



Entrustable Professional Activities

EPA 2 for Pediatric Infectious Diseases

EPA 2: Management and Prevention of Infections Associated with Medical/Surgical Devices, Surgery, and Trauma

Supervision Scale for This EPA

1. Trusted to observe only
2. Trusted to contribute with direct supervision and coaching as a member of a collaborative effort to improve care at the patient and institutional levels
3. Trusted to contribute without direct coaching as a member of a collaborative effort to improve care at the patient and institutional levels
4. Trusted to lead collaborative efforts to improve care for populations and improve systems at the institutional level
5. Trusted to lead collaborative efforts to improve care at the level of populations and systems at the regional and/or national level

Description of the Activity

A key role for subspecialists is to provide consultation for the care of children with complex, prolonged, or antimicrobial-resistant infection related to a medical/surgical device, surgery, or trauma and to advise best practices in prevention of such infections and instances when removal of a device is indicated.

Examples include: ventriculo-peritoneal shunt and other CNS device-associated and surgical-associated infections; osteomyelitis and deep wound infections associated with laminectomy/vertebral rod placement; prolonged/persistent bloodstream infection associated with intravascular catheter or cardiac shunt/graft/prosthetic valve; life-threatening infection following trauma or burn; complicated infections following surgery involving the mediastinum, the gastrointestinal or genito-urinary tract; diagnosis and management of uncommon (e.g., fungal or mycobacterial) or antimicrobial-resistant infections associated with a device, surgery, or trauma.

The specific functions which define this EPA include:

1. Demonstrating knowledge of particular microorganisms including virulence and pathogenicity associated with specific medical devices, surgical procedures, and types of trauma and other risk related factors by generating a prioritized differential diagnosis
2. Obtaining a targeted history suspecting/supporting a diagnosis and recognizing complications
3. Performing a targeted physical examination suspecting/supporting a diagnosis and recognizing complications
4. Focusing laboratory and microbiologic investigations to confirm diagnosis and suspected complications, providing recommendations to surgery teams regarding operative cultures for microbiologic studies
5. Targeting specific antimicrobial choice, dosing, delivery, combinations to optimize outcome
6. Advising appropriate surgical removal/retention of a device or debridement based on clinical evidence, review of case-specific evidence in the medical literature, and an understanding of the associated risks of each approach
7. Forging an investigative collaboration with other health providers including surgeons, pediatric subspecialists, and infection control practitioners to identify case-related infection prevention error(s) and system failures and to plan quality improvement measures for prevention



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Judicious Mapping to Domains of Competence

- Patient Care
- Medical Knowledge
- Practice-Based Learning and Improvement
- Interpersonal and Communication Skills
- Professionalism
- Systems-Based Practice
- Personal and Professional Development

Competencies Within Each Domain Critical to Entrustment Decisions

PC 7:	Developing management plans
MK 2:	Practicing EBM
PBLI 4:	Analyzing practice
PBLI 9:	Educating others
ICS 3:	Communicating with health professionals
SBP 2:	Coordinating care
SBP 6:	Identifying system errors
PPD 6:	Providing leadership to improve care

Context for the EPA

Rationale: Pediatric infectious diseases (ID) physicians must be able to diagnose and treat children in multiple medical settings with complex, prolonged, or antimicrobial-resistant infections related to a medical/surgical device, surgery, or trauma and to advise best practices in prevention of such infections and instances when removal of a device is indicated.

Scope of Practice: The scope of practice for a pediatric ID clinician includes consultative work in both inpatient and outpatient settings. A major duty of the ID clinician is to provide education for the consulting providers. Anticipatory guidance should be provided to patients and families, and realistic treatment goals should be set. The patient population includes neonates through young adults, and sometimes beyond. This document addresses the scope of knowledge and skills of the Pediatric ID physician caring for patients with infection related to a medical/surgical device, surgery, or trauma, including complex, prolonged, or antimicrobial-resistant infection.

