NEWS

Reducing Antimicrobial Resistance and Hospital-Associated Infections: The Role of the Hospitalist

The Hospitalist. 2005 September;2005(9)

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While infections that develop during hospitalization may appear to be an uncommon but recognized risk of hospital care today, the incidence of these infections has been increasing dramatically during the last 2 to 3 decades, and the risk of acquiring an organism that is resistant to 1 or more antibiotics is becoming increasingly common. Recent studies estimate that approximately 2 million patients contract healthcare-associated infections each year (1). These infections are the most common type of serious adverse event in health care, affecting up to 5–10% of hospitalized patients, leading to approximately 90,000 deaths annually, and adding approximately $5 billion to annual healthcare costs (1-3). Increasingly, healthcare-associated infection risk is viewed as a patient safety issue, as many of these infections may be avoidable or preventable by following evidence-based best practices in infection control and patient care while patients are hospitalized. This article will summarize some of the overlap between patient safety and infection control, explain some of the pressures that have led to development and cultivation of antimicrobial resistance, and describe the Centers for Disease Control and Prevention (CDC) campaign for prevention of healthcare-associated infections and antimicrobial resistance, as well as the role of hospitalists in such prevention.

Patient Safety

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) specifically identifies in its 2005 National Patient Safety Goals that hospitals and clinicians reduce the risk of healthcare-associated infections. The goals

encourage clinicians to comply with current CDC hand hygiene guidelines and that hospitals and clinicians *manage as sentinel events* all identified cases of unanticipated death or permanent loss of function associated with a heathcare-associated infection. A sentinel event is defined by JCAHO as an unexpected occurrence involving death or serious physical or psychological injury. Such an event signals the need for immediate investigation and response by the institution. By including healthcare-associated infections in this category of high-risk event, with potential morbidity and mortality, JCAHO highlights the frequency and importance of infections acquired in our healthcare system today.

Further, the Agency for Healthcare Research and Quality (AHRQ) recently published an evidence-based report, developed and written primarily by hospitalists, delineating 79 patient safety practices, of which 22 (28%) involved infection control (4). At least 5 of these 22 infection control practices were considered valuable enough, and with sufficiently strong supporting evidence, to mandate widespread implementation. Additionally, the Institute for Healthcare Improvement (IHI; www.ihi.org) recently launched its 100,000 Lives Campaign, enlisting hundreds of hospitals around the United States in a commitment to implement changes that have been proven to prevent avoidable deaths. Three of their first 6 interventions involve the reduction of healthcare-associated infections, including central-line infections, surgical-site infections, and hospital-acquired pneumonia.

Increasingly, hospital-onset infections have become a patient safety issue, and they will remain under public and institutional scrutiny while hospitals take efforts to reduce their incidence and improve care quality. Hospitalists have evolved to serve a unique role as advocate of both patients and hospitals. They should therefore foster quality improvement in the hospital, as well as lead and support initiatives that reduce hospital-acquired infections and resistance.

Healthcare-Associated Infections and Development of Resistance

Bacteria have developed multiple microbiologic and genetic mechanisms to elude antimicrobial agents. Certain practices in medical care, whether intentional or not, can promote persistence or spread of resistant microbes that can cause infections. Such practices may include:

- Inattention to basic infection control measures (e.g., hand washing)
- Unrecognized colonization (e.g., treating colonized urinary or vascular catheters, without evidence of infection)
- Unrecognized reservoirs (e.g., environmental)

- Selective pressure from overuse or inappropriate use of antibiotics
- Movement of patients and staff within a single institution and between institutions

Inappropriate use or overuse of antibiotics can actually remove or “select” the sensitive microbes and promote overgrowth of resistant organisms when present. Each of these practices may serve as a focus for quality improvement interventions to reduce resistance.

Most healthcare-associated infections (more than 80%) originate from 4 specific patient sites: urinary tract, surgical-site (wound), bloodstream, and lung (pneumonia) (5). It is not coincidental that these infection sites are frequently associated with invasive procedures, and many times with indwelling invasive devices that may be used during the course of inpatient care. For example, urinary tract infections, the most common hospital-acquired infections, are usually associated with urinary catheter use. Similarly, bloodstream infections are usually associated with intravascular catheters, and hospital-acquired pneumonia is usually associated with ventilator use.

