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RESEARCH ARTICLE

Surgical site Infection among postoperative patients of tertiary care centre in Central India - A prospective study

Dr. Anand Saxena, Dr. Mahendra Pratap Singh, Dr. Swagata Brahmchari, Dr. Malay Banerjee.

Dept. of General Surgery, L.N.Medical College & RC, Bhopal-462042 (MP)

Dept of Microbiology, , L.N.Medical College & RC, Bhopal-462042 (MP)

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Abstract:

Surgical site infection is a one of the most common postoperative complication and causes significant postoperative morbidity and mortality. WHO described Hospital acquired infections as one of the major infectious diseases having huge economic impact. There are many factors that affect the susceptibility of any wound to infection. This study was aimed to determine the incidence of surgical site infections (SSI) and to study other factors that can affect the infection rate.

This is a 2 year prospective study carried on 300 patients operated in Surgery department. The various parameters studied were age of patient, presence of Diabetes, anemia, preoperative hospital stay, details of timing of antimicrobial prophylaxis, surgical wound infection, type of surgery (emergency and elective surgery), duration of surgery, the wound classes, etc.

Surgical site infection was found to be 14.33% with higher infection rate in males and patients above 50 years of age. *Staphylococcus aureus (37.83%)* is most commonly identified organism in culture. As the preoperative stay increases, chances of SSI increases. SSI rate is more with emergency surgery than elective surgery. Obesity, Diabetes and Anemia are additional risk factors in surgical site infection.

Keywords: Surgical site infection; Nosocomial infection; surgical wound.

1. INTRODUCTION

Surgical site infection is a one of the most common postoperative complications and causes significant postoperative morbidity, mortality, prolongs hospital stay, and increase hospital costs also. Surgical site infection is categorized under a broad term Nosocomial infection (NI). Nosocomial infections are the infections acquired during hospital stay. They are important contributors to morbidity and mortality. These infections concern 2 million cases annually worldwide (1). WHO described Hospital acquired infections as one of the major infectious diseases having huge economic impact (2).

NI develops where medical and paramedical staff is in close contact with the patient in various stages of treatment. Exact source of infection is difficult to trace (2). About 25-36% of these infections are preventable through the adherence to strict guidelines by health care workers when caring patients (1). There are many factors that affect the susceptibility of any wound to infection. These factors include pre-existing illness, length of operation, wound class, and wound contamination. Other factors are extremes of ages, malignancy, metabolic diseases, malnutrition, immunosuppression, cigarette smoking, remote site infection, emergency procedures, and long duration of preoperative hospitalization (3). The infection in a wound is a manifestation of the disturbed host-bacteria equilibrium that is in favors of the bacteria.

Any purulent discharge within 30 days of an operation from a closed surgical incision, together with signs of inflammation of the surrounding tissue should be considered as wound infection, irrespective of whether micro-organisms can be cultured (3).

A wide variety of aerobic and anaerobic species of bacteria may be present, either singly or in combination. Infections of wounds, are generally associated with the production of pus and the bacteria involved are said to be “pyogenic” (pus producing). These septic events

*Corresponding author: Dr. | Dept. of General Surgery, L.N.Medical College & RC, Bhopal-462042 (MP) |
Email: dranandsaxena2011@gmail.com|

usually involve the urinary and the respiratory tracts or occur in the operative wound. The lowest infection rate (less than 2%) followed clean operations, such as elective orthopedic procedures, in which the possible sources of contamination were solely airborne or exogenous. Clean-contaminated operations that resulted in additional exposure of the operative site to the endogenous microflora had high rates of infections (10-20%) (2).

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. The advancement in medicine has resulted in the prevention and the control of this infection. The discovery of anti-microbial agents also enables us to perform surgeries in many conditions that were previously thought to be impossible in the pre-antibiotic era, due to the risk of infections. US National Research Council group in 1964 developed a system of classification for operative wounds, which was based on the degree of microbial contamination. Four wound classes with an increasing risk of SSIs were described: clean, clean-contaminated, contaminated and dirty as shown in table 1(4). This study was carried out to determine the incidence of surgical site infections (SSI) and to study other factors that can affect the infection rate.

2. MATERIALS AND METHODS:

This was the prospective study carried out in the department of Surgery of LN Medical College and research Center and JK Hospital, Bhopal during two year period (May 2010 to April 2012) on 300 admitted patients who underwent various surgical procedures.

Inclusion Criteria:

1. Age > 14 years
2. Patients not having previous infections at surgical sites.

Exclusion Criteria:

1. Refusal to participate in the study.
2. Patients who were already receiving antibiotics for >1 week.
3. Patients undergoing re-operations.
4. Patients who were failing to come for a follow-up of up to 30 days since the day of the operation.

