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# ORIGINAL ARTICLE

## A PROSPECTIVE STUDY TO ASSESS RISK FACTORS FOR SURGICAL SITE INFECTIONS IN A TERTIARY CARE CENTER

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**ABSTRACT: CONTEXT:** Surgical site infections (SSI) remain a significant problem following an operation and the second most frequently reported nosocomial infections. Aim:The current study was undertaken to identify various risk factors for SSI. **MATERIAL AND METHODS:** The prospective study was carried out on 50 abdominal surgeries of class III and class IV contamination. Details various functional parameters, laboratory investigation and surgery of patient were evaluated and analyzed with occurrence of wound infection. **RESULTS AND CONCLUSIONS:** The infection rate was 36.0% in our study population. The SSI rate was 19.04 % in contaminated ones and 48.2% in dirty surgeries. Male patients were affected more (21%) than the female patients (18.88%). The SSI rate increased with increasing age and it also increased in patients with low hemoglobin. The SSI rate was higher in emergency surgeries as compared to the elective surgeries. The infection rate was significantly higher as the order and the duration of the surgery increased.
**KEYWORDS:** SSI, Surgical site infections, Risk Factors.

**INTRODUCTION:** Surgical infections are those that occur as a result of a surgical procedure or those that require surgical intervention as part of their treatment. They are characterized by a breach of mechanical/ anatomic defense mechanisms (barriers) and are associated with greater morbidity, significant mortality, and increased cost of care.[1]

Surgical site infections (SSIs) still continue to be a significant problem for surgeons. Despite major improvements in antibiotics, better anesthesia, superior instruments, earlier diagnosis of surgical problems, and improved techniques for postoperative vigilance, wound infections continue to occur.[2] SSIs are the second most common type of nosocomial infection, accounting for 20%–25% of the total infection. Surgical site infection rate in India has varies from 2.5% to 41.9%.[3], [4], [5]

| Patient characteristics | Operation characteristics |
|---|---|
| Age<br>Nutritional status<br>Diabetes<br>Smoking<br>Obesity<br>Coexistent infections at a remote body site<br>Colonization with microorganisms<br>Altered immune response<br>Length or preoperative stay | Duration of surgical scrub<br>Skin antisepsis<br>Preoperative shaving<br>Preoperative skin prep<br>Duration of operation<br>Antimicrobial prophylaxis<br>Operating room ventilation<br>Inadequate sterilization of instruments<br>Foreign material in the surgical site<br>Surgical drains<br>Surgical technique |

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| | |
|---|---|
| | a) Poor hemostatis<br>b) Failure to obliterate dead space<br>c) Tissue trauma |

Table 1: Risk Factors for surgical site infection

While conducting a laparotomy, a surgeon experiences a variety of problems intraoperatively and post-operatively. The outcome of the intervention is directly relatedto the underlying pathology. However the co-morbid conditions, technique orsurgical expertise andpost-operative care also contribute to the final results.[6]

The term risk factor has a particular meaning in epidemiology and, in the context of SSI pathophysiology and prevention, strictly refers to a variable that has a significant, independent association with the development of SSI after a specific operation. Risk factors are identified bymultivariate analyses in epidemiologic studies (Table 1).

We carried out the present study in order to study frequency of incisional wound infections in our study population and to study association of various components of risk index with incisional wound infection.

**METHODOLOGY:**

**PATIENTS:** The study was carried out on 50 patients of age group >15 yrs who underwent class-III and class-IV Abdominal surgery in Department of Surgery in Peoples Hospital, Bhopal for abdominal surgeries.

The ethical standards for human experimentation were followed during the study and permission from the institutional ethical committee was taken.After laparotomy for any reason the details of patient was taken. Details of patients include variables reflecting patient's functional parameters, incisional wound characteristics and Laboratory investigations were done.

**EXCLUSION CRITERIA:**

- Patients less than 15 years of age.
- Patient undergoing surgeries other than abdominal surgeries.
- Previous laparotomy within the past 3month.
- Patients not giving consent.
- Deep organ infections.

The CDC criteria were used for defining the type of surgical wounds.[7]

**Class-I / Clean:** An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered.

**Class-II / Clean contaminated:** An operative wound in which the respiratory, alimentary, genital or urinary tracts are entered under controlled conditions and without unusual contamination.

