

HOSPITAL PHYSICIAN®

INFECTIOUS DISEASES BOARD REVIEW MANUAL

STATEMENT OF EDITORIAL PURPOSE

The *Hospital Physician Infectious Diseases Board Review Manual* is a study guide for fellows and practicing physicians preparing for board examinations in infectious diseases. Each manual reviews a topic essential to current practice in the subspecialty of infectious diseases.

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Prevention and Management of Vascular Access Device–Related Infections

Series Editor:

Mary E. Klotman, MD

Chief, Division of Infectious Diseases, Mount Sinai School of Medicine, New York, NY

Contributor:

David P. Calfee, MD, MS

Associate Professor of Medicine, Division of Infectious Diseases, Mount Sinai School of Medicine, New York, NY

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Prevention and Management of Vascular Access Device–Related Infections


David P. Calfee, MD, MS

INTRODUCTION

Percutaneous central venous catheters and totally implanted central venous access devices (often known as “ports”) allow for the administration of life-sustaining and life-saving therapies. As with other invasive devices and procedures, however, there are several recognized complications associated with their use. Noninfectious complications include bleeding, venous thrombosis, and pneumothorax (particularly associated with insertion of catheters into the subclavian vein). Infectious complications include local infections at the site of the device and systemic infections. The infectious complications of vascular access devices are associated with substantial morbidity and mortality. Thus, clinicians must have a thorough understanding of the pathogenesis, diagnosis, treatment, and prevention of the infectious complications of vascular access devices in order to optimize the safety of patients who require these devices.

CASE STUDY

INITIAL PRESENTATION

 A 52-year-old man was admitted to the hospital 10 days ago with severe alcohol-related pancreatitis. His course was complicated by the systemic inflammatory response syndrome and respiratory failure requiring transfer to the intensive care unit (ICU) 8 days ago. His pancreatitis is resolving but he remains orally intubated. He has a triple-lumen central venous catheter and a urinary catheter. Overnight, he developed a new fever to 38.2°C (100.8°F). Physical examination reveals no obvious sources of infection. There is no erythema, swelling, increased warmth, or discharge at the exit site of his internal jugular vein catheter. His ventilatory requirements and the quantity and characteristics of his pulmonary secretions have not changed. A chest radiograph is abnormal but unchanged as compared

with those of the past several days. Laboratory data includes an elevated white blood cell count (17,800/mm³). Blood cultures are pending.

- **What is the pathogenesis of vascular access infections?**
- **What types of infections can result from vascular access devices?**
- **How are vascular access infections diagnosed?**
- **What is the microbiology of vascular access infections?**

PATHOGENESIS OF VASCULAR ACCESS INFECTIONS

Clinical infection is typically preceded by asymptomatic bacterial or fungal colonization of the catheter or other access device. There are a number of ways in which these devices can become colonized. First, microorganisms can colonize the external surface of the catheter. This can be the result of contamination of the device during insertion or migration of microorganisms from the site where the catheter enters the skin along the external surface of the catheter. Another way in which colonization can occur is introduction of microorganisms into the catheter hub or port during access or other manipulation of the device with subsequent colonization of the internal surface of the catheter. Electronic microscopy studies have suggested that in short-term catheters, colonization of the external catheter surface predominates.¹ In catheters that have been in place for more than 10 days, colonization of the internal or luminal surface of the catheter begins to equal or surpass external colonization. Less frequent causes of vascular access device colonization include hematogenous spread of microorganisms from a distant site of infection and administration of contaminated products (eg, medications or blood products) through the device.

An important feature of catheter colonization is the production of biofilm, a complex polysaccharide secreted by many organisms that are common causes of vascular access–related infections. This biofilm can form on the external or internal surface, or both surfaces, of the device. Biofilm plays an important role in the