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Current Guidelines For Management Of Acute Bacterial Meningitis In The Emergency Department

In this issue of *EM Practice Guidelines Update*, 3 practice guidelines addressing the diagnosis and management of bacterial meningitis are reviewed. These recommendations focus on the approach to the initial assessment of a patient with suspected bacterial meningitis and the initial therapy, including antibiotics and corticosteroids. There is considerable controversy around these topics, and the guidelines do differ on several points. The reader should also note the guidelines reviewed here address different age groups: National Institute for Health and Clinical Excellence (NICE) addresses children and young people, European Federation of Neurological Societies (EFNS) addresses older children and adults, and Infectious Diseases Society of America (IDSA) addresses all ages.

Bacterial meningitis is a life-threatening neurological and infectious disease emergency. Acute bacterial meningitis (ABM) is one of the top 10 causes of infection-related death worldwide, and many survivors suffer permanent neurologic sequelae.[1] Emergency providers must therefore have a considered approach to the patient with possible ABM in order to make the diagnosis and initiate appropriate therapies efficiently and effectively.

Practice Guideline Impact

- Patients strongly suspected of having ABM should receive antibiotics prior to lumbar puncture (LP) if the LP will be delayed for any reason (such as while obtaining a computed tomography [CT] scan).
- Empiric antibiotics for suspected ABM include a third-generation cephalosporin plus vancomycin. In addition, ampicillin should be given in the very young and the elderly.
- While controversial, adjunctive steroids are recommended for older children and adults with suspected *Streptococcus pneumoniae* meningitis and should be given before or with the first dose of antibiotics, if possible.

February 2011
Volume 3, Number 2

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Editor's Note: To read more about this publication and the background and methodologies for practice guideline development, go to: http://www.ebmedicine.net/introduction

EB MEDICINE

Management Of Bacterial Meningitis And Meningococcal Septicaemia In Children And Young People Younger Than 16 Years In Primary And Secondary Care[2]

National Institute for Health and Clinical Excellence (UK). Link: http://www.nice.org.uk/nicemedia/live/13027/49339/49339.pdf

This document was developed by the National Collaborating Centre for Women's and Children's Health (NCC-WCH) and was commissioned by the National Institute for Health and Clinical Excellence (NICE), an arm of the British National Health Service (NHS). These guidelines were published in 2010 and were developed by a multidisciplinary panel representing pediatrics, general practice, infectious disease, and public health. Conflicts of interest were specified for each member of the Guideline Development Group as well as employees of the NCC-WCH.

Stages of the NICE guideline development process are explicitly stated in Section 2 of the full guideline published by the Royal College of Obstetricians and Gynaecologists (http://www.nice.org.uk/nicemedia/live/13027/49437/49437.pdf). The literature review was carried out according to prespecified criteria using literature through June 2009. Specific search strategies and terms are available in Appendix E. Evidence was graded based on a hierarchical system as shown in Tables 2.4 and 2.6 of the full guideline. Interventional studies were evaluated for quality of evidence according to predefined criteria and assigned to 1 of 8 classes (1++,1+, 1-, 2++, 2+, 2-, 3, 4). Studies of the accuracy of diagnostic tests were similarly evaluated and assigned to 1 of 5 classes (Ia, Ib, II, III, IV). Strength of recommendations was not graded.

This guideline is targeted to those who work in or use the NHS in England, Wales, and Northern Ireland, especially healthcare professionals involved in the care of children and young people. Cost-effectiveness was explicitly considered in making these recommendations. The recommendations refer to all patients aged under 16 years.

Excerpted recommendations retain original numbering of the NICE guideline linked at http://www.nice.org.uk/nicemedia/live/13027/49339/49339.pdf. Only recommendations pertinent to emergency medicine are excerpted here.

1.1 Bacterial Meningitis And Meningococcal Septicemia In Children And Young People - Symptoms, Signs, And Initial Assessment

1.1.1 Consider bacterial meningitis and meningococcal septicemia in children and young people who present with [these] signs and symptoms. [This is a partial list from Table 1]

- Fever
- Vomiting/nausea
- Lethargy
- Irritability
- Ill appearance
- Refusing food/drink
- Headache
- Muscle ache/joint pain
- Respiratory symptoms/signs or breathing difficulty
- Non-blanching rash
- Stiff neck
- Altered mental state
- Shock
- Seizures
- Meningeal signs, or focal neurologic deficit

- Be aware that some children and young people will present with mostly non-specific symptoms or signs, and the conditions may be difficult to distinguish from other less important (viral) infections presenting in this way.

