Section: General Surgery

Original Research Article

PREOPERATIVE RAZOR SHAVING VERSUS NO HAIR REMOVAL AND SURGICAL SITE INFECTION IN CLEAN LAPAROSCOPIC SURGERY: A PROSPECTIVE RANDOMISED COMPARATIVE STUDY

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ABSTRACT

Background: Razor shaving of the operative site is still routine in many Indian surgical units, although international guidelines advise against it. Evidence specific to laparoscopic surgery, where incisions are small and port sites are few, is limited. We compared surgical site infection (SSI) after razor shaving 12 hours before surgery with no hair removal in clean laparoscopic procedures.

Materials and Methods: This prospective randomised comparative study was conducted over 12 months at a tertiary teaching hospital in North India. Adults undergoing elective clean laparoscopic surgery were allocated by a computer-generated sequence to razor shaving the evening before surgery (Group A, n = 88) or no hair removal (Group B, n = 88). All patients received a prophylactic antibiotic 1 hour before and after surgery (two doses) and povidone-iodine skin preparation. A single investigator assessed wounds on postoperative days 7, 14 and 30 using the Southampton wound scoring system. The primary outcome was study-defined SSI, meaning any wound abnormality of Southampton grade I or higher within 30 days. Swabs from affected wounds were cultured.

Results: Of 176 patients, 145 (82.4%) were women and 168 (95.5%) underwent laparoscopic cholecystectomy. Study-defined SSI occurred in 3 patients (1.7%; 95% CI 0.6–4.9%): 2 of 88 (2.3%) in the shaved group and 1 of 88 (1.1%) in the unshaved group (risk difference 1.1 percentage points, 95% CI −4.2 to 6.9; p = 1.00). All three events were Southampton grade I, detected on day 7, culture-negative and resolved by day 14. None had purulent discharge. No new SSI was recorded on day 14 or day 30. In an exploratory, unadjusted analysis, SSI was more frequent in patients with diabetes (2/10, 20.0%) than without (1/166, 0.6%; p = 0.008). Operating time did not differ between patients with and without SSI (p = 0.295).

Conclusion: In clean laparoscopic surgery, no statistically significant difference in SSI was found between razor shaving and no hair removal. All events were minor. Because only three events occurred and the study was underpowered, the estimate is imprecise and does not exclude clinically meaningful differences. The findings are consistent with guideline advice against routine razor shaving and should be confirmed in a larger trial.

Keywords: Surgical wound infection, Hair removal, Preoperative care, Laparoscopy, Cholecystectomy, Diabetes mellitus.

INTRODUCTION

Surgical site infection (SSI) is one of the most common healthcare-associated infections. It prolongs hospital stay, adds to treatment costs and delays return to work.[1,2] The World Health Organization estimates SSI rates of 1.2–5.2% in high-income countries and up to 23.6% in low- and middle-income countries.[3] In India and similar settings, simple and low-cost preventive steps therefore carry real clinical and economic weight.

Removing hair from the operative site has been part of surgical preparation for more than a century. The practice rests on the belief that hair harbours bacteria and interferes with incision, suturing and dressing.[4] Razor shaving, however, causes microscopic cuts and abrasions in the stratum corneum. These small breaks allow skin flora, particularly Staphylococcus aureus, to multiply before the incision is made.[5,6] Seropian and Reynolds first showed in 1971 that razor shaving the night before surgery was linked to a higher wound infection rate than depilatory cream or no hair removal.[7] Cruse and Foord later reported a similar pattern in their five-year study of more than 23,000 wounds.[8]

Current guidelines reflect this evidence. The Centers for Disease Control and Prevention (CDC), WHO and the UK National Institute for Health and Care Excellence (NICE) all recommend against routine hair removal. When hair must be removed, they advise electric clippers on the day of surgery rather than razors.[4,9–11] A Cochrane review found no clear difference in SSI between hair removal and no hair removal, but reported more SSI with razors than with clippers.[12] A network meta-analysis of randomised trials reached a similar conclusion.[13]

Despite this, razor shaving on the evening before surgery remains standard in many Indian public hospitals. It is often done by ward staff or barbers as part of a fixed preoperative routine. Most of the published trials enrolled patients having open abdominal, cranial, ear or urological operations.[14–17] Laparoscopic surgery differs in several respects. The incisions are small, fewer in number and exposed for less time, and SSI rates are lower than after open surgery.[18] Whether shaving adds any risk, or offers any benefit, in this setting has had little direct study.