Curricular Components That Support the Functions of the EPA

1. Demonstrating knowledge of particular microorganisms including virulence and pathogenicity associated with specific medical devices, surgical procedures, and types of trauma and other risk related factors by generating a prioritized differential diagnosis
 - Identifies the organisms, knows the frequency, discusses the differences in potential severity of infection between the organisms to which patients with urinary catheters, intravascular catheters, central nervous system catheters, cardiac shunt/graft/valves, orthopedic devices, peritoneal catheters, and patients undergoing mechanical ventilation are most susceptible (e.g., pan-susceptible *E. coli* vs. Extended Spectrum Beta-lactamase [ESBL])



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- Identifies the organisms, knows the frequency, and knows the differences in potential severity of infection between the organisms to which patients with different surgical procedures (e.g., mediastinal, gastrointestinal, or genito-urinary tract) are most susceptible (e.g., Gram negative bacilli and anaerobes in the setting of intestinal surgery)
 - Identifies the organisms, knows the frequency, and knows the differences in potential severity of infection between the organisms that cause infection in the setting of trauma, based on the type of trauma and where the injury occurred. (e.g., *Aeromonas* or *Vibrio sp.* in a water-related injury)
 - Develops a pathogen specific differential diagnosis based on the specific clinical scenario including device type, surgical procedures, and/or trauma
2. Obtaining a targeted history suspecting/supporting a diagnosis and recognizing complications
- Determines possible risk factors for various infecting organisms, including behavioral, geographic, and medically related risk factors
 - Recognizes the clinical manifestations of infections in patients with urinary catheters, intravascular catheters, central nervous system catheters, cardiac shunt/graft/valves, orthopedic devices, peritoneal catheters, and patients undergoing mechanical ventilation
 - Knows that the risk of infection is highest in the immediate postoperative period
 - Explains how the time course between placement of a surgical device and the development of infection influences the likely etiology of infection
 - Recognizes the importance of gathering an adequate history with regard to infection prevention strategies related to the surgery or device placement
3. Performing a targeted physical examination suspecting/supporting a diagnosis and recognizing complications
- Determines the general state of the patient to be acutely, subacutely, or chronically ill and understands that the time course of physical exam findings influences the likely etiology of infection (e.g., rapid onset of symptoms with *pain out of proportion* to exam findings as seen with necrotizing fasciitis).
 - Distinguishes abnormal and key normal exam findings relevant to the suspected device-related infectious process on physical exam (e.g., phlebitis in a tunneled catheter)
 - Interprets physical exam findings in the context of the patient's history and clinical features of the suspected infectious process including unusual pathogens (e.g., nontuberculous mycobacteria in the setting of contaminated traumatic wound)
 - Recognizes that failure to heal a surgical wound may represent underlying infection even in the absence of other signs of inflammation (especially in the immune-compromised host)
4. Focusing laboratory and microbiologic investigations to confirm diagnosis and suspected complications; providing recommendations to surgery teams regarding operative cultures for microbiologic studies
- Applies a working knowledge of appropriate specimen collection, handling, and processing, and test performance characteristics in the decision to obtain a given test (e.g., sensitivity, specificity, positive and negative predictive value)
 - Determines the appropriate cultures and stains to obtain based on the potential pathogen (e.g., fungal stain and culture of tissue from dirt contaminated open wound)



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- Knows what laboratory studies are needed based on the potential type of infection (e.g., cerebrospinal fluid [CSF] white blood cell [WBC] count/differential, protein, and glucose to evaluate possible ventriculoperitoneal [VP] shunt infection)
- Communicates to the appropriate service what studies are needed and the appropriate manner to collect the specimen (e.g., tissue for nucleic acid testing to be placed in sterile specimen cup)
- Determines the settings in which it is most appropriate to obtain culture and/or molecular testing (e.g., nucleic acid testing for difficult to culture organisms or in the setting of prior antimicrobial therapy)
- Analyzes culture/test results within the clinical context of the patient to determine the likelihood of a diagnosis (e.g., differential time to positivity in the diagnosis of central line-associated blood stream infection [CLABSI])
- Recognizes infection may be present even in the setting of normal laboratory markers (e.g., normal CSF WBC in coagulase negative staphylococcal VP shunt infection)
- Determines appropriate imaging studies to evaluate extent of infection based on clinical context (e.g., abdominal ultrasound for VP shunt related pseudocyst)
- Recognizes that there are circumstances in which it is recommended to stop or withhold antibiotics prior to obtaining cultures

