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Original Article

Evaluation of Depilatory Cream, Razor and Clipping Method of Hair Removal in Pre-operative Skin Preparation and Its Effects on Surgical Site Infection

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Abstract

Background: Surgical site infestation is a challenge facing surgeons across the world. Various hair removal methods have impact on the incidence of surgical site infestation.

Aims and Objectives: Aims and objectives of the study were to evaluate the methods of hair removal (comparing conventional razor technique, depilatory cream, and clipping) and its effect on post-operative surgical site wound infection.

Materials and Methods: Randomized controlled trial was conducted from June 2015 to July 2016 at Department of General Surgery undergoing elective open abdominal surgery (clean and clean contaminated cases) in Ramaiah Hospital. Sample size of 227 was considered. Patients aged >18 and <60 years undergoing elective open abdominal surgeries (clean and clean contaminated cases) were included in the study.

Result: In the period of study (14 months), there was surgical site infection rate of 12.16% (statistically significant) with razor, 4.88% with depilatory cream, and 2.82% with clipping. Razor method had 10.81% of skin injuries and depilation and clipping had no skin injuries. Similarly, razor method had 12.16% of erythema and depilation and clipping had no erythema. Razor method had 4.05% of rashes and depilation method had 1.22% of rashes; there was no rash with clipping. In razor method, 5.41% of patients had partial removal of hair; in depilatory method, 3.66% of patients had partial removal of hair; and in clipping method, 8.45% patients had partial removal of hair.

Conclusion: Preparation with razor method had more complications compared to depiliatory cream and clipping, which was statistically significant. However, depiliatory cream and clipping had similar results.

Keywords: Depilation, Hair clipping, Razor shaving, Surgical site infection

INTRODUCTION

Infection in vicinity of surgical incisions within 30 days of an surgical procedure, stated as surgical site infection (SSI), provides significantly to surgical morbidity and mortality each year. SSI accounts for 15% of all hospital acquired infections and among surgical patients and it is the most common nosocomial infection.[1]

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Economic burden with diagnoses, treatment, and management of SSI can be disturbing. The patients developing SSI have longer hospitalizations and are likely to spend time in hospital and are 5 times more likely to be readmitted and are twice as likely to die.[2,3] Treatment of SSIs can be prolonged, leading to long morbidity and economic impacts. Understanding this substantial morbidity and economic burden, in 1999, the Centers for Disease Control issued standardized guidelines for the prevention of surgical infections. These includes making specific evidence-based recommendations for modifying patient factors that might predispose to infection, for the utility of antimicrobial prophylaxis, for optimizing sterility in the operating room, and for the use of antiseptic agents for skin preparation.[4,5] The selection of which specific

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agent to use for skin preparation was not answered due to the diversity of sites and approaches in surgery and the absence of data on SSI risk in well-controlled, operation-specific studies.[6] Hence, the choice of agent should be based on the surgeon's knowledge of the product's efficacy, economy, and ease of use.[7,8]

In this endeavor, skin preparation methods play an important role, which includes selecting a right antiseptic solution to selecting a right technique of removal of hair in surgical site. Although number of studies have been conducted in this area, there is always a need for a local study which can throw light on various factors impacting the development of SSIs in a particular hospital, yet can contribute on a global level furthering the collective efforts of surgical academicians worldwide.[9,10]

The evolution of these continues endlessly. Innumerable studies have been carried out to determine the best possible method. However, no consensus has been achieved as yet. The process of developing the best method. Hence still continues; hence, the need to carry out the study to develop an optimum method of pre-operative skin preparation. In this context, this study intends to evaluate clipping versus depilatory cream versus razor in pre-operative skin preparation and its effects on SSI.[11]

Aims and Objectives

Aims and objectives of the study was to evaluate the methods of hair removal (conventional razor technique, depilatory cream, and clipping) and its effect on post-operative surgical site wound infection.