We therefore compared the incidence and grade of SSI after razor shaving 12 hours before surgery with no hair removal in patients undergoing clean, elective laparoscopic surgery. We also examined whether patient factors such as body mass index (BMI), diabetes, smoking and operating time were associated with SSI.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective, randomised, comparative study conducted in the Department of General Surgery, Government Medical College and Hospital, Chandigarh, India, over 12 months. The study formed part of a postgraduate thesis approved by the Institutional Ethics Committee and registered with Panjab University. It followed the Declaration of Helsinki and the ICMR National Ethical Guidelines for Biomedical and Health Research. Written informed consent was obtained from every participant in English, Hindi or Punjabi.

Participants

Adults aged 18 years or older scheduled for elective laparoscopic surgery classified as clean (CDC wound class I),[4] were eligible. We excluded pregnant or lactating women; patients with uncontrolled diabetes (HbA1c above 8%); skin disease at the planned incision sites; wounds left to heal by secondary intention; immunocompromised patients, including those with HIV infection or receiving chemotherapy or systemic steroids; and patients with collagen vascular disorders.

Randomisation and intervention

Participants were allocated in a 1:1 ratio using a computer-generated random sequence. In Group A (shaved), the abdominal wall and any other planned port-site region were shaved with a razor blade by the hospital barber on the evening before surgery, about 12 hours before incision. In Group B (unshaved), no hair was removed. Because the intervention is visible, neither patients nor the assessor could be blinded.

Perioperative care

Perioperative care was the same in both groups. Patients with diabetes were optimised before surgery. A prophylactic intravenous antibiotic was given 1 hour before incision, with a second dose given after surgery (two doses in total). The skin was prepared with three coats of povidone-iodine. Standard laparoscopic techniques were used, and all port sites were closed primarily.

Outcomes and follow-up

A single investigator (HS) examined all wounds on postoperative days 7, 14 and 30 to avoid inter-observer variation. Wounds were graded using the Southampton wound scoring system, which ranges from grade 0 (normal healing) to grade V (deep or severe infection).[20] Grade I denotes normal healing with mild bruising or erythema; grade II, erythema with other signs of inflammation; grade III, clear or haemoserous discharge; grade IV, pus; and grade V, deep or severe infection.

The primary outcome was SSI within 30 days of surgery. For this study, SSI was defined as a Southampton score of grade I or higher at any review. This is a deliberately sensitive definition that captures the earliest visible wound change. It is broader than the CDC definition of superficial incisional SSI, which requires purulent drainage, a positive culture from the incision, or local signs of infection leading the surgeon to open or diagnose an infected wound.[19] To allow comparison with CDC-based studies, we also recorded whether any event

had purulent discharge or a positive culture. Secondary outcomes were the Southampton grade, the organism isolated, and the association of SSI with patient and operative factors. Data were recorded on a pre-designed case record form, including age, sex, BMI, smoking, alcohol use, comorbidities, procedure and operating time.

Microbiology

Swabs were collected from wounds with any sign of infection and processed by standard culture methods. Antimicrobial susceptibility testing was planned using the Kirby–Bauer disc diffusion method, interpreted according to Clinical and Laboratory Standards Institute guidelines.[21]

Sample size

The sample size was estimated from SSI rates of 4.5% with and 2.8% without hair removal reported by Kattipattanapong et al,[15] assuming a 95% confidence level and 90% power, and was set at 88 patients per group (176 in total). On recalculation with the standard formula for comparing two independent proportions,

$n \text{ per group} = [z_{1-\alpha/2}\sqrt{(2\bar{p}\bar{q})} + z_{1-\beta}\sqrt{(p_1q_1 + p_2q_2)}]^2 / (p_1 - p_2)^2$

with $p_1 = 0.045$, $p_2 = 0.028$, $\bar{p} = (p_1 + p_2)/2$, $q = 1 - p$, a two-sided α of 0.05 ($z = 1.96$) and 90% power ($z = 1.2816$), about 2,556 patients per group would be required to detect this difference. The study was therefore underpowered for its primary comparison, as discussed under Limitations.

