



General Surgery

A STUDY ON CLINICAL EVALUATION OF PREOPERATIVE SKIN PREPARATION WITH AQUEOUS POVIDONE IODINE ONLY AND IN COMBINATION WITH ALCOHOLIC CHLORHEXIDINE IN PATIENTS UNDERGOING CLEAN ELECTIVE SURGERIES

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ABSTRACT **BACKGROUND** It is an established fact now that the normal skin of healthy human beings harbors a rich bacterial flora. Normally considered non-pathogenic, these organisms may be a potential source of infection of the surgical wound. Approximately 20% of the resident flora are beyond the reach of surgical scrubs and antiseptics. The goal of surgical preparation of the skin with antiseptics is to remove transient and pathogenic microorganisms on the skin surface and to reduce the resident flora to a low level. Povidone iodine (Iodophors) and chlorhexidine are most often used antiseptics for pre-operative skin preparation. Most Surgical site infections are caused by skin flora inoculated into the incision during surgery; therefore, the most common SSI pathogens are all gram-positive cocci—Staphylococcus epidermidis, S. aureus, and Enterococcus spp. For infra-inguinal incisions and intracavitary surgery, gram-negative bacilli such as Escherichia coli and Klebsiella spp. are potential pathogens. When surgery is performed on the pharynx, lower gastrointestinal tract, or female genital tract, anaerobic bacteria become potential Surgical site infection pathogens.

KEYWORDS : Surgical Site Infection, Antiseptic, Povidone Iodine, Chlorhexidine

INTRODUCTION

Despite many advances in the surgical techniques in the past few years, post-operative wound infection still remains a major problem. Although only occasionally a cause of mortality, it is a frequent cause of increased morbidity leading to prolonged hospitalization of the patient. Wound infections occur in approximately 5% of patients undergoing major abdominal surgery¹. Several factors contribute to the development of post-operative wound infections, some relating to the patient and some relating to the procedure itself².

A patient, who is undergoing any kind of surgery faces a potential risk of getting infection from his environment – be it the operation theatre or be it the ward. Shooter (1956) and Blower (1960) pointed out the source of post-operative wound infection to be operation theatre and ward respectively³. Of course, patient himself cannot be excluded from being a source of infection. Burke (1963) found that in 50% of the operations the strains of staphylococcus aureus isolated were the same as those from patients nose and hence concluded the patient himself to be a source of infection⁴. Obviously, wound infection in a particular patient may be a result of multiple and diverse factors.

Most of the modern achievements in surgery are due to two basic principles i.e. asepsis and antisepsis. The term asepsis and antisepsis denote two policies or methods whereby access of bacteria to wound and its consequent infection is halted. Moynihan (1920) was true when he said, "Our bacteriological experiment may be conducted with one of the two intentions:

1. The exclusion of all organisms from the wound.
2. The destruction of all organisms reaching the wound by a bactericide applied to wound surfaces"

Asepsis:- Asepsis may be defined as the exclusion of bacteria from the field of surgical procedures by the previous sterilization of everything employed in / on it.

Antisepsis:-Antisepsis aims at erecting a chemical barrier between the tissue and the source of infection. It consists of applying to part of the body a chemical capable of killing or at least inhibiting the growth of bacteria so that even if the bacteria gain access to the body, they will be prevented from attacking it. This is probably the

best possible ideal⁶.

Many techniques are there for skin preparation before surgery, the commonest being initial scrub with antiseptic soap solution, followed by painting the prepared area with antiseptic paint solution but degerming of the skin can be done with antiseptics used for less than one minute which is as effective as five-minute scrub with germicidal soap solution followed by painting with antiseptics⁷.

The two commonly used antiseptics are povidone iodine and chlorhexidine and this study is undertaken to compare the efficiency of povidone iodine alone and in combination with antiseptic agent containing alcohol and chlorhexidine against bacterial flora on the skin of operation site under conditions those encountered in operating rooms.

OBJECTIVES

1. To evaluate the efficacy of povidone iodine alone and in combination with antiseptic agent containing alcoholic chlorhexidine in preoperative skin preparation by taking swab culture.
2. To compare the rate of postoperative wound infection in both the group

METHODS

Sixty Patients (Thirty in each Group) undergoing clean elective surgery with no focus of infection on the body were included in the study. The pre-operative skin preparation in each group is done with the respective antiseptic regimen. In both the groups after application of antiseptics, sterile saline swab culture was taken from site of incision. In cases which showed growth of organisms, the bacteria isolated were identified by their morphological and cultural characteristics.

Inclusion Criteria:

1. Patients undergoing clean elective surgery in department of general surgery. Clean surgery is defined as surgery in which no viscus was opened.
2. Patients with no focus of infection anywhere on the body, afebrile and having normal WBC counts.
3. Patients irrespective of their age and sex.
4. Patients neither immunocompromised nor on any long-term steroids

Exclusion Criteria :

1. Patients undergoing emergency surgery
2. Immunocompromised patients and patients on long term steroids, patients suffering from malignancies or undergoing chemotherapy or radiation therapy.
3. Patients with septicemia and having focus of infection somewhere on the body manifested clinically by fever and increased total and differential counts.
4. Contaminated surgeries in which viscus was opened were excluded from the study.

