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Study of Impact of Implementation of Quality Care Bundle for Surgical Site Infection in Tertiary Care Centre

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Abstract:
This study examines the effectiveness of a quality care bundle in reducing surgical site infections (SSIs) at a tertiary care hospital in Indore. A total of 500 patients with SSIs were analysed. Following the implementation of the care bundle, SSI cases declined significantly from 50 to 20 (a 60% reduction), and the incidence rate dropped from 10% to 4%. The intervention also led to a decrease in the average hospital stay from 7 days to 5 days and improved medical device utilization (0.75 to 0.60). Infection rates among elective surgeries fell from 8.33% to 3.33%, while emergency surgeries saw a decline from 12.5% to 5%. These results underscore the effectiveness of structured infection prevention measures in enhancing patient safety, reducing complications, and optimizing hospital efficiency.

Keywords: Surgical site infection, quality care bundle, patient safety, infection prevention.

INTRODUCTION

Surgical site infections (SSIs) remain a significant cause of postoperative morbidity and mortality, leading to prolonged hospital stays, increased healthcare costs, and adverse patient outcomes globally. Despite advances in surgical techniques and infection control practices, SSIs continue to represent one of the most common healthcare-associated infections, particularly in tertiary care centers where complex surgical procedures are routinely performed. The prevention of SSIs is a critical component of patient safety and quality improvement initiatives in surgical care.

Evidence-based guidelines and quality indicators have been developed to standardize and enhance SSI prevention efforts. The Centers for Disease Control and Prevention (CDC) and the Hospital Infection Control Practices Advisory Committee (HICPAC) have issued comprehensive recommendations emphasizing appropriate antibiotic prophylaxis, maintenance of normothermia, glycemic control, and aseptic surgical techniques as key preventive measures[1,2]. Furthermore, the World Health Organization (WHO) has provided updated global guidelines that reinforce these interventions and advocate for structured surveillance and adherence to quality indicators to reduce SSI incidence[3].

Implementation of these quality indicators in tertiary care settings can be challenging due to variations in resources, staff training, and compliance monitoring. However, studies have demonstrated that systematic application of these measures significantly lowers SSI rates and improves overall surgical outcomes[4]. This paper aims to evaluate the impact of implementing quality indicators for SSI prevention at a tertiary care center, focusing on adherence to recommended practices and the resulting effect on infection rates and patient safety. By examining these outcomes, the study seeks to contribute valuable insights into effective strategies for enhancing the quality of surgical care and minimizing the burden of SSIs.

MATERIAL AND METHODS:

AIM AND OBJECTIVES OF THE STUDY:

1. To determine the prevalence of SSI in a tertiary care hospital.
2. To determine the effectiveness of application of quality indicator in reduction of SSI in a tertiary care hospital.

RESEARCH METHODOLOGY

This is an hospital based prospective interventional Qualitative study with study population being health care workers working in the institute during the period of study

Inclusion And Exclusion Criteria's

Inclusion: All operated cases with "primary skin closure"

Exclusion:

- Infection present at time of Surgery (PATOS)
- Stitch abscess, "pin site" infections/colostomy stomas & burn site infections

The study was carried in 2 parts including analysis before intervention, intervention and after intervention phases, phase 1 included a 6-month pre intervention, phase of intervention and phase 2 included the post-intervention phase of 6 months duration. Phase 1 - records of patient with NSI was be noted during the prescribed time period among the study population. The intervention included organizing classroom presentations, pre and post-test lecture and demonstration, Onsite trainings for collection as well as processing of sample Implementation of care bundles to the clinician and other health care workers was done in batches of 15 participants as mentioned below.

Training Period for Each Batch: 5 Hours

Topics Included in Training

- Introduction and Importance of prevention of SSI
- Introduction to care bundle for prevention of SSI

Per-operative Interventions

- Antibiotic Prophylaxis
- Skin Preparation
- Patient Hygiene

Intra-operative Interventions

- Hand Hygiene and Sterility
- Environmental Control
- Normothermia

Post-operative Interventions

- Wound Care

- Antibiotic Use.
- Monitoring
- Reporting and Monitoring

After intervention the study was continued as phase 2 during which cases of SSI were noted and compared with data of phase 1.

Predesigned, pretested and validated proforma was used to collect the data from case files and treatment record of the patients

The study was conducted at a tertiary care centre at Indore after obtaining approval from the Institutional Research Ethical Committee and written consent from patient's attendants/relatives.

All the data recorded was recorded by pretested and validated proforma from the case sheets and treatment records of the patients.

