

Do Protective Lead Garments Harbor Harmful Bacteria?

BRIAN F. GROGAN, MD; WILLIAM C. CRANSTON, DSC, PA-C; DONNA M. LOPEZ, RN, BSN;
CHRISTOPHER FURBEE, PA-C, DSC; CLINTON K. MURRAY, MD; JOSEPH R. HSU, MD;
SKELETAL TRAUMA RESEARCH CONSORTIUM

abstract

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This study attempted to identify and characterize bacteria present on shared-use protective lead shielding garments worn in the operating room. Those worn at the authors' institution were collected and swabbed in designated 5×5-cm areas. Swabs were sent to the clinical laboratory for bacterial isolation and identification. All isolates were identified using standard microbiological methods. Isolates then underwent antimicrobial susceptibility testing as per standard hospital procedures. Of 182 total collected swabs, bacteria were isolated on only 5 (2.7%) samples. Coagulase-negative *Staphylococci* was identified on 3 samples and the remaining 2 grew coagulase-negative *Staphylococci* and gram-positive rods. The collection sites for these isolates were the lead apron, midline, bottom outer surface (n=3), thyroid shield midline, inner surface (n=1), and skirt midline, bottom inner surface (n=1). Of the collected samples, 98.3% were negative for bacterial growth. The remaining isolates were consistent with common skin flora. No multi-drug resistant organisms were identified on any garments. Standard cleaning procedures at the institution are an effective way to prevent growth of bacteria on shared-use protective lead shielding garments worn in the operating room.

Dr Grogan and Mr Cranston are from the Department of Orthopaedic Surgery; Dr Murray is from Infectious Disease Service, Department of Medicine SAMMC, SAUSHEC; Ms Lopez and Dr Hsu are from the US Army Institute of Surgical Research, Fort Sam, Houston, Texas. Mr Furbee is from the Department of Orthopaedic Surgery, General Leonard Wood Army Community Hospital, Fort Leonard, Wood, Missouri.

Drs Grogan, Murray, and Hsu; Messrs Cranston and Furbee; Ms Lopez; and the Skeletal Trauma Research Consortium have no relevant financial relationships to disclose.

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Correspondence should be addressed to: Brian Grogan, MD, Department of Orthopaedic Surgery, San Antonio Military Medical Consortium, San Antonio Uniformed Services Health Education Consortium, 3851 Roger Brooke Dr, Fort Sam, Houston, TX 78234 (brian.grogan@us.army.mil).

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Intraoperative radiographs are commonly obtained by orthopedic surgeons to confirm fracture reduction or check the placement of hardware used in fracture fixation. At many hospitals, protective lead shielding garments worn during procedures that require the use of radiographic studies are shared among surgeons and operating room staff. Although the majority of the lead shielding is worn under sterilized surgical gowns, there are areas of the shielding, such as the hem of a lead vest, the skirt, or the outer surface of the thyroid shield, that may be open to the surgical environment. The protective lead garments used intraoperatively come into direct contact with health care providers' skin and clothing. Garments may be exposed to patient blood and body fluids preoperatively and postoperatively while transporting and positioning patients. In addition, garments may become contaminated if stored improperly (placed on shelves, stands, or the floor) on a soiled surface. The purpose of this study was to identify potential bacterial colonization of shared-use protective lead garments used in the operating room.

MATERIALS AND METHODS

This study was conducted at a 224-bed (with expansion capability to 450-bed) Level 1 trauma center with 12 main operating rooms. Normal hospital protocol for cleaning shared-use protective lead garments consists of immediate spot cleaning of gross contamination as needed and weekly cleaning every Friday afternoon with isopropanol 14.3% and ethylene glycol monobutyl ether 2.49% CaviWipes Disinfecting Towelettes (Metrex Research Corporation, Romulus, Michigan).

An initial survey of all of the operating rooms and service cores at the authors' institution was conducted to catalogue the number and type of protective lead garments used by the surgeons and operating room staff. All of the shared-use protective lead garments (over-the-shoulder vests, wrap-around skirts, and thyroid neck shields) used in the main operating rooms

at the authors' institution were collected on a Thursday night and swabbed with pre-moistened BBL CultureSwab Collection & Transport System (Becton, Dickinson and Company, Sparks, Maryland) swabs in designated 5×5-cm areas.

The sampled areas were selected because of their proximity to the edges of coverage by a sterile surgical gown, their proximity to the skin of the surgeon or operating room staff, or both. Samples were taken from vests in the midline at the collar and the bottom hem on both the front and back sides, from skirts in the midline at the waist and bottom hem front and back, and from thyroid shields in the midline at the center of the collar front and back. Swabs were sent to the clinical laboratory for bacterial isolation and identification. All isolates were identified using the laboratory's standard microbiological methods.