MATERIALS AND METHODS

Randomized controlled trial was conducted from June 2015 to July 2016 at Department of General Surgery undergoing elective open abdominal surgery (clean and clean-contaminated cases) in Ramaiah Hospital. Patients aged >18 and <60 years undergoing elective open abdominal surgeries (clean and clean-contaminated cases) were included in the study. Contaminated and infective cases, patients on prolonged antibiotic therapy, immunocompromised conditions, patients on steroids, patients with uncontrolled diabetes mellitus, patients with organ failure, surgeries involving perineum, and genital organs were excluded from the study. Sample size of 227 was considered for the study based on the previous studies and admission rates of our hospital. Based on randomization through computer allotment, 82 patients were treated with depilation method of hair removal, 74 patients were treated with shaving with razor as method of hair removal, and 71 patients were treated with clipping method of hair removal. Hair removal methods were performed 2 h before skin incision, by the nursing staff on the day before proposed operation. All patients will have antibiotics administration 1 h before skin incision on the proposed day of surgery and continued till 24 h postoperatively and then stopped. All patients will be assessed postoperatively for the presence of wound infection. A modification of the Southampton wound infection scoring system will be used for grading infection. All patients will be followed up and the operative site will be assessed on post-operative day 2, 5, 7, and will be followed up to maximum period of 30 days for the presence of any wound infection. Dressings will be opened only in case of any wound soakage, pain, and fever.

Statistical Methods

In the statistical analysis of our study, continuous variables were presented as mean for parametric data and median if the data are nonparametric or skewed. Student's *t*-test was applied for calculation of statistical significance whenever the data followed normative distribution. Mann–Whitney test was applied whenever data followed non-normative distribution. Categorical variables were expressed as frequencies and percentages. Nominal categorical data between the groups were compared using Chi-square test or Fisher's exact test as appropriate. $P < 0.05$ was taken to indicate a statistically significant difference. Minitab version 17 was used for computation of statistics.

RESULTS

In the above study, mean age of the subjects in depilation group, razor group, and clipping group was 51.54 ± 17.082, 51.9 ± 17.164, and 48.9 ± 11.67, respectively (Tables 1-7 and Figures 1-3).

DISCUSSION

SSI (Table 8)

We compared results of our study regarding SSI in 3 groups – depilatory cream, razor method, clipping with the previous studies – recent as well as old. We found that our study had SSI rate of 4.88% with depilatory cream. Studies by Manish Bansal *et al.* (2015), Karegoudar, (2012), Moro *et al*., Ratanalert had lower rate of SSI with depilatory cream than us. Whereas, studies by Mukesh Suvera *et al*., 2015, had a higher rate of SSI with depilatory cream than us.[12,13] In all the studies enumerated, SSI ranged from 0.6% to 8% (Table 9).

In reference to SSI in razor group, we found that our study had SSI rate of 12.16%. Studies by Moro *et al.* and

Table 1: Type of surgeries

Type of surgeries	Razor	Depilation	Clipping	Total
Exploration and laparotomy	2	2	1	5
Hemicolectomy	2	2	1	5
Open para umbilical hernia with mesh repair	4	8	6	18
Open inguinal hernia with mesh repair	4	7	6	17
Lap appendicectomy	5	10	8	23
Lap cholecystectomy	32	31	27	90
Open pericystectomy	3	2	2	7
Lap herniorraphy	10	4	8	22
Lap pericystectomy	5	5	6	16
Lap spleenectomy	1	1	2	4
Open appendicectomy	1	2	1	4
Open cholecystectomy	3	2	2	7
Sub total gastrectomy	2	6	1	9
Total	74	82	71	227

Table 2: Pre-hospital duration of stay (in days)

Hair removal method	Count	Mean±SD	*P* value
Razor	74	2.76±1.43	
Depilation	82	1.66±1.32	
Clipping	71	1.96±1.03	

SD: Standard deviation

Table 3: Post-hospital duration of stay (in days)

Hair removal method	Count	Mean±SD	*P* value
Razor	74	4.11±2.624	
Depilation	82	2.95±2.532	
Clipping	71	3.68±2.435	

SD: Standard deviation

Table 4: Adequacy of hair removal

Hair removal	Hair removal method			Total	*P* value
	Razor	Depilation	Clipping		
Complete	70	79	65	216	0.21
Partial	4	3	6	11	
Total	74	82	71	227	

