicts of interest.

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