Group I : Antiseptic regimen used for preoperative skin preparation is three coats of aqueous povidone iodine IP 5% w/v marketed as Betadine.

Group II : Antiseptic regimen used is single coat of agent containing chlorhexidine gluconate 2.5% v/v in 70% propanol followed by two coats of aqueous povidoneiodine IP 5% w/v.

In both the groups after application of antiseptics, sterile saline swab culture was taken immediately from site of incision (figure 16) and was transferred to microbiology department to determine whether any microorganisms were left behind and hence to compare the efficacy of both the regimes of skin preparation. Post operatively, first dressing was done on third postoperative day with aqueous solution of povidone iodine alone and patients were followed up till the time of sutures removal (7-10 days) to look for any signs of wound infection according to Southampton wound grading system.

If any purulent discharge was seen, pus culture and antibiotic sensitivity tests were done to know whether causative organisms were same which were left behind preoperatively after skin preparation and hence incomplete disinfection was the cause for wound infection or whether the infection was acquired in the ward.

RESULTS

In no case, in any group, any irritation of skin or any hypersensitivity reaction was observed. No generalized reaction was noted either. No toxicity was observed in any case in either of the groups.

NATURE OF OPERATIONS AND SITE OF INCISION

The diagnosis and nature of operations were variable and thus site of incisions also varied and incisions were found all over the body. All the surgeries were clean and elective

Table-1 : Diagnosis Of Subjects

| Diagnosis | Group I | | Group II | | Total | |
|-----------------------------------|-----------|---------------|-----------|---------------|-----------|---------------|
| | No. | % | No. | % | No. | % |
| Multinodular goitre | 1 | 3.33 | 2 | 6.67 | 3 | 5.00 |
| Solitary nodule L. lobe-thyroid | 1 | 3.33 | 2 | 6.67 | 3 | 5.00 |
| Solitary nodule R. lobe-thyroid | 2 | 6.67 | 1 | 3.33 | 3 | 5.00 |
| Colloid goitre | 1 | 3.33 | 1 | 3.33 | 2 | 3.33 |
| B/L Direct inguinal Hernia | 2 | 6.67 | 1 | 3.33 | 3 | 5.00 |
| L. direct inguinal hernia | 1 | 3.33 | 4 | 13.33 | 5 | 8.33 |
| L. indirect inguinal hernia | 2 | 6.67 | 1 | 3.33 | 1 | 1.67 |
| R direct inguinal hernia | 3 | 10.00 | 2 | 6.67 | 5 | 8.33 |
| R. indirect inguinal hernia | 3 | 10.00 | 5 | 23.33 | 9 | 15.00 |
| Epiplastic hernia | 1 | 3.33 | 3 | 10 | 7 | 11.66 |
| Incisional hernia | 3 | 10.00 | 4 | 13.33 | 7 | 11.66 |
| Para-umbilical hernia | 1 | 3.33 | 1 | 3.33 | 2 | 3.33 |
| Umbilical hernia | 1 | 3.33 | 1 | 3.33 | 2 | 3.33 |
| Divarication of Recti | 1 | 3.33 | - | - | 1 | 1.67 |
| Fibroadenoma L. Breast | 1 | 3.33 | 1 | 3.33 | 2 | 3.33 |
| Lipoma R. leg | 1 | 3.33 | - | - | 1 | 1.67 |
| Lipoma L. Posterior axillary fold | 1 | 3.33 | - | - | 1 | 1.67 |
| Lipoma R supraclavicular region | 1 | 3.33 | - | - | 1 | 1.67 |
| R. Lower limb varicose vein | 1 | 3.33 | 1 | 3.33 | 1 | 1.67 |
| Total | 30 | 100.00 | 30 | 100.00 | 60 | 100.00 |

CULTURE RESULTS

Sterile saline swab culture was taken from site of incision after skin disinfection with respective antiseptic regimen to compare the efficacy of both the regimen. In patients with positive culture results, microorganisms were further strained with antibiotic sensitivity test.

Table-2 : Microbiological report* with percentage of cases with positive culture results from site of incision in both the groups.

| Microbiological report | Group I | | Group II | | Total | |
|-----------------------------|-----------|---------------|-----------|---------------|-----------|---------------|
| | Number | % | Number | % | Number | % |
| No growth | 24 | 80.00 | 29 | 96.66 | 53 | 88.33 |
| Staph.albus (coagulase -) | 3 | 10.0 | 1 | 3.33 | 4 | 6.67 |
| Staph. aureus (coagulase +) | 1 | 3.33 | - | 0.00 | 1 | 1.67 |
| Bacillus subtilis | 2 | 6.67 | - | 0.00 | 2 | 3.33 |
| Growth present | 6* | 20.00 | 1* | 3.33 | 7* | 11.67 |
| Total | 30 | 100.00 | 30 | 100.00 | 60 | 100.00 |

* Culture taken from site of incision after skin disinfection with respective agents.

