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WINTER 2016

CODECOMMUNICATIONS

Hospital-acquired Infections and the Benefits of Using Disposable Medical Equipment during Resuscitation Events

Introduction

Hospital-acquired infections (HAIs) can be caused by a variety of pathogenic infectious agents—viruses, fungi, and most frequently, bacteria. The most common are bloodstream infections, followed by ventilator-associated pneumonia (VAP), urinary tract infections (UTI), and surgical-site infections. They are often a byproduct of poor sanitation practices within the hospital. Many of these infectious agents are part of the normal flora of health care workers, but given the weakened state of most hospitalized patients, they are easily transmitted through direct contact with the patient—a recipe for disaster.

Due to the increase in invasive procedures and the resistance of pathogenic organisms to many antibiotics, HAI are on the rise. In 2011, an estimated 722,000 patients contracted an infection during a stay in an acute-care hospital in the US, and about 75,000 of them died as a result of it.[1] This equates to more than 200 deaths every day from HAI. More recent data put the death rate at more than 99,000 deaths per year.[1]

Cast of Characters

The Centers for Disease Control and Prevention (CDC) published a report on antibiotic resistance in 2013, listing the most dangerous pathogens in the United States (Table 1).

Clostridium difficile (C. difficile) is the causative agent of a life-threatening diarrhea. These infections primarily occur in people who have had both recent medical care and antibiotics, often in hospitalized or recently hospitalized patients. The most common cause of health care–associated infections in U.S hospitals, *C. difficile* was responsible for approximately 453,000 infections and 29,000 deaths in the U.S. in 2011, according to the CDC.[2] Estimates of related medical costs range from in excess of $1 billion to more than $4 billion per year in acute-care facilities.[3,4] Deaths related to *C. difficile* increased 400% between 2000 and 2007, making this the most deadly pathogen hospitalized patients and hospital staff have to fear.[3,4]

Pathogen	Threat Level
Clostridium difficile	Urgent
Carbapenem-resistant Enterobacteriaceae	Urgent
Drug-resistant *Neisseria gonorrhoeae*	Urgent
Multidrug-resistant *Acinetobacter*	Serious
Drug-resistant *Campylobacter*	Serious
Fluconazole-resistant *Candida* (a fungus)	Serious
Extended spectrum ß-lactamase producing Enterobacteriaceae (ESBLs)	Serious
Vancomycin-resistant *Enterococcus* (VRE)	Serious
Multidrug-resistant *Pseudomonas aeruginosa*	Serious
Drug-resistant non-typhoidal *Salmonella*	Serious
Drug-resistant *Salmonella Typhi*	Serious
Drug-resistant *Shigella*	Serious
Methicillin-resistant *Staphylococcus aureus* (MRSA)	Serious
Drug-resistant *Streptococcus pneumoniae*	Serious
Drug-resistant tuberculosis	Serious
Vancomycin-resistant *Staphylococcus aureus* (VRSA)	Concerning
Erythromycin-resistant Group A *Streptococcus*	Concerning
Clindamycin-resistant Group B *Streptococcus*	Concerning

Table 1 – Most common pathogens causing hospital-acquired infections and their threat levels

Based on *Antibiotic Resistance Threats in the United States, 2013*, published by the Centers for Disease Control and Prevention.

Second on the list but equally concerning is Carbapenem-resistant Enterobacteriaceae (CRE). Untreatable and hard-to-treat infections from CRE bacteria are on the rise among patients in medical facilities. CRE have become resistant to nearly all the antibiotics we have today. Almost half of hospital patients who get nosocomial bloodstream infections from CRE die from the infection. It causes 9,000 infections per year and 600 deaths annually; however, this is expected to rise sharply given its antibiotic-resistant nature.[3,4]

Cost to Healthcare

According to the most recent report on health care–associated infections from the CDC, one of every 25 patients will suffer from an HAI, lengthening the stay in the ICU to an average of 8 additional days.[1] This can heavily impact the hospital budget as these infections are no longer covered by Medicare. Under a 2008 provision to the Medicare Modernization Act, most payments from Medicare for treatment of a secondary infection that was acquired in the hospital are prohibited. Total costs are estimated to be between $4.5 and $5.7 billion annually.[3] Only 5% of these health care–associated infections resulted in the admission of the patient being reclassified to a higher DRG, leaving the hospital to absorb 95% of the costs. Figure 1 summarizes some of the factors and costs associated with hospital-acquired infections.

Over 99,000 deaths per year in the United States
Increased ICU stay 8: days
Increased average hospital stay: between 7.4 and 9.4 days
Total dollar cost: between $4.5 and $5.7 billion
Average cost per infection: $13,973
Increased total cost per patient who survives: approximately $40,000

Figure 1 – Hospital-acquired infections metrics[6]

Lessons Learned from 2014 Ebola Outbreak

The recent outbreak of Ebola in Africa was unprecedented, with over 17,000 cases and 6,487 confirmed deaths. While mainly contained to Western Africa, five health workers as well as one photojournalist were flown to the United States for treatment. In one case, two health care workers in Dallas became infected and tested seropositive from direct contact with an infected patient.

What we learned from the outbreak is how ill-equipped we were at dealing with a highly infectious agent on U.S. soil. Lack of personal protective equipment and negative-pressure patient confinement rooms were just a few examples of the lack of preparedness. More rigorous protocols and training programs to deal with pathogenic epidemics are now in place, but other mechanisms can be implemented to reduce transmission.

What Can Health Workers Do to Reduce HAI?

Rigorous sanitation protocols, training, and handwashing are paramount to reducing the spread of pathogens that could cause HAI, but there are a few other steps and precautions that can be taken in the hospital.

Reusing medical equipment is a major source of introducing secondary infections. It is essential to sterilize all reusable medical equipment that touches a patient by autoclaving (steam sterilizing). However, a fair amount of equipment (particularly devices with electronics) cannot be immersed in a fluid without damaging the device. All medical device equipment has an ingress protection (IP) rating to let you know if it can be cleaned by moist heat or bleach. An IP rating chart is available online at http://www.dsmt.com/resources/ip-rating-chart. Only a device rated IP68 can be autoclaved, one of the few ways to ensure that not only all pathogens but also any spore-forming bacteria as well as viruses have been removed. Spore-forming bacteria include *C. difficile*, the "urgent" threat level pathogen responsible for a majority of the HAI.

The Case for Disposable Electrodes and CPR Sensors

CPR feedback devices are highly recommended by the American Heart Association to help achieve high-quality CPR, which has been linked to improved patient outcomes.[7,8] These devices are available from different manufacturers in both reusable and disposable forms. Those that are reusable should be sterilized if used on another patient as infectious agents can reside in body fluids, such as sweat, blood, saliva, and vomit. However, several devices now on the market do not carry an IP rating

any higher than 55, which means they cannot be steam sterilized (Figure 2). In addition, rubber gaskets around these devices make them particularly susceptible to hosting infectious agents and more challenging to clean with bleach.

ZOLL offers a disposable CPR sensor that completely eliminates this issue, yet provides vital information on CPR quality, such as depth and rate (Figure 3). The CPR sensor is attached to the electrode, so there are no additional cables and nothing extra that has to be put in place, which saves crucial time during a resuscitation.

With training, good protocols in place, and the use of disposable medical equipment, such as CPR feedback sensors whenever possible, HAI can be contained, and costly and time-consuming outbreaks of *C. difficile* can be greatly reduced.

Figure 2 – Examples of reusable CPR feedback devices that cannot be steam cleaned.

Figure 3 – Disposable CPR Feedback Device

About the Author:

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