All the data recorded was collected and tabulated under different categories in MS Excel windows 11 and same was used for the analysis by different tests of statistics to draw conclusion by using SSPS version 21 software. The data was analysed with respect to rate and percentage as applicable. Paired t test was used to calculate statistical significance where $P<0.05$ was considered as level of statistical significance.

OPERATIONAL DEFINITIONS FOR THE STUDY

Surgical site Infection (Superficial SSI)

The Infection, which happens within 30 days post-surgery, and the infection, which involves only skin and sub cutaneous tissues

OR

The Infection occurring within 30 or 90 days post- surgical procedure and the infection involving deep soft tissues (e.g., fascial and muscle layers)

SSI rate = <u>Number of patients developing SSI in a period x 100</u>

Total number of clean surgeries performed in that period

Device utilisation rate = <u>Number of surgical procedures</u> x 100

Number of patient days

OBSERVATIONS AND RESULTS

A Total of 500 patients with SSI were analysed in the study and the results are as follows:

Table 1: Demographic Data for Surgical Site Infections (SSIs) :

Demographic character	Number of Patients
Total Patients	500
Gender wise distribution of patients	
Male	300
Female	200
Age wise distribution of patients	
Under 30	50
Age 30-50	200
Over 50	250

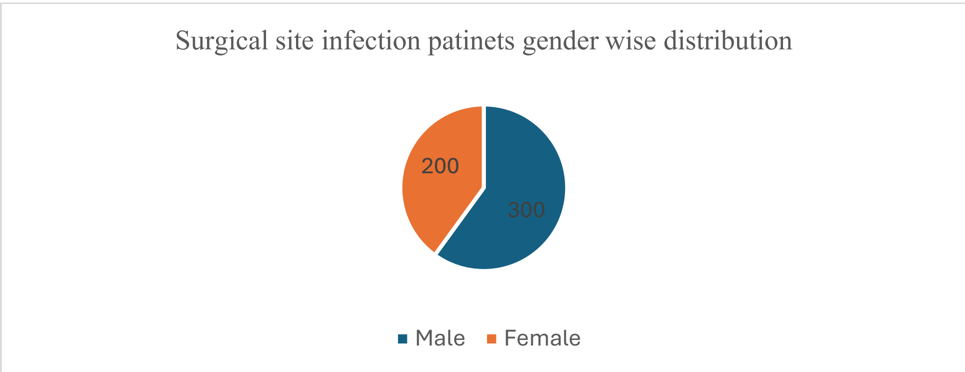
Demographic character	Number of Patients
Type of surgery	
Elective Surgery	300
Emergency Surgery	200
Elective surgeries	
Hernia Repair	100
Cholecystectomy	80
Joint Replacement	70
Other Elective Surgeries	50
Emergency surgeries	
Appendectomy	60
Trauma Surgery	70
Bowel Obstruction	40
Other Emergency Surgeries	30

Table 2: impact of implementation of quality care bundle for prevention of SSIs

Category	Before Implementation	After Implementation	Reduction (%)
Number of SSIs	50	20	60%
Incidence Rate (per 100 patients)	10%	4%	60%
Average Length of Stay (days)	7	5	-
Device Utilization Ratio	0.75	0.60	-
Elective Surgery - SSIs	25/300 (8.33%)	10/300 (3.33%)	-
Emergency Surgery - SSIs	25/200 (12.5%)	10/200 (5%)	-

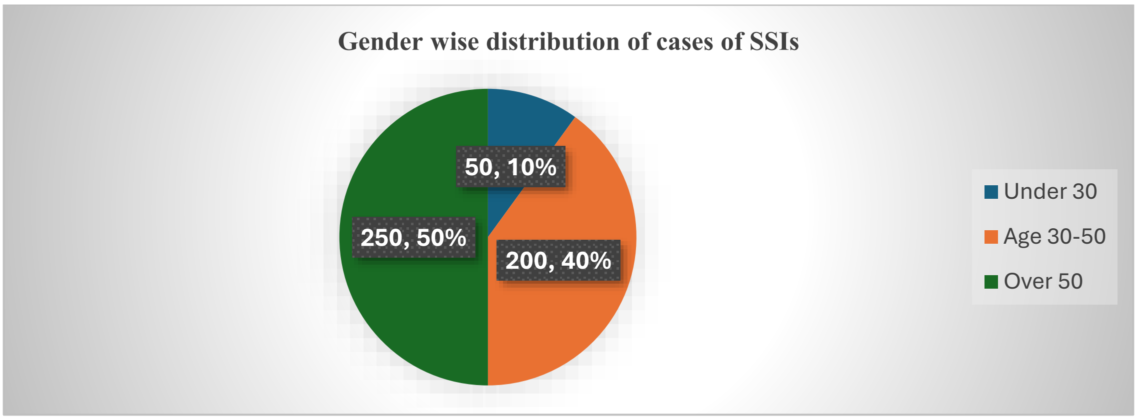
P value for Average length of stay and SSI Device Utilization Ration is 0.0019 and 0.039 respectively.

