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Impact of Surgical Site Infections on Patient Outcomes and Healthcare Costs

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ABSTRACT
Surgical site infections (SSIs) are a significant concern in healthcare, impacting both patient well-being and healthcare expenditures. This study examines the specific effects of SSIs on patient outcomes and healthcare costs in the context of Indian healthcare facilities, utilizing a sample size of 100 patients. Data was collected from Indian hospitals, comparing two groups patients with SSIs and those without. The study assessed parameters including hospital stay duration, readmission rates, surgical complications, antibiotic usage, quality of life, mortality and associated healthcare costs. Patients with SSIs in Indian hospitals had an extended hospital stay, averaging 15 days compared to 7 days for those without SSIs. This translated to an additional cost of ₹40,000 per patient. Furthermore, SSIs led to a 25% higher readmission rate within 30 days, incurring an extra ₹10,000 per readmission. Surgical complications were 35% more prevalent in patients with SSIs, contributing an average cost of ₹15,000 per complication. Increased antibiotic usage added ₹5,000 per patient. Patients with SSIs reported a 20-point reduction in their quality of life score (0-100). The mortality rate among those with SSIs was 7%, resulting in the loss of 7 lives in the sample. In total, patients with SSIs incurred an additional healthcare cost of ₹60,000 per patient and the financial burden on these patients included ₹7,000 in out-of-pocket expenses. This study highlights the substantial impact of SSIs on patient outcomes and healthcare costs in the Indian healthcare setting. Efforts to prevent SSIs through effective infection control measures and improved surgical practices are crucial not only for patient well-being but also for reducing the economic burden on healthcare systems and patients in India.

INTRODUCTION

Surgical site infections (SSIs) represent a formidable challenge within the landscape of modern healthcare. These infections, which occur as a consequence of surgical procedures, have profound implications for patient outcomes, healthcare resource utilization, and costs. This introduction delves into the multifaceted dimensions of SSIs, emphasizing their significance in the Indian healthcare context, where the burden of such infections is notable. With a sample size of 100 patients as a reference point, this narrative elucidates the far-reaching implications of SSIs on both patients and healthcare systems in India.

Background: Surgical site infections constitute a subset of healthcare-associated infections (HAIs) characterized by their occurrence at the site of a surgical incision or within the surgical wound. They are among the most common HAIs and encompass a range of clinical presentations, from superficial infections that involve only the skin and subcutaneous tissue to more severe, deep-seated infections affecting organs and internal structures. SSIs are associated with various factors, including the type of surgery, patient risk factors, and the quality of perioperative care.

Magnitude of the problem: The incidence of SSIs varies worldwide and in India, these infections pose a significant healthcare challenge. India, with its diverse patient population, a wide array of surgical procedures, and a range of healthcare facilities, faces a unique set of challenges in mitigating the impact of SSIs. As healthcare in India continues to evolve, understanding the specific implications of SSIs within this context is of paramount importance.

Patient outcomes: SSIs are not merely infections; they are disruptors of patient well-being. Among patients who develop SSIs, extended hospital stays are almost a given. The prolonged duration of hospitalization not only affects patient's lives but also places additional stress on already overburdened healthcare facilities. On average, patients with SSIs in India require an additional 8 days of hospitalization, with the associated costs soaring to ₹40,000 per patient. These extended stays have implications for the overall capacity of hospitals and the allocation of healthcare resources.

Readmission rates: Patients who experience SSIs in India are confronted with a higher likelihood of readmission within 30 days of discharge. These readmissions, often necessitated by persistent or recurrent infections, contribute to further healthcare expenses. In this scenario, SSIs lead to a 25% higher readmission rate, with each readmission incurring an additional cost of approximately ₹10,000. The cycle of infection, treatment and readmission imposes a heavy financial and emotional burden on patients and their families.

Surgical complications: SSIs are not isolated events; they frequently trigger a cascade of complications. In India, 35% of patients with SSIs experience additional surgical complications, including the formation of abscesses, wound dehiscence (the surgical wound reopening) and the need for supplementary surgeries to address the infection. These complications contribute significantly to the financial burden, with each complication increasing costs by an average of ₹15,000 per patient. Moreover, they impede the patient's recovery, leading to increased suffering and a lower quality of life.

Antibiotic usage: The treatment of SSIs invariably involves the administration of antibiotics. However, the overuse or misuse of antibiotics can have far-reaching consequences, contributing to antibiotic resistance a burgeoning public health concern. Patients in India who develop SSIs incur an average antibiotic cost of ₹5,000 per patient. The prudent use of antibiotics is not only essential for individual patient care but also for preserving the efficacy of these critical drugs for future generations.

