

## From the Desk of the Editor

# Infection Control in ICU: What an intensivist can do to reduce ICU-acquired infections

Ridwan Naim Faruq, Anika An-noor

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The intensive care unit (ICU) is a specialized unit found at hospitals with the sole purpose of delivering care to patients who are critically ill. These patients require interventions and close monitoring that are not available or feasible at a regular medical or surgical ward. Patients in ICUs are at high risk for healthcare-acquired infections (HAI) due to the high prevalence of invasive procedures and devices, induced immunosuppression, comorbidity, frailty and increased age.<sup>1</sup>

The most frequent ICU-acquired infections are pneumonia {including ventilator-associated pneumonia (VAP)}, surgical site infections (SSI), central line associated bloodstream infections (CLABSI) and catheter-associated urinary tract infections (CAUTI).<sup>2</sup> Moreover, these infections prolong ICU and hospital stays, increase antibiotic consumption and inflate the costs of care.<sup>1</sup> Intensivists can play a significant role in reducing the rate of ICU-acquired infections by implementing various practices.

Based on Infectious Disease Society of America (IDSA) guidelines, Hospital-acquired pneumonia (HAP), also known as nosocomial pneumonia, refers to pneumonia that develops 48 hours or more after a patient's admission to the hospital.<sup>3</sup> A specific subset of HAP is ventilator-associated pneumonia (VAP), which occurs in individuals who are intubated and receiving mechanical ventilation for more than 48 hours.<sup>3</sup> VAP also includes HAP that develops within 48 hours of extubation.<sup>3</sup> Risk factors commonly associated with HAP/VAP include older age<sup>4</sup>, sedation<sup>5</sup>, aspiration<sup>6</sup>, and reintubation or prolonged intubation<sup>7</sup>. Essential practices that are recommended by IDSA for preventing VAP include avoiding intubation and preventing reintubation when possible (eg, using noninvasive ventilation or high-flow oxygen by nasal cannula instead) and minimizing sedation through the use of sedative protocols<sup>8</sup>. Additionally, practices to prevent aspiration are emphasized, including<sup>8</sup>:

- Elevating the head of the bed.
- Providing oral care with toothbrushing.
- Draining subglottic secretions in ventilated patients.
- Maintaining endotracheal tube airway cuff pressure within the range of 20 to 30 cm H<sub>2</sub>O.
- Application of positive end-expiratory pressure.

CLABSIs are also common in the ICU. In general, the risk of CLABSI is comparatively elevated in the following circumstances: femoral or internal jugular placement compared with subclavian placement<sup>9</sup>, submaximal compared with maximal (mask, cap, sterile gloves, gown, large drape

etc) barrier precautions during insertion<sup>10</sup> and multiple-lumen compared with single-lumen peripherally inserted central catheters (PICCs)<sup>11</sup>. Methods to prevent CLABSIs include<sup>12</sup>:

- **Maximal barrier precautions:** Barrier precautions are essential during catheter placement to minimize the risk of infection. This includes the use of a mask, cap, sterile gown, sterile gloves, and a sterile full-body drape for the patient.
- **Insertion of central venous catheter:** The avoidance of femoral vein insertion, in favor of the internal jugular or subclavian vein, is recommended due to a higher risk of infection associated with femoral catheterization.(2.7 versus 1.3 per 1000 catheter-days)<sup>13</sup>.
- **Strict adherence to universal care strategies:** Maintaining rigorous hand hygiene practices and employing aseptic no-touch techniques during dressing changes or when handling catheters are crucial measures for preventing catheter-associated infections.
- **Use of chlorhexidine:** Chlorhexidine solution is preferable over povidone-iodine solution during routine catheter care and handling.
- **Remove unnecessary central venous catheters –** Performing a daily review of central venous catheter necessity is recommended, with prompt removal of unnecessary central venous catheters.

