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General Surgery

COMPARATIVE STUDY OF PREOPERATIVE SKIN PREPARATION WITH AQUEOUS POVIDONE-IODINE ONLY AND IN COMBINATION WITH ALCOHOLIC CHLORHEXIDINE IN PATIENTS UNDERGOING CLEAN ELECTIVE SURGERY IN TERTIARY CARE CENTRE

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ABSTRACT **Aims And Objectives:** To study the effectiveness of povidone-iodine only and combined with an antiseptic solution containing alcoholic chlorhexidine in preoperative preparation of the skin. **Materials And Methods:** This comparative study was conducted in PES hospital Kuppam, including 120 subjects presenting to the General surgery O.P.D. with clinical features of hernia undergoing mesh hernioplasty from January 2020 to June 2021. The preoperative preparation of skin in each group was done with respective antiseptic regimens: Group I: The antiseptic regime used for preoperative skin preparation was three coatings of aqueous povidone-iodine I.P. 5% (Betadine). Group II: The antiseptic regime used was a single coating of agent containing chlorhexidine gluconate 2.5% v/v in 70% propanol accompanied by two coatings of aqueous povidone-iodine I.P. 5% w/v **Inclusion Criteria:** All patients aged 18 years and above undergoing Hernia repair (mesh hernioplasty) with no septic foci anywhere on the body, afebrile, having Normal WBC counts, and is neither immunocompromised nor on any other long-term steroids **Exclusion Criteria:** Patients undergoing emergency surgery and Chronic medical illnesses – hypertension, diabetes mellitus, CAD, COPD is precluded from the study results**:** Regime II had greater efficacy in decreasing colonization at the incision site (3.3% in Group II in Comparison to 13.3% in Group I). Regime I inefficacious in decreasing bacterial load at the incision site is a significant source of wound infections in the postoperative period. **Conclusion:** povidone-iodine 5% combined with chlorhexidine gluconate 2.5% regime should be introduced in preoperative skin preparation for all surgical procedures for effectiveness in preventing bacterial growth.

KEYWORDS : povidone iodine, alcoholic chlorhexidine, bacterial load, incision site, post operative infection.

INTRODUCTION

Preoperative skin preparation is crucial for practice in any surgery. As the skin is a significant source of microorganisms, it is evident that enhancing skin antisepsis would reduce surgical-site infections. The apparent target of this step is to decrease postoperative wound infection[1,2].

Although many surgical techniques have been introduced in the past few years, postoperative wound infection remains significant. It is rarely a cause of mortality, but it persistently increases morbidity, therefore prolonging patient hospitalization. Surgical Site Infections are the third most commonly reported nosocomial infections worldwide.[3]

The most commonly used antiseptic agents for skin preparation include aqueous or alcohol-based iodophors and chlorhexidine gluconate.

The study compares the effectiveness of povidone-iodine only & combined with an antiseptic solution containing alcoholic-Chlorhexidine in preoperative preparation of skin among all patients undergoing hernia repair (mesh hernioplasty) in the general surgery department of a tertiary care hospital.

AIMS AND OBJECTIVES

To study the effectiveness of povidone-iodine only and combined with an antiseptic solution containing alcoholic chlorhexidine in preoperative preparation of the skin.

MATERIALS AND METHODS:

This comparative study was conducted in PES hospital Kuppam, including 120 subjects presenting to the General surgery O.P.D. with clinical features of hernia undergoing mesh hernioplasty from January 2020 to June 2021

Inclusion Criteria:

- All patients aged 18 years and above undergoing Hernia repair (mesh hernioplasty) were included in the study
- Patient with no septic foci anywhere on the body, afebrile, and having Normal WBC counts
- Patient neither immunocompromised nor on any other long-term steroids

Exclusion Criteria:

- Patients undergoing emergency surgery were precluded from the study.
- Chronic medical illnesses – hypertension, diabetes mellitus, CAD, COPD

Methods Of Collection Of Data:

This study comprised of 120 cases (60 in each group) in which a comparative analysis was done. For each case preoperatively:

- A thorough history was taken, routine investigations i.e., hemoglobin, total WBC count, differential count, E.S.R., R.B.S., and chest radiograph was done to find out any source of infection present before the study.
- Preoperative parts preparation(shaving) was done simultaneously on the previous evening, and the antibiotic protocol was followed (i.e. amoxicillin- single dose given I.V at the time of anesthesia). But the antibiotic regime is ineffective on microbial flora (both residual and transient) on the skin surface before incision, and hence, microbial colonization at the incision site will only be affected by antiseptic solutions used for preoperative skin preparation.
- The preoperative preparation of skin in each group was done with respective antiseptic regimens:

Group I: Antiseptic regime used for preoperative skin preparation was three coatings of aqueous povidone-iodine I.P. 5% (Betadine).