Figure 1: Gender wise distribution of patients of surgical site infection



Above graph shows gender wise distribution of cases of Surgical site infection. Out of total 500 patients 300 (60%) were male while 200 (40%) patients were female, suggesting a higher prevalence of surgical site infection among males.

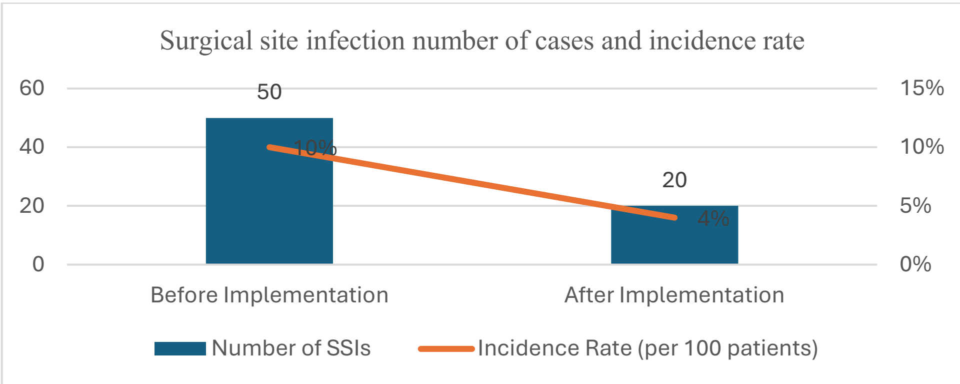
Figure 2: Age wise distribution of patients of surgical site infection



Above graph shows age wise distribution of cases of Surgical site infection. 50 patients (10%) were of age 30 years or below, 200 patients (40%) belonged to age group of 30 to 50 years while remaining 250 patients (50%) were of age more than 50 years.

The age distribution shows that the majority of patients requiring surgical procedures were over 30 years old with half of the patients being over 50 years. This trend suggests the likelihood of needing a surgical intervention increasing with age.

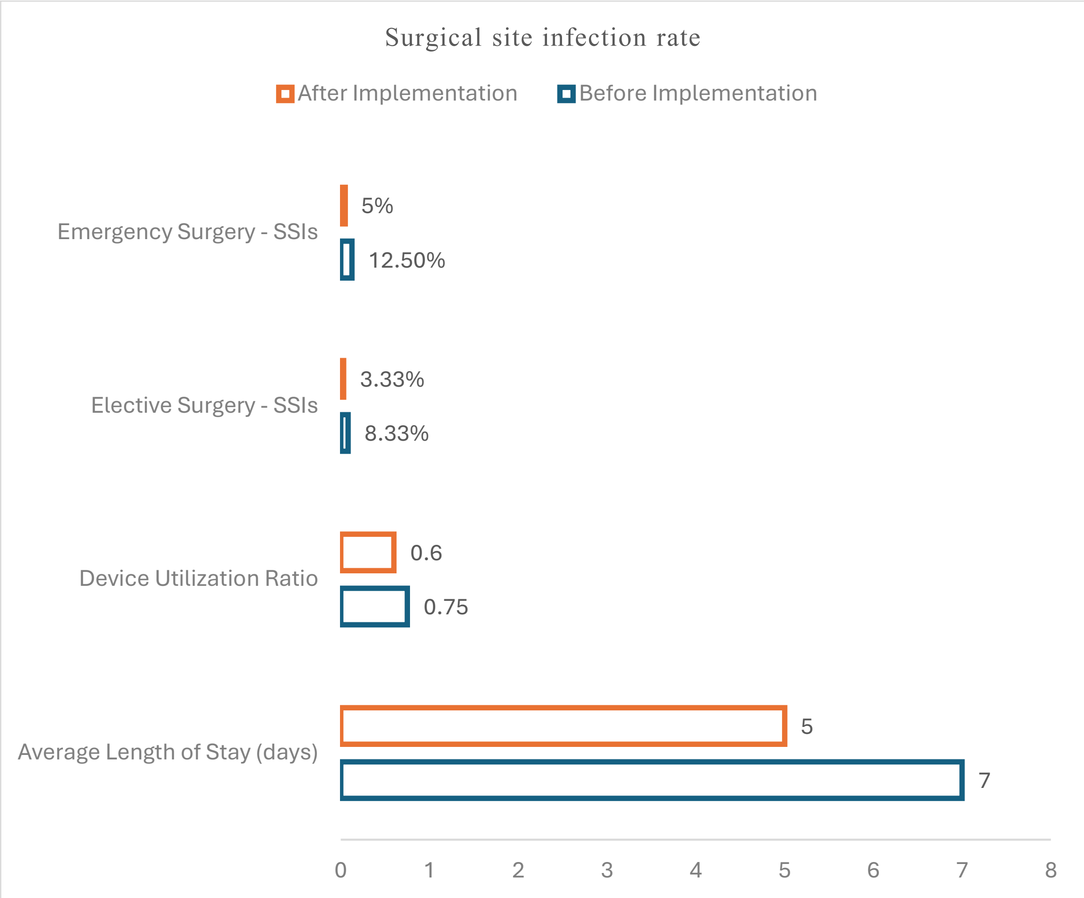
Figure 3: Number and incidence rate of surgical site infection cases before and after implementation of care bundle