5. Targeting specific antimicrobial choice, dosing, delivery, combinations to optimize outcome

- Develops an empiric therapeutic management plan for the following common medical/surgical device, surgery or trauma infections based on the most likely etiology of infection: CLABSI, Candidemia, ventricular shunt infection, post-operative abdominal infection, orthopedic hardware associated infection, dog/cat bite
- Recognizes host factors that influence the likelihood of certain pathogens and chooses correspondingly appropriate antimicrobial therapy (e.g., Gram-negative rod CLABSI in a total parenteral nutrition [TPN] dependent child with short gut syndrome)
- Utilizes past culture results when available to better tailor empirical antimicrobial therapy (e.g., child with prior history of colonization or infection with ESBL)
- Recognizes sites that require higher antimicrobial dosing (e.g., central nervous system infections) and knows that some antimicrobials don't reach necessary levels in certain tissue compartments
- Knows the appropriate mode of antimicrobial delivery (e.g., parenteral vs. enteral) for common medical/surgical device, surgery or trauma infections listed above
- Uses susceptibility results including minimum inhibitory concentrations (MICs) to determine definitive therapy and instances when more specific resistance testing should be performed (e.g., MIC to vancomycin of 2 mg/L)
- Uses antimicrobial specific PK/PD data to target appropriate therapy
- Identifies when combination therapy may be indicated to treat an infection (e.g., considering addition of rifampin for treatment of hardware associated infection)
- Develops an appropriate plan to select second-line antimicrobials in the setting of drug allergies, interactions, or other contraindications to typical empiric therapy
- Makes a plan to escalate therapy in situations in which the patient is not clinically improving and/or as the clinical diagnosis evolves
- Advises surgical teams on the optimal timing of and appropriate agents of perioperative antibiotics

6. Advising appropriate surgical removal/retention of a device or debridement based on clinical evidence, review of case-specific evidence in the medical literature, and an understanding of the associated risks of each approach



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- Knows the typical indications for removal of a central venous line (CVL) in the setting of CLABSI/Candidemia (e.g., infection due to *Staphylococcus aureus*, tunnel infection)
 - Knows the typical indications for removal of other medical/surgical devices including ventricular shunt, baclofen pump, vagal nerve stimulator, orthopedic hardware, and cardiac devices (such as pacemakers and artificial heart valves)
 - Acknowledges that in certain situations infected hardware may not be able to be removed without significant risk and develops a management plan in collaboration with the surgical team and the patient
 - Recognizes that infection may recur in situations where a medical/surgical device is retained and educates the consulting service and patient/family on sign/symptoms of recurrence of device associated infection
 - Advocates for debridement of necrotic or infected tissue in the setting of device associated and/or trauma associated infections
7. Forging an investigative collaboration with other health providers including surgeons, pediatric subspecialists, and infection control practitioners to identify case-related infection prevention error(s) and system failures and to plan quality improvement measures for prevention
- Plans infection prevention strategies related to prevention of surgical or device infection (e.g., use of antibiotic impregnated catheter)
 - Maintains collaborative communication with surgeons, other pediatric subspecialists, the microbiology laboratory, and infection control practitioners to be able to identify failures in the system that may lead to increases in infection rates
 - Recognizes if postoperative infection rates increase and participates in a root cause analysis to investigate possible reasons (e.g., perioperative prophylactic antibiotics not being given at the appropriate time)
 - Explains strategies to mitigate root cause(s) of infection identified by quality improvement methods to decrease post-op infection rates
 - Knows when to alert the Department of Public Health in the setting of a device associated infection outbreak (e.g., contaminated heart valves or ventricular shunts)

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