Because many of the invasive devices that are utilized during the course of inpatient care carry significant risk, including infection risk, it is incumbent upon hospitalists to be aware of these risks, to explain these risks to their patients, and to take all steps at their disposal to help reduce such risk in their patients. Dr. Julie Gerberding, Director of the CDC, has emphasized that the 2 greatest predictors of infection risk in the hospital are length of stay and use of invasive devices (6). While excellent evidence already demonstrates that hospitalists reduce length of stay (7), they should also spearhead the efforts to minimize the use of invasive devices whenever possible, and lead evidence-based efforts to minimize infection in hospitalized patients when invasive devices must be used.

Prevention of Resistance: Best Practices

CDC/SHM Collaboration

In September 2003, the Society of Hospital Medicine (SHM) and the CDC entered into a collaborative agreement to educate hospitalists about the reduction of hospital-acquired infections and the prevention of antimicrobial resistance. The long-term goals of this agreement include developing quality-improvement initiatives and research in the area of antimicrobial resistance reduction. The short-term goals include development of educational materials and resources for hospitalists aimed at reducing hospital-acquired infections and resistance. SHM has provided instruction in the reduction of hospital-acquired infections and antimicrobial resistance, in workshop format, to its membership at national, regional, and local chapter meetings.

SHM has also developed an Internet-based educational tool for antimicrobial resistance on its Web site, which will soon be transformed into a new Web-based Resource Room to educate membership on antimicrobial resistance and reduction of hospital-acquired infections.

CDC Campaign

(www.cdc.gov/drugresistance/healthcare/)

The CDC, in collaboration with the National Institutes of Health (NIH) and the Food and Drug Administration (FDA), as well as professional societies, healthcare organizations, public health agencies, and corporate partners, has developed its Campaign to Prevent Antimicrobial Resistance to facilitate the implementation of educational and behavioral interventions that will assist clinicians in appropriate antimicrobial prescribing. The goals of these intervention programs are to improve clinician practices and prevent antimicrobial resistance. The campaign focuses on 4 main strategies: prevent infection, diagnose and treat infection, use antimicrobials wisely, and prevent transmission. Multiple 12-step programs have been developed (or are in the process of development), targeting specific patient populations, including hospitalized adults, dialysis patients, surgical patients, hospitalized children, and long-term-care patients. Each of these patient populations is relevant to the practicing hospitalist, who may access the educational materials and resources cost-free on the Internet. The CDC provides on-line resources (Web site listed above), including a downloadable slide-set, a 12-step fact sheet, and tips for patients. The program translates existing scientific evidence and national guidelines into *action steps* that can be taken now to prevent antimicrobial resistance.

The 12 Steps to Prevent Antimicrobial Resistance in Hospitalized Adults was the first intervention program to be initiated, because hospital patients are at especially high risk for serious antimicrobial-resistant infections. The rate of multiple drug-resistant organisms causing infection within our hospitals is increasing at a rapid rate. Currently, national data demonstrate that more than 50% of *Staphylococcus aureus* isolates causing infections in intensive care units (ICUs) are resistant to methicillin (MRSA), while more than 40% are resistant in other non-ICU hospital units (9). Similarly, gram-negative organisms have developed resistance, with more than 25% of *Pseudomonas aeruginosa* ICU isolates now resistant to fluoroquinolones (9), with a much higher percentage resistant at some institutions. This rapidly growing problem has led the CDC to develop the following 12 Steps to Prevent Antimicrobial Resistance in Hospitalized Adults:

Prevent Infection

1. Vaccinate

2. Get the catheters out

Diagnose and Treat Infection Effectively

3. Target the pathogen
4. Access the experts

Use Antimicrobials Wisely

5. Practice antimicrobial control
6. Use local data
7. Treat infection, not contamination
8. Treat infection, not colonization
9. Know when to say “no” to vanco
10. Stop treatment when infection is cured or unlikely

Prevent Transmission

11. Isolate the pathogen
12. Break the chain of contagion

These steps are designed to optimize patient safety and the outcome of infectious disease management, and hospitalists have the ability to utilize these recommendations to improve the care of their patients.

Hospitalists must employ efforts to prevent infections that may occur during hospitalization as well as those that may bring patients back to the hospital. Such efforts include predischarge influenza and pneumococcal vaccination when indicated, to reduce the more than 100,000 hospitalizations and 20,000 deaths due to influenza and the more than 12,000 deaths due to *Streptococcus pneumoniae* (10). Clinicians should get annual influenza vaccines as well, to reduce transmission to patients and to other healthcare workers.

