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CORR Insights®: What Orthopaedic Operating Room Surfaces Are Contaminated With Bioburden? A Study Using the ATP Bioluminescence Assay

William L. Hennrikus MD

Where Are We Now?

In their prospective diagnostic study, Drs. Richard and Bowen used adenosine triphosphate (ATP) bioluminescence to measure

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cleanliness in the orthopaedic operating room (OR). Having originated in the food service industry, this novel method to measure cleanliness is finding its way into the healthcare setting [1, 2, 8]. ATP hydrolysis ($\text{ATP} \rightarrow \text{ADP} + \text{Pi} + \text{energy}$) is found in all living organisms, including bacteria, which makes ATP bioluminescence monitoring a practical technique to measure localized bioburden on contaminated surfaces. This topic is important because bioburden present on surfaces in the OR can potentially lead to postoperative infections [5]. I am not aware of any previous studies that evaluated the use of ATP bioluminescence as a measurement of cleanliness in orthopaedic ORs.

In their study, Drs. Richard and Burden demonstrated that multiple OR surfaces are not as clean as we would anticipate. In fact, the authors contend

that if one were to compare the results of their study to the criteria set forth by the restaurant industry, surfaces such as the OR light handles, patient positioners, and the right side of the OR table headboard would not pass restaurant standards. Decreasing the risk of postoperative infections is a major focus of all hospitals and surgeons [7]. For example, the Surgical Care Improvement Project and the American Academy of Orthopaedic Surgeons both emphasize the importance of minimizing nosocomial orthopaedic infections [4, 10].

Where Do We Need To Go?

Contaminated OR surfaces can increase the risk of orthopaedic infections particularly after procedures in which instrumentation is used and hardware implanted [3, 6]. Given the profound impact that surgical site infections have on patient outcomes, appropriate cleaning techniques in the OR is vitally important. ATP bioluminescence is a useful tool to measure

W. L. Hennrikus MD (✉)
Department of Orthopaedics, Penn State
College of Medicine, 30 Hope Drive,
Hershey, PA 17033, USA
e-mail: whennrikus@hmc.psu.edu

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the effectiveness of OR cleaning and sterilization protocols. We need to rethink our OR cleaning and sterilization protocols. Generally, the recommended tool for monitoring cleaning efficacy is visual assessments, but visual assessment alone does not always provide an accurate measure of surface cleanliness [9].

The authors of the current study found that OR surfaces such as the undersurface of the OR table headboard, Bair Hugger™ buttons, and tourniquet machine buttons should be routinely cleaned as part of a hospital protocol. Beyond those recommendations, we need more research that evaluates the direct correlation between ATP bioluminescence and clinical infection. The logical next step in this line of research would be determining the reliability of the ATP bioluminescence method in the OR environment.

How Do We Get There?

Evaluating microbiological samples taken from OR surfaces and correlating them with increased bioburden found with ATP bioluminescence technology can help promote improved surgical cleaning practices. Although the results of the current pilot study are promising, the direct correlation between ATP bioluminescence and

clinical infection was not evaluated by Drs. Richard and Bowen. A prospective study comparing the ATP bioluminescence method to actual microbiologic cultures of the same surfaces should be performed in order to determine the reliability of the ATP bioluminescence method in the OR environment. If ATP is found to be reliable, then current OR cleaning and sterilization protocols should be changed from visual inspection of surface cleanliness to chemical tests such as ATP. The use of ATP testing may identify environmental surfaces that require additional cleaning prior to the next surgical case. Improved cleanliness of hospital surfaces can reduce the risk of nosocomial postoperative surgical infections [7, 10]. Within orthopaedic surgery, where implantation of hardware is common, reducing the risk of environmental contamination is imperative.

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