Surgical Site Infections (SSI) and associated factors in a tertiary care teaching hospital in North Karnataka

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Abstract

Background: Surgical site infections are the second most common Hospital associated infections. Infections prolong hospital stays, create long-term complications, increase resistance to antibacterials, this presents a massive additional financial burden for health systems, generate high costs for patients and their family, and cause unnecessary deaths.

Objectives: To estimate the cumulative incidence of Surgical site infection in patients undergoing surgery in different categories, study bacteriology, and the different factors associated with the occurrence of SSI.

Methods: A prospective study was conducted on 190 surgical cases admitted during the study period in the general surgery wards of a teaching hospital. All relevant pre-operative and post-operative factors contributing to development to surgical site infection were collected. Wound check was done for detecting the SSI on day 2/3, day 7 or Suture removal and day 30 postoperative. SSI was diagnosed in patient having signs of inflammation. Culture of the discharge from wound taken if present and sent for microbiological test.

Results: Superficial surgical site infection was detected in 19 out of 190 patients (10%). The age of study subjects ranged from 18 years to 85 years. Almost half the patients had 1 or more chronic co-morbid conditions like diabetes, hypertension, anemia etc. In 57% of the surgeries were completed within an hour. Only 8.4% surgeries extended more than 2 hours.12.6% patients required preoperative blood transfusion. Surgical implants including drains and tubes were used in 68% cases. All the cases those underwent surgery were administered antibiotics postoperatively. 93% received preoperative antibiotics also. Preoperative preparations of the patients were routinely done. E. coli was the most commonly isolated organism.

Conclusion: Surgical site infections can be prevented with good infection control practices and patient education. Interventions to decrease incidence of preventable SSI will not only improve safety but also quality of health care.

Key words: surgical site infection, risk factors, microbial profile.

Introduction

Hospital associated Infections are as old as the hospitals itself. Significant advances in infection control practices pioneered by Ignaz Semmelweis, Joseph Lister, Florence Nightingale, etc have reduced their burden significantly. Surgical site infections are the second most common Hospital associated infections.

SSIs are defined as infections related to the operative procedure that occurs at or near the surgical incision within 30 days of an operative procedure or within one year if an implant is left in place[1].

Recent work by the World Health Organization's (WHO) Clean Care is Safer Care program shows that surgical site infection (SSI) is the most surveyed and frequent type of HAI in low and middle income countries (LMICs), affects up to one-third of the patients who have under gone surgical procedure [2].

In LMICs, the pooled incidence of SSI is 11.8/100 surgical procedures (range 1.2-23.6%). SSI is one of the most common post-operative complications and causes significant post-operative morbidity and mortality.

While the global estimates of SSI have varied from 0.5% to 15%, studies in India have consistently shown higher rates ranging from 23% to 38%[3].

A study by Subramanian et al, at All India Institute of Medical Science estimated an infection rate of 24.8%.

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A similar study by Ganguly et al. in Aligarh reported an infection rate of 38.8%. The incidence of SSI was found to be related to the type of wounds and varied with the operation location[4].

Health care-associated infections have high economic health care burden. They create additional suffering and come at a high cost for patients and their families. Infections prolong hospital stays, create long-term disability, increase resistance to antimicrobials, this leads to massive additional financial burden for health systems, generate high costs for patients and their family and cause unnecessary deaths[5].

Factors associated with SSIs result from the complex interaction between the health of the patient, the nature and number of organisms contaminating the surgical site, and the surgical technique. Patient-related factors implicated in the development of SSIs include advanced age, co morbidity (renal failure, cirrhosis, diabetes, coronary artery disease, chronic obstructive pulmonary disease, smoking, cancer, shock, malnutrition, obesity), preexisting infections, preoperative hospital stay, host-defense deficiency such as immune compromised state, and colonization with Staphylococcus aureus or other potential pathogens.

Procedure-related factors include surgery duration, technique, quality of preoperative skin preparation, inadequate sterilization of surgical instruments, use of antiseptics, duration of surgical scrub, preoperative shaving, antimicrobial prophylaxis, operation- room ventilation, poor homoeostasis, use of surgical drains, foreign material in the surgical site, and tissue trauma[6].

The objective of the study was to estimate the cumulative incidence of SSI in patients undergoing surgery indifferent categories, study bacteriology by subjecting the wound discharge for culture and sensitivity of the organism to find out the drug of choice rather empirical treatment, and the different factors associated with the occurrence of SSI, like novel health care practices in the General Surgery wards of Hospital.

Materials and Methods

This study was carried out in the surgical units of Karnataka Institute of Medical Sciences Hospital in Hubli, Karnataka, India, on 190 cases who underwent surgeries during the 3 months study period from Jan-March 2020.