1.2 Pre-Hospital Management Of Suspected Bacterial Meningitis And Meningococcal Septicemia

1.2.1 Primary care healthcare professionals should transfer children and young people with suspected bacterial meningitis or suspected meningococcal septicemia to secondary care as an emergency.

1.2.2 Transfer children and young people with suspected bacterial meningitis without non-blanching rash directly to secondary care without giving parenteral antibiotics.

1.2.3 If urgent transfer to hospital is not possible... administer antibiotics to children and young people with suspected bacterial meningitis.

1.2.4 [In those with] suspected meningococcal disease (meningitis with non-blanching rash or meningococcal septicemia) give parenteral antibiotics (intramuscular or intravenous benzylpenicillin) at the earliest opportunity, either in primary or secondary care, but do not delay urgent transfer to hospital to give the parenteral antibiotics.

1.3 Diagnosis In Secondary Care

Investigation and management in children and young people with petechial rash

1.3.2 Give intravenous ceftriaxone immediately to children and young people with a petechial rash if any of the following occur at any point during the assessment (these children are at high risk of having meningococcal disease):

- Petechiae start to spread
- The rash becomes purpuric
- There are signs of bacterial meningitis
- There are signs of meningococcal septicemia
- The child or young person appears ill to a healthcare professional

1.3.3 If a child or young person has an unexplained petechial rash and fever (or history of fever), carry out the following investigations:

- Full blood count
- Measurement of C-reactive protein (CRP)
- Coagulation screen
- Blood culture
- Whole-blood polymerase chain reaction (PCR) for *Neisseria meningitides*
- Blood glucose
- Blood gas

1.3.4 In a child or young person with unexplained petechial rash and fever (or history of fever), but none of the high-risk clinical manifestations [see symptom list on page 2]:

- Treat with intravenous ceftriaxone immediately if the CRP and/or white blood cell count (especially neutrophil count) is raised, as this indicates an increased risk of having meningococcal disease.

Polymerase chain reaction tests for bacterial meningitis and meningococcal disease

1.3.8 Perform whole blood real-time PCR testing for *N meningitidis* to confirm a diagnosis of meningococcal disease.

Performing lumbar puncture and interpreting cerebrospinal fluid (CSF) parameters for suspected bacterial meningitis

1.3.16 Do not allow lumbar puncture to delay the administration of parenteral antibiotics.

1.3.18 In children and young people with suspected meningitis or suspected meningococcal disease, perform a lumbar puncture unless any of the following contraindications are present:

- Signs suggesting raised intracranial pressure
  - Reduced or fluctuating level of consciousness (Glasgow Coma Scale score less than 9 or a drop of 3 or more)
  - Relative bradycardia and hypertension
  - Focal neurological signs
  - Abnormal posture or posturing
  - Unequal, dilated, or poorly responsive pupils
  - Papilledema
  - Abnormal "doll's eye" movements
- Shock
- Extensive or spreading purpura
- After convulsions until stabilized
- Coagulation abnormalities

- Coagulation results (if obtained) outside the normal range
- Platelet count below 100 x 10^9/L
- Receiving anticoagulant therapy

- Local superficial infection at the lumbar puncture site
- Respiratory insufficiency (lumbar puncture is considered to have a high risk of precipitating respiratory failure in the presence of respiratory insufficiency)

1.3.21 Start antibiotic treatment for bacterial meningitis if the CSF white blood cell count is abnormal:
- In neonates, 20 cells/microliter or more
- In older children and young people, more than 5 cells/microliter or more than 1 neutrophil/microliter, regardless of the other CSF variables

Cranial computed tomography in suspected bacterial meningitis
1.3.27 Use clinical assessment and not cranial CT to decide whether it is safe to perform a lumbar puncture. CT is unreliable for identifying raised intracranial pressure.