Table 5: Complications of hair removal methods

Complications	Total			
	Razor	Depilation	Clipping	Total
Skin injuries	8	0	0	8
Erythema	9	0	0	9
Rashes	3	1	0	4
P value	0.04	0.07	0.08	

Table 6: SSIs in study groups

SSI	Razor	Depilation	Clipping	Total
No	63	79	69	212
Yes	9	4	2	15
Total	74	82	71	227
Percentage of SSI	12.16	4.88	2.82	6.61
P value	0.03	0.15	0.26	-

SSIs: Surgical site infections

Table 7: Microorganism in surgical site infections in study groups

Microorganism	Razor	Depilation	Clipping	Total	*P* value
Staphylococcus aureus	5	2	1	8	0.234
Escherichia coli	3	1	0	4	0.369
Pseudomonas	1	0	0	1	0.325
No growth	0	1	1	1	0.213
Total	9	4	2	11	0.0238

Powis *et al.* had lower SSI rate than our study. Studies by Mukesh Suvera *et al*., 2015, had SSI rates higher than our study.[14,15]

In reference to SSI in clipping method, we found that our study had SSI rate of 2.82%. Studies by Balthazar *et al*. (1985) had SSI of 1%, Sellick *et al.* (1989) had 0.2%, and Alexander *et al*. (1981) had 2.6%. Relatively higher percentage of SSI in our study can be ascribed to paramedical staff performing the procedure.[16,17]

The removal of hair might be needed to adequately view or access the operative site and it is sometimes undertaken because of an increased risk of microbial contamination of the operative site from the presence of hair. However, microabrasions of the skin caused due to shaving using razors might support the multiplication of bacteria, within the skin surface, especially if undertaken several hours before surgery.[18,19] An increase in the number of microorganisms colonizing the skin around the operative site may facilitate contamination of the wound and subsequent development of SSI. The increased SSI risk associated with shaving has been attributed to microscopic cuts in the skin that later serve as foci for bacterial multiplication. Shaving immediately before the operation compared to shaving within 24 h preoperatively was associated with decreased SSI rates. If shaving was performed >24 h before operation, the

