

# Evaluation of Preoperative Hair Removal and its Relationship with Postoperative Wound Infection at a Tertiary Health Facility in North-eastern Nigeria

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## Abstract

**BACKGROUND:** The general surgery unit of Federal Teaching Hospital Gombe performs several surgeries via the hair bearing areas. A pilot study by the unit on the incidence of SSI for all clean surgeries showed an alarming forty- six percent. <sup>(38)</sup> The reported infection rate for such infection is <2% by CDC standard. This study was done to probe the role of preoperative hair removal in such high infection rate. **OBJECTIVES:** the study aimed to determine the relative postoperative wound infection rates of Razor blade shaving and cream depilation. It also assessed the adequacy of hair removal by both methods and the type of skin injuries or reactions that follow each method **METHODS:** a prospective, cross-sectional, double-blinded study was done between July 1<sup>st</sup> to December 31<sup>st</sup> 2016 on 98 patients that met the inclusion criteria and randomized by balloting. BIC shaving stick produced by BIC SOCIETE, FRANCE and VEETO CREAM(thioglycollate) produced by RECKIT BENCKISER, were used for preoperative hair removal. Adequacy of hair removal, post shaving skin injuries and reactions were assessed preoperatively by research assistants. Post-operative wounds were graded using the Southampton wound scoring system for SSI. Data obtained was analyzed with SPSS software version 20.0 and statistical relationships were assessed using Chi-square. **RESULTS:** a total of 98 patients were recruited for the study. 53(54.1%) were males and 45(45.9%) were females. The mean age was 45.99(± 12.522) with a range of 16-76 years.

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Majority (88.8%) had open repair of abdominal wall hernia, followed by Scalp lipoma (6.1%), groin lipoma (3.1%) scalp osteoma and superficial Parotidectomy (1%) each. 57(58.2%) had razor blade shaving and 41(41.8%) had cream depilation. 91(92.9%) had adequate hair removal considering both methods. Depilatory cream use is however, more effective, with (97.6%) adequacy. Razor blade shaving recorded (89.5%) adequacy. Out of the patients, only 4(4.1%) had skin injuries and all are in the razor blade group. Depilatory cream use caused more skin reactions (7.3%) compared to razor blade use (1.8%). 6(6.1%) of all the patients developed SSI and 5(83.3%) ( $\chi^2$  1.6662) are in the razor blade group. Majority of the postoperative wounds (83.3%) are Southampton class A & B. 16.7% is class C CONCLUSION: preoperative hair removal using razor blade or cream depilation is associated with postoperative wound infection (6.1%). Razor blade shaving is however more prone to postoperative wound infection, although, the difference in the infection rate is not statistically significant (p-value 0.197). Preoperative cream depilation is more efficient and safer. LIMITATIONS: The sample size is rather small, as only patients presenting at the general surgery unit were recruited. This limited the scope of subjects that were assessed, as other units in the surgery department also operate in hair bearing areas. Multiple nurses were involved in the razor blade shaving and cream application, inter-personal differences in technique may affect the outcome in terms of skin injury. Subjective method of direct visual assessment of skin injury was resulting in missing non obvious skin injuries. The use of electron viewing microscope would have improved the discovery of such injuries.

**Keywords:** Hair removal; Razor; Depilatory cream; Postoperative wound infection.

## 1. Introduction

The aim of every surgeon after a successful surgery is an uneventful postoperative recovery and early return to preoperative state. Postoperative wound infection is one of the most common complication of surgery and places considerable burden on the patients and the health care system [1]. Surgeons have adopted several antiseptic measures to obviate postoperative wound infection. Preoperative hair removal is one of such measures. The most widely used methods of hair removal employed are: razor blade shaving, use of clippers and depilatory creams [1]. In developing nations such as Nigeria, use of razor blade shaving is the most widely practiced and this is often followed by various degrees of skin injuries and subsequent surgical site infection. It is the earliest method of hair removal and most countries have not adopted the newer techniques of clipping or use of depilatory cream. This may be related to the negligible cost of razor blade, ease of use and the failure of health facilities to adopt newer methods of hair removal. Although studies have been done locally and demonstrated superiority of depilatory cream, razor blade usage has remained in vogue [4]. This relationship of razor blade shaving, skin injuries and postoperative wound infection has been established by several authors [3]. A reduction in postoperative wound infection rates has been documented upon substituting preoperative razor blade shaving with use of depilatory cream for hair removal [4]. Preoperative hair removal has not been accepted wholesale by all surgeons due to its observed contribution to postoperative wound infection rates. The Centre for Disease Control strongly recommends that, preoperative hair removal should not be done; unless the hair interferes with the operation [1]. Presence of hair will evidently reduce the cleanliness of the operative field, interfere with surgical incision and placement of sterile adhesive tapes or wound dressings. Hair is thus removed if surgery is to be performed at body parts with thick, dense hairs. The CDC recommends hair removal just