The number of SSIs reduced significantly from 50 to 20, reflecting a 60% decre-
ase. This substantial reduction indicates that the intervention was highly effective in preventing surgical site infections, contributing to improved patient outcomes and overall hospital safety.

The incidence rate of SSIs per 100 patients also saw a 60% reduction, from 10% to 4%. This consistent r eduction with the number of SSIs underscores the success of the intervention in lowering the risk of infections among surgical patients.

Figure 4: Rate, device utilization ration and average length of stay in surgical site infection cases before and after implementation of care bundle



The graph depicts SSI rate for elective and emergency surgeries, Device utilization ration and average length of stay of patients before and after implementation of care bundle for prevention of SSI. For elective surgeries, SSIs decreased from 8.33% to 3.33%. It highlights the intervention's success in making planned surgeries safer for patients, reducing infection risk significantly.

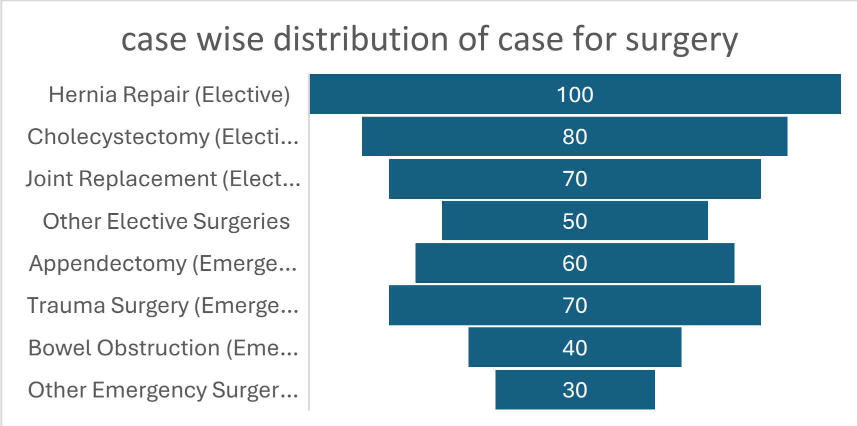
For emergency surgeries, SSIs decreased from 12.5% to 5%,. Emergency surgeries inherently carry high er risks, so this significant reduction demonstrates the intervention's effectiveness even in more critical a nd high-stakes scenarios

The average length of hospital stay decreased from 7 days to 5 days.

The device utilization ratio saw a reduction from 0.75 to 0.60, a 20% decrease. This suggests more effect ive and efficient use of medical devices, likely contributing to the reduction in SSI and promoting better hygiene practices.

P value for Average length of stay and SSI Device Utilization Ration is 0.0019 and 0.039 respectively, showing statistically significant reduction on average length of stay and device utilization ration on cases of SSI.

Figure 5: Reason for surgery in cases of SSI



A significant 60% of the surgeries were elective, indicating planned and possibly nonurgent procedures. In contrast, 40% were emergency surgeries, requiring immediate medical attention.

Among the elective surgeries, hernia repairs were the most common, accounting for 20% of the total patient population, followed by cholecystectomy (16%) and joint replacements (14%). Other elective surgeries make up 10%.

In the emergency category, trauma surgery was the leading cause, accounting for 14% of the total, followed by appendectomies at 12% and bowel obstructions at 8%. Other emergency surgeries constitute 6%.