Statistical analysis

Data were analysed with SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Normality of continuous data was assessed with the Shapiro–Wilk test. Normally distributed data are reported as mean ± standard deviation and skewed data as median (interquartile range, IQR); groups were compared with the Mann–Whitney U test. Categorical data are reported as number (percentage) and compared with the chi-square test or Fisher's exact test, as appropriate. A two-sided p value below 0.05 was considered significant. In addition, 95% confidence intervals (CI) were calculated for SSI rates (Wilson method) and for the difference in SSI between groups (Newcombe method). Only three SSI events occurred, so a multivariable analysis was not possible. The comparisons of SSI across patient factors are therefore unadjusted and are reported as exploratory findings.

RESULTS

Patient characteristics

A total of 176 patients were randomised, 88 to each group. All received the allocated intervention and completed 30-day follow-up, and none were excluded from analysis. [Figure 1] Baseline characteristics are shown in [Table 1]. Mean age was similar in the shaved and unshaved groups (44.4 ± 14.7 vs 44.7 ± 13.8 years). Women made up 82.4% of the cohort, reflecting the predominance of gallstone disease. Laparoscopic cholecystectomy accounted for 168 procedures (95.5%). The remaining eight, all in the shaved group, were five totally extraperitoneal (TEP) hernia repairs, one intraperitoneal onlay mesh repair and two laparoscopic cyst excisions.

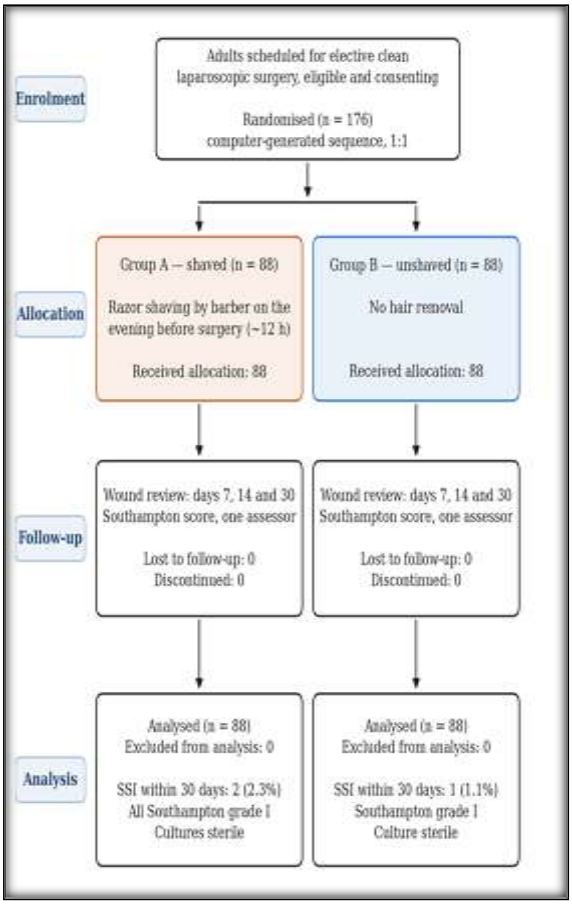


Figure 1: Flow diagram of participants through the study. SSI, surgical site infection

By chance, the groups differed at baseline in four respects despite random allocation. The shaved group had more men (27.3% vs 8.0%; p = 0.002) and a higher proportion of overweight or obese patients (73.9% vs 58.0%; p = 0.038). All non-cholecystectomy procedures were in the shaved group (p = 0.007). Median operating time was 5 minutes longer in the unshaved group (50 vs 45 minutes; p < 0.001).

Table 1: Baseline and operative characteristics of the two groups

Characteristic	Group A, shaved (n = 88)	Group B, unshaved (n = 88)	p value
Age, years, mean ± SD	44.4 ± 14.7	44.7 ± 13.8	0.657[a]
Age, years, median (IQR)	41.5 (33.0–55.0)	43.0 (34.0–54.5)	
Male sex, n (%)	24 (27.3)	7 (8.0)	0.002[b]
BMI 18.5–24.9 kg/m², n (%)	23 (26.1)	37 (42.0)	0.038[b]