before the surgery and preferably with single head disposable electric clippers [1]. The Norwegian Centre for Health Technology Assessment guidelines recommends use of clippers and depilatory creams [6]. The systemic review of Cochrane Database recommends the use of both clipping and depilatory cream in preference to razor blade shaving and advocated for increased randomized control trials comparing all the methods of hair removal. [2] Tanner J in a systemic review of Cochrane Database recommends that preoperative hair removal shall be avoided where possible. If hair is to be removed, it shall be done in a manner that preserves skin integrity and clipping is considered to be the best method available [28]. This prospective cross-sectional study seeks to assess shaving with razor blade and use of depilatory cream for preoperative hair removal and their relationship with postoperative wound infection. A comparison of the results obtained will be made with those from other facilities in Nigeria, Africa and globally. This will highlight the most efficient way of hair removal, the incidence of skin injuries and reaction and the method of hair removal most associated with surgical site infection. Recommendation can be made to the study centre on the method of hair removal that is safer to practice.

## **2. Materials**

### **2.1 Study Center**

Federal Teaching Hospital Gombe (formerly a Federal Medical Centre) was established in 1996. It has a 354 bed capacity and serves as a referral centre mainly for Gombe state and also receives referrals from health facilities in neighbouring North-Eastern states.

### **2.2 Study Design**

This is a prospective cross sectional study of adult patients who presented at the general surgery unit of Federal Teaching Hospital Gombe for elective, clean surgeries at the general surgery unit via a hair bearing area.

### **2.3 Study Population**

Adult male and female patients requiring clean surgeries through a hair bearing area.

### **2.4 General Objectives**

To determine if routine preoperative hair removal and method of removal influence postoperative wound infection.

### **2.5 Specific Objectives**

- I. To determine the relative postoperative wound infection rates of razor shaving and depilatory cream.
- II. To determine adequacy of hair removal by both methods of hair removal.
- III. To determine the types of skin abrasions and reaction from the effect of individual methods.
- IV. To make appropriate recommendations.

## **2.6 Inclusion Criteria**

All adult patients (16 years and above, 15 years is the upper limit for paediatric age group at FTH GOMBE) undergoing clean surgeries with access through hair bearing areas.

## **2.7 Exclusion Criteria**

- I. Patients undergoing clean contaminated, contaminated or dirty surgeries.
- II. Patients with background immune-suppression, jaundice, on neo-adjuvant chemotherapy or preoperative antibiotics.
- III. Patients that do not consent.
- IV. Patients with history of allergy to depilatory creams.

## **2.8 Methods**

The study is a prospective cross-sectional type. It was carried out at the General Surgery Unit of the Surgery department at Federal Teaching hospital Gombe from July 1<sup>st</sup> to December 31<sup>st</sup> 2016. Ethical clearance was obtained from the Ethical and Research Committee of the hospital. Details of the study were explained to each patient by the researcher. Both English and Vernacular were used for the explanation, for those that do not understand English language. Demographic data of patients was obtained and entered in to a proforma. Relevant clinical information was obtained from the patient's record and physical examination findings. These were entered in to the proforma designed for this study by the researcher. Patient's privacy was protected, as the proforma was designed devoid of space for patient's name, residential address, tribal or ethnic origin. All patients that met the above inclusion criteria and were admitted in to surgery unit for elective surgery were randomized in to two groups every week using a balloting system by the researcher. Consecutive patients were asked to pick one of two folded papers with either razor shaving or depilatory cream use written on it. The first group had preoperative hair removal by BIC shaving stick, manufactured by BIC, SOCIETE BIC- 92611 Clinchy Cedex-France. The shaving was done on the morning of the surgery by a nurse trained by the researcher. The second group had depilatory cream shaving also on the morning of the surgery. The cream was applied also by a trained nurse after a patch test. VEETO cream was used for depilation. Before the surgery the operative field was inspected by a senior surgical resident apart from the Author and assessed for adequacy of hair removal, presence and type of skin injuries or reaction. The findings were stored in a sealed envelope bearing only the patient's hospital number. Antiseptic skin preparation with Povidone iodine was used for all the selected patients. The type of surgery performed and time taken are noted. The type of anaesthesia used, length of exposure, method of skin closure and suture materials used were recorded by the surgeon. Postoperatively all wounds were examined from fourth to seventh day by the unit consultant. All patients were followed up for at least five weeks. The modified Southampton scoring system was used to grade wound infection. Grade 1 wound infection was taken as presence of undue redness and swelling, Grade 2 as discharge of serous or haemoserous fluids from surgical wound, Grade 3 as discharge of pus from wound and Grade 4 as discharge of pus and