Quality of life and mortality: Beyond the physical and financial consequences, SSIs erode the quality of life for affected patients. Patients who develop SSIs report a significant reduction in their quality of life, with a 20-point decline on a scale of 0-100. This decline encompasses both physical discomfort and psychological distress, further underscoring the multifaceted nature of SSIs. In their most severe form, SSIs can lead to patient mortality. While many SSIs are treatable, severe infections can result in a 7% mortality rate among affected patients in the Indian context. Each life lost to an SSI is not only a tragedy but also underscores the urgency of effective prevention strategies.

Economic impact: The financial repercussions of SSIs extend beyond the healthcare system. Treating SSIs in India requires additional healthcare resources, including extended hospital stays, medications, diagnostic tests and surgical interventions. These added costs strain healthcare budgets and resources, impacting the overall healthcare infrastructure.

Financial burden on patients: Patients who experience SSIs in India are not only grappling with physical and emotional distress but also face an additional financial burden. This burden encompasses out-of-pocket expenses, including copayments and deductibles,

which average₹7,000 per patient. These costs can have long-term consequences, affecting the financial stability of patients and their families and potentially limiting their access to healthcare services.

MATERIALS AND METHODS

Study design: This study employed a prospective observational design to assess the incidence and factors contributing to surgical site infections (SSIs) among patients undergoing various surgical procedures at Kakatiya Medical College.

Study setting: The research was conducted at Kakatiya Medical College, a tertiary care hospital located in Warangal, Telangana, India. This hospital serves a diverse patient population and offers a wide range of surgical services.

Study duration: The study spanned from January 2019 to December 2019, encompassing a full calendar year to capture seasonal variations in infection rates.

Study population: The study population consisted of all patients undergoing surgical procedures during the study period, encompassing a broad spectrum of surgical specialties including general surgery, orthopedics, gynecology, urology and others.

Sample size: The sample size was determined based on the historical incidence of SSIs in the hospital. A sample size of 100 patients was chosen to ensure a representative sample.

Data collection: Data collection was conducted by a team of trained healthcare personnel, including nurses and medical officers, who were responsible for daily surveillance of surgical patients. Data collected included patient demographics, preoperative risk factors (e.g., age, comorbidities), surgical details (e.g., type of surgery, duration) and postoperative care (e.g., wound care, antibiotic administration). Surgical site infections were identified based on the criteria set by the centers for disease control and prevention (CDC).

Outcome measures: The primary outcome measure was the incidence of SSIs, which was defined as infections occurring within 30 days post-surgery (or within one year for implant-related procedures). Secondary outcome measures included the types of pathogens involved in SSIs the need for surgical interventions to manage SSIs and the impact of SSIs on patient outcomes (e.g., length of hospital stay, readmission rates and mortality).

Data analysis: Data analysis was conducted using statistical software (e.g., SPSS or R). Descriptive statistics were used to summarize patient demographics, surgical characteristics and SSI rates.

Bivariate and multivariate analyses were employed to identify potential risk factors associated with SSIs.

Ethical considerations: Ethical approval for the study was obtained from the Institutional Ethics Committee of Kakatiya Medical College. Informed consent was obtained from all study participants, or their legally authorized representatives, prior to enrollment.

RESULTS

Increased length of hospital stay: In India, patients who develop SSIs often require an extended hospital stay. On average, patients with SSIs stayed in the hospital for 15 days, while those without infections stayed for 7 days. This extended stay resulted in an average cost increase of₹40,000 per patient (Table 1).

Higher readmission rates: Patients with SSIs in India had a 25% higher readmission rate within 30 days of discharge compared to those without SSIs. These readmissions incurred an additional cost of approximately ₹10,000 per patient (Table 2).

Surgical complications: SSIs led to surgical complications in 35% of cases, including abscess formation, wound dehiscence and the need for additional surgeries. These complications added an average cost of ₹15,000 per patient.

Increased antibiotic usage: Patients with SSIs received antibiotics for an extended duration, resulting in an average antibiotic cost of₹5,000 per patient. Overuse of antibiotics also contributes to long-term healthcare costs due to potential antibiotic resistance.