Inclusion Criteria: Age>18 years, Patients with clean and clean-contaminated category operated electively and contaminated and dirty category as emergency surgeries, Prophylactic antibiotics administered for the groups of Class II, III, and IV at the right time and duration.

Exclusion Criteria: Refusal to participate in the study, Patients who were already receiving antibiotics for>1 week, Patients undergoing re-operations, Patients who were could not come for a follow-up of up to 30 days since the day of the operation.

Method of data collection:

The patients were explained about the purpose of the study and an informed consent was taken. Data was collected about the relevant preoperative and postoperative factors contributing to development of surgical site infection using the WHO Tool for SSI Surveillance data collection tools. All relevant clinical documents including preoperative, operative, post-operative notes, culture sensitivity tests and basic biochemical investigations were referred for accurate at collection. Wound check was done for detecting the SSI on day 2/3, day 7 or Suture removal and day 30 postoperative. SSI was diagnosed if patient has signs of inflammation.

Statistical Analysis: The data was entered in Microsoft excel and processed in the Statistical Package for Social Sciences software for windows, version 21.0. The results were summarized as frequencies and percentages.

Results

The study was conducted on 190 surgical cases of a tertiary care hospital. Superficial surgical site infection was detected in 19 out of 190 patients (10%). The age of study subjects ranged from 18 years to 85 years. Majority of the patients belonged 30-45 years followed by 46-60 years age group. 61.6% were males and 38% were females. The ratio between elective and emergency surgeries was 2:1. Majority of these surgeries were open (98.9%)

Table1: Baseline characteristics of the study participants

Baseline Characteristics		Frequency	Percent
Age	18-29 Years	44	23.2
	30-45 Years	65	34.2
	46-60 Years	58	30.5
	≥60 Years	23	12.1
Gender	Male	117	61.6
	Female	73	38.4
ASA Grade of Patient	1	88	46.3
	2	94	49.5
	3	3	1.6
	4	5	2.6
Wound Classification	Clean	97	51.1
	Clean Contaminated	73	38.4
	Contaminated	18	9.5
	Dirty	2	1.1

Risk factors for SSI

Majority of the patients (96%) had an ASA score of 1 or 2. The wounds classification was Clean, Clean Contaminated, Contaminated and Dirty in 51.1%, 38.4%, 9.5% and 1.1% cases respectively. Almost half the patients had 1 or more chronic co-morbid conditions like diabetes, hypertension, anemia etc.

Preoperative preparations of the patients were routinely done. Preoperative shaving was done in 50% and scrub bath in 75% cases. Surgical hand wash was done using soap and water in 60% cases and antimicrobial like chlorhexidine was used in 40%.

57% of the surgeries were completed within an hour. Only 8.4% surgeries extended more than 2 hours. 12.6% patients required preoperative blood transfusion. Surgical implants including drains and tubes where used in 68% cases. All the cases who underwent surgery were administered antibiotics post operative.93% received preoperative antibiotics also.

Table2: Risk factors for surgical site infections.

Risk Factors		Frequency	Percent
Mode of Surgery	Elective	127	66.8
	Emergency	63	33.2
Type of Surgery	Open	188	98.9
	Laparoscopic	2	1.1
Comorbid Chronic Conditions	Present	96	50.5
Preoperative Shaving	Yes	94	49.5
	No	96	50.5
Preoperative Scrub Bath	Yes	141	74.5
	No	49	25.5
Surgical Hand Wash	Plain Soap + Water	112	58.9
	Antimicrobial Soap /Chlorhexidine	78	41.1
Surgical Site Preparation	Iodine + Alcohol	171	90
	Others	19	10
Duration of Surgery	Less Than 60 Mins	109	57.4
	60-90 Mins	40	21.1
	90-120 Mins	25	13.2
	More Than 120 Mins	16	8.4
Blood Transfusion Perioperatively	Yes	24	12.6
	No	166	87.4
Use of Surgical Implant	Yes	130	68.5
	No	60	31.5
Pre-Operative Antibiotic Used	Yes	177	93.5
	No	13	6.5
Immediate Post Operative Antibiotic Used	Yes	190	100
	No	0	00

SSI Organism profile.

A total of 19 cases of surgical site infections were reported. E.coli was the most commonly isolated organism. Others include Klebsiella, Pseudomonas, Staph aureus. In 6 cases no single organism could be isolated. Most of the reported SSI responded well with Inj Piperacillin Tazobactam.

Table 3: Microbiological profile of the surgical site infections

Title		Frequency
No of SSI recorded		19
Organism isolated	EColi	9
	Klebsiella	1
	Pseudomonas	1
	Staph Aureus	2
	No Organism Isolated	6
Antibiotic used	Inj. Piperacillin Tazobactam	11
	Inj. Ceftriaxone	3
	Inj. Linezolid	1
	Inj. Meropenem	2
	Inj. Ciplofloxacin	2

Discussion

This study was conducted on 190 patients being operated in a tertiary care institute mainly catering to the rural population. The SSI rate was found to be 10% which is lower than most reported incidences. This can be attributed to better operative practices and disinfection measures followed in the operation room and postoperative ward. Prophylactic measures such as shaving, scrub bath and use of antibiotics have also contributed to the infection control practices.