wound dehiscence. The Southampton scoring system has been found to be simple and reliable [1].

## 2.9 Sampling Method

A purposive randomized sampling was used for the patients that met the inclusion criteria.

## 2.10 Sample Size

The sample size has been determined by the formula [1].

$$N = \frac{Z^2 (p) (1-p)}{D^2}$$

Where N = minimum sample size

Z = standard score corresponding to a given confidence level i.e. 1.96 at 95% Confidence level

P = prevalence of SSI among the population (assumed to be 50% =0.5)

D = degree of accuracy at 5% = 0.05

$$\text{Therefore, } N = \frac{(1.96)^2 (0.5) (1-0.5)}{(0.05)^2}$$

= 96 (minimum sample size)

## 2.11 Statistical Analysis

At the end of the study, all data obtained was processed and analysed using the Statistical Package for Social Sciences (SPSS) version 17.0 statistical software. The analysis of relationship between variables was done using appropriate statistical tests such as Chi-square test and logistic regression. The p-value of  $\leq 0.05$  was considered as statistically significant.

## 3. Results

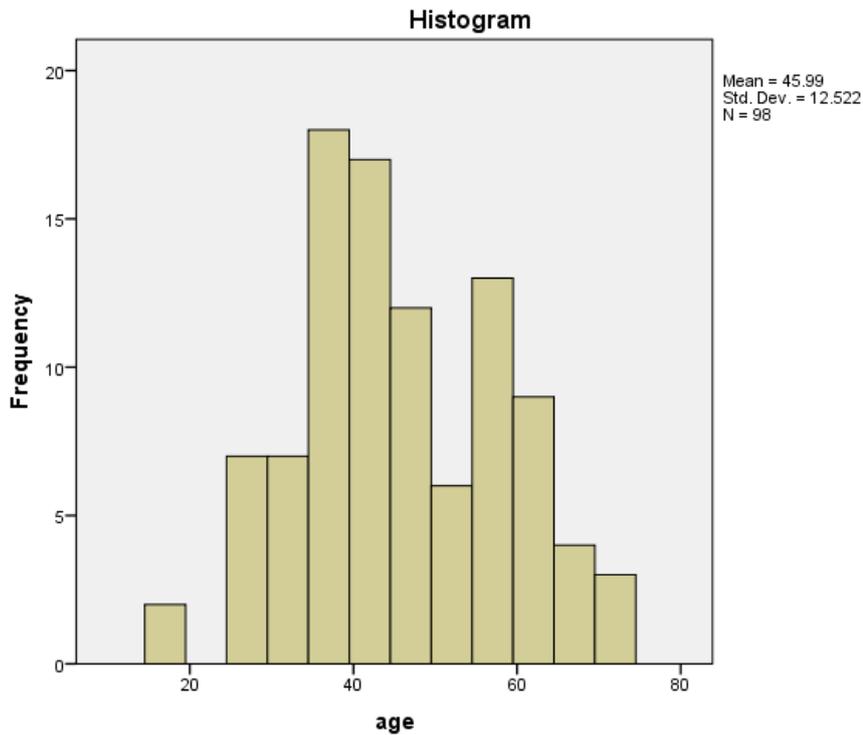
This study was conducted on 98 patients of the General Surgical unit admitted for clean elective surgeries via hair bearing areas. All the patients that were recruited for the study participated and were followed up for five weeks after the surgery.

53 (54.1%) were males and 45(45.9%) were females (Table 1).

**Table 1:** Gender distribution of the patients (N=98)

	Frequency	Percent
Male	53	54.1
Female	45	45.9
<b>Total</b>	<b>98</b>	<b>100.0</b>

The age range is 16 -76 with a mean age of  $45.99 \pm 12.522$  (fig 1).