**Class-III /Contaminated:** Open, fresh, accidental wounds. In addition, operations with major breaks in sterile techniques or gross spillage from the GIT and incisions in which acute, non-purulent inflammations are encountered.

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**Class-IV / Dirty:** Old traumatic wounds with retained devitalized tissues and those that involve the existing clinical infection or perforated viscera.

CDC's NNIS (National Nosocomial Infection Surveillance) System was used for defining SSIs.[8] According to this system, the infection was considered to be an SSI, if the infection occurred within 30 days after the operation or within 1 year if the implant was in place and the infection appeared to be related to the operation. Stitch abscess was not included under SSIs.

A detailed history regarding pre-operative stay, antibiotic therapy, the type of surgery and the nature (Elective/ emergency), order and the duration of the operation was taken. Samples in the form of swabs were collected aseptically from the wounds at the time of the first dressing, anytime up to 30 days from the wounds giving serous, purulent discharge, showing signs of inflammation, or from wounds that dehisced spontaneously.

Occurrence of SSI was compared to presence one or more risk factors for SSI and analysed.

**RESULT:** A total of 50 surgical wounds of contaminated and dirty class were included in the study. The overall infection rate was 36.0%.

| | No. of cases | wound infection | Wound not infected | % wound infection |
|---|---|---|---|---|
| Class III | 21 | 4 | 17 | 19.04 % |
| Class IV | 29 | 14 | 15 | 48.2 % |

Table 2: Infection rate according to type of surgery

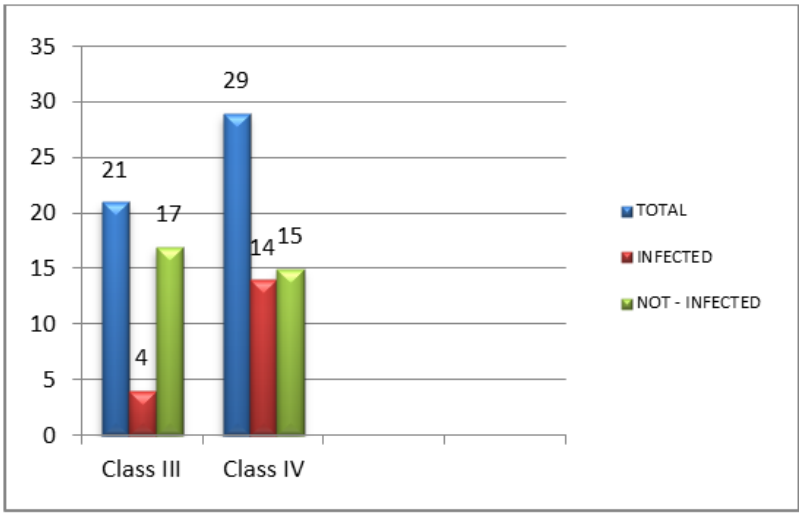


**Fig. 1**

The number of infected cases in contaminated surgery was 4/21(19.04) and 14/20 (48.2%) in dirty surgeries.

11/32 (34.3%) males and 7/18(38.88%) females were infected.

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| | No. of cases | Wound infected | Wound not infected | % Wound infection |
|---|---|---|---|---|
| MALES | 32 | 11 | 21 | 34.30 % |
| FEMALES | 18 | 7 | 11 | 38.88 % |

Table 3: Infection rate in relation to sex of patient

Shows the infection rate in elective and emergency surgeries. SSIs were present in as high as 14/31 (45.16%) cases in emergency surgeries as compared to their presence in 4/19 (21.05%) cases in elective surgeries.

| TOTAL CASES | EMERGENCY | | %wound | ELECTIVE | | % wound |
|---|---|---|---|---|---|---|
| | -31 | | Infection | -19 | | Infection |
| | INFECTED | NOT INFECTED | | INFECTED | NOT INFECTED | |
| 50 | 14 | 17 | 45.16% | 4 | 15 | 21.05% |

