



Comparison of Rate of Surgical Site Infection Using Clipper or Surgical Blade for Hair Removal After Fixation of Lower Limb Fracture

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ABSTRACT

Objective: To compare the frequency of surgical site infection following operative fixation of close lower limb fractures using either clipper or surgical blade for hair removal. **Study Design:** Randomized controlled trial. **Duration and Place of Study:** This study was conducted from 1st April 2025 to 31st June 2025 at the Department of Orthopedics, Lady Reading Hospital, Peshawar. **Methodology:** A total of 304 adult patients undergoing internal fixation for closed lower limb fractures were randomly assigned into two equal groups of 152 each. Group I underwent preoperative hair removal with a battery powered clipper, while for Group II we used surgical blade. All participants received standardized perioperative care. Surgical site infection within four weeks of surgery was diagnosed clinically based on erythema, tenderness, and purulent discharge. **Results:** Surgical site infection occurred in 9 patients (5.9%) in the clipper group compared to 23 patients (15.1%) in the surgical blade group, demonstrating a statistically significant difference ($p=0.009$). **Conclusion:** Preoperative hair removal using a clipper significantly reduces the rate of surgical site infection compared with a surgical blade.

INTRODUCTION

Long bone fractures can result from low to high energy trauma, low energy fall, road traffic accidents, fall from height, and gunshot injuries¹⁻⁴. Healing of fractures is determined by the condition of the surrounding soft tissues and the local blood supply to the bone⁵. There are a number of options for the treatment of long bone fracture starting from conservative treatment, external fixator to internal fixation with interlocking nails or plates and screws.

One of the dreaded complication in managing patients with fractures is surgical site infection (SSI)⁶. It can be superficial involving skin and subcutaneous tissue or deep (deep to the deep fascia).⁷ SSI is a global burden and according to WHO, the incidence ranges from 1.2 to 23.6% in low and middle income countries and 1.2-5.2% in high income countries⁸. SSI begets increased cost, delayed healing and sometimes no healing at all.

One of the important steps to reduce SSI is hair removal before surgery over the surgical site. Hairless surgical field is important to apply surgical drapes and dressing. Three main techniques are in use currently in health care Shaving with razor, use of clipper and chemical depilation. There are merits and demerits/to the different techniques.^{2, 9} In

a study by Thapa et al the rate of surgical site infection was 14.4% with shaver and 5% with electric clipper⁵.

A recent Cochrane study concluded that if hair has to be removed, moderate certainty evidence suggests clipper probably results in less SSI, compared to shave with razor, meaning that there is a possibility that it is substantially difference⁴.

Our rationale is to address this critical knowledge gap by performing a high quality Randomized Control trail (RCT) on use of either clipper or surgical blade in pre-operative skin preparation of trauma patients.

METHODOLOGY

This randomized controlled trial was carried out in the Department of Orthopedics at Lady Reading Hospital, Peshawar, between 1st April 2025 to 31st June 2025. Approval for the study protocol was granted by the institutional research and ethics committee (Ref no: 02/LRH/MTI, dated 01/01/2025) before recruitment commenced. The total sample size was calculated through the WHO sample size calculator, assuming an expected infection rate of 14.4% in patients where a surgical blade was used and 5% in those where a clipper was used.¹ With an 80% power of the test, 95% confidence level, and an

anticipated 5% attrition rate, the calculated sample comprised 304 participants, equally distributed into two groups of 152 each. Participants were recruited through a non-probability consecutive sampling approach. In this study we use block randomization using sealedenvelope.com using block size of 6. Both the patient and outcome assessor were blinded but surgeon was not blinded.

All adults aged 18 years or more of either gender who received treatment with internal fixation for a closed lower limb fracture were eligible for enrollment. Exclusion criteria was open fractures, corticosteroids use, pathological fractures, compartment syndrome, and any predisposing systemic illness that would interfere with wound healing. Written consent was provided by all participants following the clear explanation of the purpose of the research study, the potential harms, and the perceived benefits.