**Figure 1:** Age distribution of the patients

Majority of the patients were young adults, admitted for an elective open repair of abdominal wall hernia.

**Table 2:** Surgeries conducted on the patients (N=98)

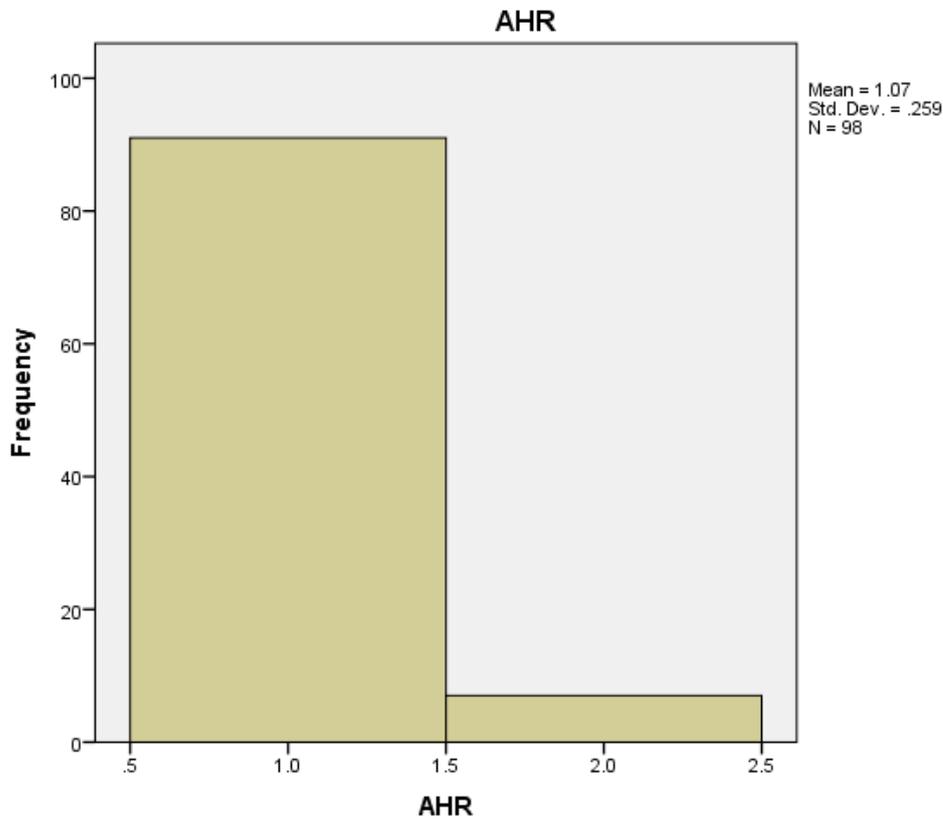
Surgery	Frequency	Percent
AH	87	88.8
GL	3	3.1
SL	6	6.1
SO	1	1.0
SP	1	1.0
<b>Total</b>	<b>98</b>	<b>100.0</b>

57 (58.2%) of the patients had preoperative Razor blade shaving, while, 41(41.8%) used depilatory cream for hair removal (Table 3).

**Table 3:** Method of hair removal (N=98)

MHR	Frequency	Percent
RAZOR	57	58.2
CREAM	41	41.8
Total	98	100.0

A total of 91(92.9%) patients had adequate hair removal and 7(7.1%) patients had inadequate hair removal necessitating re-shaving (Fig 2).



