

## Original Research Article

# A comparison of postoperative wound infection rates after preoperative hair removal with razors versus clippers in a sub-urban setting

Bamidele I. Omolabake<sup>1\*</sup>, Ken N. Ozoilo<sup>2</sup>

<sup>1</sup>Department of Surgery, College of Health Sciences, Benue State University, Makurdi, Nigeria

<sup>2</sup>Department of Surgery, College of Health Sciences, University of Jos, Jos, Nigeria

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### \*Correspondence:

Dr. Bamidele I. Omolabake,

E-mail: [obamidele@bsum.edu.ng](mailto:obamidele@bsum.edu.ng)

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## ABSTRACT

**Background:** Preoperative hair removal from hair bearing areas is widely practised. Razors are widely used in poor resource settings despite concerns that they may be associated with surgical wound infection. In contrast, clippers are not commonly used in this setting because they are expensive. Objective was to compare effectiveness of depilation, cost and wound infection rates following the use of razors and clippers in preoperative hair removal in clean surgical operations in a resource-poor setting.

**Methods:** A randomized controlled study was carried out over 1 year. Surgeries were randomized into two groups who had preoperative hair removal using razors and clippers respectively. The participants were then monitored postoperatively for wound infection.

**Results:** Seventy-nine operative sites were assigned to each group. Seventy-six (96%) and 65 (82%) operative sites in the razor-shaved and hair-clipped group respectively had complete hair removal ( $p=0.005$ ). Twenty-three (29%) and 4 (5%) operative sites in the razor-shaved and hair-clipped group respectively had some degree of skin injury ( $p=0.000$ ). The total rate of wound infection was 5.7%, however, 7 (8.9%) and 2 (2.5%) operative sites in the razor-shaved and hair-clipped groups respectively were infected ( $p=0.167$ ). The mean cost incurred in the razor-shaved and hair-clipped group was approximately ₦ 587±1,644.60 and ₦ 1,272±883.46 respectively ( $p=0.001$ ).

**Conclusions:** Though razors provided more effective depilation, they caused more surface abrasions and were associated with more wound infections, though not statistically significant. Clippers are however associated with greater cost and this could be a major constraint where resources are limited.

**Keywords:** Clean surgical operations, Clippers, Razors, Wound infection

## INTRODUCTION

Surgeons have traditionally practised hair removal as part of preoperative preparation of hair bearing areas of the body and this practice still enjoys wide application.<sup>1-4</sup> Reasons for this practice include the facilitation of surgery, facilitation of adhesive draping and dressings, reduction of surgical site infections (SSI), reduction of pain and discomfort associated with wound dressing changes and for psychological reasons.<sup>5-11</sup>

The methods used in hair removal include shaving with razor blades, hair-clipping with clippers and the use of depilatory creams. The present consensus appears to favour the use of clippers and depilatory creams over razors for hair removal.<sup>12-14</sup>

However, pre-operative razor shaving is still commonly used in surgical practice in developing countries including Nigeria.<sup>3,4,15</sup> This may be because razor shaving is cheap, convenient, widely available, and easily accessible. The process is fast, does not require any

training and is applicable in ubiquitous settings. In contrast, clippers are expensive, not as readily available and require some training for its effective use.<sup>1,16</sup>

Though preoperative hair removal is done to reduce postoperative wound infection, several authors have identified the method and timing of hair removal as important contributors to surgical wound infection and there is no agreement regarding the optimal timing of each intervention.<sup>13-15,17-19</sup> Razors may be inferior to hair clipping in terms of postoperative wound infection rates.<sup>13,14</sup> This is because razors predispose to skin abrasions and cuts which may become contaminated by skin flora and other microbes leading paradoxically to increased wound infection. Razors are still widely used over clippers in our environment due to cost-considerations. This may partly explain the relatively high incidence of surgical wound infection in Nigeria compared to other developed countries where preoperative razor shaving is less practised.

It is not clear if clippers and razors will result in different wound infection outcomes in clean wounds- which are a subset of operative wounds least susceptible to develop wound infection. To the best of our knowledge, no study has compared razor depilation with clipping in a low resource setting such as ours. We therefore set out to compare these two techniques by assessing the following parameters: quality of shave, wound infection rate and cost of each technique.