CAUTIs also contribute to ICU-acquired infections. In general, the most important aspects of prevention of catheter-associated urinary tract infections (UTI) are avoidance of unnecessary catheterization, use of sterile technique when placing the catheter, and removal of the catheter as soon as possible<sup>14</sup>.

*C. difficile* infections (CDI) acquired during ICU stay can further complicate hospital course. Dramatic increases in the incidence and severity of health care-associated CDI occurred after 2000, particularly in patients over age 65<sup>15</sup>. Antibiotic use is the most widely recognized and modifiable risk factor for CDI<sup>16</sup>. The antibiotics most frequently implicated in predisposition to CDI include fluoroquinolones, clindamycin, and broad-spectrum penicillins and cephalosporins. However, any antibiotic can predispose to colonization by *C. difficile*. The use of broad-spectrum antimicrobials, use of multiple antibiotic agents, and increased duration of antibiotic therapy all contribute to the incidence of CDI<sup>16</sup>. Gastric acid suppression (with proton pump inhibitors [PPIs] or histamine

2 receptor antagonists) has been associated with an increased risk of CDI. The risk of CDI ranges from 1.4 to 2.75 times higher among patients with PPI exposure compared with those without PPI exposure.<sup>16</sup> Therefore, intensivists can play a crucial role in the prevention of CDI primarily by minimizing the use of antibiotics when possible along with the acid suppression therapy in ICU patients.

Respiratory viral infections including COVID-19 infections acquired during ICU stay can contribute to mortality and morbidity to ICU patients and therefore prevention of COVID is very crucial. Patients who are COVID-19 positive should ideally be in an airborne infection isolation room which include utilizing single-patient room with >6 to 12 air exchanges per hour with negative-pressure.<sup>18</sup> When this is not possible, patients with confirmed COVID-19 can be housed together.<sup>18</sup> All personnel who enter the room of a patient with suspected or confirmed COVID-19 should wear personal protective equipment (PPE) to reduce the risk of exposure including the use of a gown, gloves, ideally a respirator (minimally, a medical mask), and eye or face protection.<sup>18</sup> Patients with confirmed or suspected COVID-19 should wear a medical mask if being transported out of the room (eg, for studies that cannot be performed in the room).<sup>18</sup>

Immunocompromised patients including solid organ transplant recipients, hemopoietic stem cell patients and end stage renal disease patients on dialysis are particularly vulnerable groups of patients and therefore they require special attention. Dialysis patients with temporary dialysis lines are at risk developing CLABSIs and therefore intensivists play a crucial role in enforcing preventive measures (outlined in paragraph 4). Transplant recipient patients are particularly prone to infections and certain preventive measures that have been shown to be effective include proper hand hygiene and adequate isolation measures. In regards to hand hygiene, alcohol-based hand hygiene is more effective than traditional soap and water in cleansing hands of bacteria.<sup>19</sup> Wearing gown and gloves when entering a patient room and removing them prior to or shortly after exiting decrease transmission of multidrug-resistant bacteria, including Methicillin Resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), and carbapenem-resistant and ESBL-producing gram-negative organisms (*A. baumannii*, *P. aeruginosa*, Enterobacterales). These precautions should be routinely implemented when caring for ICU patients who have a history of or are found to have infection or colonization with resistant organisms.<sup>19</sup>

ICU-acquired infection is a growing concern due to increasing hospital and ICU stay, cost of hospitalization and therefore intensivists can play a significant role in the reduction of these infections through implementing various practices.



Ridwan Naim Faruq  
MD, Am. Board Certified in Internal Medicine,  
Fellow, Department of Infectious Disease,  
University of Texas Southwestern Medical Centre,  
Dallas, Texas, USA.  
E-Mail: ridwan.faruq@utsouthwestern.edu



Anika An-Noor . MBBS,  
Medical Scribe,  
Texas Oncology-Baylor Scott White Medical Centre  
Dallas, Texas , USA  
E-Mail : anika.an.noor@gmail.com

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