Because catheters and other invasive devices are the No. 1 cause of hospital-acquired infections, evidence-based efforts must be utilized to reduce the likelihood of such infections. An estimated 250,000 catheter-related bloodstream infections (CR-BSI) occur each year, with an attributable cost of at least $25,000 per infection and an attributable mortality of 12–25% (11). Because of this, the CDC has recommended adherence to *performance indicators* for reducing bloodstream infections (8,12). Such performance indicators are based on strong evidence (13-15) and include the following:

1. Appropriate site selection for catheter placement (i.e., subclavian over femoral or internal jugular) (14)
2. Appropriate hand hygiene and aseptic technique (including use of maximal sterile barriers) during catheter placement

3. Adequate skin asepsis (using chlorhexidine preferentially over iodine or alcohol based solutions) (15)
4. Catheter discontinuation when no longer essential
5. Antibiotic-impregnated catheters in high-risk patients

Recent studies have demonstrated that CR-BSI can be significantly reduced or even virtually eliminated with educational efforts combined with strict adherence to evidence based guidelines for prevention, as well as efforts to remove catheters early (16).

To diagnose and treat infections effectively, hospitalists must obtain appropriate cultures, target *empiric* therapy to the likely pathogens and local antibiogram data, and target *final* therapy to the known pathogens and antimicrobial susceptibility test results. The correct regimen, timing, dosage, route, and duration of antibiotic can impact morbidity and mortality in patients presenting with infectious diseases. Therefore, careful selection becomes crucial, and accessing infectious disease expertise in complex or critically ill patients with infectious diseases can be lifesaving.

Wise or appropriate use of antimicrobials can be facilitated by multiple efforts within hospitals. First, practicing antimicrobial control at the institutional level may involve use of standardized antimicrobial order forms, formulary restrictions, prior approval to start or continue specific antimicrobials, pharmacy substitution or switch, multidisciplinary drug utilization evaluation, provider performance feedback, or computerized decision support ordering systems. Many of these efforts can reduce costs while improving outcomes. Second, because the prevalence of resistance can vary by location, patient population, hospital unit, and length of stay, knowledge of the inpatient population that one treats (e.g., community vs. tertiary care, immunocompetent vs. immunosuppressed, or ICU vs. non-ICU) as well as the local antibiogram can help clinicians make decisions regarding initial antimicrobial selections.

Third, curbing antimicrobial overuse can be fostered by avoiding treatment of contamination or colonization. Contaminated cultures may be reduced by using and advocating proper antisepsis for blood cultures and other culture specimens. Recognition of organisms unlikely to represent true bacteremia (e.g., *Corynebacterium*), as well as those very likely to represent true bacteremia (e.g., *Staphylococcus aureus* or Entero-bacteriaceae), and interpreting culture results within clinical context help clinicians effectively treat positive cultures when indicated and avoid treating contaminants. Additionally, recognizing when cultures from urinary catheters, intravascular catheters, and endotracheal tubes represent colonization rather than infection and taking active steps to obtain accurate (rather than colonized) cultures can further curb nonindicated

antibiotic use. For example, routinely sending catheter tips for culture is not indicated. Also, urinalysis should always accompany urine cultures sent from urinary catheters. Fourth, stopping antimicrobial therapy when infections are cured, cultures are negative and infection unlikely, or when infection is not diagnosed also limits antimicrobial overuse.

Finally, prevention of infection transmission from patient to patient or from healthcare worker to patient can be accomplished by use of standard infection control precautions, use of appropriate isolation precautions and handling of bodily fluids, and accessing infection control experts when questions arise. Frequent and effective hand hygiene as well as empowering all hospital staff to take part in and enforce infection control measures will help reduce transmission of infection by healthcare personnel.

In summary, antimicrobial resistance and hospital-acquired infections represent an enormous issue for patients, providers, hospitals, and the public. Hospitalists are positioned to take a large role in improving patient safety by supporting, following, and advocating the recommended guidelines and evidence-based measures to reduce the incidence of hospital-acquired infections at the local and national levels. Great investment of time, resources, and efforts in quality-improvement initiatives are necessary to reduce resistance, reduce infection, and improve overall outcomes for our patients.

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