## METHODS

**Study design:** Randomized controlled study.

**Study location:** Jos University Teaching Hospital, Jos Nigeria.

**Study period:** January 2017 to January 2018.

### Inclusion criteria

Adult patients aged 18 and above who presented with conditions that required surgery involving a clean wound (based on the CDC criteria) with access through a hair-bearing area of the body. Such patients and/or their caregivers (in those who cannot give consent) were willing to participate in the study

### Exclusion criteria

This included the following: 1) Patients who were anticipated to have clean surgery but turned out to be contaminated even if they gave consent previously. 2) Patients who performed self-hair removal prior to surgery. 3) Obviously immunosuppressed patients such as poorly controlled diabetes mellitus, AIDS, malignancies, and other co-morbidities that directly predisposed to wound infections. 4) Patients on preoperative antibiotics for other ailments

### Sample size calculation

The minimum sample size was determined to be 71 per study arm using the formula:  $n_1 = n_2 = [(2pqm)] / [z_{1-\alpha/2} + (p_1q_1 + p_2q_2)]^2 / \Delta^2$ . The  $p_1$  was set at 12.8% based on a previous work by Adisa et al.<sup>16</sup> The  $p_2$  was set at 1% which is the infection rate of clean wounds.<sup>20</sup>

### Study procedure

Adult patients presenting for surgeries that would involve clean wounds requiring access through hair bearing parts of the body were recruited for the study. The patients were randomized using an online software into either of two groups. One group had razor depilation while the second group had hair removal by clipping. Patients in whom multiple procedures were planned (e.g. bilateral hernia) had each incision randomised separately. In either case, hair removal was done in the preparation room, by dry shave, two hours prior to surgery.

In the first group, a Gillette II® razor (Gillette, USA) was used while in the second group, a 9604 3M surgical clipper by Remington® (Neuss, Germany) with disposable clipper head was used.

Assessment of shave was done using a tool like that of Adisa and colleagues.<sup>16</sup> Subsequently, skin preparation was similar, with chlorhexidine and methylated spirit in all patients. No patient had prophylactic antibiotics.

Postoperatively, the patients were assessed for wound infection using the CDC criteria and where infection occurred, it was graded using the Southampton wound grading system.<sup>20</sup> Direct cost of hair removal (including additional costs of management of wound infection where these occurred), were assessed.

### Ethical approval

Ethical approval was obtained from the Health and Research Ethics Committee of Jos University Teaching Hospital, Jos. Only patients who granted consent were recruited for the study.

### Statistical analysis

All data were entered into a structured proforma and analysed using the Statistical Package for Social Sciences (SPSS) version 21 statistical software. Parametric data were analysed using the students t-test and non-parametric data using chi square/fisher exact.

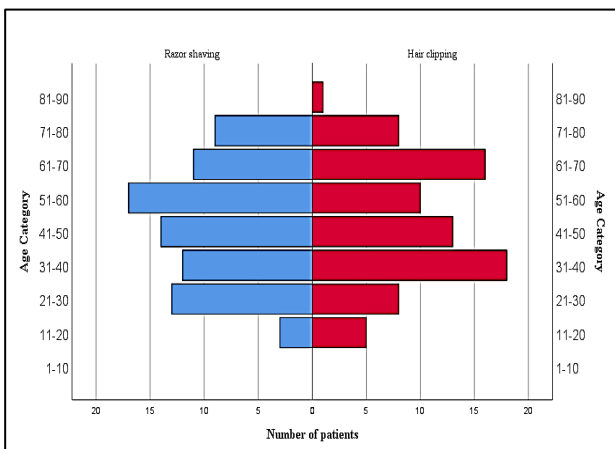
## RESULTS

One hundred and forty-six patients requiring 158 procedures were recruited into the study. There were 129 males (88.4%) and 17 females (11.6%) with a mean age of 49.1±16.7 years and an age range of 18 to 83 years.

Majority of the participants (73%) were between the fourth and seventh decades of life (Table 1 and Figure 1).

