To Beard or Not to Beard? Bacterial Shedding Among Surgeons

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abstract

Beards in the operating room are controversial because of their potential to retain and transmit pathogenic organisms. Many bearded orthopedic surgeons choose to wear nonsterile hoods in addition to surgical masks to decrease contamination of the operative field. The goal of this study was to determine whether nonsterile surgical hoods reduce the risk of bacterial shedding posed by beards. Bearded (n=10) and clean-shaven (n=10) subjects completed 3 sets of standardized facial motions, each lasting 90 seconds and performed over blood agar plates, while unmasked, masked, and masked and hooded. The plates were cultured for 48 hours under aerobic and anaerobic conditions. Colony-forming units (CFUs) were quantified, expanded, and identified. Overall, the addition of surgical hoods did not decrease the total number of anaerobic and aerobic CFUs isolated per subject, with a mean of 1.1 CFUs while hooded compared with 1.4 CFUs with the mask alone (P=.5). Unmasked subjects shed a mean of 6.5 CFUs, which was significantly higher than the number of CFUs shed while masked (P=.02) or hooded (P=.01). The bearded group did not shed more than the clean-shaven group while unmasked (9.5 vs 3.3 CFUs, P=.1), masked (1.6 vs 1.2 CFUs, P=.9), or hooded (0.9 vs 1.3 CFUs, P=.6). Bearded surgeons did not appear to have an increased likelihood of bacterial shedding compared with their nonbearded counterparts while wearing surgical masks, and the addition of nonsterile surgical hoods did not decrease the amount of bacterial shedding observed. [Orthopedics. 2016; 39(2):e290-e294.]

Beards in the operating room have sparked controversy because of their potential to retain and transmit pathogenic organisms.1-5 Even after it is washed with soap and water, facial hair may retain enough microorganisms to establish infection.1 In an extreme example, an outbreak of 16 severe surgical site infections was linked to a surgeon whose hair was colonized by *Staphylococcus aureus* despite negative throat and nose culture findings.2

McLure et al6 compared rates of bacterial shedding in bearded and clean-shaven medical personnel who wore surgical masks and performed a series of facial motions. This study found that bearded men shed more colony-forming units (CFUs) than both clean-shaven men (P<.01) and women (P<.001) and concluded that facial hair may be unsafe in a sterile environment.

Despite the potential risk of infection posed by beards, they are common among surgeons and operating room staff. At the authors’ institution, many surgeons, including those with and without beards, elect to

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wearing nonsterile surgical hoods to minimize the risk of surgical site infection. These hoods have been shown to be superior to surgical masks alone and as efficacious as sterile ventilated hoods in decreasing the number of bacterial CFUs in wounds by 98% to 99%. Multiple studies have shown that facial hair can act as a reservoir for pathogenic organisms. However, the study by McLure et al is the only investigation that has compared the degree of bacterial shedding over a sterile field in bearded and clean-shaven men. The goal of the current study was to determine whether nonsterile surgical hoods reduce the risk of bacterial shedding posed by beards.

**Materials and Methods**

After institutional review board approval was obtained, 10 bearded and 10 clean-shaven subjects at the study institution were identified and provided consent to participate in the study. The clean-shaven group consisted entirely of orthopedic surgeons. Because of a limited number of bearded orthopedic surgeons, the bearded group included 6 orthopedic surgeons, 2 general surgeons, and 2 orthopedic surgical ancillary staff.

Beard length was measured by placing a ruler perpendicular to the underside of the chin, specifically, 1 cm posterior to the apex of the chin in the midline. The average of 3 measurements, rounded to the nearest half centimeter, was recorded as the final beard length. Average beard length (±SD) was 12 ± 7 mm (range, 5-25 mm). Three beards were shorter than 10 mm (mean length, 5 ± 0 mm), 4 were between 10 and 19 mm (12.5 ± 2.9 mm), and 3 were 20 mm or longer (21.6 ± 2.8 mm) (Figure 1).