BMI 25.0–29.9 kg/m², n (%)	50 (56.8)	44 (50.0)	
BMI ≥ 30 kg/m², n (%)	15 (17.0)	7 (8.0)	
Smoker, n (%)	3 (3.4)	0	0.246[c]
Alcohol use, n (%)	9 (10.2)	4 (4.5)	0.248[c]
Diabetes mellitus, n (%)	5 (5.7)	5 (5.7)	1.000[c]
Hypertension, n (%)	14 (15.9)	12 (13.6)	0.832[c]
Hypothyroidism, n (%)	4 (4.5)	2 (2.3)	0.682[c]
Laparoscopic cholecystectomy, n (%)	80 (90.9)	88 (100)	0.007[c]
Laparoscopic hernia repair or cyst excision, n (%)	8 (9.1)	0	
Operating time, min, median (IQR)	45 (40–50)	50 (45–55)	< 0.001[d]
Operating time, min, mean ± SD	48.2 ± 8.9	51.3 ± 7.7	

Overweight or obese in the text combines BMI 25.0–29.9 and ≥ 30 kg/m² (shaved 65/88, 73.9%; unshaved 51/88, 58.0%); the BMI p value compares all three categories.[a] Chi-square test across six age bands;[b] chi-square test; [c] Fisher's exact test;[d] Mann–Whitney U test. BMI, body mass index; IQR, interquartile range; SD, standard deviation.

Surgical site infection

Study-defined SSI occurred in 3 of 176 patients (1.7%; 95% CI 0.6–4.9%). Two occurred in the shaved group (2.3%; 95% CI 0.6–7.9%) and one in the unshaved group (1.1%; 95% CI 0.2–6.2%). The difference was not significant (p = 1.00), with a risk difference of 1.1 percentage points (95% CI −4.2 to 6.9) and a risk ratio of 2.0 (95% CI 0.2–21.7). [Figure 2A]

All three events were detected on postoperative day 7 and were Southampton grade I, with mild bruising or erythema only. None had discharge or pus, and wound swabs from all three grew no organism. No event therefore met the purulence or culture criteria of the CDC definition of superficial incisional SSI. All three had resolved by day 14, and no new SSI appeared by day 3. [Table 2]

Table 2: Surgical site infection (Southampton grade I or higher) by group and time point

Outcome	Group A, shaved (n = 88)	Group B, unshaved (n = 88)	p value
SSI at day 7, n (%)	2 (2.3)	1 (1.1)	1.00[a]
Southampton grade I	2	1	
Southampton grade II–V	0	0	
Purulent discharge (grade IV or higher)	0	0	
Positive wound culture	0	0	
SSI at day 14, n (%)	0	0	
SSI at day 30, n (%)	0	0	
Cumulative 30-day SSI, n (%; 95% CI)	2 (2.3; 0.6–7.9)	1 (1.1; 0.2–6.2)	1.00[a]

SSI was defined as a Southampton score of grade I or higher at any review. a Fisher's exact test. CI, confidence interval (Wilson method); SSI, surgical site infection.

Exploratory analysis of patient factors

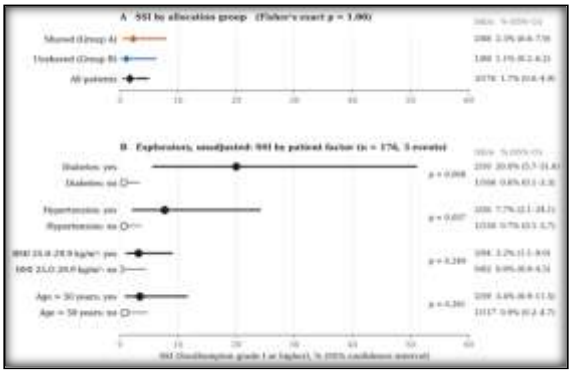
Table 3 and Figure 2B show SSI rates across the whole cohort by patient and operative factors. These comparisons are unadjusted and rest on three events, so they are exploratory. SSI was more frequent in patients with diabetes: 2 of 10 (20.0%) compared with 1 of 166 (0.6%) without diabetes (p = 0.008). One of these two patients was in each group. SSI was also more frequent in patients with hypertension (7.7% vs 0.7%), although this did not reach significance (p = 0.057). Both hypertensive patients with SSI also had diabetes.