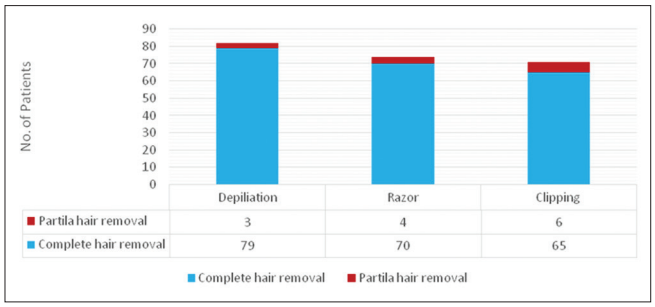

Figure 1: Adequacy of hair removal

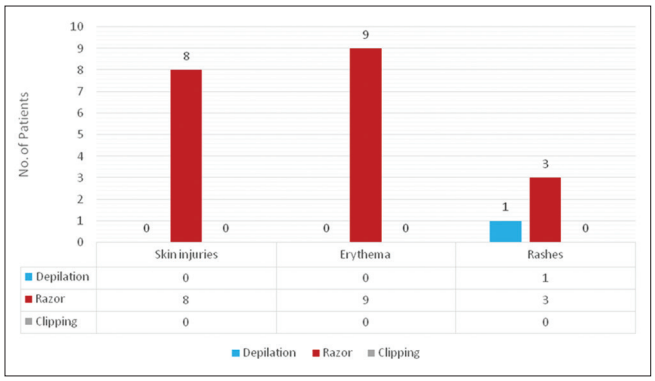

Figure 2: Complications of hair removal methods

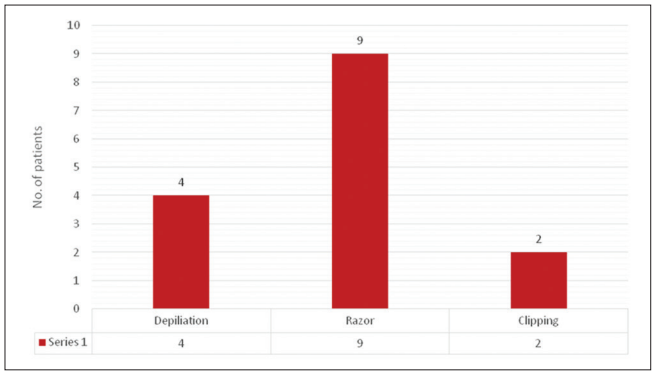

Figure 3: Surgical site infections in study groups

SSI rate was high. Clipping hair immediately before an operation also has been associated with a lower risk of SSI than shaving or clipping the night before an operation.[20]

In pooling 1420 patients from the seven studies, Cochrane database systematic review by Tanner *et al.* found a SSI rate of 10% among the razor-shaved patients compared to 7% among those who had depilatory cream application. However, no statistically significant association was demonstrated in the meta-analysis. It was, therefore, suggested that though depilatory cream reduces the proportion of patients who would develop post-operative wound infection, other endogenous and exogenous factors in and around the patients may also contribute significantly to the development of wound infection alongside the method of hair removal employed preoperatively.

Skin Injury

Regarding skin injury in our study, we found that, no patient in depilation group and clipping group had skin injury. In razor group 8 (10.81%) patients had skin injuries and significant difference was found.

In a study by Adewale *et al.* (2011), for evaluation of presence and grade of skin injuries and skin reactions, their study showed no injuries at all in the majority (83.4%; 138 of 165) of patients, tiny single injuries in 10% (16 of 165); multiple small injuries in 6% (9 of 165); and large skin injuries in 1% (2 of 165) in the areas where hairs were removed. Of the 79 patients who had cream depilation, the majority (76; 96.2%) had no skin injuries, two (2.5%) had single tiny injuries, and only one (1.3%) had multiple small injuries. In contrast, of the 86 patients who had razor shaving, 62 (72.1%) had no skin injuries, 14 (16.3%) had single tiny injuries, eight (9.3%) had multiple small injuries, while two (2.3%) had large injuries. This difference was

Table 8: SSI rates in a variety of different surgery types

Author	Procedure	SSI rate (%)
Bakkum-Gamez *et al.*, 2013	Surgical management of endometrial cancer	9.9
Teija-Kaisa *et al.*, 2013	Breast operations (lumpectomy, mastectomy)	6.7
Lake *et al*., 2013	Hysterectomy	2.71
Lopez-Contreras *et al.*, 2012	Total primary hip prosthesis	3
	Total primary knee prosthesis	3.3
Young *et al.*, 2011	Knee replacement, spinal surgery and arthroplasty	11.1
Huotari *et al.*, 2006	Hip arthroplasty	3.9
	Knee arthroplasty	2.3
Thomas *et al*., 2004	Total hip replacement	4.86
	Total knee replacement	5.15
Chung *et al.*, 1991	Total hip replacement	1.3-11
	Other clean orthopedic surgeries	0.7-9

SSI: Surgical site infection

Table 9: Surgical site infection in hair removal methods

Author	SSI rate with depilatory cream (%)	SSI rate with razor (%)	SSI rate with clipping (%)
Our study	4.88	12.16	2.82
Mukesh Suvera *et al*., 2015	8	14.5	-
Manish Bansal, 2015	2	16	-
Karegoudar, 2012	0.6	5.6	-
Cochrane Database Systematic Review by Tanner *et al.*	7	10	-
Balthazar *et al*. 1985	-	2	1
Sellick *et al*., 1989	-	1.2	0.2
Alexander *et al.*, 1981	-	4.5	2.6

SSI: Surgical site infection

demonstrated to be statistically significant ($P < 0.0001$). In terms of the skin reactions, there were none in 97% (160 of 165) of the patients when both groups were taken together. In those who had cream depilation, 96% (76 of 79) had no skin reaction. Similarly, 84 of the 86 (98%) of patients who had razor shaving had no skin reaction.[21] The findings indicated that skin sensitivity and reactions were about the same for the two methods of hair removal.