DISCUSSION:

In this study we analysed the impact of a care bundle implementation on surgical site infections (SSIs) in a tertiary care hospital. The results demonstrated significant improvements post-implementation in terms of reduced SSIs, shorter length of stay, and a lower device utilization ratio.

These findings were compared with those from studies by Horgan BA[6], Wai Khuan Ng[7] and Shalini Ahuja[5]. we observed that he implementation of the care bundle resulted in a significant reduction in the number of SSIs, from 50 to 20, marking a 60% decrease. This reduction is crucial as it directly correlates with improved surgical outcomes and reduced complications. Horgan BA[6] observed a reduction in SSI rates from 25.3% (24/95) in T0 to 10.1% (10/99) in T2, indicating a similar trend of significant improvement post-intervention. Wai Khuan Ng[7] reported a decrease in SSI rates from 2.8% in Q3 2013 to 1.0% in Q2 2014, underscoring the effectiveness of targeted interventions. Shalini Ahuja (2022) highlighted multiple studies showing SSI reductions, with factors such as BMI and duration of surgery playing key roles. Our study's results align with these findings, reinforcing the importance of implementing comprehensive care bundles to reduce SSIs effectively.

We noticed that the incidence rate of SSIs decreased from 10% (50 out of 500 patients) to 4% (20 out of 500 patients), demonstrating a 60% reduction. This substantial decrease mirrors the results observed by Horgan BA[6], who reported a reduction from 25.3% in T0 to 10.1% in T2. The decrease in incidence rates in both studies highlights the effectiveness of care bundle implementation in improving patient safety and outcomes. Wai Khuan Ng[7] also observed a reduction from 2.8% to 1.0%, further validating the impact of antimicrobial prophylaxis and root cause analysis. Shalini Ahuja[5] emphasized the role of tailored interventions in reducing SSI rates, with our study's findings aligning with these observations.

The average length of hospital stay decreased from 7 days to 5 days, reflecting a 28.57% reduction. Shorter hospital stays are associated with faster recovery times, reduced healthcare costs, and lower risks of hospital-acquired infections. Horgan BA[6] reported a decrease in median length of stay from 10 days in T0 to 7 days in T1 and 8 days in T2, indicating similar improvements in patient recovery times post-intervention. The alignment between these studies underscores the significance of effective care bundles in enhancing surgical outcomes and reducing hospital stays.

The device utilization ratio decreased from 0.75 to 0.60, marking a 20% reduction. This metric indicates the proportion of patients requiring devices such as catheters, and its reduction suggests better adherence to guidelines and judicious use of medical devices. While specific device utilization ratios were not highlighted in the compared studies, the overall reduction in SSIs and improved outcomes imply similar improvements in device management.

The importance of antimicrobial prophylaxis, hygiene discipline, and other care bundle components in achieving these results cannot be overstated.

Comparative Analysis

Study by Horgan BA[6] observed significant reductions in SSI rates and length of stay, aligning with our study's findings. The reduction in SSI rates from 25.3% to 10.1% and the decrease in median length of stay from 10 to 7 and 8 days indicate substantial improvements post-intervention, similar to our observed reductions.

Study by Wai Khuan Ng[7] achieved significant reductions in SSI rates from 2.8% to 1.0%, emphasizing the importance of antimicrobial prophylaxis and root cause analysis. These interventions align with our care bundle components, resulting in comparable reductions in SSI rates and improved surgical outcomes.

Study by Shalini Ahuja[5] highlighted multiple studies showing reductions in SSI rates, with factors such as BMI and duration of surgery affecting outcomes. Our study's findings of reduced SSI rates, shorter hospital stays, and improved device utilization ratios align with these observations, reinforcing the effectiveness of tailored interventions and continuous monitoring.

Cecilia et[8] al reported maximum cases of surgical in emergency surgeries however in this study more number of surgical site infections were observed among elective surgeries.

The results of our study align with those of previous studies, reinforcing the effectiveness of care bundle implementations in reducing SSI rates, shortening hospital stays, and improving overall surgical outcomes. The significant reductions observed in our study are consistent with findings by Horgan BA[6], Wai Khuan Ng[7], and Shalini Ahuja[5], demonstrating the robustness of these interventions in diverse clinical settings.

Continuous monitoring, adherence to best practices, and a multidisciplinary approach are essential to sustain these improvements and ensure optimal patient care. The differences in baseline SSI rates and patient demographics highlight the need for tailored interventions to address specific patient populations effectively.

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