Table 4: Infection rate in relation to urgency of operation

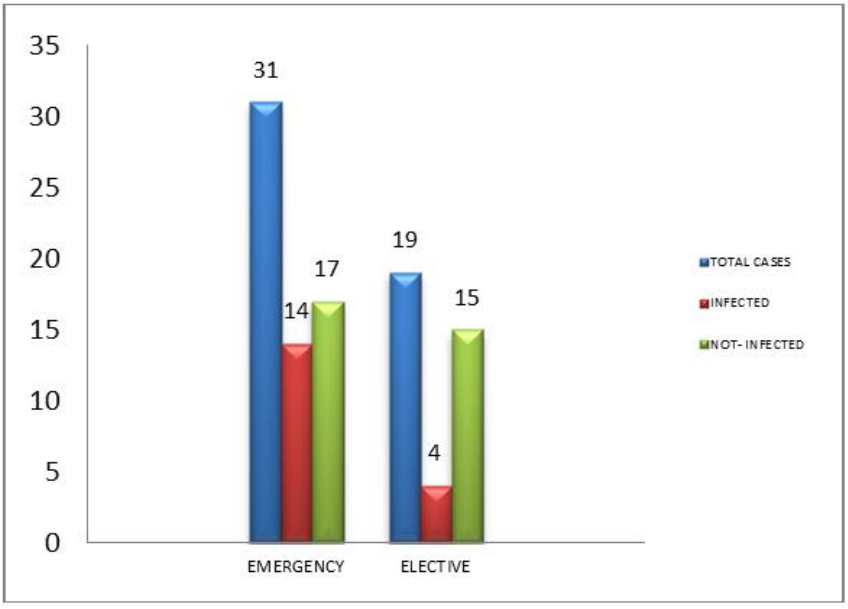


**Fig. 2**

Infection rate was more in obese (43.7%) and underweight (40.0%) patients as compared to normal (31.03%) patients.

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| | No. of patient | Infection | Wound not infected | % wound infection |
|---|---|---|---|---|
| Obese | 16 | 07 | 09 | 43.7 % |
| Normal | 29 | 09 | 20 | 31.03 % |
| Underweight | 05 | 02 | 03 | 40 % |

Table 5: Infection rate in relation to BMI of patient

7/23 (30.4%) patients in the age group of 20- 39 yrs, 6/17 (35.2%) patients in the age group of 40-59 yrs, 5/8(62.5%) patients in the age group of >60 yrs, The age wise distribution of SSIs showed a higher infection rate in the age group of more than 60 years.

| | No. of Cases | Wound Infections | Wound NotInfected | % Wound Infection |
|---|---|---|---|---|
| 0-19 | 2 | 0 | 2 | 0% |
| 20 -39 | 23 | 7 | 16 | 28.57 % |
| 40- 59 | 17 | 6 | 11 | 41.66 % |
| >60 | 8 | 5 | 3 | 50 % |

Table 6: Infection rate in relation to age group of patient

The infection rate with respect to the duration of surgery is shown in. The rate of SSIs increased as the order and the duration of the surgeries increased.

| Duration of operation | No. of cases | Infection | Wound not infected | % wound infection |
|---|---|---|---|---|
| 0- 59 min | 0 | 0 | 0 | 0 |
| 60 -119 min | 7 | 1 | 6 | 14.2 % |
| 120-179 min | 20 | 6 | 14 | 30 % |
| 180- 239 min | 19 | 09 | 10 | 47.3 % |
| 240-299 min | 4 | 2 | 2 | 50 % |

Table 7: Infection rate in relation to Duration of surgery

Infection rate increases ASA grade of the patient increased. Highest infection rate was found in patient with ASA grade IV (85.7%).

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| | No. of cases | Wound infection | Wound not infected | % Wound infection |
|---|---|---|---|---|
| Grade I | 0 | 0 | 0 | 0 |
| Grade II | 22 | 4 | 18 | 18.1 % |
| Grade III | 21 | 8 | 13 | 38. 09 % |
| Grade I V | 7 | 6 | 01 | 85.7% |