In a study by Bansal (2013), they found 14 (28%) patients had skin injury by shaving razor which were single, multiple or large while no patients had skin injury by depilatory cream ($\chi^2 = 14.03$; $P = 0.0002$) showed that depilatory cream was much safer than razor shaving. Skin reaction occurred in 1 (2%) patient by shaving razor and in 3 (6%) patients by depilatory cream (Table 10).[22]

Table 10: Comparison of skin injury

Author	Depilatory cream (%)	Razor (%)
Our study	0	10.81
Bansal, 2015	0	14
Adewale *et al*., 2011	3.80	27.90

Table 11: Comparison of our study results with similar standard studies

Author	Depilatory cream (%)	Razor (%)	Clipping (%)
Our study	96.34	94.39	91.25
Bansal, 2015	31	46	-

Erythema and Rashes

Regarding erythema, we found that no patient in depilation group and clipping group had erythema. In Razor group, 9 patients had skin erythema and a significant difference was found. Regarding rashes, 1 patient in depilation group had rashes and in razor group 3 patients had rashes. No rashes were found in clipping group. However, no significant difference was found.

It is generally believed by surgeons that the use of depilatory cream produces clean, intact skin without the risk of developing lacerations or abrasions. It can, however, cause skin irritation or rash, especially in the groin area. If possible, long hair should be cut with a pair of scissors before applying the cream so that less amount of cream is used. The chemical in the hair removal cream affects the chemistry of the individual hair strands. The active chemicals in the cream break down keratin, the principal protein, which normally requires a blade for depilation or any other harsh treatment. The effects of the cream vary, based on the strength, color and coarseness of the hair being removed as well as the length of time the cream is left undisturbed on the hair to act. The most common complications with creams are rashes and erythema which can also increase the risk of post-operative infection. Depilatory creams have an advantage in areas which are difficult to be shaved or if the patient has been scheduled for diagnostic procedures and operations in the same area in close succession. Clipping method, by virtue of its technique, is devoid of any erythema.

Adequacy of Hair Removal

Most surgeons who practice pre-operative hair removal do so to avert interference of hairs with skin incisions and subsequent closure, to discourage hairs from falling into wounds, to prevent interference with the application of adhesive drapes and wound dressings, and to prevent patients from experiencing severe pain on removal of adhesive dressings. Hence, the selection of hair removal method would in part be based on its effectiveness in completely removing hairs.

Our study found that in depilation group 79 patients had complete removal of hair and 6 patients (3.66%) had partial removal of hair. In razor group, 70 patients had complete removal of hair and 2 (5.41%) patients had partial removal of hair. In clipping method, 68 patients had complete removal of hair and 6 patients (8.45 %) had partial removal of hair. No statistically significant difference was found in our study between the groups (Table 11).

The findings in this study by Adewale *et al.* (2011) showed that cream depilation achieved better complete hair removal in more cases than shaving with a razor blade (88.6% vs. 61.6% $P < 0.0001$). This finding compared favorably with reports of the previous studies. In one of the earliest studies on the use of depilatory cream for pre-operative hair removal, Prigot and colleagues reported excellent hair removal in 89.5% of the cases.

In a study conducted by Bansal, this study was conducted on 100 patients with 50 patients in each group. 31 (62%) patients had complete hair removal by shaving razor while 46 (92%) patients had complete hair removal by depilatory cream. Hence ($\chi^2 = 11.06$; $P = 0.0009$), complete hair removal was significantly associated with depilatory cream application than razor shaving.

Standards and recommended practices from the association of perioperative registered nurses state that pre-operative skin preparation of surgical patients should include little or no hair removal, cleansing of the area around the surgical site and use of an antiseptic agent immediately before the surgical incision.

CONCLUSION

Most of the studies reinforce the fact that results are similar to our study, in which depilatory cream and clipping is less traumatic to skin compared to shaving resulting in lesser rates of SSI, which is statistically significant. We recommend larger population, multicenter, randomized controlled studies to further investigate the relationship of post-operative wound infection to the method of pre-operative hair removal observed in this study.

Limitation of the Study

In our study, we have not standardized skills of surgeon, experience of paramedical staff in performing their respective role.

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