

# **A Retrospective Analysis on the Effectiveness of Far-UVC (222nm) Light in Reducing Surgical Site Bacterial Contamination in Shoulder Surgery**

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## **INTRODUCTION:**

Surgical site infections are a significant healthcare challenge, contributing to patient morbidity, prolonged hospital stays, and increased healthcare costs. Conventional UVC (254nm) light effectively reduces bacterial contamination but poses safety risks for human exposure. Far-UVC (222nm) is emerging as a safe, effective alternative for microbial reduction. However, its effectiveness in an in vivo surgical setting remains unproven.

## **METHODS:**

**Study Design:** A retrospective analysis was conducted at a single hospital to assess the efficacy of Far-UVC (222nm) light in reducing bacterial contamination at surgical incision sites in patients undergoing elective shoulder procedures.

**Participants:** Eligible patients included adults undergoing elective shoulder surgeries. Exclusion criteria included active infections at the time of surgery and revision surgeries.

**Intervention:** A baseline control group of 20 swabs, exposed only to air in the surgical suite (<5 seconds), were cultured for bacterial growth.

The study comprised two cohorts of patients. In cohort 1, patients underwent a standardized surgical preparation using an evidence-based standard of care protocol. In cohort 2, surgical sites were additionally exposed to Far UVC light for 40 seconds at a distance of 5 cm.

**Sample Collection:** In both cohorts, after completion of the skin prep and prior to incision, two specimens were obtained from the proposed incision site. Standard bacterial culture swabs were used and sent for aerobic and anaerobic cultures that were held for 14 days.

**Outcome Measures:** The main outcome was bacterial contamination determined by the cultures. Given the known high rate of false positive from the literature, a positive result required both samples of a given cohort to grow out the same bacteria in culture. A secondary analysis considered a positive result as at least one of the two cultures returning positive. All patients were followed for a minimum of 3 months to assess for post-operative infections.

**Statistical Analysis:** Data were analyzed using Chi-squared tests, with significance set at  $p < 0.05$  to determine if a difference existed between the two cohorts. A post hoc power analysis was also performed.

**Ethics Approval:** The study received ethics approval from the institutional IRB.

## **RESULTS:**

A total of 143 patients were analyzed, with 108 in Cohort 1 and 35 in Cohort 2. The mean age was 69.4 years (SD 11.9) for Cohort 1 and 69.5 years (SD 10.9) for Cohort 2, showing no significant difference ( $p = 0.186$ ). The male-to-female ratio was similar, with 60 males in Cohort 1 and 19 in Cohort 2 ( $p = 1.0$ ).

**Surgical times were comparable:** Cohort 1 had a mean time of 44.84 minutes (SD 19.22) and Cohort 2 had a mean of 49.4 minutes (SD 17.5), with no significant difference ( $p = 0.271$ ).

A control group exposed to air for less than 5 seconds yielded 2 positive cultures out of 20 specimens (10% positivity rate).

In terms of bacterial contamination, Cohort 1 had 24 positive cultures (22.2%) compared to 2 positive cultures (5.7%) in Cohort 2, indicating a significant difference ( $\chi^2 = 4.639$ ,  $p = 0.031$ ). The relative risk of a positive culture in Cohort 2 compared to Cohort 1 was approximately 0.257, suggesting a 74.3% lower likelihood of positive results in Cohort 2.

For the secondary outcome (only 1 of 2 specimens positive), Cohort 1 had 49 positives (45.3%), while Cohort 2 had 9 positives (25.7%), with a Chi-square statistic of approximately 4.692 ( $p = 0.030$ ).

One patient in the non-UVC cohort developed cellulitis, but no deep infections occurred. A post hoc power analysis indicated a study power of 98.91% for detecting a 20% difference.

## **DISCUSSION AND CONCLUSION:**

This study demonstrates that Far-UVC (222nm) light significantly reduces bacterial contamination in shoulder surgeries compared to standard protocols. The substantial difference in positive culture rates for both primary and secondary outcomes indicate that Far-UVC could be a valuable addition to surgical practices, potentially minimizing the risk of surgical site infections. Integrating Far-UVC (222nm) light into surgical protocols represents a potential promising advancement in enhancing surgical safety.