1.3.28 If a CT scan has been performed, do not perform a lumbar puncture if the CT scan shows radiological evidence of raised intracranial pressure.

1.3.30 Do not delay treatment to undertake a CT.

Management In Secondary Care

Antibiotics for suspected bacterial meningitis or meningococcal disease
1.4.1 Treat children aged 3 months or older with suspected bacterial meningitis without delay using intravenous ceftriaxone.

1.4.2 Treat children younger than 3 months with suspected bacterial meningitis without delay using intravenous cefotaxime plus amoxicillin or ampicillin.

1.4.3 Treat suspected meningococcal disease without delay using intravenous ceftriaxone.

1.4.4 Treat those children and young people with suspected bacterial meningitis who have recently traveled outside the UK or have had prolonged or multiple exposure to antibiotics (within the past 3 months) with vancomycin in addition to the above antibiotics.

1.4.8 If herpes simplex meningoencephalitis is part of the differential diagnosis, give appropriate antiviral treatment.

Corticosteroids

1.4.39 Do not use corticosteroids in children younger than 3 months who have suspected or confirmed bacterial meningitis.

1.4.40 Give dexamethasone (0.15 mg/kg to a maximum dose of 10 mg, 4 times daily for 4 days) for suspected or confirmed bacterial meningitis as soon as possible if the lumbar puncture reveals any of the following:
- Frankly purulent CSF
- CSF white blood cell count greater than 1000/uL
- Raised CSF white blood cell count with protein concentration greater than 1 g/L
- Bacteria on Gram stain

1.4.42 If dexamethasone was not given before or with the first dose of antibiotics, but was indicated, try to administer the first dose within 4 hours of starting antibiotics, but do not start dexamethasone more than 12 hours after starting antibiotics. ■

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Practice Guidelines For The Management Of Bacterial Meningitis[3]

Clinical Infectious Disease. 2004;39:1267-1284. Link: http://cid.oxfordjournals.org/content/39/9/1267.full

This guideline was developed by the Infectious Diseases Society of America and was published in 2004. The document was authored by a multidisciplinary group composed of infectious disease specialists (pediatric and adult) as well as a neurologist and a neurosurgeon. The specific methodology used for creating these guidelines was not reported.

Evidence was evaluated for quality according to predefined, specified criteria and assigned to 1 of 3 classes (I, II, III). Recommendations were graded A, B, C, D, E, based on the strength of evidence.

A: Good evidence to support a recommendation for use; should always be offered.

B: Moderate evidence to support a recommendation for use; should generally be offered.

C: Poor evidence to support a recommendation; optional.

D: Moderate evidence to support a recommendation against use; should generally not be offered.

E: Good evidence to support a recommendation against use; should never be offered.

Conflicts of interest were reported and included authors consulting for, receiving grant support from, and serving on the speaker's bureau for various pharmaceutical companies.

Only recommendations pertinent to emergency medicine are excerpted here.

Which Patients With Suspected Bacterial Meningitis Should Undergo CT Of The Head Prior To Lumbar Puncture?

Recommended criteria for adult patients with suspected bacterial meningitis who should undergo CT prior to lumbar puncture (B-II)

- Immunocompromised state
- History of central nervous system (CNS) disease
- New onset seizure
- Papilledema
- Abnormal level of consciousness
- Focal neurologic deficit

What Specific CSF Diagnostic Tests Should Be Used To Determine The Bacterial Etiology Of Meningitis?

- All patients being evaluated for suspected meningitis should undergo a Gram stain examination of cerebrospinal fluid (CSF) **(A-III)**.
- The Practice Guideline Committee (PGC) does not recommend the routine use of [latex agglutination due to false positives and evidence that testing does not affect management] **(D-II)**.
- Some would recommend [latex agglutination] for patients with a negative CSF Gram stain result **(C-II)**.
- Latex agglutination may be most useful for the patient who has been pretreated with antimicrobial therapy and whose Gram stain and CSF culture results are negative **(B-III)**.
- Broad-based polymerase chain reaction (PCR) may be useful for excluding the diagnosis of bacterial meningitis with the potential for influencing decisions to initiate or discontinue antimicrobial therapy. Further refinements of the available techniques may lead to their use in patients with bacterial meningitis for whom the CSF Gram stain result is negative **(B-II)**.