Taking all the patients with growth positive (i.e. patients with positive culture

results from site of incision after skin disinfection with respective antiseptic

regimen) together the above table can be interpreted as above (Table 2).

It was observed from this study (Table 2) that the proportion of cases with

growth in Group I was 6(20.0%) whereas in case of Group II was 1(3.3%) and this

difference in the proportion of patients with growth after skin disinfection between the two groups is found to be statistically significant (Z=2.01, p<0.03).

FOLLOW UP

Post operatively patients were followed up to the time of suture removal (usually 7-10 days) to know the percent of cases who developed wound infections.

The grade of wound infection was determined by Southampton wound grading systems.

Table 3 shows the cases with different grades of wound infection.

Table-3:Wound Infection Grade during follow up period

| Follow up (wound infection grade) | Group 1 | | Wound culture sensitivity | Group 2 | | Wound culture sensitivity | Total | |
|-----------------------------------|-----------|------------|---------------------------|-----------|------------|---------------------------|-----------|------------|
| | Num ber | % | | Numb er | % | | Numb er | % |
| Grade 0 | 24 | 80.0 | - | 29 | 96.7 | - | 53 | 88.3 |
| 1c | 1 | 3.3 | Enterococcus* | 1 | 3.3 | Staph epidermidis* | 2 | 3.3 |
| 2a | 1 | 3.3 | Staph epidermidis* | - | - | - | 1 | 1.7 |
| 3a | 2 | 6.7 | Bacillus subtilis | - | - | - | 2 | 3.3 |
| 4 | 2 | 6.7 | Staph albus, Staph aureus | - | - | - | 2 | 3.3 |
| total | 30 | 100 | - | 30 | 100 | - | 60 | 100 |

·Organisms other than those isolated from sterile incision site swab , indicating ward acquired infections.

·Taking all the patients with wound infections together Table 3 can be interpreted as below (Table 5).

Table 4: Comparison of total number of infected cases in both the groups during follow up period.

| Follow up (Wound Infection Grade) | Group I | | Group II | | Total | |
|-----------------------------------|-----------|--------------|-----------|--------------|-----------|--------------|
| | Number | % | Number | % | Number | % |
| Grade 0 | 24 | 80.0 | 29 | 96.7 | 53 | 88.3 |
| Infected | 6* | 20 | 1* | 3.3 | 7 | 11.7 |
| Total | 30 | 100.0 | 30 | 100.0 | 60 | 100.0 |

It was observed from this study (Table-4) that the proportion of cases infected in

Group I was 6(20.0%) whereas in case of Group II was 1(3.3%) and this difference in the proportion of wound infection rate between the two groups is found to be statistically significant (Z=2.01, p<0.03).

The relation between microbiological result of culture taken from site of incision preoperatively, after skin preparation and wound infection in post-operative follow up period is shown in Table 19.

Table 5: Relationship between microbiological report and post-

operative wound infection rate

| Microbiological report | Group I | | | Group II | | |
|------------------------|--------------|-----------|-------|--------------|-----------|-------|
| | No infection | Infection | Total | No infection | Infection | Total |
| No Growth | 22 | 2 | 24 | 28 | 1 | 29 |
| Growth | 2 | 4 | 6* | 1 | 0 | 1* |
| Total | 24 | 6 | 30 | 29 | 1 | 30 |

It is noted from Table 5 that out of 6 cases with growth in group I, only 4 had wound infection. Similarly the only one infection in group II was ward acquired. Ward infections were defined as infection occurring in patients with no growth in cultures from site of incision.

In patients with no growth isolated from incision site, two patients acquired ward infection in group I and one patient acquired ward infection in group II.

Table 6: Relationship between microbiological report and post operative wound infection rate after excluding ward infection.

| Microbiological report | Group I | | | Group II | | |
|------------------------|--------------|------------------------------------|-------|--------------|------------------------------------|-------|
| | No infection | Infection (without ward infection) | Total | No infection | Infection (without ward infection) | Total |
| No growth | 22 | - | 22 | 28 | - | 28 |
| Growth | 2 | 4* | 6 | 1 | 0* | 1 |
| Total | 24 | 4 | 28 | 29 | 0 | 29 |

*Z=2.04, p<0.03

This study (Table-06) has revealed that the proportion of infected cases after excluding the ward infection in Group I was 4 whereas in case of Group II it was none and this difference in the proportion of infected cases between the two groups is found to be statistically significant (Z=2.04, p<0.03).

Note:-

Growth : positive culture results from site of incision after skin disinfection. **Infection**: Infection of surgical site in post-operative period (till suture removal). **Ward acquired infection** :Patients with no growth but developing infection in post-operative period

CONCLUSION

1-Overall in Group I where only povidone iodine was used, 6 patients still had microbial colonization of the site of incision whereas in Group II where combination of povidone iodine and chlorhexidine was used, in only 1 patient microorganisms could be cultured from site of incision.

2-Out of the patients with positive culture result from site of incision, in group I, four patients developed wound infection, whereas in group II none of the patients developed wound infection.

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