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Original research article

A study on organism causing surgical site infections and to detect the sensitive antibiotic to treat the infection

[1]Dr.Bharat Kumar Hindinamani,[2]Dr.CGSunil,[3]Dr.Deepak Kumar KP

[1]Assistant Professor, Department of General Surgery, Karnataka Institute of Medical Sciences, Hubli, Karnataka, India

[2]Assistant Professor, Department of General Surgery, SDM College of Medical Sciences and Hospital, SDM University,Dharwad, Karnataka, India

[3]Assistant Professor, Department of General Surgery, Rajarajeshwari Medical College, Bangalore, Karnataka, India

CorrespondingAuthor:
Dr. Deepak Kumar KP

Abstract

Many factors in a patients undergoing surgery have been identified to be associated with the risk of developing SSI. The prevention of these infections is complex and requires identification of contributing risk factors and integration of a range of measures before, during and after surgery. This is a comparative study in which patients will be studied in two groups. In each case preoperatively, detailed history was taken and routine investigation like hemoglobin,total count, RBS, LFT and chest X-ray were done to rule out any acute or chronic infection. In this study among the patients who had SSIs the microbiological examination revealed E.coli as the organism in 28.6% patients and Staphylococcal aureus in 71.4% patients present in chlorhexidine alcohol group. In providing iodine group 35% patients had infection with E.coli and 65% patients had infection with Staphylococcal aureus.

Keywords: Organism, surgical site infections, staphylococcal aureus

Introduction

Surgical Site Infections (SSIs) are Health care-associated infections (HAIs) which are potential complications associated with any type of surgical procedure. Although SSIs are among the most preventable HAIs, they still represent a significant burden in terms of patient morbidity and mortality and additional costs to health systems and service payers worldwide. SSI is both the most frequently studied and the most commonly HAI reported hospital-wide in low and middle-income countries (LMICs)[1].

Many factors in a patients undergoing surgery have been identified to be associated with the risk of developing SSI. The prevention of these infections is complex and requires identification of contributing risk factors and integration of a range of measures before, during and after surgery.

In India incidence of SSI is high and with no proper surveillance system to monitor it and also ever growing difficulties to manage SSI due to resistance of isolated organisms for a wide range of antibiotics makes its necessary to reduce all preventable causes of SSI and to stratify patients based on their risk factors for development of SSI and appropriate action to be taken to prevent it[2].

The Centre for Disease Control's (CDC) National Nosocomial Infection Surveillance (NNIS) system established in 1970 was used to monitor SSI and help in risk stratification.

A successful SSI surveillance programme includes standardized definitions, surveillance methods and stratification of SSI according to risk factors such as physical status of the patient, surgical wound type and duration of surgery which are found to be associated with SSI.

The epithelium of the skin, which is given the special name of epidermis, is of stratified squamous variety. The various skin appendages-sebaceous glands, sweat glands, nails and hair are specialized derivatives of this epidermis, which is ectodermal in origin[3].

The connective tissue part of the skin, which is mesodermal in origin, is the dermis, consisting mainly of bundle of collagen fibres together with some elastic tissue, blood vessels, lymphatics and nerve fibres.

Intact skin forms a mechanical barrier i.e. First line of defense against Microorganisms. The skin surface or

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epidermis is not a favourable environment for microbial colonization[13].
The anatomy and physiology of the skin vary from one part of the body to another and the normal resident microbiota reflects these variations. Most skin bacteria are found on the superficial cells, colonizing dead cells or closely associated with oil or sweat glands in the skin folds and pores[14]. The adult human skin is covered with approximately two square meters of skin. It has been estimated that this surface area supports about 1015 bacteria[4].

Methodology

Source of data

All those patients admitted to general surgical wards and who are posted for clean and clean contaminated elective surgeries.

Study design: This is a comparative study conducted on 300 patients.

Inclusion criteria

- Patients undergoing clean and clean contaminated elective surgery in the Department of General Surgery.

Exclusion criteria

- Patients undergoing emergency surgery.
- Immuno compromised patients (HIV).
- Patients on long term steroids.
- Patients with diabetes mellitus.
- Patients with history of allergy to study agents.

Method of collection of data

This is a comparative study in which patients will be studied in two groups. In each case preoperatively, detailed history was taken and routine investigation like hemoglobin,total count, RBS, LFT and chest X-ray were done to rule out any acute or chronic infection.

- The preoperative skin preparation in each group is done with the respective antiseptic regimen.
- **Group A:** Antiseptic regimen used for preoperative skin preparation is 2% chlorhexidine alcohol (2% in 70% isopropyl alcohol).
- **Group B:** Antiseptic regimen 10%povidone iodine.

Results

Table 1: Gender distribution of participants among groups

Sex	Group A		Group B	
	n	%	n	%
Female	68	45.3	70	46.7
Male	82	54.7	80	53.3
Total	150	100	150	100

Chi square value: 0.05 P value:0.81 (Not significant)

In this study most of the patients were males in both groups (54.7% in group A and 53.3% in group B). The male to female ratio in group A was 1.2:1 and in group B it was 1.14:1 suggesting that both groups were comparable.