**Figure 2:** Adequacy of hair removal

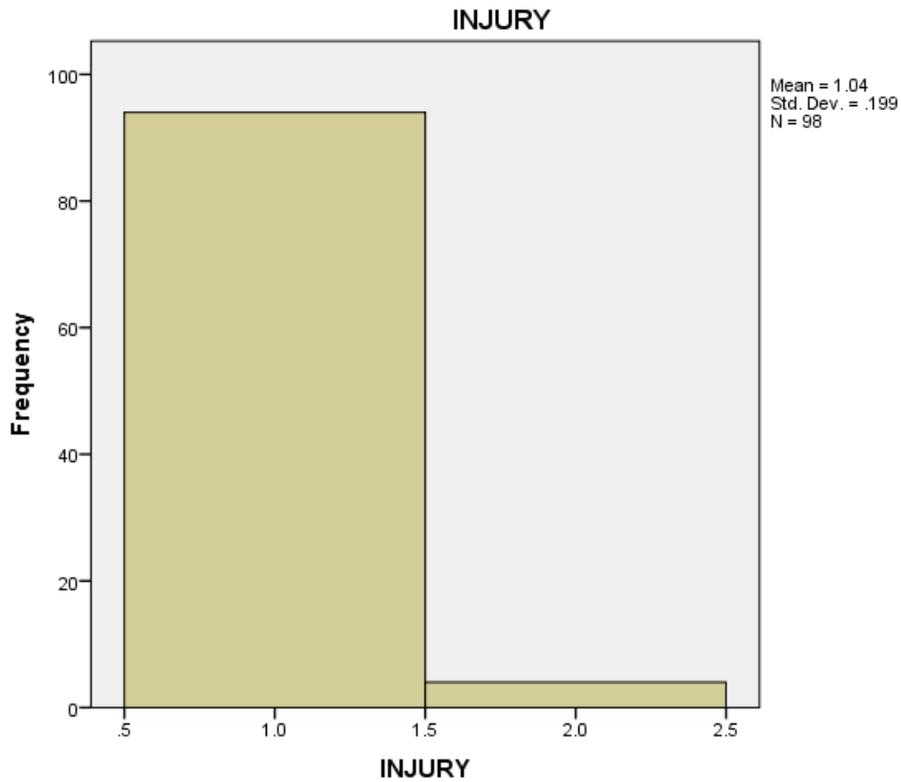
Considering each group separately, 51(89.5%) of those that used razor blade for shaving had adequate hair removal and 40(97.6%) of the depilatory cream group had adequate hair removal (Table 4). Those with inadequate hair removal in both groups had scanty hair remnants not requiring Further shaving except for 1(14.29%) in the razor blade group (Table 4).

**Table 4:** Relationship between adequacy of hair removal and method of hair removal (N=98)

AHR/MHR		RAZOR	CREAM	Total
A	Count	51	40	91
	% within AHR	56.0%	44.0%	100.0%
IA	Total	6	1	7
	% within AHR	85.7%	14.3%	100.0%
	Total	57	41	98

$X^2$  (2.352), p-value 0.125 (not statistically significant)

Evaluation of both groups for skin injuries revealed 94(95.9%) patients had no skin injuries, while, 4(4.1%) had skin injuries (fig 3).



**Figure 3:** Skin Injury

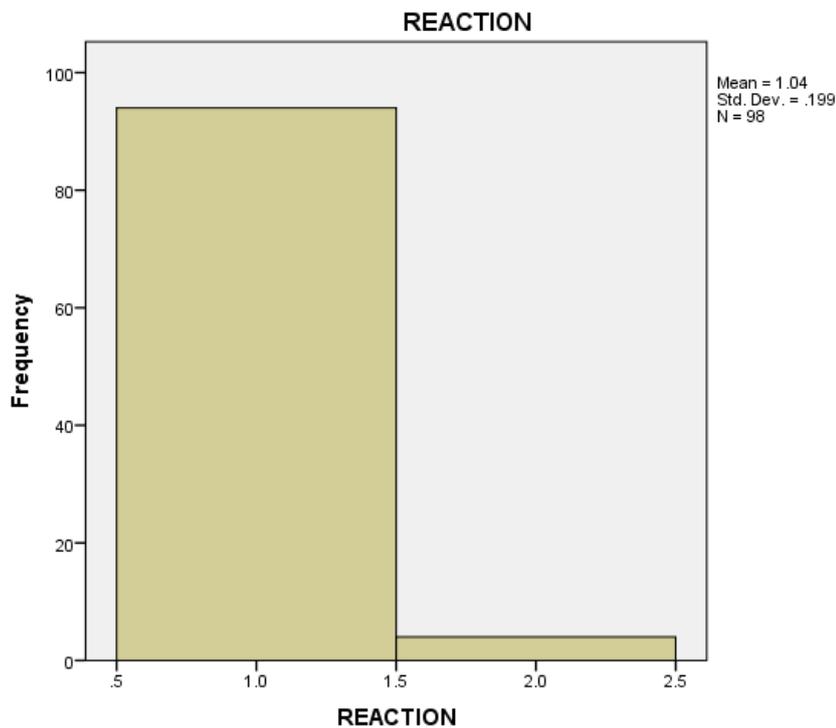
No skin injury was recorded in the depilatory cream group. Out of the 57 patients in the razor blade group, 4(7%) had skin injuries (table 5).