What Laboratory Testing May Be Helpful In Distinguishing Bacterial From Viral Meningitis?

- Measurement of CSF lactate is not recommended for patients with suspected community-acquired bacterial meningitis **(D-III)**.
- Measurement of serum CRP concentration may be helpful in patients with CSF findings consistent with meningitis, but for whom the Gram stain result is negative and the physician is considering withholding antimicrobial therapy on the basis of the data showing that normal CRP has a high negative predictive value in the diagnosis of bacterial meningitis **(B-II)**.
- Enteroviral reverse transcription PCR [leads to shortened time-to-identification and] may lead to shortened patient hospitalization, decreased use of antimicrobial therapy for treatment of presumed bacterial meningitis, and reduced need for ancillary diagnostic tests **(B-II)**.

How Quickly Should Antimicrobial Therapy Be Administered To Patients With Suspected Bacterial Meningitis?

- ...[T]here are inadequate data to delineate specific guidelines on the interval between the initial physician encounter and the administration of the first dose of antimicrobial therapy **(C-III)**.

What Specific Antimicrobial Agents Should Be Used In Patients With Suspected Or Proven Bacterial Meningitis?

***Recommendations with presumptive pathogen identification by positive Gram stain* [from Table 3]**

- *S pneumoniae*: vancomycin plus third-generation cephalosporin[a,b] **(A-III)**
- *N meningitides*: third-generation cephalosporin[a] **(A-III)**
- *Listeria monocytogenes*: ampicillin[d] or penicillin G[d] **(A-III)**
- *Streptococcus agalactiae*: ampicillin[d] or penicillin G[d] **(A-III)**
- *H influenzae*: third-generation cephalosporin[a] **(A-I)**
- *Escherichia coli*: third-generation cephalosporin[a] **(A-II)**

***Recommendations for empirical therapy for purulent meningitis based on patient age* [from Table 4]**

- Less than 1 month: ampicillin plus cefotaxime or ampicillin plus an aminoglycoside **(A-III)**
- 1 month to 50 years: vancomycin plus third-generation cephalosporin[a,b] **(A-III)**
- More than 50 years: vancomycin plus ampicillin plus third-generation cephalosporin[a,b] **(A-III)**

[a]Ceftriaxone or cefotaxime
[b]Some experts would add rifampin if dexamethasone is also given **(B-III)**
[d]Addition of an aminoglycoside should be considered

What Is The Role Of Adjunctive Dexamethasone Therapy In Patients With Bacterial Meningitis?

- There are insufficient data to make a recommendation on the use of adjunctive dexamethasone in neonates with bacterial meningitis **(C-I)**.
- Available evidence supports the use of adjunctive dexamethasone in infants and children with *H influenzae* type b meningitis **(A-I)**.
- In infants and children with pneumococcal meningitis, there is controversy concerning the use of adjunctive dexamethasone therapy **(C-II)**.
- Adults with suspected or proven pneumococcal meningitis [should be treated with] dexamethasone (0.15 mg/kg q6h for 2-4 days with the first dose administered 10-20 minutes before, or at least concomitant with, the first dose of antimicrobial therapy) **(A-I)**.
- Adjunctive dexamethasone should not be given to any infants and children who have already received antimicrobial therapy, because administration of dexamethasone in this circumstance is unlikely to improve patient outcome **(A-I)**.
- Adjunctive dexamethasone should not be given to adult patients who have already received antimicrobial therapy, because administration of dexamethasone in this circumstance is unlikely to improve patient outcome **(A-I)**.
- The data are inadequate to recommend adjunctive dexamethasone to adults with meningitis caused by other bacterial pathogens, although some authorities would initiate dexamethasone in all adults, because the etiology of meningitis is not always ascertained at the initial evaluation **(B-III)**.
- Adjunctive dexamethasone [should] be administered to all adult patients with pneumococcal meningitis, even if the isolate is subsequently found to be highly resistant to penicillin and cephalosporins **(B-III)**.
- In patients with suspected pneumococcal meningitis who receive adjunctive dexamethasone, addition of rifampin to the empirical combination of vancomycin plus a third-generation cephalosporin may be reasonable pending culture results and in vitro susceptibility testing **(B-III)**. ■

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EFNS Guideline On The Management Of Community-Acquired Bacterial Meningitis: Report Of An EFNS Task Force On Acute Bacterial Meningitis In Older Children And Adults[4]

European Journal of Neurology. 2008;15(7):649-659.

