

## QUESTION 1: When should instrument trays be opened during surgery to minimize the risk of contamination?

RECOMMENDATION: Instrument trays should be opened as close to the time of surgery as possible. Once opened, trays and instruments should be covered with a sterile towel or drape when not in use.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 97%, Disagree: 2%, Abstain: 1% (Unanimous, Strongest Consensus)

### RATIONALE

The importance of airborne bacterial contamination of surgical incisions in the operating room has been appreciated for decades [1–4]. Pasquarella et al. [5] demonstrated airborne particles in the orthopaedic arthroplasty operating room (OR) to be a source of contamination for early surgical site infections (SSIs). Surgical instruments tend to be contaminated during the procedure by airborne particles and microbes, allowing surgical instruments to act as fomites even if the surgical field is not grossly contaminated [6]. Post-sterilization contamination of sets containing surgical instruments has been shown to increase the rate of deep SSIs in orthopaedic patients [7].

Airborne contamination in the OR is not constant throughout the perioperative period. Brown et al. [8] demonstrated that bacterial air counts during antiseptic preparation and draping of the patient were 4.4 times higher than during surgery, leading them to recommend opening instruments after patient preparation and draping have been completed. Chauveaux et al. [9] also noted a four-fold increase in airborne contaminants during the preparation of the limb and draping of the patient and recommended against opening of instruments until after the patient has been fully draped.

Two manuscripts clearly address the time-dependent contamination rate of orthopaedic instruments. Dalstrom et al. [10] opened trays in an OR and left the instruments exposed to the environment without an ongoing procedure, but with light traffic. They reported a time-dependent rate of contamination in opened trays, with 4% of trays contaminated by 30 minutes compared to 30% of trays contaminated after 4 hours of exposure. Trays opened and then subsequently covered with a sterile towel were protected from contamination ( $p = 0.02$ ). Although this finding does not give a clear guideline for how long a sterile tray can be exposed to the open environment before the contamination risk becomes unacceptable (i.e., causes surgical wound infections), the authors demonstrated a direct correlation between the exposure times of open instrument trays and the risks of bacterial contamination. Coverage of the implants with a sterile towel mitigated the risk to a significant degree. Bible et al. [11] demonstrated similar protection from contamination with a sterile towel, but have contradicted the time-dependent contamination rate. Covered implants were less likely to be contaminated prior to implantation versus those that were uncovered (2 vs. 16.7%,) in their study. The simple, practical step of covering the surgical tray with a sterile towel significantly reduced the contamination risk. Therefore, no matter the expected duration of a case, implant tray coverage is a simple way to reduce the risk of contamination once a tray has been opened.

Based on the limited available data, a moderate conclusion can be made. Instrument trays should be kept in sterile packaging and opened only after the patient has been prepped and draped. Additionally, instruments should be opened as close to the time that they will be used in the procedure as possible, as there is a time-dependent contamination rate of instruments opened and exposed to the operating room environment.

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