**Table 5:** Relationship between skin Injury and method of hair removal (N=98)

INJURY/MHR		RAZOR	CREAM	Total
NI	Count	53	41	94
	% within INJURY	56.4%	43.6%	100.0%
	Total	4	0	4
IN	% within INJURY Total	58.2%	41.8%	100.0%
		57	41	98

$\chi^2$  (3.000), p-value 0.083 (not statistically significant)

A total of 94(95.9%) had no skin reaction following the preoperative shaving (fig 4).



**Figure 4:** Skin Reaction

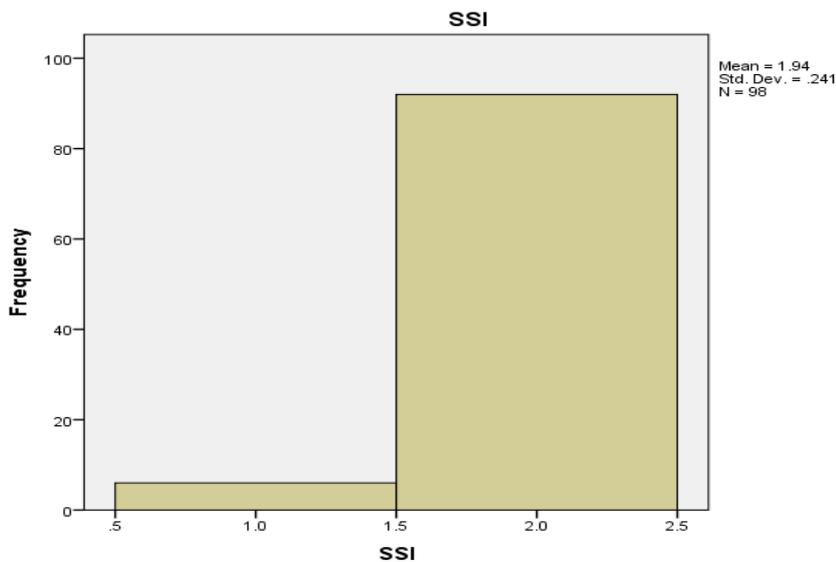
1(1.8%) out the 57 patients in the razor blade group, developed reaction, mainly an erythematous patch. 3(7.3%) out of the 41 patients in the depilatory cream had erythematous skin reaction with weal (table 6).

**Table 6:** Relationship between method of hair removal and skin reaction (N=98)

MHR/REACTION		REACTION		Total
		NR	R	
RAZOR	Count	56	1	57
	% within MHR	98.2%	1.8%	100.0%
	% within REACTION	59.6%	25.0%	58.2%
	% of Total	57.1%	1.0%	58.2%
MHR	Count	38	3	41
	% within MHR	92.7%	7.3%	100.0%
	% within REACTION	40.4%	75.0%	41.8%
	% of Total	38.8%	3.1%	41.8%
Total	Count	94	4	98
	% within MHR	95.9%	4.1%	100.0%

$\chi^2$  (1.885), p-value 0.170 (not statistically significant)

6 (6.1%) out of the 98 patients developed SSI. 92(93.9%) of the patients did not develop (fig 5).