Group II: Antiseptic regime used was a single coating of agent containing chlorhexidine gluconate 2.5% v/v in 70% propanol accompanied by two coating of aqueous povidone-iodine I.P. 5% w/v, which is shown in the following steps.

Step 1: Single coating of chlorhexidine -gluconate 2.5% v/v in 70% alcohol (FIG 1).

Figure 1

Step 2: Chlorhexidine-containing agent is spread evenly and allowed to form a layer.

Step3: Two coatings of aqueous povidone-iodine are applied (FIG 2).

Figure 2

Swab culture was drawn immediately from the incision site after applying antiseptics in two groups (FIG 3). It was transferred to the microbiology laboratory to identify whether any pathogens were left behind and compare the effectiveness of two regimes of skin preparation.

Figure 3

The swabs were inoculated on the microbiology department's blood, McConkey's agar plates, and nutrient broth. The media was incubated aerobically at 37 degrees for 24-48 hrs.The isolated bacteria were recognized by their cultural & morphological characteristics. Grams stain, coagulase test, & Antibiogram were done. Antibiogram is done against the following antibiotics

- Ampicillin
- Amoxicillin
- Ciprofloxacin
- Gentamicin
- Erythromycin

Postoperatively, the first dressing was done on the 3rd postoperative day with povidone-iodine alone, and patients were followed until the time of sutures removal (7-10 days) to look for any signs of wound infection.

For example: -
- Purulent/serous discharge from the wound
- Redness of the surrounding area
- Pain associated with discharge
- Increased local rise of temperature
- Induration of the surrounding area

Suppose discharge is present, culture sensitivity and Antibiogram were sent to know whether causative organisms were the same, which were left behind preoperatively after skin preparation. Hence, incomplete disinfection was the cause of wound infection.

RESULTS:

Table 1 Distribution Of Age, Gender And Diagnosis Of The Study In Group 1 And 2

variables	Group 1(povidone-iodine only) n-60	Group 2 (chlorhexidine+ povidone-iodine) n- 60	Total
Age in years			
21 - 30	23.3% (n-14)	30.0%(n-18)	26.7%(n-32)
31 - 40	33.3%(n-20)	25.0%(n-15)	29.2%(n-35)
41 - 50	20.0%(n-12)	18.3%(n-11)	19.2%(n-23)
51 - 60	16.7%(n-10)	21.7%(n-13)	19.2%(n-23)
61 - 70	6.7% (n-4)	5.0%(n-3)	5.8%(n-7)
Gender			
Male	63.3%(n-38)	58.3%(n-35)	60.1(n-73)
female	36.7%(n-22)	41.7%(n-25)	39.9(n-47)
Diagnosis of subjects			
Ventral hernia	25.0%(n-15)	18.3%(n-11)	21.7%(n-26)
Left direct inguinal hernia	6.7%(n-4)	10.0%(n-6)	8.3(n-10)
Left indirect inguinal hernia	35.0%(n-21)	30.0%(n-18)	32.5%(n-39)
Right direct inguinal hernia	23.3%(n-14)	25.5%(n-15)	24.2%(n-22)
Right indirect inguinal hernia	10.0%(n-6)	16.7%(n-10)	13.3%(n-16)

Interpretation:

Mean age was 40.1 ± 12.3 years in the group 1 and was 40.1 ± 12.4 years in the group 2, and these means were comparable among the two groups. Male outnumbered the females. Left indirect inguinal hernia was most common (32.5%). however surgery performed for all groups were same.

Table 2 Culture Results From Incision Site And Presence Of Growth

variables	Group 1 (povidone-iodine only) n= 60	Group 2 (chlorhexidine +povidone iodine) n= 60	Total
Culture results from the incision site			
No growth	86.7%(n-52)	96.7%(n-58)	86.4%(n-110)
Staph. Albus	6.7%(n-4)	3.3%(n-2)	10.2%(n-6)
Staph. Aureus	3.3%(n-2)	0.0%(n-0)	1.7%(n-2)
Bacillus subtilis	3.3%(n-2)	0.0%(n-0)	1.7%(n-2)
Presence of growth			
No growth	86%(n-52)	96.7%(n-58)	83.3%(n-110)
Growth present	13.4%(n-8)	3.3%(n-2)	16.7%(n-10)

Interpretation:

swabs taken from the incsion site yeilded no growth in 86.7% and 96.7% in group and group 2 respectively.