The experimental protocol described by McLure et al was used to compare the results. To minimize bacterial contamination, participants were tested in an empty room in the presence of a single investigator. Bacterial shedding was assessed with 2 standard blood agar plates placed 15 cm below the chin of the seated subject. Two plates placed 50 cm from the subject acted as the control. Subjects performed a series of facial motions in a standardized pattern for 90 seconds. To minimize contamination by oral flora, subjects were asked not to open their mouths. All subjects wore clean disposable surgical caps and a surgical scrub top. Each subject was evaluated 3 times: while unmasked, while masked, and while masked with a nonsterile surgical hood. Flat pleated, tie-on surgical masks (Model 1818; 3M, St Paul, Minnesota) and polypropylene spunbound surgical hoods (Filtration Systems Products, Inc, Pevely, Missouri) (Figure 2) were studied. One plate each was incubated at 37°C aerobically and anaerobically for 48 hours. Colonies were counted and identified with matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI BioTyper; Bruker Daltonics, Billerica, Massachusetts).

Based on the data of McLure et al, power analysis determined that inclusion of 10 subjects per group was sufficient to detect a 40% difference between the number of CFUs in masked and clean-shaven groups. The Wilcoxon signed rank-sum test was used to evaluate differences within groups. The Kruskal-Wallis rank-sum test was used to determine differences between groups. All analysis was performed with the JMP statistical software package, version 8 (SAS Institute Inc, Cary, North Carolina). P < .05 was considered statistically significant.

**Results**

A mean of 6.5 CFUs (anaerobic and aerobic) were isolated per subject while unmasked, and this number was significantly higher than the number isolated while masked (1.4 CFUs, P = .02) or hooded (1.1 CFUs, P = .01). The addition of a surgical hood, compared with the use of masks alone, did not lower the number of CFUs isolated (P = .5). Bearded and clean-shaven subjects shed similar amounts of bacteria while unmasked (9.5 vs 3.3 CFUs, P = .1), masked (1.6 vs 1.2 CFUs, P = .9), or hooded (0.9 vs 1.3 CFUs, P = .6) (Figure 3).

The number of aerobic CFUs isolated was similar in bearded and clean-shaven subjects while unmasked (4.6 vs 2.5 CFUs, P = .4), masked (0.4 vs 0.6 CFUs, P = .9), or hooded (0.8 vs 0.5 CFUs, P = .9).

**Figure 1:** Photographs of 1 tested subject. Clean-shaven. The mustache shown was not present during testing (A). Beard between 10 and 20 mm (B). Beard of 20 mm or more (C). The clean-shaven subjects had no facial hair present. The bearded subjects had full beards. No mustaches, goatees, or other styles of facial hair were included.

**Figure 2:** Photograph showing the surgical mask and nonsterile surgical hood used in the experimental protocol.
The organisms isolated from aerobic cultures are shown in Table 1.

The number of anaerobic CFUs isolated was similar in bearded and clean-shaven subjects while unmasked (4.9 vs 0.8 CFUs, \(P=.07\)), masked (1.2 vs 0.6 CFUs, \(P=.5\)), or hooded (0.8 vs 0.5 CFUs, \(P=.9\)). The organisms isolated from anaerobic cultures are shown in Table 2.

When participants were stratified by beard length (0 mm, <10 mm, 10-19 mm, and \(\geq\)20 mm), subjects with beards that were 2 cm or longer shed more than clean-shaven subjects (18 vs 3.3 CFUs, \(P=.03\)). No differences in shedding were observed between any group while masked (\(P=.4\)) or hooded (\(P=.3\)) (Figure 4).

**Discussion**

McLure et al.\(^6\) previously reported that bearded men wearing surgical masks and performing facial motions showed more aerobic bacterial shedding than clean-shaven subjects. The current study replicated the experimental protocol of McLure et al.\(^6\) to compare data. McLure et al.\(^6\) found that 10 bearded men shed a total of 29 CFUs compared with 8 CFUs shed by women (\(P<.0001\)) and 5 CFUs shed by clean-shaven men (\(P<.01\)). In comparison, the 10 bearded and 10 clean-shaven men in the current study shed a total of 4 and 6 aerobic CFUs, respectively. Further, the current study found no difference in bacterial shedding between bearded and clean-shaven subjects while unmasked, masked, or hooded. There was a trend for bearded subjects to shed more bacteria while unmasked, but this difference did not reach statistical significance. This trend was eliminated with the addition of surgical masks, with or without hoods.