Table 8: Infection rate in relation to ASA grade of patient

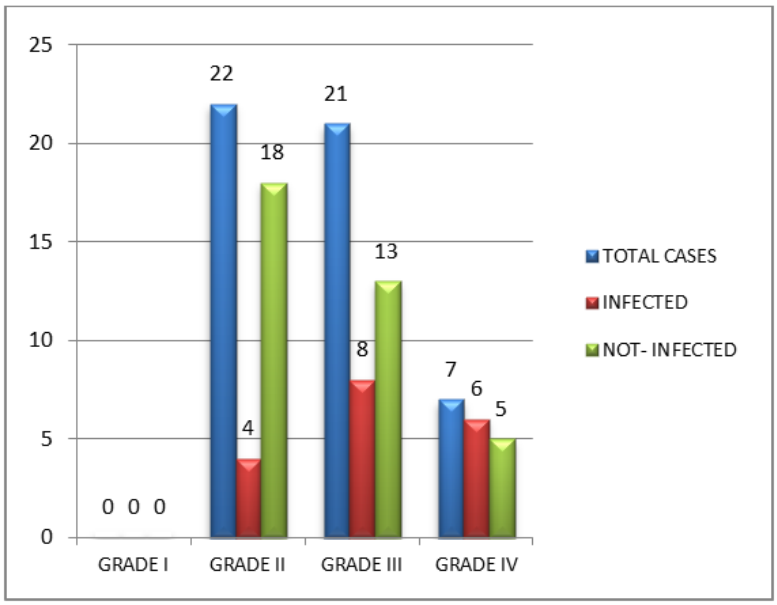


**Fig. 3**

High Infection rate was found in patients with low hemoglobin.

| | Elective cases | | Emergency cases | | |
|---|---|---|---|---|---|
| | No. of cases | Infection | No. of cases | Infection | % wound infection |
| Hemoglobin <10 gm % | 3 | 0 | 19 | 09 | 40.9 % |
| Hemoglobin > 10 gm % | 16 | 4 | 12 | 05 | 32. 1 % |

Table 9: Infection rate in relation to Hb level of patient

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**DISCUSSION:** Relative incidence of surgical site infections in our study population is 36.0%. High incidence is attributed to inclusion of only contaminated and dirty abdominal cases in study. This is comparable to the observed wound infection rates in contaminated and dirty cases of 27.6 % by Cruse & Foord in their prospective study on 62, 939 patients.[9]

In our study we recorded a wound infection rate of 45.16% for emergency surgeries and a rate of 25.05% for elective surgeries. Debra L Malone et al, 2001, demonstrated that emergency procedures were associated with increased risk for SSIs.[10] In our study SSI rateincreased with increase in operating time. Overall SSI rate increased 2.1 times from 2 hr-3 hrs, and 3.5 times if operation lasts 4hrs. Cruse & Foord, 1980, showed that the rate of infection of clean wounds roughly doubles with every hour.[9]

In our study wound infection was higher in patients operated in emergency with Hb<10gm% (40.9%). It was also noted that in a specific group viz: Elective or Emergency wound infection was higher in patient with Hb<10gm%. It goes without saying that, the ability to fight infections is compromised in patients with low haemoglobin. In our study we found a very high infection rate in patients with high.

ASA scores. An ASA score of 4 was associated with an infection rate of 85.7%. A gradual increase of wound infection rate was found with an increase in ASA score. This can be attributable to the associated diabetes, anemia, hypoprotienemia, which appear to be risk factors for infection. It was also noticed that patients reporting in emergency had a higher average ASA score and that they had higherdegree of contamination of the peritoneum on exploration.

In a study conducted by Debra L. Malone et al in the Deptt. Of Surgery, Veterans Administrative Maryland Health Care System, and Departmentof Epidemiology, University of Maryland School of Medicine, she found an increased incidence of SSI with increasing ASA score from 0.96% in ASA 1 group to 7.14% in the ASA 5 group. The majority of the SSIs were associated with an ASA score of 3, consistent with severe systemic disease that is not incapacitating to life.

In our study a wound infection rate of 43.7 % was found in obese patients as compared to 31.03% in normal for weight patients. The wound infection rate in underweight patients was even higher i.e. 40 %.

In our study obesity and malnutrition both were associated with a higher wound infection rate. Debra L. Malone et al, in Feb. 2001 in her study reported association of pre-operative weight loss to increased risk of SSI. The findings in our study are in cohesion with her views.[10]

Our study reveals that though SSIs have been widely studied since a long time, they still remain as one of the most important causes of morbidity and mortality in surgically treated patients. The steps taken to reduce SSIs are still not adequate. Proper infection control measures should reduce SSIs in the future.

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