**Table 1: Patients' characteristics: age and gender distribution.**

Age (years)	Gender	
Interval (N)	Males (N=129)	Females (N=17)
<20	8	1
21-30	21	4
31-40	27	5
41-50	26	1
51-60	26	3
61-70	22	0
71-80	15	3
81-90	1	0



**Figure 1: Hair removal method and age distribution of patients.**

**Table 2: Operation performed and hair removal method.**

Operation performed	Razor shaving	Hair clipping
<b>Anterior abdominal wall hernia repairs</b>		
Inguinal herniorrhaphy	49	61
Umbilical herniorrhaphy	2	0
Paraumbilical herniorrhaphy	4	4
Epigastric herniorrhaphy	2	1
<b>Lump excisions</b>		
Lipoma excision	15	8
Sebaceous cyst excision	5	2
Dermoid cyst excision	0	1
Lymph node excision	0	1
Parotidectomy	2	1
<b>Total</b>	<b>79</b>	<b>79</b>

$\chi^2=2.973$ ;  $df=1$ ;  $p=0.085$

Razor shaving and hair clipping were applied to an equal number of operative sites (79 each). The mean age of those who were razor shaved was  $49.15 \pm 16.4$  years, as against  $47.08 \pm 17.1$  years for those who were hair-clipped

( $p=0.977$ ). In the razor-shaved group, 10 operative sites (12.7%) were in females while in the hair-clipped group, 7 operative sites (8.9%) were in females ( $p=0.598$ ). The distribution of the types of surgeries done are as shown in Table 2.

The mean time interval between hair removal and commencement of surgery for the razor-shaved group was  $24.52 \pm 19.05$  minutes compared to  $23.07 \pm 15.99$  minutes in the hair-clipped group ( $p=0.818$ ). The mean duration of surgery for the razor shaved group was  $58.86 \pm 28.09$  minutes compared to  $61.48 \pm 27.23$  minutes for the hair clipped group ( $p=0.888$ ).

**Table 3: Hair removal method versus adequacy of hair removal.**

Adequacy of Hair removal	Razor shaving	Hair clipping
Grade I/hair completely removed	76	65
Grade II/scanty hair remnant not necessitating removal	3	14
Grade III/hair remnant necessitating further removal	0	0
<b>Total</b>	<b>79</b>	<b>79</b>

$\chi^2=7.976$ ;  $df=1$ ;  $p=0.005$

The assessment of adequacy of hair removal showed that 76 (96%) of operative sites in the razor-shaved group and 65 (82%) of operative sites in the hair-clipped group had complete hair removal ( $p=0.005$ ), Table 3. The assessment of presence of skin injuries following hair removal is as shown in Table 4.

**Table 4: Hair removal method versus presence of skin injuries.**

Presence of skin injuries	Hair removal method	
	Razor shaving	Hair clipping
Grade I/no skin injuries noticed	56	75
Grade II/single tiny (<1 cm) area of skin injury	19	3
Grade III/multiple tiny (<1cm) area of skin injury	4	1
Grade IV/large (>1 cm) area/areas of skin injury	0	0
<b>Total</b>	<b>79</b>	<b>79</b>

$\chi^2=16.192$ ;  $df=2$ ;  $p=0.000$

Postoperative wound infection occurred in 7 (8.9%) patients in the razor-shaved group and 2 (2.5%) patients in the hair-clipped group ( $p=0.167$ ). Of the two wounds infected in the hair-clipped group, one each was grade III and grade IV respectively. Of the seven wounds infected in the razor-shaved group, 1 was grade III while the rest

were grade IV. In the razor-shaved group, four cases of wound infection cultured *Escherichia coli* and two cases cultured *Staphylococcus aureus*. In the hair-clipped group, the two cases of wound infection cultured *Escherichia coli*.

The unit cost of a razor was ₦ 80.00 while a clipper head, cost ₦ 1,200.00. The mean cost of the hair-removal device was ₦ 78.99±9.00 in the razor-shaved group and ₦ 1,139.24±264.77 in the hair-clipped group (p=0.000). The total cost of treating the seven cases of wound infection in the razor-shaved group was ₦ 40, 250.00 while that incurred in treating the two cases of wound infection in the hair-clipped group was ₦ 10,450.00. The mean cost incurred with hair removal (i.e. cost of purchase of the hair-removal device plus cost of managing wound infection) was ₦ 586.46±1644.60 in the razor group while the mean cost incurred in the hair-clipped group was ₦ 1,272.15±883.46 (p=0.001).

