Antimicrobial Stewardship: The Role of Vascular Access Teams

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Abstract

Interventions that address the increasing threat of multidrug resistance are the responsibility of all health care disciplines. Vascular access teams ensure that vascular access needs are met, facilitating antimicrobial agent administration. Competent vascular access practice includes participation on interprofessional teams and provision of expert knowledge that enables medication administration and process monitoring.

Keywords: *antibiotic stewardship, antimicrobial stewardship, process improvement*

Introduction

The use of antibiotics and other antimicrobial agents in the provision of health care are ubiquitous. The influence of their use, whether appropriate or inappropriate, is part of the current discussion regarding antimicrobial stewardship and links to development and selection of multidrug-resistant pathogens. Although antimicrobial stewardship has been a discussion for more than 2 decades, the discussion has become increasingly important when considering patient outcomes in all settings where care is delivered. Antimicrobial stewardship is now a national agenda. The National Action Plan for Combating Antimicrobial Resistant Bacteria[1] released by the White House in early 2015 stresses the importance of creating antibiotic stewardship programs in all acute care hospitals. Payers such as the Centers for Medicare and Medicaid Services have also attached importance to these programs by including them in program conditions of participation.[2] These plans and standards are based on Centers for Disease Control and Prevention Core Elements of Hospital Antibiotic Stewardship Programs[3] recommendations and include the following:

- Leadership commitment: Dedicating necessary human, financial, and information technology resources;
- Accountability: Appointing a single leader responsible for program outcomes;
- Drug expertise: Appointing a single pharmacist leader responsible for working to improve antibiotic use;
- Action: Implementing at least 1 recommended action, such as systemic evaluation of ongoing treatment need after a set period of initial treatment (eg, antibiotic time out after 48 hours);
- Tracking: Monitoring antibiotic prescribing and resistance patterns;
- Reporting: Regular reporting information on antibiotic use and resistance to doctors, nurses, and relevant staff; and
- Education: Educating clinicians about resistance and optimal prescribing.

These recommendations seem to coalesce around the activities of prescribers, pharmacists, and microbiologists who examine what is being ordered, if the orders adhere with guidelines and drug prescribing information, and the targeted organisms. Consequently, on the surface it appears that antimicrobial stewardship responsibilities are limited to these disciplines with extension into a leadership and quality arena focusing on monitoring and sharing of information. However, if the overarching goals of stewardship programs are to improve patient outcomes, then responsibilities regarding antimicrobial stewardship extend beyond those disciplines and represent a touchstone program for which there are tangible responsibilities across the entire facility.

Patient Case and Management

A 64-year-old woman was admitted to the hospital with elevated body temperature. Upon evaluation in the emergency department, she was noted to have a temperature of 102.5°F and was hemodynamically unstable. She was

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subsequently admitted to our intensive care unit where blood cultures were obtained. The initial Gram's stain yielded gram-positive cocci and after 24 hours, cultures were positive for staphylococci. A transesophageal echocardiogram identified vegetation on her mitral valve. Treatment was initiated using a continuous infusion of nafcillin through her single vascular access device. Two days later, she spiked a fever of 103°F and repeat blood cultures again identified staphylococci.

Upon investigation of the patient's continued positive blood cultures, it was noted that the nafcillin infusion was more than 12 hours behind schedule. That is, the patient had missed 12 hours of dosing over the course of the prior 24 hours. Since her first day of admission, she had received other medications that were not compatible with nafcillin, so her dosing had been interrupted on multiple occasions. No additional vascular access had been inserted or attempted.

Discussion

The case study introducing this discussion introduces a paradigm for the roles and responsibilities regarding antimicrobial stewardship relevant to those professionals who are part of vascular access teams. Information that follows will provide a dissection of the case aiming to connect professional responsibilities of vascular access teams, nursing, pharmacy, quality, the executive leadership, and infection prevention and control as a means of demonstrating the wider responsibility and opportunity that exists to address stewardship program interventions.

Vascular Access Teams

A major responsibility of vascular access teams is to use knowledge regarding intended treatments or interventions and forecast vascular access needs of an individual patient. In this particular instance, it can be assumed that this patient would require at least maintenance intravenous fluids, the continuous nafcillin infusion, antipyretics, and vasopressors. Continuous nafcillin infusion needs to be exactly that—a continuous, uninterrupted infusion. In this patient, with only a single vascular access device, her continuous infusion was interrupted as part of her care, but prioritization of her care resulted in inadequate treatment of her admitting problem. Part of the vascular access team's responsibility is to assist in the evaluation of patient need, or have a process in place that can be used by nursing staff to achieve mutual care goals. Under the old paradigm of antibiotic administration, doses may have been scheduled to be given every 4 hours. If a dose was late or missed, a subsequent dose would be administered shortly thereafter and little patient influence may have resulted. In contemporary treatment, we now understand the pharmacokinetics and dynamics of antibiotics, leading to another step toward precision medicine—continuous exposure of the pathogen to the drug used for treatment. This may be accomplished via continuous antibiotic infusion for some treatment regimens. Interruption of the infusion in this case resulted in a failure to adequately treat a patient with confirmed endocarditis. In this situation, the vascular access team was complicit in a failure to facilitate appropriate administration of this antibiotic, resulting in a potentially compromised outcome. Their role in stewardship was to enable the receipt of the proper dose of nafcillin through continuous infusion via adequate vascular access. The Table provides an example of surveillance that a vascular access team might perform in response to the findings from this case.

Table. Vascular access team surveillance: Antimicrobial stewardship monitoring example

Surveillance of patients receiving sequential dosing of antimicrobial agents
(A) Number of patients with documentation indicating 1 or more missed doses of antimicrobial agent
(B) Number of patients ordered to receive sequential antimicrobial agents
Proportion of missed sequential antimicrobial dosing = A/B × 100
Surveillance of patients receiving continuous dosing of antimicrobial agents
(A) Number of patients where rate of continuous flow is not congruent with amount administered
(B) Number of patients ordered to receiving continuous antimicrobial agents
Proportion of missed continuous antimicrobial dosing = A/B × 100

Nursing

It is the responsibility of nursing personnel to administer medication as ordered. If there is failure to administer medication as ordered, protocols should be in place to report and remedy the barriers. In this situation, at least 12 hours' worth of infusion were not administered to this patient. This indicates that there were likely multiple episodes of infusion interruption and multiple opportunities to correct the process deviations. As the primary health care workers responsible for medication management, nurses carry a responsibility for following the Medication Management Standards that are part of accreditation. The Centers for Medicare and Medicaid Services and accrediting organization such as The Joint Commission specifically address safe medication management, which includes administration, monitoring, and evaluation processes. Relevant medication management standards include MM.06.01.01, MM.07.01.03, and MM.08.01.01.[4] In this case study, it is unclear if nursing understood the importance of continuous infusion and the influence of missed dosing. In this instance, antimicrobial stewardship involves training and assurance of staff competence when antimicrobial agents are administered as well as monitoring of adherence to medication administration policies and procedures.