



# Best Practice

Evidence Based Practice Information Sheets for Health Professionals

## The Impact of Preoperative Hair Removal on Surgical Site Infection

### Information Source

This *Best Practice* Information Sheet has been derived from a systematic review conducted by the Norwegian Centre for Health Technology Assessment, Oslo<sup>1</sup> and is used with kind permission. It includes reference to the Centre for Disease Control (CDC)<sup>2</sup> guideline for prevention of surgical site infection. The references to both publications are available via web sites of the respective institutions listed on the back of this information sheet.

### Background

Surgical site infections are reported to be the third most frequently occurring nosocomial infection among hospitalised patients. Early studies identified that surgical site infections can increase length of stay by up to 7.3 days, and result in additional costs. Other studies support the findings of increased length of stay and costs as

**This Information Sheet Covers the Following Concepts:**

- **Shaving versus no hair removal**
- **Shaving versus clipping**
- **Shaving versus depilation**
- **Timing of preoperative hair removal with razor or clippers**
- **Wet versus dry shaving**

well as increased morbidity and mortality. In part, the frequency of surgical site infection and associated morbidity and mortality can be attributed to increases in the numbers of surgical patients, the aging population and range of co-morbidities.

### Levels of Evidence

All studies were categorised according to the strength of the evidence based on the following revised classification system.<sup>2</sup>

**Category IA** Strongly recommended for implementation and supported by well-designed experimental, clinical or epidemiological studies.

**Category IB** Strongly recommended for implementation and supported by some experimental, clinical or epidemiological studies, and strong theoretical rationale

**Category II** Suggested for implementation and supported by suggestive clinical or epidemiological studies or theoretical I rationale.

No recommendation; unresolved issue: The evidence is inadequate or insufficient, or there is a lack of consensus on effectiveness

In addition to this, there is evidence that some of the routine interventions used in health care facilities contribute to the increased risk of surgical site infection.

Although a range of perioperative measures are used in an attempt to reduce the incidence of surgical site infection, the scientific basis of many such interventions has not been rigorously established.

**Table 1**

Pathogen	Percentage of Isolates <sup>2</sup>	
	1986-1989 (N=16,727)	1990-1996 (N=17,671)
Staphylococcus aureus	17	20
Coagulase-negative staphylococci	12	14
Enterococcus spp.	13	12
Escherichia coli	10	8
Pseudomonas aeruginosa	8	8
Enterobacter spp.	8	7

Note: Pathogens representing less than 5% have been excluded

In particular, individual studies have questioned the practice of hair removal, finding that hair removal with a razor results in increased rates of postoperative surgical site infections. Studies into the effects of hair removal with a razor have shown that shaving causes small nicks in the skin, which become colonised by organisms and may lead to infection. More recently, a systematic review was conducted that combined a range of studies, adding weight to the argument that preoperative hair removal should not be considered a routine practice.

Surveillance data suggests the type of causative organisms associated with surgical site infection have not changed markedly over the last 10 - 15 years. However, the proportions of causative organisms have changed, as Table 1 illustrates. Antimicrobial resistant organisms are causing an increasing proportion of surgical site infections.

There has also been a rise in the numbers of infections caused by fungal organisms and these changing proportions have been attributed to the increasing acuity of surgical patients, immunocompromisation and the use of broad spectrum antibiotics. Surgical site infections caused by rare organisms warrant a formal review of practices, materials and personnel. Contaminated adhesive dressings; elastic bandages, colonised surgical personnel, tap water and contaminated disinfectant solutions have been identified as sources of rare organism outbreaks.

While contamination is a risk factor, the majority of surgical site infections can be attributed to the patients' own flora. In particular, the skin, mucous membranes and hollow viscera are commonly colonised with endogenous flora. Methods to reduce the incidence of surgical site infection should include interventions that reduce the impact of

endogenous flora on the incision site or deeper layers.

Classification of surgical wounds has been used to assign a risk category for surgical site infection based on the degree of wound contamination at the time of surgery. Classification of surgical wounds enables facilities to monitor infection rates for different classifications of wounds, and implement risk reduction strategies in accordance with the degree of risk associated with a type of wound (see Table 2). A range of factors have been associated with increased surgical site infection rates, including the increasing risk profile of surgical candidates, and complexity of surgical procedures. Preoperative hair removal has traditionally been considered a beneficial strategy to counter the increase risk of infection. However, evidence indicates that hair removal may also be a risk factor.

## Interventions

### Shaving versus no hair removal

Preoperative hair removal with a razor blade became a widely established practice based on the assumption that it would prevent postoperative surgical site infections. This has remained routine practice until relatively recent times. One randomised study of approximately 400 patients compared wet shaving with no hair removal. The authors found no statistically significant decrease in the incidence of surgical site infection in the unshaved study group. Other studies comparing shaving with no hair removal used different preoperative skin preparation solutions. Therefore the study

results are not a reliable representation of the effects of hair removal. Studies using large samples, (60,000 wounds and 10 year follow up) with less rigorous designs favoured no hair removal and demonstrated statistical significance. These findings are weakened by the lack of controls, and by the use of different treatments between study groups. The results suggest an association between shaving and infection, but do not demonstrate a reliable effect. In summary, shaving has been found to increase the incidence of surgical site infection in low quality studies, while higher quality studies suggest, but have not conclusively demonstrated, a benefit associated with no hair removal.

**Table 2**      **Surgical Wound Classification** (Garner JS & Simmons B)<sup>2</sup>

Class I/Clean:	An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow non-penetrating (blunt) trauma should be included in this category if they meet the criteria.
Class II/Clean-Contaminated:	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.
Class III/Contaminated:	Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g. open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation is encountered are included in this category.
Class IV/Dirty-Infected:	Old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

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## Shaving versus clipping

The use of electric clippers for hair removal is commonly compared with shaving as the control in randomised studies, as shaving is still considered routine practice.