Swabs were held at 4°C until cultured. Maximum hold time was 12 hours. The swabs were plated onto trypticase soy agar plates with 5% sheep blood (a nutrient growth medium) and MacConkey agar plates (a selective medium). All agar plates were incubated at 37°C and 5% CO₂ for 48 hours. The plates were checked daily for growth. All gram-negative isolates were placed on the Siemens' Walkaway (Siemens Healthcare Diagnostics, Deerfield, Illinois) for identification. All gram-positive isolates were catalase tested. Catalase-positive isolates were tested for coagulase and were also gram stained. The isolates were identified as *Staphylococcus aureus*, coagulase-negative *Staphylococci*, or gram-positive rods. Gram-positive, catalase-negative isolates were gram-stained and then identified using the optochin disc assay, bacitracin disc assay, bile esculin agar, salt broth, and the Christie, Atkins, Munch-Petersen (CAMP) test.

RESULTS

All of the shared-use protective lead vests, skirts, and thyroid shields used in the main operating room were tested. Of 182 total collected swabs, bacteria were

isolated on 5 (2.7%) samples. Coagulase-negative *Staphylococci* was identified on 3 samples, whereas the remaining 2 were mixed cultures growing coagulase-negative *Staphylococci* and gram-positive rods. The collection sites for these isolates were the lead apron, midline, bottom outer surface (n=3); lead thyroid shield midline, inner surface (n=1); and lead skirt, midline, bottom inner surface (n=1).

DISCUSSION

A literature search yielded 2 published studies examining the presence of bacteria on lead garments.^{1,2} An abstract presented by Elsayed et al¹ indicated the presence of coagulase-negative *Staphylococci*, diptherioids, and aerobic spore-bearing organisms on 18 of 19 lead garments worn in the operating room. No effort was made to determine which area of the garments had the highest rates of contamination. The authors reported that bacteria can survive on lead aprons and recommended stricter guidelines for decontamination between procedures. No specific cleaning protocol was proposed. In contrast, a study by Rahmatulla et al² reported no growth from the baseline culture of a protective lead vest used in a dental clinic. No mention of the location of the sample from the single garment tested was made.

It has been previously established that equipment coming into direct contact with multiple health care providers and patients can be colonized with harmful bacteria.³⁻⁶ These studies indicate that hospital keyboards can harbor a variety of organisms including *S. aureus*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, methicillin-resistant *S. aureus*, vancomycin-resistant *Enterococcus*, and others.

A 2005 review article by Neely et al⁵ issued cleaning guidelines based on past computer keyboard contamination studies. Similar findings were reported in a 2006 article by Rutala et al⁶ confirming that hospital keyboards are contaminated with potentially harmful pathogens, but that keyboards can be effectively cleaned with common hospital-grade disinfectants. A study

examining hospital scissors used for patient care indicated that 78% of the scissors samples were colonized with microorganisms; cleaning the scissors with alcohol resulted in sterile repeat cultures in 89% of samples.⁷ Knowing that lead garments are used by multiple providers and potentially come into contact with patients, it seems plausible that the garments may be contaminated with dangerous multi-drug resistant pathogens that could potentially be eliminated by a standardized cleaning protocol.

This study attempted to identify the presence of bacteria on shared-use lead protective garments. Of the 182 samples collected, 5 (2.7%) were positive. The bacteria isolated were common skin flora. The results seem to indicate that the current cleaning protocol in place at our institution, which consists of spot cleaning of gross contamination as needed and scheduled weekly cleaning with Metrex CaviWipes Disinfecting Towelettes, is adequate for the prevention of lead vest colonization with clinically relevant multi-drug resistant bacterial isolates. It is also possible that protective lead garments provide a poor surface for the establishing

and sustaining bacterial growth; perhaps no routine cleaning is needed.

This study had limitations. Standard environmental contamination collection techniques were used. The samples were collected in a clinical environment and had no positive or negative control group to validate our collection methods. The lead garments sampled are produced by several manufactures and have differing surface characteristics; we do not have baseline data regarding the ability of bacteria to colonize the different vest materials.

This study did not identify any clinically relevant bacterial isolates on the shared-use protective lead garments used in the operating room at the authors' institution. Only 2.7% of the collected samples were positive for any bacterial growth; these isolates were consistent with common skin flora. Multi-drug resistant organisms were not identified on the protective lead garments. Basic standard cleaning procedures currently in place at our institution appear effective in preventing bacterial colonization of shared-use protective lead.

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