Reliability of the sterility of surgical instruments in the operating room: Do we have a problem?

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BACKGROUND

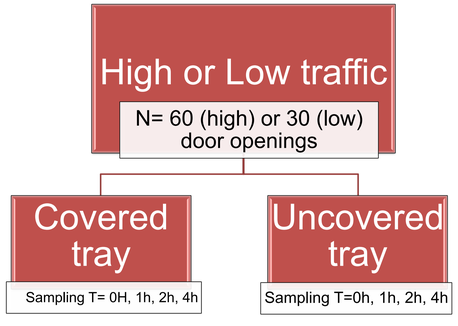
Preventing infections and maintaining instrument sterility as much as possible is an important goal of any surgery and orthopaedic surgery especially.
The aim of this study was to determine whether instrument tray sterility is affected by the amount of time trays are left open in the operating room, and the impact of traffic on bacterial contamination of covered and uncovered open trays.

INTRODUCTION

The sterility of operating-room instruments throughout a surgery, barring any known irregularities, is an assumption currently made by surgeons. However, little is actually known about the validity of this assumption once the trays are opened.
While operating room (OR) conditions are standardized and tightly controlled in order to decrease bacterial wound contamination, some common surgical practices may affect these conditions and allow contamination of surgical instruments. For example, opening operating room doors multiple times during a surgery will affect airflow and airborne particulates despite air filtration and adequate air exchanges[1].

Researchers have found that bacterial contamination of instrument trays is time-dependent and that it can be decreased by covering trays[2].There are no current recommendations concerning the timing of setting up a sterile field and opening surgical trays in relation to room preparation and patient entry and preparation. These practices vary based upon hospital, surgeon and nursing preferences[3,4].
Patient factors can also create unexpected delays that prolong the time instrumentation is open for use, yet instrument availability is a finite resource.

METHODS



Two sterile orthopaedic surgical instrument trays were opened in a positive-air-flow operating room each week for six consecutive weeks (twelve opened trays during the study period, alternating each week between high or low traffic).
Trays were randomly assigned to covered (by surgical drape) or uncovered group and were opened using standard sterile technique.
** Control swabs of freshly opened sterile instruments had no growth.*

RESULTS

Cultures were reported as having “No growth,” or by the number of colonies, recorded as total CFUs. Organisms were identified to the species level.

Table 1. Summary of Total CFUs by Sampling Event

WEEK	OR TRAFFIC	TRAY (COVERED OR UNCOVERED)	TOTAL CFUS	SPECIES (AMOUNT)
1	Low	Covered	0	-
1	Low	Uncovered	0	-
2	High	Covered	1	1
2	High	Uncovered	12	4
3	Low	Covered	0	-
3	Low	Uncovered	1	1
4	High	Covered	0	-
4	High	Uncovered	0	-
5	Low	Covered	0	-
5	Low	Uncovered	0	-
6	High	Covered	0	-
6	High	Uncovered	0	-

Table 2. Characteristics of positive sampling events

WEEK	OR TRAFFIC	TRAY	SAMPLE TIME	SAMPLE LOCATION	ORGANISM TYPE	CFU
2	High	Covered	4	Tray	Staphylococcus epidermidis	1
2	High	Uncovered	2	Combined (tray + inst. Swab)	Staphylococcus epidermidis	1
2	High	Uncovered	4	Tray	Staphylococcus hominis	3
2	High	Uncovered	4	Instrument	Staphylococcus hominis	2
2	High	Uncovered	4	Tray	Micrococcus luteus	4
2	High	Uncovered	4	Instrument	Staphylococcus lugdunensis	2
3	Low	Uncovered	4	Instrument	Bacillus species not anthracis	1

RESULTS

- Specimens taken during the 12 sampling events yielded positive cultures in three swabs of trays (25% of all trays), three swabs of instruments (25% of all instrument sets) and one combined swab of instruments and tray (Table 1). Of culture positive trays, one was in the covered group and two in uncovered group.
- When looking at time after tray opening as a factor of tray sterility, we did observe a time-dependent trend towards increasing contamination after 2-4 hours open. There was no contamination at the 1-hour mark, one contamination event at 2-hour and three contamination events at 4-hours (p= 0.173).
- Bacteria grew, at low colony count from three of 12 instrument trays. Six of 7 positive cultures occurred during high traffic simulation, and 6 of 7 occurred in uncovered trays. Based on a negative binomial regression of total CFUs, neither Traffic (p = 0.130) nor Tray Coverage (p = 0.130) reached statistical significance, but when growth did occur, it was more likely to happen when trays were uncovered, and when OR traffic was high.

DISCUSSION

Bacterial contamination of operating room trays and instruments is not common, but when it does occur it appears to be in the setting of high operating room traffic, and in uncovered trays. We also observed that contamination events were more likely after 2-4 hours from opening the tray.
If a tray is opened but not immediately used, it should be covered to minimize exposure to environmental contaminants. Operating room traffic, especially in implant procedures, should be kept to a minimum.

REFERENCES

1. Tjade OH, Gabor I. Evaluation of airborne operating room bacteria with a Biap slit sampler. *Journal of Hygiene*. 1980;84(1):37-40. doi:10.1017/s0022172400026498.
2. Dalstrom DJ, Venkatarayappa I, Manternach AL, Palcic MS, Heyse BA, Prayson MJ. Time-Dependent Contamination of Opened Sterile Operating-Room Trays. *The Journal of Bone and Joint Surgery-American Volume*. 2008;90(5):1022-1025. doi:10.2106/jbjs.g.00689.
3. Byrnes J, Schmitt J, Tommaso C, Occhino J. 72: Cost reduction techniques in the operating suite: Surgical tray optimization. *American Journal of Obstetrics and Gynecology*. 2017;216(3). doi:10.1016/j.ajog.2016.12.119.
4. Barnes CL, Cooper AM, Luque J, et al. General Assembly, Prevention, Hospital Environment: Proceedings of International Consensus on Orthopedic Infections. *The Journal of Arthroplasty*. 2019;34(2). doi:10.1016/j.arth.2018.09.068.