All three patients with SSI were overweight (BMI 25.0–29.9 kg/m²), but this was not significant (p = 0.249). No SSI occurred among smokers, alcohol users, patients with hypothyroidism or those with BMI of 30 kg/m² or more. Operating time was not longer in patients with SSI (median 40 vs 50 minutes; p = 0.295). Within each subgroup, SSI rates did not differ between the shaved and unshaved groups.

Table 3: Exploratory, unadjusted comparison of SSI by patient and operative factors (n = 176)

Factor	Present: SSI / n (%)	Absent: SSI / n (%)	p value[a]
Diabetes mellitus	2 / 10 (20.0)	1 / 166 (0.6)	0.008
Hypertension	2 / 26 (7.7)	1 / 150 (0.7)	0.057
Overweight, BMI 25.0–29.9 kg/m²	3 / 94 (3.2)	0 / 82 (0)	0.249
Obese, BMI ≥ 30 kg/m²	0 / 22 (0)	3 / 154 (1.9)	1.000
Age > 50 years	2 / 59 (3.4)	1 / 117 (0.9)	0.261
Smoking	0 / 3 (0)	3 / 173 (1.7)	1.000
Alcohol use	0 / 13 (0)	3 / 163 (1.8)	1.000
Hypothyroidism	0 / 6 (0)	3 / 170 (1.8)	1.000

[a] Fisher's exact test, unadjusted. Operating time in patients with and without SSI: mean 45.0 ± 8.7 vs 49.8 ± 8.4 minutes; median 40 vs 50 minutes (Mann–Whitney U test, p = 0.295).



[Figure 2] Surgical site infection (Southampton grade I or higher) with 95% confidence intervals (Wilson method). (A) By allocation group; the confidence intervals overlap almost entirely. (B) Exploratory, unadjusted comparison by patient factor across the whole cohort; filled markers show patients with the factor and open markers those without. With three events in total, these comparisons do not identify independent risk factors. p values are from Fisher's exact test. BMI, body mass index; CI, confidence interval; SSI, surgical site infection.

DISCUSSION

In this randomised study of clean laparoscopic procedures, we found no statistically significant difference in SSI between razor shaving and no hair removal. The overall SSI rate was 1.7%, with 2.3% after razor shaving and 1.1% without hair removal. Every event was Southampton grade I, culture-negative and resolved within two weeks. With only three events, the study was underpowered; the estimate is imprecise and does not exclude clinically meaningful differences. In exploratory analysis, SSI was associated with diabetes.

Shaving and SSI

Our findings agree with the wider trial evidence. Kowalski et al. randomised general surgery patients to clipping or no hair removal in a non-inferiority trial and found no increase in SSI when hair was left in place.[22] Dhamnaskar et al. compared shaving with no shaving in 464 patients having elective abdominal surgery. They found no significant difference at 7, 14 or 30 days, although absolute SSI numbers were higher after shaving.[17] Kattipattanapong et al. in ear surgery, Menéndez et al. in endoscopic urology and Kumar et al. in cranial surgery reached the same conclusion.[14–16] Systematic reviews by Niël-Weise et al., Tanner and Melen and Lefebvre et al. all found that hair removal did not prevent SSI, and that razors performed worse than clippers.[12,13,23]

The numerical difference in our study, two events after shaving and one without, lies well within the play of chance. It is, however, in the direction expected from the known effect of razors on skin. Shaving damages the stratum corneum and leaves small wounds that are colonised within hours.[5,7] Shaving the evening before surgery, as in our protocol, gives these abrasions the longest time to become colonised. Seropian and Reynolds showed that SSI rose as the interval between razor shaving and incision grew longer.[7] With only three events, our study can neither confirm nor exclude this effect.

Two features of laparoscopic surgery probably explain the low event rate in both groups. Port-site incisions are short and exposed only briefly, and laparoscopic cholecystectomy carries a lower SSI risk than open surgery.[18] All patients also received standard prophylaxis: timed antibiotics, povidone-iodine skin preparation and primary closure. These measures carry most of the preventive benefit, and they may leave little room for hair management to change outcomes.[9,10,27]

The outcome definition matters when reading these figures. We counted any wound of Southampton grade I or higher as SSI so that even the earliest wound change would be captured. Grade I is the lowest abnormal grade and describes mild bruising or erythema around an otherwise healing wound. It may represent early inflammation or simple tissue reaction rather than established infection.[20]

None of the three events had discharge, pus or a positive culture, so none met the objective CDC criteria for superficial incisional SSI.[19] Under a CDC-based definition, the SSI rate would have been 0 of 88 in both groups. The reported rates should therefore not be interpreted as equivalent to CDC-defined SSI rates. This does not weaken the comparison between groups, because the same definition, assessor and schedule were applied to both arms.

