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Research Article

Tip the Hat: Does A Superior Cloth Surgeons Cap Really Exist?

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Background

The efficacy of operating room headwear has been in debate for several years as governing organizations, including the Joint Commission, CDC, and the Association of Perioperative Registered Nurses, have published guidelines without clear evidence in support of these practices. In the 2016 edition of the Association of Perioperative Registered Nurses Procedure Manual all operating room personnel are to wear disposable bouffant-style hats. Several studies have suggested that hair is a vehicle for bacterial dispersal, however, there has been no definitive evidence that connects bacteria in the hair to surgical site infections. In November, 2017 an article was published in the Journal of the American College of Surgeons entitled "Hats Off: A Study of Different Operating Room Headgear Assessed by Environmental Quality Indicators." Though this study has demanded criticism by those in control of OR policy, it is not without validity.

When assessing cloth skull caps, there was no difference in terms of microbial or particulate shedding compared to disposable skull caps, and lower particulate shedding compared to disposable bouffant caps. This suggests that cloth skull caps are superior to bouffant hats. In determining OR headwear an additional option exists, one that has not been so publicly scrutinized: antimicrobial cloth skull caps. To this date no studies have compared antimicrobial cloth skull caps to regular cloth skull caps. We hypothesized that antimicrobial skull caps will harbor less bacterial burden then regular cloth skull caps.

Methods

Hats

Antimicrobial cloth skull caps were purchased from Dickies, hat serial code 83566A titled "Adult's Antimicrobial Scrub Hat". These are unisex caps with ties in the back. They contain Certainty™ antimicrobial fabric technology. The EPA-registered antimicrobial fabric technology in Certainty™ inhibit and minimize the growth of unwanted microorganisms on the fabric through a polymer deliver system of silver ions into the fibers of the fabric. It is a well-known fact that silver ions and silver-based compounds are highly toxic to microorganisms. Regular cloth caps were purchased new and 100% cotton, unisex fit, with ties in the back.

Study Design

Caps were individually packaged and dispersed to general surgery residents and attending surgeons on Fridays. Only one cap was dispersed each week, either "antimicrobial" or "regular cloth." The first caps distributed were regular cloth caps. The caps were to be worn with "routine use" throughout the week and returned back in its packaging the following Friday for analysis. Routine use was defined as though this was your own personal cap with special instruction not to wash the caps. After returning the caps the following Friday new antimicrobial caps were distributed with the same instructions. After the cap was returned it was swabbed on the cap exterior including the front, sides, back and top. The swab was then capped and sent to the lab for speciation and sensitivities. A total of 13 participants were involved. In the first cycle 100% of caps were returned for both the regular cloth and antimicrobial groups. The caps were laundered in the hospital facility prior to distributing and again after being returned. Caps were redistributed to 8 participants in the second cycle and similarly collected. In this second cycle one regular cloth cap was lost and not returned. All antimicrobial caps were returned. This leaves a total of 21 antimicrobial caps sampled and 20 regular cloth caps sampled.

Statistical Analysis

A cross-tabulation and chi-square statistic was conducted to assess if there was a statistically significant difference between bacterial growth on cloth caps and antimicrobial cloth caps. A cross-

tabulation and chi-square statistic was used due to the nominal measurement of both the independent and dependent variables.

Results

The antimicrobial cloth caps had statistically significantly less growth than the regular cloth caps in the following: Staphylococcus epidermidis (p<0.001), Staphylococcus capitus (p< 0.001), Staphylococcus aureus (p=0.03), Micrococcus luteus (p=0.05), Diptheroids (p< 0.001), and Bacillus sp. (p=0.01). There was no significant difference in bacterial growth between antimicrobial cloth and regular cloth in the following: Staphylococcus hominis (p= 0.60), Staphylococcus haemolyticus (p= 0.76), gram negative rods (p= 0.30), or Streptococcus mitus/ oralis (p= 0.28) (Table1).

Table 1:

	Caps			
Growth	**Cloth (n = 21)**	**Antimicrobial (n = 20)**	**χ2**	**p**
Staphylococcus epidermidis	17	4	18.01	.00*
Staphylococcus Capitus	12	5	16.32	.00*
Staphylococcus Hominis	3	5	1.00	.60
Staphylococcus Haemolyticus	4	4	.54	.76
Staphylococcus Aureus	4	0	4.65	.03*
Gram Neg Rod	1	0	1.07	.30
Micrococcus Luteus	8	4	5.98	.05*
Diptheroids	11	0	15.78	.00*
Bacillus Sp.	5	0	5.97	.01*
Streptococcus mitus/oralis	1	0	1.13	.28

Note * = p < .05.

Discussion

Operating room headwear has been called into question and has been hotly debated in the literature as of late. The surgical skull cap has been the identity of a surgeon since its inception and has been scrutinized without rigorous scientific testing until recently. Here we bring up yet another option, the antimicrobial cloth surgeons cap. The antimicrobial cloth caps used in the study employ Certainty™ Antimicrobial Fabric Technology. This technology uses silver ions within the fabric to inhibit and minimize growth of microbes. Our results suggest this to be true with routine use of these caps among general surgery residents and attending surgeons. There was significantly less growth in the antimicrobial caps for each species that exhibited routine growth in the regular cloth hats, including Staphylococcus epidermidis, Staphylococcus capitus, Micrococcus luteus, and Diptheroids. Species with growth on regular cloth caps and sterile on antimicrobial cloth caps include Staphylococcus aureus, Diptheroids, and Bacillus species (Table 1). Overall, when comparing antimicrobial cloth caps to regular cloth caps there was less bacterial growth and higher rates of sterile swabs suggesting possible benefit to employing this fabric technology in the operating room.

Limitations

There are several limitations in this study worth mention. First, this is a single-institution study requiring participant involvement via residents and attending physicians. Early results demonstrated a wide difference in bacterial growth allowing a small study size to suggest a significant difference between the caps. Second, "routine use" is certainly not standardized allowing for a wide variation of use between participants. Participants were instructed to use each hat the same in an attempt to control this. Third, as each hat was used for a 7-day interval the amount of time spent in the operating room may be different depending on scheduling. And finally, because this is a prospective, non-randomized, non-blinded study inherent bias does exist. We also understand that there are several companies that produce antimicrobial fabrics. Some of these may have improved antimicrobial properties and perform better than others.

Conclusion

In this study we observed a significant difference in bacterial growth in regular cloth caps versus antimicrobial cloth caps in favor of antimicrobial cloth technology. This does not directly suggest a difference in operating room related infections however adds to the armamentarium of OR headwear with clear data to suggest a possible benefit with antimicrobial surgical caps. Further investigation for possible microbial resistance with routine use of antimicrobial fabric is warranted. Additionally, and a comparison analysis of disposable skull caps swabbed after each use is planned [1].

References

1. Markel TA, Gormley T, Greeley D, Ostojic J, Wise A et al. (2017) Hats Off : A Study of Different Operating Room Headgear Assessed by Environmental Quality Indicators. Journal of the American College of Surgeons 225(5): 573-581.

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