Link: http://www.efns.org/fileadmin/user_upload/guidline_papers/EFNS_guideline_2008_management_of_community-acquired_bacterial_meningitis.pdf

This guideline was developed by the European Federation of Neurological Societies (EFNS), a consortium comprised of 44 European national neurological societies. The guideline is authored by 6 neurologists and 1 infectious disease specialist. Conflicts of interest were not addressed.

Evidence for this guideline was identified by searches of MEDLINE®, EMBASE, the Cochrane databases, and reference from relevant articles. Search terms are explicitly stated in the guideline. Evidence was evaluated for quality according to predefined criteria and assigned to 1 of 4 classes (I, II, III, IV). Recommendations were graded (A, B, C) based on the strength of evidence for each question.

A: Established as effective, ineffective, or harmful.
B: Probably effective, ineffective, or harmful.
C: Possibly effective, ineffective, or harmful.

The primary objective of this guideline was to assist neurologists with the diagnosis and treatment of community-acquired bacterial meningitis in older children and adults. Only recommendations pertinent to emergency medicine are excerpted here.

Early Management Of Acute Bacterial Meningitis: Recommendations

- Care of patients with suspected ABM should be considered as an emergency and fast-tracked for rapid assessment and treatment. We propose the following timeline for management of ABM: admission to hospital within first 90 minutes of making contact with health service, and assessment and treatment commenced within 60 minutes of hospital admission, and no longer than 3 hours after contact with health service **[IVC].**
- Prehospital antibiotic treatment should only be initiated for patients with strong suspicion of disseminated meningococcal infection (meningococcemia) because of the unpredictable risk of early circulatory collapse from adrenocortical necrosis (Waterhouse Fredrichsen syndrome). For other patients, rapid preadmission antibiotic therapy should be considered only if a delay in excess of 90 minutes in hospital transfer is anticipated **[IIIC]**.
- Lumbar puncture with CSF analysis is the specific investigation required for diagnosis and management of ABM. Therefore, if diagnosis of bacterial meningitis is suspected and there are no clinical contraindications, lumbar puncture should be performed as soon as safely possible **[IIIC]**.
- In patients with symptoms and signs suggestive of raised intracranial pressure or with high risk of cerebral herniation following lumbar puncture (imaging evidence of intracranial mass lesion, obstructive hydrocephalus or midline shift), diagnostic lumbar puncture should be postponed **[IA]**.

- In a patient with suspected ABM in whom lumbar puncture is being delayed or postponed, antibiotic therapy should be commenced immediately after collecting blood sample for culture. Intravenous or intramuscular benzyl penicillin or intravenous cefotaxime or ceftriaxone should be administered as empirical therapy for ABM and may be commenced immediately **[IIIA]**.
- In patients with known history of severe beta-lactam allergy, vancomycin should be administered as the alternative for pneumococcal meningitis and chloramphenicol for meningococcal meningitis **[IVC]**.
- In regions with known or suspected penicillin-resistant strains of pneumococcus, high-dose vancomycin should be used in combination with a third-generation cephalosporin **[IVC]**.
- Patients with risk factors for listerial meningitis (old age, immunosuppressed, and/or signs of rhombencephalitis) should receive intravenous amoxicillin in addition to a third-generation cephalosporin as the empirical treatment of ABM initially **[IVC]**.