Wound infection was diagnosed if any one of the following criteria were fulfilled:

a. serous or non-purulent discharge from the wound,
b. pus discharge from the wound.
c. serous or non-purulent discharge from the wound with signs of inflammation (oedema, redness, warmth, increased local temperature, fever > 38°C, tenderness) (5).

Swabs were obtained from wounds and were processed without delay using standard microbiological methods (6).

Wound class was considered as clean, clean contaminated, contaminated and dirty as per National Research Council classification criteria (Table 1), This classification is based on the extent of intraoperative contamination(7).

The data collected includes age of patient, Diabetes, preoperative hospital stay, details of timing of antimicrobial prophylaxis, surgical wound infection, type of surgery (emergency and elective surgery), duration of surgery, the wound classes, Hemoglobin percentage apart from demographic profile of the patient.

Timing of administration of prophylactic antimicrobial was considered early operative if it was given more than 2 hours before incision, pre-operative if it was given less than 2 hours before incision, peri-operative if it was during surgery and post-operative if it was given after the completion of surgery (4).

Collected data was analyzed using Microsoft Excel sheet.

3. RESULTS:

Out of 300 patients observed, 43 patients developed surgical site infections (14.33%). Out of 43 infected cases, 37 cases were culture positive (86.04%, 37/43), while 6 cases were culture negative (13.96%, 6/43).

Classification of wounds according to National Research Council	
Class I/ Clean	Surgical wounds that exhibit no infection or inflammation; operations not involving the entry of the uninfected respiratory, digestive, genital or urinary tracts. Operations in which aseptic conditions are fully maintained: surgical wounds are primarily closed and, if necessary, drained using a closed system. Surgical wounds after non-penetrating trauma injuries are included in this class if they fulfill the above criteria.
Class II/ Clean Contaminated	Surgeries involving opening of the respiratory, digestive, genital or urinary tracts under controlled contaminated conditions and without abnormal contamination. Operations involving biliary tract, appendix, vagina and oropharynx that exhibit no evidence of infection and where aseptic conditions are fully maintained are included in this class.
Class III/ Contaminated	Fresh (within 7 h of causal event), open trauma injuries. Surgical procedures with a major in sterile technique (open heart surgery), or with significant contamination from the gastrointestinal tract. Wounds with acute, non-purulent inflammation are included in this class.
Class IV/ Dirty	Old (more than 7 h after causal event) trauma injuries with devitalized tissue and with preexisting clinical infection or perforated viscera. This definition suggests that organisms giving rise to postoperative infection were present in the surgical area prior to the surgery.

Table -1 showing National Research Council's classification of wounds.

Age and Sex: Out of a total of 233 male patients, 34(14.59%) had SSIs, whilst 9 (13.43%) out of 67 female patients had SSIs. Thus, it could be inferred that males were more prone to operative wound infections. Age of more than 50 years was found to be a risk factor for the Post-operative wound infections.

Quetlet Index (BMI): Most of the patients had a Quetelet Index of between 20-30 kg/m^2. The obesity was more common in females and a Quetelet index of more than 40 was identified as a risk factor for the Post-operative wound infections.

Pre-op. Hospital stay	No. of patients	Infected patients	SSI rate
0-1	68	04	5.88%
2-5	96	13	13.54%
6-10	32	07	21.88%
>10	13	04	30.77%

Table 2 showing SSI rate according to preoperative hospital stay in days:

Causative Organism: The pathogens isolated were *Staphylococcus aureus (14/37, 37.83%), Escherichia coli (9/37, 24.32%), Klebsiella sp. (4/37, 10.81%), Coagulase negative Staphylococci (4/37, 10.81%), Pseudomonas aeruginosa (2/37, 5.40%), Proteus mirabilis (1/37, 2.7%)* and others *(3/37, 8.10%)*

Wound class	Total Patients	Infections	SSI rate
Clean	223	27	12.1%
Clean contaminated	46	7	15.2%
Contaminated	23	3	13.04%
Dirty	**8**	**6**	**75%**

Table 3 showing SSI rate according to the wound class

Emergency Vs. Elective Surgery: In patients with emergency surgery, the infection rate was 16.48% (15/91) while in patients operated electively the rate was 13.39% (28/209).

Preoperative Hospital stay: Table-2 show that in elective surgery the rate of infection increased with increase in preoperative hospital stay. The infection rate in patients having pre-operative hospital stay 0-1 days was 5.88% (4/68), in patients with pre-operative hospital stay 2-5 days was 13.54% (13/96) and in patients with pre-operative hospital stay 6-10 days was 21.88% (7/32).