Intraoperative information on hair removal was extracted from operative notes whether hip fracture, femur fracture, patella fracture and tibia fracture. Standard postoperative care was ensured for all the patients in the form of intravenous hydration, analgesia, antibiotic prophylaxis, and periodic wound dressings. The surgical wound was monitored every day during inpatient stay and then at two-week intervals for four weeks following discharge. According to center for diseases control (CDC) Surgical site infection (SSI) is defined as the presence of erythema of greater than 1 cm from wound margin, tenderness on palpation and presence of sero-sanguinous or purulent discharge on physical examination occurring within 4 post-op weeks.

Statistical analysis was conducted using IBM SPSS version 25. Quantitative variables were described as mean and standard deviation or median with interquartile range depending on data distribution assessed through the Shapiro-Wilk test. Qualitative variables were expressed as frequencies and percentages. Comparison of infection rates between the two hair removal methods was made using the Chi-square or Fisher's exact test at a 95% confidence level, with a p-value of ≤ 0.05 considered statistically significant. Additional stratification was performed for potential confounders, and post-stratification tests were applied to determine the association between these factors and infection occurrence.

RESULTS

Basic demographic characteristics are provided in table 1.

Table 1
Patient Demographics in Both Groups

Variables	Clipper n=152 Mean ± SD	Surgical Blade n=152 Mean ± SD
Age (years)	35.03 ± 8.95	42.41 ± 11.24
BMI (Kg/m ²)	25.59 ± 2.17	26.54 ± 2.31
Gender n (%)	Male 100 (65.8%)	86 (56.6%)
	Female 52 (34.2%)	66 (43.4%)
Residence n (%)	Rural 64 (42.1%)	84 (55.3%)
	Urban 88 (57.9%)	68 (44.7%)
Socioeconomic Status n (%)	Poor 60 (39.5%)	71 (46.7%)
	Middle 73 (48.0%)	64 (42.1%)
	Rich 19 (12.5%)	17 (11.2%)
Affected Side n (%)	Right 90 (59.2%)	76 (50.0%)
	Left 62 (40.8%)	76 (50.0%)

Comorbidity n (%)	Diabetes	17 (11.2%)	19 (12.5%)
	Hypertension	18 (11.8%)	14 (9.2%)
	Other	39 (25.7%)	26 (17.1%)
	None	78 (51.3%)	93 (61.2%)

The primary end-point analysis showed a significantly higher rate of surgical site infections, 09 (5.9%) in the clipper group versus 23 (15.1%) in the surgical blade group (p=0.009) (Table 2).

Table 2
Comparison of Surgical Site Infection Between the Two Groups

Surgical Site Infection	Clipper n=152 n (%)	Surgical Blade n=152 n (%)	P Value
Yes	9 (5.9%)	23 (15.1%)	0.009
No	143 (94.1%)	129 (84.9%)	
Total	152 (100%)	152 (100%)	

Stratified analysis by demographic factors is available in Table 3.

