

1.09 CENTRAL NERVOUS SYSTEM INFECTIONS

Introduction

Central nervous system (CNS) infections in children can cause significant morbidity and mortality and require prompt diagnosis and management. CNS infections include meningitis, encephalitis, infections of CNS implanted devices, parameningeal infections, spinal epidural abscesses, and others. The common infectious pathogens and predisposing risk factors vary by infection type, as do the overall severity of illness and the expected outcome. Likewise, the type and severity of infection dictates the choice of pharmacological and other therapeutic agents. To optimize outcomes, management often requires coordination of care with subspecialists, including infectious disease physicians, neurologists, neurosurgeons, and others. Pediatric hospitalists are uniquely equipped to provide both coordinated acute care and develop an integrated transition plan for post-discharge care and placement.

Knowledge

Pediatric hospitalists should be able to:

- Discuss the most common etiologic agents of different CNS infections for children of varying chronological ages and predisposing factors.
- Discuss the common presenting signs and symptoms of CNS infections, including those features that differentiate meningitis, encephalitis, parameningeal infections (including brain abscess, subdural empyema, and intracranial epidural abscess), and spinal epidural abscess, considering variation in presentation by chronological age.
- Discuss how the presence of comorbid conditions, such as immunocompromised status, implanted CNS devices, developmental delay, and others, may impact or alter some elements of the history and physical examination.
- Discuss the impact of cerebrospinal fluid (CSF) shunts on risk for CNS infection, particularly in the first month following shunt placement, as well as the indications for shunt tap, shunt externalization, and/or removal.
- Review alternative diagnoses that may mimic the presentation of CNS infection, such as autoimmune diseases involving the CNS, stroke, toxidromes, psychiatric disorders, neoplastic syndromes, and others.
- List predisposing conditions for parameningeal infections, including sinusitis, otitis media, mastoiditis, and orbital cellulitis.
- Discuss appropriate microbiologic, virologic, and serologic tests utilized to establish a diagnosis, including the use of indirect sampling from rectal or nasopharyngeal sites.
- Discuss the risks, benefits, indications, and contraindications for lumbar puncture.
- Compare and contrast CSF analysis values found in bacterial, viral, fungal, parasitic, and aseptic meningitis, encephalitis, and parameningeal infections.
- Explain the indications for imaging of children with meningitis, encephalitis, ventricular infections, and parameningeal infections, stating the modality of choice for each diagnosis.

- Compare and contrast the value of computed tomography versus magnetic resonance for diagnostic imaging of CNS infections of the head, neck, and spine, attending to sedation needs, local availability, radiation exposure, and contrast versus non-contrast images.
- Discuss initial antimicrobial therapy for CNS infections, and how this varies by age, site of infection, presence of CSF shunt, CNS drug penetration, and regional microbial drug resistance patterns.
- Describe the most common acute complications of CNS infections, including fluid and electrolyte imbalance, seizures, and increased intracranial pressure.
- Explain patient characteristics that indicate a requirement for higher level of care and/or monitoring for children with CNS infection.
- Discuss the prognosis and long-term sequelae of different CNS infections.
- Describe criteria, including specific measures of clinical stability, which must be met before discharging or transferring patients with CNS infections.

Skills

Pediatric hospitalists should be able to:

- Elicit a thorough medical history, with emphasis on elements that may distinguish between types of CNS infections.
- Perform a thorough physical examination, to elicit key features of various types of CNS infections, such as mental status changes and focal versus global neurological findings.
- Perform a lumbar puncture as indicated or coordinate lumbar puncture with appropriate subspecialists when assistance is required.
- Initiate an empiric antimicrobial regimen based on patient history, underlying comorbid conditions, and initial diagnostic testing.
- Tailor antibiotic regimens and duration of therapy based on microbiologic culture and sensitivity data, as well as the patient's clinical condition and underlying comorbidities.
- Adhere consistently to proper infection control practices.
- Perform frequent careful reassessments, note changes in clinical status, manage acute complications, and identify indications for transfer to a higher level of care.
- Engage and coordinate consultants, such as neurologists, neurosurgeons, infectious diseases specialists, rehabilitation therapists, and others when indicated, including those whose support is required by the presence of neurological sequelae.
- Coordinate care with subspecialists and the primary care provider to arrange an appropriate transition plan for hospital discharge inclusive of therapies, school needs, and psychosocial support.

Attitudes

Pediatric hospitalists should be able to:

- Realize responsibility for sensitive and clear communications with the family/caregivers regarding diagnosis, treatment plans, and potential neurologic sequelae, engaging consultants as appropriate.

- Recognize the importance of collaboration with subspecialists and the primary care provider to ensure coordinated longitudinal care for children with CNS infections.
- Advocate and work with hospital and community leaders to assure that proper services are available for children requiring short and long-term support services.

Systems Organization and Improvement

In order to improve efficiency and quality within their organizations, pediatric hospitalists should:

- Lead, coordinate, or participate in the development and implementation of cost-effective, safe, evidence-based care pathways to standardize the evaluation and management for hospitalized children with CNS infections.

References

1. Tunkel AR, Glaser CA, Bloch KC, et al. The management of encephalitis: clinical practice guidelines by the Infectious Diseases Society of America. *Clin Infect Dis*. 2008;47(3):303-327. <https://doi.org/10.1086/589747>.
2. Harrison C. Focal Suppurative Infections of the Nervous System. In: Long SS, Prober CG, Fischer M, eds. *Principles and Practice of Pediatric Infectious Diseases*. 5th ed. Philadelphia, PA: Elsevier, 2017:329-340.