American Journal of Infection Control ■■ (2018) ■■-■■

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Covering the instrument table decreases bacterial bioburden: An evaluation of environmental quality indicators

Troy A. Markel MD [a,*], Thomas Gormley PhD [b], Damon Greeley PE [c], John Ostojic IH [d], Jennifer Wagner PhD, CIC [c]

[a] Department of Surgery, Riley Hospital for Children, Indiana University Health, Indianapolis, IN
[b] School of Concrete and Construction Management, Middle Tennessee University, Murfreesboro, TN
[c] Onsite-LLC, Indianapolis, IN
[d] ARTEC Environmental Monitoring, Indianapolis, IN

Key Words:
Operating room table covers
environmental quality indicators
EQI

Background: Covering the instrument table during surgery may decrease contamination. We hypothesized that (1) covering the instrument table in an operating room (OR) during static periods of nonuse and dynamic periods of active use would dramatically decrease the bacterial bioburden on the table, and (2) the use of sterile plastic table covers would be equivalent to sterile impervious paper covers in reducing the bioburden in a dynamic environment.

Methods: Bacterial contamination of the instrument table was evaluated by settle plates in static and dynamic ORs. Airborne particulate and bacterial contaminants were sampled throughout the room. Tested groups included instrument tables covered with sterile impervious paper covers, sterile plastic covers, or no covers.

Results: Covering the instrument table during static and dynamic operating room conditions resulted in a significantly decreased bacterial load on the instrument table. No differences were seen between paper and plastic covers.

Conclusions: A significant decrease in bacterial bioburden on the instrument table when the table was covered during static and dynamic periods was observed, suggesting the utility for covering the instrument table during periods of nonuse and during active surgeries.

Surgical site infections are a costly aspect of today's health care system.[1] Therefore, finding ways to reduce surgical site infections is of utmost importance, both for patient care and for optimal resource utilization within hospital systems. In this regard, optimizing sterile conditions in the operating room may reduce airborne and subsequent surface contamination to which a patient is exposed. One way to do this while simultaneously reducing costs may be to cover the instrument table during periods of nonuse. If an operation will be delayed, this would allow the instruments and sterile equipment to be protected until the operation can commence.

The 2017 Association of periOperative Registered Nurses (AORN) "Guidelines for Sterile Technique" state, "When there is an unanticipated delay, or during periods of increased activity, a sterile field that has been prepared and will not immediately be used may be covered with a sterile drape,"[2] and also recommends that "when sterile fields are covered, they should be covered in a manner that allows the cover to be removed without bringing the part of the cover that falls below the sterile field above the sterile field."[2] The rationale for this ideology stems from the theory that bringing the part of the cover that was below the sterile field above it may allow air currents to draw microorganisms and other contaminants from the floor and deposit them onto the sterile field.[2]

Despite these recommendations, there are only limited data to support the practice of covering the instrument table during periods of nonuse. AORN previously did not support covering the instrument table with any type of drape or cover because of the potential for contamination of the table when the cover was removed. In 2013 however, they changed their guidance based on 2 studies that demonstrated a significant reduction of instrument contamination when the instruments were covered.[3,4] In one of these studies however, the findings may be more related to the use of ultraclean air

* Address correspondence to Troy A. Markel, MD, Riley Hospital for Children, Indiana University Health, 705 Riley Hospital Dr, RI 2500, Indianapolis, IN 46202.
E-mail address: tmarkel@iupui.edu (T.A. Markel).

Funding/support: Supported by TIDI Products, who manufactured and supplied one of the table covers tested in this study.
Conflicts of interest: None to report.

0196-6553/
https://doi.org/10.1016/j.ajic.2018.02.032

ventilation systems and preparing the instrument tables within this system as opposed to the application of the covers themselves. The researchers found that preparing the instruments in an ultraclean air environment and covering them reduced contamination by 28-fold, whereas covering the instruments in a standard preparation room decreased contamination by only 4-fold.[3]

A 2013 study demonstrated that a sterile plastic drape placed directly on the instrument table was equally as effective as disinfecting the instrument table with 70% alcohol and 1% iodine before placing the instruments on the table.[5] However, previous studies have not examined the use of plastic drapes to sterilely cover instruments during periods of nonuse or during periods of active surgery. Therefore, it is not clear if these types of covers are effective in decreasing the bacterial bioburden on the sterile instrument table.

Realizing there is a need to develop more consistent evidence-based practices, AORN states "The health care organization should develop a standardized procedure in collaboration with infection prevention personnel for covering sterile fields to delineate the specific circumstances when sterile fields may be covered and to specify the method of covering and the length of time a sterile field may be covered."[2] They also note that an easy method of draping and removal will ultimately be most effective and that a standardized mechanism for covering instrument tables when not in use should be used.