**Figure 5:** Surgical Site Infection rate

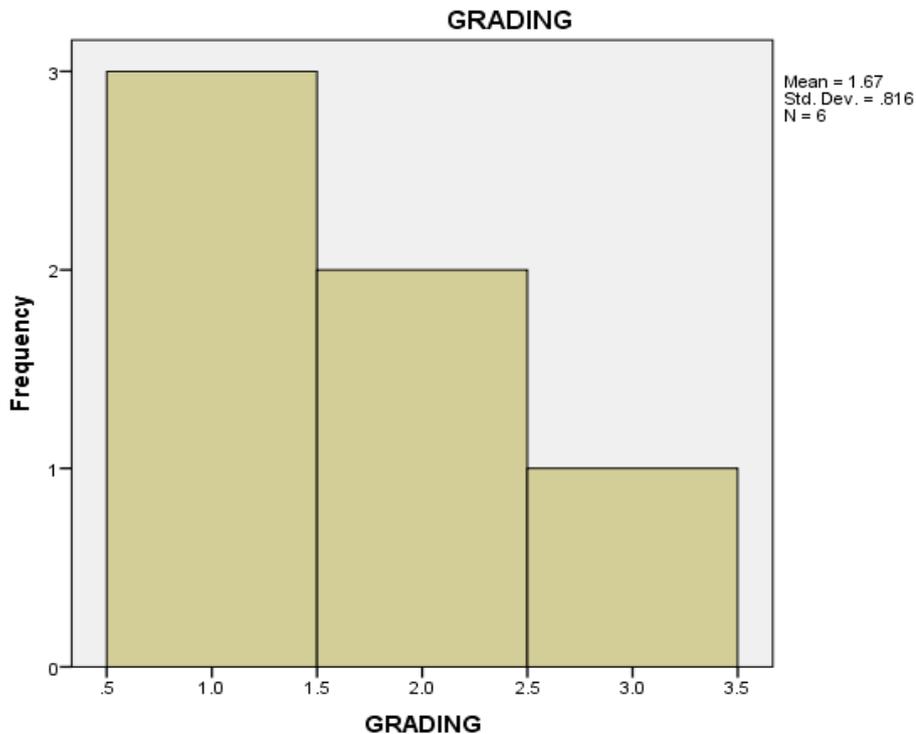
5(83.3%) of these patients are in the razorblade group and 1(16.7%) in the depilatory cream group (table 7).

**Table 7:** Relationship between surgical site infection and method of hair removal (N=98)

SSI/MHR		MHR		Total
		RAZOR	CREAM	
S	Count	5	1	6
	% within SSI	83.3%	16.7%	100.0%
	% within MHR	8.8%	2.4%	6.1%
	% of Total	5.1%	1.0%	6.1%
NS	Count	52	40	92
	% within SSI	56.5%	43.5%	100.0%
	% within MHR	91.2%	97.6%	93.9%
	% of Total	53.1%	40.8%	93.9%
Total	Count	57	41	98
	% within SSI	58.2%	41.8%	100.0%

$X^2$  (1.664), p-value 0.197 (not statistically significant)

When the SSI in both groups is classified, 3(50%) are grade A, 2(33.3%) are grade B and 1 (16.7%) is grade C. 1(33.3%) of those in grade A is in the depilatory cream (fig 6).



**Figure 6:** Grading.

MCS of the discharge from the wounds of those with grade B and C yielded staphylococcus aureus and E. coli (B) and streptococcus pyogenes (C).

#### 4. Discussion

This study indicated that cream depilation achieved better hair removal than razor blade shaving (97.6%/89.5%  $P=0.125$ , table 4). This finding is similar to reports of other studies [4,14]. Reported excellent hair removal after using depilatory cream in 89.5% of their subjects [38]. The relatively higher adequacy of hair removal by depilatory cream use noted in our study compared to previous works may be related to emphasis placed on proper application and observance of the prescribed waiting period before removal of the applied cream. Twenty (20) minutes waiting period was adopted for all patients, this is sufficient to allow complete dissolution of the hair by the active ingredient in the cream. Skin injury has been a major concern after hair removal, particularly, with razor blade shaving. Razor blade shaving causes more skin injuries compared to depilation in this study. Although only 4(4.1%, table 5) of the total patients had skin injuries, 100% are from the razor blade group (table 5). This injury rate is by far better than those recorded in other studies [4]. Observed that, more than one-quarter (27.9%) of the shaved patients had skin injuries of various degrees, 3.8% of those who had depilatory cream application for hair removal also had skin injuries [4] recorded 16.1% skin injuries after razor shaving. The BIC Shaving stick, manufactured by BIC, SOCIETE BIC- 92611 Clinchy Cedex-France; was used in this study. It is easy to use because of its handle and combines the two properties of safety and disposability. Previous workers used ordinary razor blade [4]. The use of depilatory cream has also been found to be the most effective method of hair removal by other authors, with almost 100% efficiency [14]. In this study, 1(1.8%, table 6) out of the 57 patients in the razor blade group developed skin reaction; mainly an erythematous patch. 3(7.3%) out of the 41 patients in the depilatory cream had erythematous skin reaction with weal. The slight increase in skin reaction rate of the depilatory cream group is not statistically significant ( $p=0.175$ , table 6) and is not life threatening. It occurred despite a skin patch test. This may be an idiosyncratic reaction or the cream was left longer than 20minutes by the Nurse who applied it [14]. Recorded the following wound infection rates following preoperative hair removal with razor shaving and depilatory cream, about six percent with razor blade and; less than one percent with Depilatory cream. Postoperative wound infection is evidently commoner with razor shaving, probably; reflecting a higher micro abrasion rate. This study showed a higher infection rate is associated with razor shaving as compared with depilation (83.3%/16.7%  $p=0.197$ , table 7). With a  $p$ -value  $>0.05$  the difference is however not statistically significant. Meta-analysis of seven trials in Cochrane systemic review in 2006 showed that patients are more likely to develop an SSI when they are shaved with razor rather than cream depilation. (2) Similar observations are reported by other studies. (4). 6.1% (Table 7) was our infection rate; this is significantly lower than that recorded in a pilot study at same study centre, 46%.<sup>(38)</sup> This remarkable difference may reflect the role of the methodology adopted in patient selection, randomization and the tools used in the hair removal. The higher infection rates in the pilot study could also be influenced by other factors such as instruments sterilization, observance of Asepsis and lack of use of standard wound scoring system like the Southampton score. It is thus paramount to strictly audit all the processes involved in surgery at the unit and form an Infection control unit. In this study higher grades of postoperative wound infections are also noted with razor blade shaving. This may be explained by the higher skin injuries and loss of skin integrity. Coagulase negative staphylococcus aureus is the most common organism cultured and E. coli. These may be