Patient factors

In exploratory analysis, diabetes was associated with SSI. Two of the ten diabetic patients had an SSI event, compared with one of 166 non-diabetic patients. This finding rests on two events in ten patients, is unadjusted, and has a wide confidence interval (5.7–51.0%).

It should not be read as evidence that diabetes caused these wound events in our cohort. As contextual evidence only, not confirmation, it is consistent with a meta-analysis by Martin et al., which found that diabetes raises the odds of SSI by about 50% across surgical specialties.[24]

Guidelines already recommend perioperative glucose control for all surgical patients, and our observation is in line with that advice.[9,10]

The borderline association with hypertension may reflect overlap with diabetes, as both hypertensive patients with SSI were also diabetic.

All three SSI events occurred in overweight patients, but none occurred in the 22 obese patients, and the association was not significant. Obesity is an established risk factor for SSI.[25]

Larger studies are needed to judge whether being overweight alone adds risk after laparoscopic

surgery. Smoking, alcohol use and hypothyroidism showed no association, but these groups were small.

Operating time was about 5 minutes longer in the unshaved group. This difference is too small to matter clinically and did not relate to SSI, as patients with SSI had, if anything, shorter operations. Longer operating time raises SSI risk mainly in prolonged procedures.[4,26] In operations lasting under an hour, as here, it is unlikely to be a relevant factor.

Clinical implications

Razor shaving adds a routine task, a barber's time and a consumable to each operation. Our study did not demonstrate a benefit from routine razor shaving in clean laparoscopic surgery, although it was not powered to exclude a small effect in either direction. These results are consistent with CDC, WHO and NICE advice to avoid routine hair removal.[9–11]

If hair must be removed for technical reasons, these guidelines recommend clippers on the day of surgery.[10,12]

Established measures such as glycaemic control, timely antibiotic prophylaxis and careful skin antisepsis remain central to prevention.

Strengths and limitations

The study had several strengths. Allocation was randomised, perioperative care was standardised, and follow-up was complete to 30 days. A single assessor graded every wound with a validated scale, which removed inter-observer variation.

The study also has important limitations. First, it was underpowered for its primary comparison. Detecting a difference between 4.5% and 2.8% with 90% power at a two-sided α of 0.05 would need about 2,556 patients per group. Only three events occurred, and the wide confidence interval for the risk difference, from −4.2 to 6.9 percentage points, reflects this. The estimate is imprecise, does not exclude clinically meaningful differences, and should not be read as proof of equivalence.

Second, chance baseline imbalances occurred despite randomisation. The shaved group had more men (27.3% vs 8.0%), more overweight or obese patients (73.9% vs 58.0%), and all eight non-cholecystectomy procedures, including five mesh hernia repairs. Median operating time was 5 minutes longer in the unshaved group. Each of these factors could influence wound outcomes. With three events, no adjusted or stratified analysis was possible, so residual confounding cannot be ruled out.

Third, neither the assessor nor the patients could be blinded, which may have introduced detection bias. Fourth, SSI was defined broadly as Southampton grade I or higher, and all events were grade I and culture-negative. The results therefore say little about CDC-defined, deep or organ-space infection. Fifth, the analysis of patient factors was unadjusted and exploratory. Finally, a clipper arm was not included, and the findings apply to clean laparoscopic procedures, mostly cholecystectomy, in a single centre.

CONCLUSION

In clean laparoscopic surgery, we found no statistically significant difference in SSI between razor shaving the evening before surgery and no hair removal. SSI was uncommon in both groups, and all events were minor, culture-negative and self-limiting. Because only three events occurred and the study was underpowered, clinically meaningful differences between the two approaches cannot be excluded. In exploratory analysis, diabetes was associated with SSI, but this observation needs confirmation. These findings are consistent with current guidance against routine razor shaving. A larger multicentre trial, ideally with a clipper arm and adjustment for baseline factors, is needed to confirm them.

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