Table 1: Impact of SSIs on hospital stay and costs in India in 100 patients

Outcome	Patients with SSIs	Patients without SSIs	Difference
Average hospital stay (days)	15	7	+8 days
Additional cost per patient (₹)	40,000	-	+ 40,000
Readmission rate (%)	25%	-	+25%
Additional cost per readmission (₹)	10,000	-	+ 10,000
Surgical complications (%)	35%	-	+35%
Additional cost per complication (₹)	15,000	-	+ 15,000
Antibiotic usage cost (₹)	5,000	-	+ 5,000
Quality of life reduction (0-100)	-20	-	-20
Mortality rate (%)	7%	-	+7%
Additional healthcare cost per patient (₹)	60,000	-	+ 60,000
Financial burden on patients (₹)	7,000	-	+ 7,000

Table 2: Impact of SSIs on patient outcomes and costs in India in 100 patients

Outcomes	Values
Average hospital stay (days)	15 days
Additional cost per patient (₹)	40,000
Readmission rate (%)	25%
Additional cost per readmission (₹)	10,000
Surgical complications (%)	35%
Additional cost per complication (₹)	15,000
Antibiotic usage cost (₹)	5,000
Quality of life reduction (0-100)	-20
Mortality rate (%)	7%
Additional healthcare cost per patient (₹)	60,000
Financial burden on patients (₹)	7,000

Impaired quality of life: Patients with SSIs reported a significantly lower quality of life during their recovery period, with a 20-point reduction in their quality of life scores on a scale of 0-100.

Mortality: Severe SSIs led to a 7% mortality rate among affected patients, resulting in the unfortunate loss of 7 lives in this sample of 100 patients.

Increased healthcare costs: The total healthcare costs for patients who developed SSIs were, on average, ₹60,000 higher per patient compared to those without infections. This includes the added costs of extended hospitalization, surgical interventions, medications, and readmissions.

Financial burden on patients: Patients who experienced SSIs faced an additional financial burden, with out-of-pocket expenses averaging ₹7,000 in copayments and deductibles. This financial burden can have long-term consequences for patients and their families, impacting their ability to afford healthcare services.

DISCUSSIONS

Burden of SSIs in Europe: The study by Badia *et al*.[1] conducted a systematic review across six European countries, emphasizing the significant impact of SSIs on healthcare costs and patient outcomes. The review found that SSIs led to increased hospitalization duration and healthcare costs. These findings highlight the widespread implications of SSIs across European healthcare systems.

Economic burden in low-and middle-income countries: Monahan *et al*.[2] conducted a systematic review focusing on low-and middle-income countries, shedding light on how SSIs impact resource-constrained healthcare systems. This study underscores the global scope of the SSI problem, particularly in settings where resources are often limited.

Specific pathogens and surgery types: Patel *et al*.[3] explored the burden of SSIs associated with select spine operations and emphasized the role of Staphylococcus aureus. This study underscores the importance of understanding specific pathogens and surgery types prone to SSIs, allowing for tailored preventive measures and antibiotic strategies.

Burden in the netherlands: Koek *et al*.[4] investigated the burden of SSIs in the Netherlands, including cost analyses and disability-adjusted life years. This study provides valuable insights into the impact of SSIs in a specific country, demonstrating the importance of local data in healthcare planning.

Cost-analysis of care bundle: Jiménez-Martínez *et al*.[5] conducted a cost-analysis study of a care bundle to prevent SSIs after craniotomy. Their findings underscore the potential cost-effectiveness of preventive measures, prompting discussions on the implementation of similar bundles in other surgical contexts.

Health-related quality of life: Totty *et al*.[6] explored the impact of SSIs on health-related quality of life after vascular surgery, emphasizing the broader consequences of SSIs on patient well-being. This aspect highlights the importance of considering quality of life beyond clinical and economic aspects.

Telemedicine in wound assessment: Totty *et al*.[7] investigated the use of photograph-based telemedicine in postoperative wound assessment for diagnosing SSIs. This technology-driven approach could significantly improve early detection and reduce the impact of SSIs, as shown in their study.

European perspective: Leaper *et al*.[8] provided a comprehensive European perspective on the incidence and economic burden of SSIs, offering a long-term view of trends and changes in SSI incidence and costs over time.

Predicted financial consequences: Jenks *et al*.[9] predicted the financial consequences of eliminating SSIs from an English hospital, offering insights into the potential return on investment in SSI prevention efforts.

Adverse impact of SSIs in english hospitals: Coello *et al*.[10] studied the adverse impact of SSIs in English hospitals, shedding light on how these findings align with other research and how English hospitals have responded to mitigate SSIs.

In our study conducted at Kakatiya Medical College, we observed a significant clinical and economic impact of surgical site infections (SSIs) in the Indian context. These findings underscore the urgent

need for robust prevention strategies to mitigate SSIs, enhance patient outcomes and alleviate the economic burden on healthcare systems and patients in India.

CONCLUSION

our study reaffirms the substantial clinical and economic impact of surgical site infections (SSIs). SSIs lead to extended hospitalization, heightened healthcare costs and adverse patient outcomes. Promising prevention measures like care bundles and telemedicine can help alleviate this burden. Recognizing the urgency of comprehensive prevention efforts is essential, as SSIs continue to challenge healthcare systems worldwide.

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