Table 3 Follow Up Wound Infection Grade With No. Of Infected And Non Infected In Each Group.

Variables	Group 1 (povidone-iodine only) n=60	Group 2(chlorhexidine +povidone iodine) n=60	Total
Follow-up (wound infection grade)			
Grade 0	86.7%(n-52)	98.3%(n-59)	91.5%(n-111)
IC	0.0%(n-0)	1.7%(n-1)	1.7%(n-1)
IIA	0.0%(n-0)	0.0%(n-0)	0.0%(n-0)
IIIA	6.7%(n-4)	0.0%(n-0)	3.4%(n-4)
IV	6.7%(n-4)	0.0%(n-0)	3.4%(n-4)
Follow-up (No. of infected cases)			
Grade 0	86%(n-52)	98%(n-59)	98.3%(n-111)
Infected	13.3%(n-8)	1.7%(n-1)	1.7%(n-9)
Infection and growth status of wound			
Not Infected	86.7%(n-53)	98.3%(n-59)	92.5%(n-111)
Infected with no culture	13.3%(n-2)	1.7%(n-1)	2.5%(n-3)
Infected with growth present on culture	10.0%(n-6)	0.0%(n-0)	5.0%(n-6)

Interpretation:

At follow up wound was graded according to the Southampton wound grading system in which grade IC was 86.7% and 98.3% in group 1 and 2 respectively.

The infected wound with growth present on culture was 10.0% and 0.0% in group 1 and 2 respectively which is statistically significant.

Table 4 Culture And Antibiogram Reports With Positive Growth From The Swabs Taken From Wound Infection Postoperatively In Group I

	Group 1					
Pt. no	Pt.2	Pt.3	Pt.4	Pt.6	Pt.7	Pt.8
Wound infection grade	IV	IV	IIIA	IV	IIIA	IV
Culture result	Staph. Albus	Staph. Albus	Staph. albus	Staph. Aureus	Bacillus subtilis	Bacillus subtilis
Antibiogram						

Ampicillin	S	R	S	S	S	S
Amoxycillin	S	R	S	S	S	S
Ciprofloxacin	S	S	S	S	S	S
Gentamicin	S	S	S	S	S	S
Erythromycin	S	S	S	S	S	S

Interpretation:
These culture and antibiogram reports reveal that the organisms responsible for infection in the postoperative period were the same, left behind because of an ineffective antiseptic regime in group I.

DISCUSSION:
Regarding the wound infections, **Moynihan**[49] mentioned that, "Our bacteriological experiment may conduct with one of the two goals:

- All microbes are precluded from a wound site.
- All microbes are destroyed in the wound by application of bactericide on wound surface.

Asepsis & antisepsis are fundamental principles for most of the modern surgery.

Asepsis:
Asepsis is defined as the exclusion of bacteria from the field of surgical procedures by sterilization of everything employed in it.

Antisepsis:
Antisepsis aims at creating a chemical barrier between the tissue and the source of infection.

- Multiple randomized, controlled trials surveying various regimens for skin disinfection prior to surgery proved that alcoholic-Chlorhexidine is more effective in decreasing incision site bacterial load & further wound infection than povidone-iodine. There is significant effect of Chlorhexidine on Gram+ve bacteria, mostly on coagulase-ve Staphylococcus, than other disinfectants.
- Few studies with post operative infection rate which showed alcoholic-Chlorhexidine is superior:

AUTHOR	POVIDONE IODINE ALONE (GROUP 1) INFECTION RATE	POVIDONE IODINE + CHLORHEXIDINE (GROUP2) INFECTION RATE
Brown et al.	8.1%	6.0%
Darouiche et al.	16.1%	9.5%
Ranjeet et al.	15.95%	9.96%
Ajay et al.	13.3%	0.0%
Sistla et al.	9.5%	7%
Current study	13.3%	1.7%

CONCLUSION:
Thus, the advantage of this regime was justified in reducing colonization rate at the incision site and postoperative wound infection, hence it is judicious to use this regime in all surgical procedures. Therefore, the above study concludes that because of the effectiveness in preventing bacterial growth, povidone-iodine 5% combined with chlorhexidine gluconate 2.5% regime should be introduced in preoperative skin preparation for all surgical procedures.

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