Is Sterile Field Turnover Necessary? A Metagenomic and ATP-Based Evaluation of Contamination During Revision Arthroplasty

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INTRODUCTION: Turning over the sterile field during revision knee arthroplasty (rTKA) has been suggested as a means of preventing periprosthetic joint infection (PJI). The rationale behind changing drapes, instruments and gowns is that bioburden, either from the operative room/team or from the wound (in infected procedures) can deposit in the sterile field and can be transferred into the surgical wound prior to closure. To date, no comprehensive evaluation of the sterile field for evidence of viable bioburden has been performed.

METHODS: Ten patients (5 aseptic, 5 with culture positive PJI) undergoing both component revision knee arthroplasty (rTKA) were prospectively consented and enrolled. Following debridement and component removal, 5 locations within the sterile field were swabbed: 1) incise drapes, 2cm away from the wound, 2) drape directly underneath the knee, 3) plantar aspect of the foot, 4) the Mayo stand where surgical instruments were placed, 5) the chest area of the surgeon's gown. Swabs were separately sent for metagenomic sequencing (bacterial DNA/RNA was detected using established thresholds) and immediate ATP testing using a luminometer to identify that viable organisms were present.

RESULTS SECTION: Bacterial DNA/RNA was detected on 56% (14 of 25) of surfaces in PJI cases, 76% (19 of 25) in aseptic cases (p=0.23). High ATP activity was detected across the sterile field, with no significant differences among cases (p=0.37) (Figure 3). *C. acnes*, *P. aeruginosa*, and reads of *E. coli* were found. The organism causing PJI was found within the sterile field in 2 of 5 PJI cases (*S. aureus*, *P. arginousa*). The surgeon's gown, mayo stand, and foot were the most common sites for positive bacterial DNA/RNA (80%; 8/10).

DISCUSSION: Bacterial DNA/RNA is present in multiple locations within the sterile field during rTKA surgery, with positive ATP activity suggesting that the pathogens are viable. Skin flora was detected, even in aseptic cases. The clinical implications of these findings remain unclear.

SIGNIFICANCE/CLINICAL RELEVANCE: Bacterial DNA/RNA and ATP activity are present throughout the sterile field once components have been removed in revision surgery. Further testing is needed to determine what extent of contamination is from the patient's own flora versus environmental contamination.

REFERENCES:
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IMAGES AND TABLES:

Figure 1. ATP Luminometer

Figure 2. Swabbed locations

ATP Test Results

Area	Location	p-value	Median: Septic (RLU)	Median: Aseptic (RLU)
1	2 cm lateral to incision	0.2857	7921	5287
2	Underneath knee	0.5556	2409	5102
3	Plantar aspect of foot	0.4127	3330	6389
4	Surgeon gown	0.5556	7076	6500
5	Mayo Stand	0.1111	5379	7364

Figure 3. ATP contamination between septic and aseptic procedures across all five areas analyzed (all p > 0.05).