from Nosocomial trans-infection. These organisms were reported by other workers [4]. This study reaffirmed the need for abandoning the use of razor blade for preoperative shaving and the adoption of clipping or depilatory cream use as advocated by CDC [7]. However, the study indicated that high injury rates and the consequent high SSI following razor blade shaving could be reduced by substituting the traditional razor blade with BIC shaving stick. The handle and the ergonomics of blade placement reduce the injury rates. The efficiency of depilatory cream could be improved by allowing for maximum time of contact to allow the thioglycollate dissolve the hair. The adoption of 20 minutes resulted in 100% removal rate. The need for eliciting history of allergy and doing pre-application patch test cannot be over emphasized to ensure patients' safety. The sample size of about a hundred patients may however, influence the results noted in this study. A large sample size comprising of patients with varying pathology may be more representative of the relationship between the methods of shaving and SSI. The economics of use of single use electrical clippers may be inhibitive in a country with out-of-pocket payment for health services. This highlights the need for increased budgetary allocation for health, reducing financial wastages and enforcing accountability in the use of the allocated resources. The National Insurance coverage should be universal to allow the implementation of clinically sound strategies that will help in reducing SSI and its rippling effects on the patient, health care system and the national economy.

#### **4.1 Conclusion**

It is obvious from the study that depilatory cream skin preparation is more effective in hair removal (97.6%, table 4), causes least skin injuries (0.0%/100%, table 5) and efficient in reducing postoperative wound infection (16.7%/83.3%, table 7). Although, use of cream may be associated with skin reaction (7.3%/1.8%, table 6); a pre-application patch test will reduce such problems. The traditional razor blade use should be halted and the use of clipping or depilatory cream adopted were preoperative hair removal is deemed necessary. A large, randomised control trial involving other units that use same operating theatre and with patients sharing almost similar demographic variables is needed to fully elucidate the role of preoperative shaving in the high postoperative wound infection.

#### **4.2 Recommendations**

1. Preoperative shaving should preferably be by use of depilatory cream after a test patch.
2. If razor blade shaving will be used, the BIC shaving stick should be used and be done by an experienced Nurse.
3. Each Surgeon that shave his surgical site preoperatively should have the post-operative wound assessed independently using a standard wound scoring system.
4. Electric power supply should be improved, procurement of single use electrical clippers covered by National Health Insurance Scheme for successful use of clipper.

#### **LIST OF ABBREVIATIONS USED**

CDC - Centre for Disease Control

SSI	-	Surgical Site Infection
NNIS	-	National Nosocomial Infection Surveillance
SENIC	-	Study on the Efficacy of Nosocomial Infection Control
MCS	-	Microscopy, Culture and Sensitivity
USA	-	United States of America
OAUTH-		Obafemi Awolowo University Teaching Hospital
AL	-	Abdominal wall hernia
GL	-	Groin subcutaneous lipoma
SL	-	Scalp lipoma
SO	-	Scalp Osteoma
SP	-	Superficial Parotidectomy
AH	-	Adequacy of hair removal
MHR	-	Method of hair removal

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