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Major Article

# Perioperative hair removal in the 21st century: Utilizing an innovative vacuum-assisted technology to safely expedite hair removal before surgery

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***Background:*** Perioperative hair removal using clippers requires lengthy cleanup to remove loose hairs contaminating the operative field. We compared the amount of hair debris and associated microbiologic contamination produced during clipping of surgical sites using standard surgical clippers (SSC) or clippers fitted with a vacuum-assisted hair collection device (SCVAD).

***Methods:*** Trained nurses conducted bilateral hair clipping of the chest and groin of 18 male subjects using SSC or SCVAD. Before and during clipping, measurements of particulate matter and bacterial contamination were evaluated on settling plates placed next to each subject's chest and groin. Skin condition after clipping and total clipping/cleanup times were compared between SSC and SCVAD.

***Results:*** The microbial burden recovered from residual hair during cleanup in the SSC group was 3.9 $\log_{10}$ CFU and 4.6 $\log_{10}$ CFU from respective, chest, and groin areas. Use of the SCVAD resulted in a significant ($P < .001$) reduction in both residual hair and microbial contamination within the operative field compared with SSC.

***Conclusions:*** Use of SCVAD resulted in significant ($P < .001$) reduction in total time required to clip and clean up residual hair contaminating the operative field compared with standard practice (ie, SSC), eliminating the need to physically remove dispersed hairs, which can harbor a significant microbial burden, from within the operative field.



Preoperative hair removal by clipping rather than shaving was among the Surgical Care Improvement Project's sentinel core measures.[1] In an era of value-based purchasing, optimizing the practice of these evidence-based process measures has important financial implications for hospitals and other acute-care facilities.[2,3] Following Association of periOperative Registered Nurses-recommended practices, if a patient's hair is likely to interfere with the surgical procedure and removal is deemed warranted, the following practice is applied:[4]

- Hair removal should be performed on the day of the surgery, in a location outside the operating or procedure room;
- Only hair interfering with the surgical procedure should be removed; and
- Hair should be clipped with a single-use electric or battery-operated clipper, or clipped with a reusable head that can be disinfected between patients.

The location of perioperative hair removal has been a concern of operating room nurses and other health care professionals because hair can be a significant source of microbial contamination and the removal of residual hair is often a time-consuming practice, increasing costly operating room time.[5] Furthermore, on selective

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surgical services, such as cardiac, gynecology, and urology, surgeons prefer to clip in the operating room after the patient has been sedated. This conforms to patient privacy concerns and the sensitivity of the area being clipped.

The purpose of this study was to quantify and compare the amount of loose hair or debris, and associated microbiologic contamination, produced during the clipping of surgical sites using standard surgical clippers (SSC) alone or surgical clippers fitted with a vacuum-assisted hair collection device (SCVAD). This study also evaluated total clipping time, abrasion/irritation of the skin during clipping procedures, and clinician and subject satisfaction with the clipping and hair-removal process. The standard practice of using surgical tape to remove residual hair following clipping was also evaluated for its microbial bioburden because loose hair poses a risk for microbial contamination of the surgical field or operating room environment.

## MATERIALS AND METHODS

The protocol was reviewed and approved by the Gallatin Institutional Review Board.

### *Preliminary analysis*

An initial pilot study was conducted to assess the feasibility of measuring the level of dispersed microbial and residual hair contamination produced during the clipping process using clippers with or without vacuum collection technology. Following informed consent, 3 subjects had hair clipped from the groin and lower leg regions with or without vacuum-assisted hair collection (ClipVac Hair Vacuum or Surgical Clipper; CareFusion Corp, San Diego, CA). On the left or right groin sites, a sterile surgical marker was used to demarcate a 12-inch × 8-inch bilateral area with a similar amount of hair. Tryptic soy agar (TSA) settling plates were placed adjacent to the test site before clipping. The TSA plates were placed in a 2 plate × 4 plate formation (ie, 8 plates) such that the open plates were positioned beneath the clipping site at 3.25 inches, 6.50 inches, 9.75 inches, and 13.00 inches perpendicular to the test site. The plates were exposed for 3 minutes (negative control), removed, and incubated at 30°C for 48 hours. A second set of plates were placed in the exact same position as the first set. The skin surface was carefully clipped until it was visually apparent that all hair had been removed from the test sites using either SSC or SCVAD. The plates were removed, incubated at 30°C for 48 hours, and microbial colonies from both negative control and experimental runs enumerated. A visual inspection of the groin skin surfaces adjacent to the clipping site revealed no residual hair particles following removal with the SCVAD.