Wound class: The surgical site infections with their rate according to wound class were recorded [Table 3]. Infection rate is 3.9% in clean wounds where as it was 56.7% in dirty wounds. Thus there was clear correlation between the wound infection rate and the contamination of the wound.

Diabetes: In present study out of 29 patients with Diabetes Mellitus, 7 patients had SSI. The rate of SSI was 24.13%% (7/29) in patients with Diabetes Mellitus compared to rate of SSI in patients without diabetes mellitus, which was13.28% (36/271).

Anemia: It was observed that patients having hemoglobin level below 9 gm% accounted for 7.66% (23/300). The wound infection rate was 21.73% (5/23) in these patients compared to 13.71% (38/277) in normal individuals.

4. DISCUSSION:

The present study was carried out in 300 patients who underwent various surgeries. The etiology of surgical site infections is dependent on the location of the surgery, the bacterial load in the tissue or blood peri-operatively and the integrity of host defenses[8].

The overall infection rate varies from surgeon to surgeon, hospital to hospital, one procedure to another and even from one patient to another patient. In our study, the overall surgical wound infection rate was 14.33%. Many studies from India at different places have shown the SSI rate to vary from 6.09% to 38.7% (5,9, 10,11).

The infection rate in Indian hospitals is much higher than that in other countries; for instance in the USA, it is 2.8% and it is 2-5% in European countries (9). The higher infection rate in Indian hospitals may be due to the poor set up of our hospitals and also due to the lack of attention towards the basic infection control measures.

In our study, we found that SSIs are more common in patients above 50 years of age. Narsinga et al (12) and Patel Sachin et al (6) also recorded same trends. It can be due to multiple factors like a low healing rate, malnutrition, mal-absorption, increased catabolic processes and a low immunity (12).

Obesity is well established risk factor for surgical site wound infections. In our study, Quetlet index of more than 40kg/m^2 was associated with a higher rate of post-operative wound infections similar to Narasinga Rao Bandaru et al (12).

We found staphylococcus aurius (37.83%) as most commonly identified organism from wounds similar to Shittu et al (13) but Patel Sachin et al (6) found Escherichia coli as most offending pathogen.

The infection rate in our study was more with emergency surgery when compared to elective surgery same as that reported by Patel Sachin et al (6) and Satyanarayana V. e al (4). The high rates of infection in emergency surgeries may be because of insufficient pre-operative preparation, the underlying conditions which predisposed to the emergency surgery and the more frequency of contaminated or dirty wounds in emergency surgeries(4). Emergency surgeries were usually performed by junior doctors, more often with complication & had dirtier cases (6).

Rate of infection is more in patients having longer preoperative stay in the hospital wards. Long preoperative hospital stay leads to colonization with antimicrobial resistant microorganisms and affects patients' susceptibility to infection by lowering host resistance or by

providing increased opportunity for ultimate bacterial colonization(6). Anvikar A.R. (10) and Lilani S.P. (5) also reported higher rate of SSI in patients with prolonged preoperative hospital stay.

SSI rate is more in dirty wounds as compared to clean contaminated and clean wounds. Similar findings have also been observed by other authors (3, 4, 6). SSI rate is more in clean contaminated wounds than in contaminated wounds. Underlying reason remains obscure.

Narsinga Rao Bandaru et al also agree that obesity is known to be a well established risk factor for Post-operative wound infections. Obesity contributed as strongly as the surgical procedure category to a patient's likelihood of acquiring a surgical site infection (12).

Diabetes is also a well established risk factor for SSIs. Patel Sachin et al (6) also found same findings. Anemia is also a important risk factor in development of SSI. Similar results were observed by Awan (14). However, Anemia itself is not an established factor for SSI.

The administration of antibiotics longer than 2 hours prior to surgery or post-operatively was confirmed to be associated with a higher SSI rate. The pre operative antibiotic prophylaxis could decrease post-operative morbidity, lessen the hospital stay and it could possibly reduce the overall expenditure which are attributable to the infection. The antibiotics should be administered ideally within 30 minutes and certainly within two hours of the time of incision (4).

A main limitation of our study is the small sample size. We covered only operative cases from surgery department, other cases were not included. The scenario can change if gynaec, ortho, ENT and Ophthalm cases are incorporated. More detailed study in collaboration with microbiology department for identification of organism, and antibiotics sensitivity are required.

5. CONCLUSION:

Surgical site infection is one of the important complications of Surgeries and SSI rate is increasing due to poor hygienic conditions, lack of proper antibiotics selection. Other factors that may be considered as risk factors for development of SSI are presence of anemia, diabetes, obesity, increased preoperative stay in hospital, proper timing of antibiotics administration etc.

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Conflict of Interest: None Declared