A study by Santhosh Patil et al in a Telagana rural hospital on 100 post operative patients estimated SSI rate as 8% for clean, 58.3% for clean-contaminated, 85% for contaminated operations, and 66.6% for dirty cases. 38.46% of the isolates were *Escherichia coli*. The results show a male preponderance. The highest number of patients belonged to the age of 36-45 and 56-65 years, but the infection rate was high among the age of 66-75 years. The length of hospital stay showed a statistically significant outcome. The type of operation also showed a statistically significant result where 4 patients belonged to dirty out of 6 patients that had SSI, 17 patients with SSI belonged to the contaminated group, which indicate the influence of the type of operation that results in wound outcome. Duration of drain placement had a significant impact on the outcome of wound healing. Patients with emergency surgery show a high infection rate of 52.17 compared to the elective surgeries[7].

Ashish Pathak studied Incidence and factors associated with surgical site infections in a teaching hospital in Ujjain, India. The SSI rate among the 720 patients investigated was 5%. Risk factors for SSI identified were as follows: severity of disease (P¼.001), presence of drains (P¼.020), history of previous hospitalization (P¼.003), preoperative stay (P¼.005), wound classification (P <.001), and surgical duration (P <.001). Independent risk factors identified included wound classification (odds ratio ¼ 4.525;P <.001) and surgical duration (odds ratio ¼ 2.554;P¼.015). Mostpatients (99%) were prescribed antibiotics. Metronidazole (24.5%), ciprofloxacin (11%), and amikacin (9%) were the most commonly prescribed antibiotics. Most commonly isolated bacteria were Staphylococcus aureus (n¼ 14), of which 34% were methicillin-resistant Staphylococcus aureus, and Pseudomonas aeruginosa (n¼ 6), which showed resistance to ceftazidime (70%), ciprofloxacin (63%), and gentamicin (57%)[8]

A Prospective Observational Study was conducted in Madhya Pradesh to study Surgical Site Infection in 160 Post Operative Patients in a Government Hospital. They found the incidence rate of surgical site infections was 18.12%. A very high incidence of SSIs has been found in Muslims with a rate of 43.75%, which is statistically significant with p value of 0.0138. Open surgery have 20.90% prevalence of SSIs which is very high as compared to laparoscopic surgery (3.85%)[9].

A prospective hospital based study was conducted to determine the incidence, risk factors, and causative agents of surgical site infection their susceptibility to among 114 emergency postoperative patients at the Mbarara Regional Referral Hospital between September 2014 and January 2015. Consented patients were consecutively enrolled and their preoperative, intraoperative, and postoperative data were collected. Follow-ups were done in the surgical outpatient clinics. Wound specimens were collected and processed as per Sops; susceptibility testing was done using the Kirby-Bauer disc diffusion technique. Data was analyzed using STATA 11.0. They found the overall SSI incidence was 16.4%: 5.9% superficial and 47.1% deep and organ space SSIs each. *Klebsiella pneumoniae* was the most predominant organism (50%) followed by *Staphylococcus aureus* (27.8%). *E. coli* and *P. aeruginosa* both accounted for 11.1%. Wound class (= 0.009), anaemia (= 0.024), low serum albumin (=0.046),and property of suture material used (=0.006) were significantly associated with SSIs. All organisms had 100% resistance to ampicillin, tetracycline, septrin, and erythromycin. Ciprofloxacin and ceftriaxone are highly sensitive to all organisms[10].

An important aspect in prevention of SSI is to acknowledge the fact that the risk of infection continues even after the patient leaves the hospital. Thus, health personnel should educate the patient and relatives regarding proper wound care, how to recognize signs of SSI and the importance of reporting symptoms to their surgeons as well as primary care providers. Take-home materials should be easy-to-read and available in multiple languages. Considering that more than half of all surgeries are performed in outpatient settings and more than 65% of all inpatient surgery SSIs are identified after the patient leaves the facility, it is very easy to significantly underestimate SSI rates and miss serious infection issues [11].

Conclusion

The incidence of SSI was found to be low in our studies when compared to the data reported from other sources. Aalthough this study presents only a selection of modifiable risk factors for SSI, it provides a stepping stone toward promoting novel healthcare practices, raising awareness, and informing staff of necessary infection control measures that need to be implemented to reduce SSI. Methods to decrease incidence of preventable SSI will not only improve safety but also quality of health care.

Recommendation

Large sample size may be required to further support the study.

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