Specific Antibiotic Treatment: Recommendations

- Initial antibiotic treatment of ABM should be parenteral **[IA].**

Empirical antibiotic therapy in suspected ABM

- Ceftriaxone 2 g 12-24 hourly or cefotaxime 2 g 6-8 hourly **[IIIB].**
- Alternative therapy: meropenem 2 g 8 hourly **[IIIC]** or chloramphenicol 1 g 6 hourly.
- If penicillin- or cephalosporin-resistant pneumococcus is suspected, use ceftriaxone or cefotaxime plus vancomycin 60 mg/kg/24 hourly (adjusted for creatinine clearance) after loading dose of 15 mg/kg **[IVA].**
- Ampicillin/amoxicillin 2 g 4 hourly if *Listeria* is suspected **[IVA].**

Adjunctive Therapy Of ABM: Recommendations

Corticosteroids

- Adjuvant dexamethasone is recommended with or shortly before the first parenteral dose of antibiotic in all previously well and non-immunosuppressed adults with pneumococcal meningitis at a dose of 10 mg every 6 hours for 4 days **[IA]** and children at a dose of 0.15 mg/kg every 6 hours for 4 days for Hib and pneumococcal meningitis **[IA]**.
- In all patients with clinically suspected pneumococcal (or Hib) meningitis (early focal neurological signs), we recommend that dexamethasone is given with the first dose of empirical antibiotic therapy as above **[IVC].**
- In ABM because of other bacterial etiology, routine use of high-dose dexamethasone is not presently recommended **[IA]**.
- If dexamethasone was initiated on clinical suspicion of ABM, which was subsequently proven to be inaccurate by CSF microbiology, the treatment should be promptly withdrawn.
- There is insufficient evidence to recommend the use of dexamethasone in pharmacological doses after antibiotic therapy has begun.
- By reducing subarachnoid space inflammation and blood-brain barrier permeability, steroids may lower CSF penetration of antibiotics, and patients receiving vancomycin for penicillin-resistant pneumococcal meningitis require close clinical and CSF monitoring.

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Editorial Comment

Perhaps the greatest challenge confronting emergency and primary care providers in the management of ABM is determining when to initiate either a diagnostic workup or empiric treatment of well patients whose symptoms may represent early manifestations of CNS infection. For patients who have been determined to need an assessment directed at ABM, the emergency clinician must identify the patients who should receive empiric antibiotics, the antibiotics they should receive, and when they should receive them. In addition, emergency clinicians must also determine which patients should be treated with adjunctive dexamethasone, as well as the patients on which a LP can be performed safely, with or without a preliminary CT scan.

Antibiotics. All 3 guidelines abstracted in this issue stipulate that patients with signs of meningococcemia or rapidly progressive symptoms should receive antibiotics immediately. When the patient is less ill and the pretest probability is lower, there is less clarity. The NICE guidelines state that all patients with suspected ABM should receive antibiotics "without delay" and specifically recommend that the provider "not allow LP to delay the administration of administration of antibiotics." The NICE guidelines do, however, allow for certain delays. For example, they state that in the prehospital setting, patients with suspected ABM be transported to secondary care *without* first receiving antibiotics so long as they are without a non-blanching rash, they are without signs of meningococcemia, and urgent transfer is possible. This implies that a window of time between initial suspicion of ABM and administration of antibiotics in which the LP can be completed is acceptable.

The EFNS guideline states that for patients in the hospital, "Empirical antibiotics for ABM should be considered before CSF analysis only if LP is contraindicated or the facility for rapid brain imaging prior to LP is not immediately available." The IDSA guideline specifies that in "patients in whom the LP is delayed or a CT scan is performed...blood... [cultures] must be obtained and appropriate antimicrobial and adjunctive therapy given" prior to LP or CT.

We recommend that in patients thought to have ABM, after proper isolation of the patient has been initiated, treatment with antimicrobial therapy (with or without corticosteroids) should be the next priority. In patients not thought to have ABM, but where ABM is being ruled out, the order and pace of interventions and diagnostic testing depends on pretest probability; in patients with very low pretest probability, withholding pharmacologic therapies for CT or LP is acceptable.

The guidelines generally agree on the antibiotic regimen that should be used prior to identification of an organism. All patients should receive a third-generation cephalosporin (cefotaxime if < 1 month of age, otherwise ceftriaxone). Patients aged less than 1 month or more than 50 years of age should also receive ampicillin to cover *Listeria*. In the US and other places with a high rate of penicillin-resistant *S pneumoniae*, patients should also receive vancomycin.