Table 3
Association of Surgical Site Infection with Demographic Variables

Demographics variables	Group	Surgical Site Infection		
		Yes (n, %)	No (n, %)	
Age (years)	≤40	Clipper	2 (1.8%)	108 (98.2%)
		Shaver	2 (3.0%)	64 (97.0%)
	>40	Clipper	7 (16.7%)	35 (83.3%)
		Shaver	21 (24.4%)	65 (75.6%)
Gender	Male	Clipper	6 (6.0%)	94 (94.0%)
		Shaver	14 (16.3%)	72 (83.7%)
	Female	Clipper	3 (5.8%)	49 (94.2%)
		Shaver	9 (13.6%)	57 (86.4%)
BMI (kg/m ²)	≤25	Clipper	0 (0.0%)	71 (100.0%)
		Shaver	0 (0.0%)	46 (100.0%)
	>25	Clipper	9 (11.1%)	72 (88.9%)
		Shaver	23 (21.7%)	83 (78.3%)
Residence	Rural	Clipper	6 (9.4%)	58 (90.6%)
		Shaver	22 (26.2%)	62 (73.8%)
	Urban	Clipper	3 (3.4%)	85 (96.6%)
		Shaver	1 (1.5%)	67 (98.5%)
Socioeconomic Status	Poor	Clipper	8 (13.3%)	52 (86.7%)
		Shaver	16 (22.5%)	55 (77.5%)
	Middle	Clipper	0 (0.0%)	73 (100.0%)
		Shaver	5 (7.8%)	59 (92.2%)
Rich	Clipper	1 (5.3%)	18 (94.7%)	
	Shaver	2 (11.8%)	15 (88.2%)	
Affected Side	Right	Clipper	5 (5.6%)	85 (94.4%)
		Shaver	7 (9.2%)	69 (90.8%)
	Left	Clipper	4 (6.5%)	58 (93.5%)
		Shaver	16 (21.1%)	60 (78.9%)
Comorbidity	Diabetes	Clipper	9 (52.9%)	8 (47.1%)
		Shaver	14 (73.7%)	5 (26.3%)
	Hypertension	Clipper	0 (0.0%)	18 (100.0%)
		Shaver	6 (42.9%)	8 (57.1%)
	Other	Clipper	0 (0.0%)	39 (100.0%)
		Shaver	2 (7.7%)	24 (92.3%)
	None	Clipper	0 (0.0%)	78 (100.0%)
		Shaver	1 (1.1%)	92 (98.9%)

*Fischer Exact Test

DISCUSSION

The present study aimed to compare the rate of surgical site infection between clipper and surgical blade methods for hair removal in patients undergoing fixation of lower limb fractures. The results showed a significantly lower rate of post-op infection in the clipper group (5.9%) than that in the surgical blade group (15.1%), with a p-value of 0.009 that is significant. This can be ascribed to the

difference in the shaving technique is that surgical blades produce microscopic cuts over the skin surface that can become possible portals for entry of bacteria while clippers cut the hair above the level of the skin and do not breach the continuity of the epidermis so that the natural defense mechanism of the skin against microbial penetration remains intact.

Cochrane review⁴ concluded that the risk of SSI is probably increased with razor compared with clipper (RR 1.64, 95% 1.16-2.33). Our results are largely in sync with published data.

A study done by M G Haider reported that the risk of infections dramatically decreased when open fractures were treated with rigorous debridement of the wound and prompt fixation, as well as with primary closure of the wound with continued use of antibiotics.¹⁰

A Cochrane review conclude that Comparing hair clipping to no hair removal There may not be much of a difference in the incidence of SSI between hair removal with clippers and no hair removal (risk ratio (RR) 0.95, 95% CI 0.65 to 1.39; three trials with 1733 individuals), according to low certainty data. Comparing shaving with a razor to not shaving Evidence with a moderate degree of confidence indicates that individuals who get their hair cut with a razor are likely to be at a higher risk of SSI than those who do not.¹¹

According to corrected data, we found significant difference in rate of infection in <40 years age group. Because of the uneven distribution of patient in the

different age groups, we don't think the finding is important to report. Generally, we expect more patients in the elderly age group to have SSI, given compromised immunity in that population. In accordance with our study other studies also reported comparable results.¹²⁻¹⁵

Similarly, we found significant difference in rate of infection in middle age group, rather than poor income group. Again we think its anecdotal finding. We expect patients in poor income group to have more SSI because of malnutrition.

A study done by Adisa et al. reported that Razor shaving and preoperative hair removal increase the risk of skin injuries, which have a major impact on the rates of wound infection after surgery. Using depilatory lotion to remove hair reduces these injuries and the resulting wound infection.¹⁶ Other studies also reported similar results.¹⁷⁻²⁰ Similarly, we found more patients with SSI in those who had hypertension are had undergone procedure over left lower extremity.

CONCLUSION

The difference in the rate of SSI is significant when comparing clippers versus blades.

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