On the skin of the lower leg, a surgical marker was used to demarcate the front plane of the lower leg with areas of skin that appeared bilaterally similar in terms of the amount of hair. A preweighed piece of paper was place beneath each leg. The hair was carefully clipped until it was visually apparent that hair was entirely removed from the test site by either the SSC or SCVAD. The preweighed pieces of paper were removed from beneath the volunteer's leg and reweighed. A visual inspection of the lower leg skin surfaces adjacent to the clipping site revealed no residual hair particles following removal with SCVAD.

### *Simulated surgical clipping study*

Following informed consent and before randomization, the skin of the study subjects were examined to assess that it was free from clinically evident diseases, injuries, or any other disorders that could compromised the study.

### *Inclusion/exclusion criteria*

Subjects were included in this study if they met the following requirements:

- Male, aged at least 18 years, including any ethnic background,
- Moderate to heavy (≥ 3 on Ferriman-Gallwey scale for hirsutism) hair on chest and groin,[6]
- Available to take a shower or bathe approximately 24 hours before testing, and
- In good general health.

Subjects were excluded if they had any of the following criteria:

- Presence of tattoos, insufficient hair, scars, erythema, sunburn, skin diseases, moles, cuts, lesions, skin tags, protruding veins, or other disorders on the skin of the chest or groin that might have interfered with consistent use of the test materials across a test site or with the evaluation of responses to test material use;
- Known allergy or sensitivity to sunscreens, deodorants, laundry detergents, fragrances, latex (rubber), metals, adhesives, or ink;
- Exposure of test sites to strong detergents, solvents, or other irritants within a 7-day pretest conditioning period or on the single test day;
- Exposure of test sites to antimicrobial agents, medicated soaps, medicated shampoos, or medicated lotions, use of biocide-treated pools or hot tubs, use of tanning beds, or sunbathing during the 7-day pretest conditioning period or on the single test day;
- Use of systemic or topical antibiotic medications, steroid medications, or any other products known to affect the normal microbial flora of the skin during the 7-day pretest conditioning period or the single test day;
- Removal of hair from any portion of the test sites within the prior 30 days; and
- Any currently active skin disease or inflammatory skin condition, such as contact dermatitis, eczema, or psoriasis, anywhere on the body or use of any medications that, in the opinion of the principal investigator or medical consultants, should preclude participation.

A total of 24 men consented to participate in the study; 5 subjects were excluded during preliminary examination, 19 received study materials, and 18 subjects completed the study without any protocol violations.

### *Pretesting period*

Seven days before the study, subjects were instructed to avoid use of medicated soaps, lotions, deodorants, and shampoos, as well as skin contact with solvents, detergents, acids and bases, or any other products known to affect the normal microbial populations of the skin. Subjects were provided with a personal hygiene kit containing nonmedicated soap, shampoo, lotion, and rubber gloves to be worn when in contact with antimicrobial agents, solvents, detergents, acids, or bases that could not be avoided. Subjects were instructed to exclusively use the contents of the kit during their participation in the study. The study subjects were instructed not to shave or clip the test sites during the 7 days before their assigned test day. Subjects were instructed to avoid swimming or bathing in biocide-treated pools or hot tubs. Subjects were also told that they must shower or bathe approximately 24 hours before testing.