Obtaining CT Scan. Whether to obtain a CT scan prior to performing LP is another controversy in the management of suspected ABM. Though performing a LP in the patient with elevated ICP could theoretically precipitate cerebral herniation, evidence of a causal relationship is weak; furthermore, a normal brain CT scan does not exclude the possibility of neurological deterioration following LP. NICE recommends that clinicians "use clinical assessment and not cranial CT to decide whether it is safe to perform a lumbar puncture." This "clinical assessment" includes assessing for signs of increased ICP, which would be a contraindication to LP. They explicitly recommend that in children with reduced or fluctuating consciousness or focal neurologic signs, a CT should be obtained prior to LP to detect alternative intracranial pathology.

The IDSA recommends a longer list of criteria for CT prior to LP, including immunocompromised state, history of CNS disease, new onset seizures, papilledema, abnormal level of consciousness, and focal neurologic deficit. The IDSA makes no recommendations for children.

The presence of papilledema is a contraindication to LP in the NICE guideline and an indication to perform a CT prior to LP in the IDSA guideline. This suggests that if a provider cannot confidently identify papilledema on fundoscopic examination, then CT would be indicated in any patient undergoing LP for suspected ABM. In practice, most patients who are sick enough to exceed the empiric treatment threshold will demonstrate one of the IDSA criteria for CT prior to LP. Patients who are well and neurologically normal are likely to fall in the "rule out" category, and the LP can be performed without preceding CT or empiric antibiotics. The guidelines do not specifically address the issue of febrile infants (< 60 days old), which is a common indication for LP in many EDs. The well-appearing infant who requires a LP as part of septic work-up should not receive a CT scan prior to LP.

Use Of Adjunctive Dexamethasone. Finally, the use of adjunctive dexamethasone has been the subject of significant controversy. Steroids appear to be helpful for meningitis caused by *H influenzae*, which has decreased in frequency since the Hib vaccine was introduced in the 1980s. Studies assessing the benefit steroids offer in meningitis caused by *S pneumoniae* have produced varied results, but overall, favor the use of steroids. There is minimal evidence to suggest a benefit in meningitis caused by other pathogens, including *N meningitidis*. For the emergency clinician, the relevant question is whether to give steroids empirically when starting antibiotics for suspected ABM, before an organism is identified.

The NICE guideline recommends steroids for all patients older than 3 months if the LP results suggest bacterial meningitis. The IDSA guideline does not make a recommendation for empiric steroids in children, but it does recommend steroids for adults with suspected pneumococcal meningitis. The EFNS guidelines recommend dexamethasone for all older children and adults with clinically suspected pneumococcal meningitis. Given that more than 50% of ABM is due to *S pneumoniae*, these IDSA and EFNS recommendations for steroids essentially apply to all patients in those age groups with suspected meningitis.[4,5] As to the timing of steroid administration, literature suggests that steroids are most effective if given before or with the first dose of antibiotics, but the NICE recommendations use LP results to determine whether to give steroids. Waiting for CSF results produces an unacceptable delay in patients strongly suspected of having ABM, and these sicker patients are most likely to benefit from steroids (and earlier treatment with antibiotics). The IDSA guideline recommends that steroids not be given if antibiotics were given first.

The EFNS guideline states that the data are insufficient to recommend giving steroids if antibiotics were given first. The NICE recommendations allow for up to 4 hours between first dose of antibiotics and the first dose of steroids, and this guideline is the only one to incorporate the findings from the most recent Cochrane Review, which represents the most comprehensive analysis to date on the subject.[6] Certainly, optimizing timing of steroid administration must not delay antibiotic treatment in ill patients or patients with strong clinical suspicion of ABM.

We recommend empiric steroids with the first dose of antibiotics in patients with a high pretest probability of ABM of undifferentiated etiology; in other cases, CSF testing and discussions with downstream and consultant clinicians can dictate care.

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EM Practice Guidelines Update (ISSN Online: 1949-8314) is published monthly (12 times per year) by EB Practice, LLC d.b.a. EB Medicine
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Date of Original Release: February 1, 2011. Date of most recent review: January 10, 2010. Termination date: February 1, 2014.

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Goals: Upon completion of this article, you should be able to: 1) demonstrate medical decision-making based on the strongest clinical evidence; 2) cost-effectively diagnose and treat the most critical ED presentations; and 3) describe the most common medicolegal pitfalls for each topic covered.

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