Therefore, we set out to investigate the degree of contamination on the instrument table during both static periods of nonuse and during periods of active surgery within an operating room environment. We used a validated mock surgical procedure to test environmental quality indicators.[6] We hypothesized that (1) covering the instrument table in an operating room during static periods of nonuse and dynamic periods of active use would dramatically decrease the bacterial bioburden on the table, and (2) the use of sterile plastic table covers would be equivalent to sterile impervious paper covers in reducing the bioburden in a dynamic environment.

METHODS

Operating room specifications

Static testing took place in 2 operating rooms in the same suite located in a surgery center that was attached to an academic medical center. The rooms had high efficiency particulate air filtration and measured 126.5 m^2 each. The dynamic tests took place in a single operating room in an academic medical center. It measured 194.5 m^2 and also had high efficiency particulate air filtration. All rooms had multiple array diffusers in the ceiling and 2 return grilles at opposite corners of the room. The academic medical center operating room was set for 22 air changes per hour, whereas the surgery center operating rooms were set for 28 air changes per hour.

Static testing

An experimental study was designed to test the effects of covering the instrument table during static conditions. Instrument tables were placed in operating rooms for 4, 8, or 24 hours (9 total tables with 3 tables tested at each time point). They were placed around the periphery of the sterile operating room a minimum of 30.5 cm from the wall, and at the edges of the ceiling diffuser arrays (Fig 1). Tables were 86.4 cm in height, 70 cm in width, and 121.9 cm in length. Standard hospital-issued impervious drapes were placed directly on the table. Several surgical instruments, and blood agar settle plates, were then placed on top of the impervious drapes (6 per table, 18 per time point) using sterile technique (Fig 1). A proprietary, commercially available plastic cover (Sterile Z-TIDI Products, Neenah, WI) was then placed with sterile technique over the top of the instruments and agar plates. Additional settle plates were placed around the periphery of the table on top of the plastic cover to assess the utility of the cover in decreasing bacterial load (6 per table, 18 per time point). After 4, 8, or 24 hours, agar plates on top of the covers were aseptically collected. Two representatives from the commercial plastic cover manufacturer then tore the drape along the proprietary seamed central pleat to remove it. The agar plates that were under the cover were then collected. All plates were stored cold per laboratory instructions for approximately 24 hours while they were shipped under chain of custody. Settle plates were analyzed by the team's microbiologist and quantified as colony forming units (CFU) per plate.

Dynamic testing

Study design

For dynamic testing, a mock surgical procedure that has previously been described was used to simulate real operating room

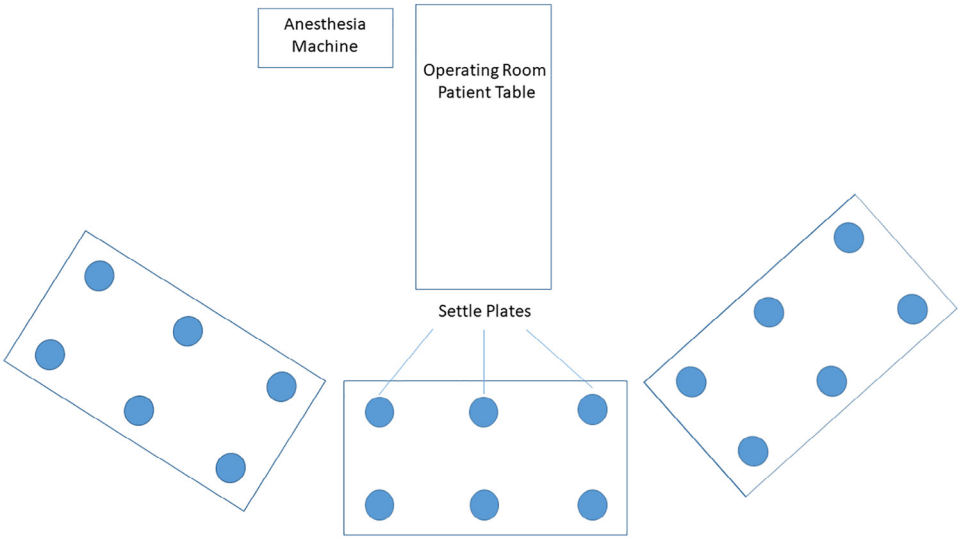

Fig 1. Static test room layout: during static testing, 3 back tables were covered, and bacterial settle plates were placed both under and over the covers for analysis.