Table 2: Surgical site infection among groups

SSI	Group A		Group B		P value
	n	%	n	%	
Superficial incisional SSI	7	4.7	20	13.3	0.01*
Deep incisional SSI	0	0	0	0	-
Organ space SSI	0	0	0	0	-
Total	7	100	20	100	

Chi square value: 6.9 P value:0.01 (Significant)

In the present study in group A, 4.7% patients had superficial SSIs compared to 13.3% in group B and this difference was statistically significant (p=0.01)

Table3: Type of organism in SSI between the two groups

Organism in SSI	Group A	Group B

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Culture	n	%	n	%
E. coli	2	28.6	7	35.0
St. aureus	5	71.4	13	65.0
Total	7	100	20	100

Chi square value: 0.096 P value:0.8 (Not Significant)

In this study among the patients who had SSIs the microbiological examination revealed E.coli as the organism in 28.6% patients and Staphylococcal aureus in 71.4% patients present in chlorhexidine alcohol group. In povidone iodine group 35% patients had infection with E.coli and 65% patients had infection with Staphylococcal aureus.

Discussion

In the presesent study after skin preparation with chlorhexidine alcohol and povidone iodine, in post-operative period 4.7% patients in group A had Superficial incisional SSIs compared to 13.3% patients in group B which was stastically significant (p=0.01), commonest organisms isolated was staphylococcal aureus. After the application of antiseptic agents there was reduction of bacterial colonization in both the groups, but significant reduction was seen in Chlorhexidine group (p<0.01)

In the present study on postoperative day three, five and seven inspection findings revealed significantly high rate of infection in group B (13.3% versus 4.7%; p=0.01). In the present study in group A two patients of breast carcinoma, two patients of inguinal hernia, one patient of umbilical hernia, one patient of cholelithiasis and one patient of incisional hernia had superficial incisional SSIs compared to 20 patients in group B that is seven patients of inguinal hernia, four patients of breast carcinoma, three patients of cholelithiasis, 3 patients of incisional hernia, 2 patients of umbilical hernia and 1 patient of paraumbilical hernia had superficial incisional SSIs. This difference was statistically significant (p=0.01). In the patients having SSIs, the wound was laid open, healed by secondary intentions and four cases secondary suturing was undertaken once the wound was clean.

These findings were similar to the results of a study done in Thailand. The study reported that, wound infection decreased from 3.2% to 2% after chlorhexidine skin preparation and the organisms found in the culture specimen included Streptococcus epidermidis, Staphylococcus aureus, Streptococcus species and Enterococcus species. The bacterial colonizations reduced significantly after skin preparations in all types of organisms. The authors also suggested other disadvantages of using povidone iodine are hypersensitivity and colour staining. The study recommended, chlorhexidine antiseptic should be the first consideration for preoperative skin preparation[5, 6].

Another randomized controlled trial was conducted on patients undergoing clean-contaminated surgery in six hospitals to preoperative skin preparation with either chlorhexidine- alcohol scrub or povidone iodine scrub and paint. The primary outcome was any surgical-site infection within 30 days after surgery. Secondary outcomes included individual types of surgical -site infections[7, 8]. A total of 849 subjects (409 in the chlorhexidine-alcohol group and 440 in the povidone-iodine group) qualified for the intention-to-treat analysis. The overall rate of surgical site infection was significantly lower in the chlorhexidine alcohol group than in the povidone iodine group (9.5% vs. 16.1%; p=0.004; relative risk -0.59; 95% confidence interval, 0.41 to 0.85). Chlorhexidine -alcohol was significantly more protective than povidone-iodine against both superficial incisional infections (4.2% vs. 8.6%. P = 0.008) and deep incisional infections (I% vs. 3%, p=0.05) but not against organ-space infections (4.4% vs. 4.5%). The study concluded that, preoperative cleansing of the patient's skin with chlorhexidine- alcohol is superior to cleansing with povidone-iodine for preventing surgical-site infection after clean contaminated surgery.

In a randomized study, the application of chlorhexidine-alcohol reduced the risk of surgical-site infection by 41% as compared with the most common practice in the United States of using aqueous povidone-iodine.

In this study among the patients who had SSIs the microbiological examination revealed E.coli as the organism in 28.6% patients and Staphylococcal aureus in 71.4% patients present in chlorhexidine alcohol group. In povidone iodine group 35% patients had infection with E.coli and 65% patients had infection with Staphylococcal aureus.

In the present majority of patients 87.3% patients in group A and 78.7% patients in group B had hospital stay upto 7 days, in group A 9.3% patients and 12% patients in groupB had hospital stay between 8 to 14 days, 3.4% patients in group A and 9.3% patients in group B had hospital stay more than 14 days. Duration of stay is more in group B patients that is povidone iodine group which is statistically significant(p=0.04%).

Though the patients who had no SSl's were fit for discharge on third or fourth postoperative day, they insisted to stay in hospital till suture removal which was undertaken on post-operative day seven as they were coming from far off places and remote villages.

Overall the present study showed that preoperative skin cleansing with chlorhexidine-alcohol significantly reduced the rate of postoperative SSIs. However, the choice of preoperative surgical-site antisepsis remains controversial and surgeons have long debated the choice of skin preparation.

The limitations of the present study were smaller sample size and risk factors for SSI's in abdominal surgeries such as age. Obesity, associated co morbid conditions such as diabetes mellitus and

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immunocompromised patients were not taken into consideration. Hence further studies with larger sample considering these risk factors would explore outcomes of SSIs using skin antisepsis with chlorhexidine alcohol.

Conclusion

In this study among the patients who had SSIs the microbiological examination revealed E.coli as the organism in 28.6% patients and Staphylococcal aureus in 71.4% patients present in chlorhexidine alcohol group. In povidone iodine group 35% patients had infection with E.coli and 65% patients had infection with Staphylococcal aureus.

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