It is unclear why the current study did not find the significant difference in bacterial shedding between bearded and clean-shaven groups that was reported by McLure et al.\(^6\). Contributing variables may include the brand of surgical masks used; however, the current study used the same soft tie-on variety that McLure et al.\(^6\) reported using. The current study also cultured the plates for 48 vs 24 hours, which theoretically would have increased the number of CFUs observed.

An important variable may be beard length, which was not reported by McLure et al.\(^6\). In the current study, average beard length was 12±7 mm (range, 5-25 mm), and all participants had a full beard. Mustaches, goatees, soul patches, and other beard variants were excluded.

In this study, participants with beards that were 2 cm or longer showed significantly more shedding than the clean-shaven subjects, but this difference was eliminated with the addition of a mask. No notable difference was found in bac-
terial shedding between beards of different lengths while the participants were masked. However, there was a trend for the longest beards to shed the least when the participants wore a mask and hood. A possible explanation for this finding may be that longer hair creates a less abrasive articulation with the material and therefore decreases shedding, although a greater number of subjects would be needed to demonstrate this finding.

At the study institution, all personnel who enter the operating room wear a nonsterile surgical hood for arthroplasty procedures. The goal of the current study was to reevaluate the risk of bacterial shedding posed by beards and the ability of masks and nonsterile surgical hoods to reduce this risk. This is an important consideration for surgeons who want to eliminate variables that are responsible for surgical site infections but also wish to wear beards. According to the social science literature, beards convey superior health, maturity, attractiveness, and dominance.8-14

The current findings are tempered by the experimental design, which attempted to isolate bacterial shedding posed by beards alone. This study likely underestimated the protective ability of both masks and hoods by eliminating confounding factors, such as talking and movement of the head and neck. A study by Friberg et al7 found nonsterile hoods to be superior to surgical masks in simulated laminar flow operative conditions.

**Table 2**

<table>
<thead>
<tr>
<th>Organism</th>
<th>Bearded</th>
<th>Clean-shaven</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus epidermidis</em></td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td><em>Propionibacterium acnes</em></td>
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<td>1</td>
</tr>
<tr>
<td><em>Staphylococcus capitis</em></td>
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<td>1</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
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<td>4</td>
</tr>
<tr>
<td><em>Klebsiella oxytoca</em></td>
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<td>0</td>
</tr>
<tr>
<td><em>Staphylococcus hominis</em></td>
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<td>1</td>
</tr>
<tr>
<td><em>Streptococcus parasanginis</em></td>
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<td>1</td>
</tr>
<tr>
<td><em>Dermabacter hominis</em></td>
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<td>1</td>
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<td><em>Staphylococcus haemolyticus</em></td>
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<td>1</td>
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<tr>
<td><em>Staphylococcus warneri</em></td>
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<tr>
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<td><em>Actinobaculum species</em></td>
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<td><em>Streptococcus infantis</em></td>
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<td>0</td>
</tr>
<tr>
<td><em>Staphylococcus lugdunensis</em></td>
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</table>

**Figure 4:** Mean total (both anaerobic and aerobic) colony-forming units (CFUs) isolated from each subject after stratification by beard length (0 mm, <10 mm, 10-19 mm, and ≥20 mm). No differences in shedding were observed between any of the groups while masked (P=.4) or hooded (P=.3). Participants with beards that were 2 cm or longer showed more shedding than clean-shaven subjects (18 vs 3.3 CFUs, P=.03) while unmasked. Error bars represent standard error.

**CONCLUSION**

Bearded surgeons did not appear to have an increased likelihood of bacterial shedding compared with their nonbearded counterparts while wearing surgical masks. The addition of nonsterile surgical hoods did not decrease the amount of bacterial shedding observed compared with the use of surgical masks alone.

**REFERENCES**

6. McLure HA, Mannam M, Talboys CA,