## DISCUSSION

The need to provide an effective and safe method of hair removal for surgery has been a concern for surgeons. We studied 158 operative sites in 146 patients which is comparable to similar work by Adisa et al and Mukesh et al.<sup>11,16</sup> However, in terms of demographics, this study involved an older population, with more males compared to that of Adisa et al and Mukesh et al.<sup>11,16</sup> Also, most of the surgeries included open herniorrhaphies, similar to that by Adisa and colleagues.<sup>16</sup>

Razors make direct contact with the skin, clearing it of hair. In contrast, clippers leave a stubble of hair. However, there was no case of grade III adequacy of hair removal (i.e. hair remnant necessitating further removal) in either group. This suggests that both methods are adequate for preoperative hair removal, in keeping with other studies.<sup>3,14,21,22</sup>

The finding that razors caused significantly more skin injuries than clippers is explained by razors contacting the skin, unlike the blades of a clipper head. This is consistent with similar finding by Mukesh and colleagues.<sup>11</sup> However, this difference in occurrence of skin trauma did not result in a significant difference in the wound infection rate, contrary to findings of others.<sup>8,11,18</sup> This study was restricted to clean wounds, which are known to have low wound infection rates.<sup>14,23</sup> The studies showing a correlation between skin trauma and increased wound infection in this context included study populations that had clean-contaminated, contaminated and dirty wounds. It would appear that clean wounds may not be associated with increased infection rates irrespective of whether there is skin trauma during shaving.

The wound infection rate of 8.8% in the razor-shaved group is slightly less than the 12.8% reported by Adisa and colleagues in Ife, Nigeria after hair removal with

razors.<sup>16</sup> This is probably because of a stricter inclusion criterion in this study. In contrast, Cruse and colleague reported a wound infection rate of 2.3% and 1.7% after hair removal with razors and clippers respectively in clean surgical operations.<sup>8</sup> This, like a similar study by Grober and colleagues found no significant difference in wound infection rates between razors and clippers- in agreement with our findings.<sup>5</sup>

The difference in the mean cost of hair removal device between the two groups was expected due to the huge difference in unit cost between shaving sticks and clipper heads, in agreement with other authors.<sup>24,25</sup> The mean cost of treating wound infections in both arms however, did not reveal any statistically significant difference. This is likely due to the low incidence of wound infection and similar spectrum of wounds in the two groups. The use of clippers cost significantly more than use of razors largely due to difference in unit cost of both devices. A previous study reported that when the cost of treating surgical site infections was added, the use of clippers was cheaper than use of razors which is in contrast to the finding of this study.<sup>24</sup> Again, this might be explained by the fact that these studies included all categories of wounds, in contrast to ours which only had clean wound.

The significance of the findings of this study is that whereas there has been advocacy by major regulatory bodies for use of clippers rather than razors in the preparation of operative sites due to lower wound infection rates associated with the former, this may not be the case when only clean wounds are considered as a subset of operative wounds.<sup>12-14</sup> Clippers are more expensive compared to razors and do not necessarily result in better wound infection rates in clean operative procedures.

Nigeria is a low income country and like most low and middle income countries, out of pocket payments constitute a significant component of health spending in our society.<sup>26-28</sup> In the presence of cost-constraints therefore, the use of razors should be considered when preoperative hair removal is necessary for clean surgical procedures.

## CONCLUSION

In conclusion, razors and clippers are effective and therefore acceptable depilators when preoperative hair removal is deemed necessary. Each has its merits and demerits; Clippers cause less skin trauma and are associated with less postoperative wound infections compared to razors but are expensive. Razors on the other hand give better quality shave and are cheap, even though associated with more skin trauma and infection. While the difference in skin trauma is significant, the difference in wound infection is insignificant.

Therefore, in the presence of cost constraints, razors may be preferred in clean operative wounds since eventual

cost of care is far less even after taking into consideration, the cost of the increased wound infection associated with its use.

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