A large randomised study compared shaving and electrical clipping the night before surgery on the outcome of mediastinitis post coronary bypass surgery in 1,980 patients. The results were statistically significant in favour of clipping ( $p=0.024$ ). Another randomised study of over 1,013 patients compared shaving and clipping the evening before, and the morning of surgery on wounds classified as Class I-III (see Table 2). The greatest reduction in surgical site infection was found in the group who had clipping on the morning of surgery ( $p>0.01$ ), a statistically significant result. Observational studies have tended to favour clipping or suggest no difference, although, two better quality studies demonstrated a significant benefit with the use of clippers compared to shaving if preoperative hair removal is required.

## Shaving versus depilation

A randomised study of 418 patients compared shaving and depilation in abdominal surgery. In this study, a lower percentage of patients who had depilation developed surgical site infections. However, the result was not statistically significant. Two other randomised studies also reported reductions in surgical site infection as percentages of outcomes, but were not able to demonstrate statistical significance, possibly due to small sample sizes. Observational studies tended to claim a more significant effect, however, the findings of observational studies

must be carefully considered prior to acceptance. Three randomised studies reported more surgical site infections in the shaved groups, lending weight to the preference for the use of depilation rather than shaving.

## Timing of hair removal via shaving or clippers

The timing of hair removal has generally been based on facilitating ease of preparatory activity by health care workers or by facility policy rather than scientific evidence. Although experts have long held the view that hair removal close to the time of surgery may reduce the risk of surgical site infection, surveys have found a majority of hospitals policy is to remove surgical site hair the evening before surgery.

A randomised study of 1,013 patients demonstrated no significant difference in surgical site infection when shaving surgical site hair the evening before surgery, or the day of surgery ( $p=0.69$ ). The same study compared use of clippers on the evening before surgery, and the day of surgery and found surgical incision sites categorised as clean were statistically less likely to develop infection when surgical hair removal was performed the morning of surgery ( $p=0.027$  on discharge). This effect was maintained at 30-day follow up ( $p=0.006$ ). One observational study of 536 patients prospectively studied the timing of preoperative shaving. This study found patients shaved 12 or more hours prior to surgery were at no greater risk of surgical site infection compared with patients shaved less than 2 hours prior to surgery ( $p=0.64$ ). However, subgroup analysis found wounds that had been categorised as "clean" (see Table 2) were less

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likely to result in a surgical site infection if hair was removed with clippers less than 2 hours prior to surgery ( $p < 0.01$ ). In summary, there is evidence to support the practice of surgical hair removal as close as practical to the time of surgery and benefits have been most clearly demonstrated for clipping. Shaving was found to result in higher rates of postoperative surgical site infection.

### Wet versus dry shaving

Only one observational study compared wet and dry shaving. The comparisons also included electrical clipping the evening prior to, or the day of surgery. The results of this study favoured the use of electrical clipping the evening before surgery, or electrical clipping the evening before surgery with a dry razor shave the day of surgery. The outcome of interest in this study was incidence of deep wound infection. There was no statistically significant difference found between the wet and dry razor blade shave groups. However, the study design lacked

control or randomisation, hence the results cannot be used to generate recommendations for practice.

### Costs

Costs related to preoperative hair removal have been described in relation to differences in infection rates, and impact on length of stay. In a study of 1,013 patients, the authors projected a saving of 655.8 days associated with the use of clippers the morning of surgery for this group of patients. Associated with this potential reduction in length of stay was a cost saving projection of US \$274,000 per 1,000 patients treated. Other studies anecdotally reported cost comparisons between wet razor shaves and depilatory creams, finding the direct costs associated with creams to be higher. However, this costing was limited, covering only minimal direct costs rather than the full range of direct and indirect costs of shaving items compared with the cost of the depilatory cream.

## Implications for Practice

The research into surgical site infection prevention found that surgical site hair need not be removed in order to reduce the risk of infection. However, the decision to remove surgical site hair must also include consideration of the potential for access to the surgical site and the field of view. Thus removal of surgical site hair may be performed for a range of reasons, but is not considered effective as a preventative measure in surgical site infection. Commonly used methods such as razor blades have been shown to lead to an increase in the incidence of surgical site infection.

Hair removal with clippers was found to be safer and resulted in a lower incidence of surgical site infections than shaving with a razor blade regardless of the timing of hair removal. The use of depilatory agents was also found to be more effective than shaving. However, studies into depilatory creams reported adverse effects such as skin irritation and allergies, hence clipping may be preferred to the use of depilatory agents.



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## Recommendations for Practice

### Shaving versus no hair removal

Where possible surgery without hair removal is preferable to preoperative hair removal with a razor blade to prevent surgical site infection (category IB).

### Shaving versus clipping

Clipping is the preferred method of hair removal to prevent surgical site infection (category IA).

### Shaving versus depilation

In patients undergoing clean abdominal surgery, depilation is preferred to razor blade hair removal to prevent surgical site infection (category IB).

### Timing of preoperative hair removal

Hair removal with clippers to be conducted as close as practical to the time of surgery, preferably less than 2 hours prior to surgery, to prevent surgical site infection (category IB).

## References

1. Kjønniksen, Andersen, Sondenaa, Segadal, 2002 Preoperative hair removal - a systematic literature review, AORN, 75, 5, 928-940
2. Mangram, Horan, Pearson, Silver, Jarvis, the hospital infection control practices advisory committee, guideline for the prevention of surgical site infection, 1999. Infection control and hospital epidemiology, 20:247-280.

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