**Expert offers advice on moving fast and mastering meningitis**

By Stacey Butterfield

When you hear about improving door-to-treatment time, you probably think of stroke or cardiac care, but experts in central nervous system (CNS) infections think meningitis should be on that list, too.

"We feel the same way about the time to antimicrobial agents," said Karen Roos, MD, who is the John and Nancy Nelson Professor of Neurology at Indiana University in Indianapolis. "Time to antimicrobial agents should be 30 minutes or less."

Dr. Roos offered advice on speeding and improving diagnosis and treatment of meningitis during the American Academy of Neurology’s annual meeting, held in Philadelphia in April.

The traditional 3 symptoms of bacterial meningitis are well known: fever, headache, and stiff neck. But altered mental status should be on that list, too, Dr. Roos said. "Patients with bacterial meningitis typically have an altered mental status. They’re not making sense, sitting on the side of the stretcher saying to you, ‘I have this terrible headache and stiff neck.’ They’re sleepy and they become increasingly obtunded or comatose as time goes on,” she said.

Not all patients will have all 4 symptoms, but 2 should be there to make you suspect the diagnosis, and most of the time, 1 of them will be fever. "It’s almost always fever unless the patient has taken an anti-inflammatory or antipyretic prior to coming to the emergency room," Dr. Roos said.

They may have additional symptoms, including photophobia, lethargy, or vomiting. "Many of them have vomiting, so don’t let that discourage or dissuade you from the diagnosis," said Dr. Roos.

A history of vaccination against meningitis should not dissuade you, either, especially if it’s recent. Neisseria meningitidis serotype B is not included in the meningitis vaccine typically given in the U.S., but it is common and has caused 3 recent bacterial meningitis outbreaks on college campuses. "We do now have the European vaccine that includes serotype B, but it takes 2 weeks for the vaccine to be effective," noted Dr. Roos.

(Therefore, if recently vaccinated, those exposed to infected patients should be given rifampin.)

In accordance with the 30-minute door-to-antibiotics goal, move quickly from diagnostic suspicion to treatment. "You’re just trying to grab some blood cultures and you’re going to empirically treat," said Dr. Roos.

While getting blood for cultures, also order serum procalcitonin and a C-reactive protein test, she advised. "The serum procalcitonin is highly predictive of bacteremia, invasive bacterial infection, sepsis. That’s a good test. The C-reactive protein is nonspecific. If it’s negative, it’s helpful in ruling out invasive bacterial disease," said Dr. Roos.

CT scans should be ordered for patients who have an abnormal level of consciousness, U.S. board members keep in touch with defined, immune compromised state, papilledema, or poorly visualized fundi, or for those who come from an endemic area for syphilis.

The recommendations on initial drug treatment haven’t changed much in a while, according to Dr. Roos. "Empire therapy for bacterial meningitis is really based on our concern that you have a penicillin- and cephalosporin-resistant pneumococcus. Streptococcus pneumoniae is the most common cause of community-acquired bacterial meningitis," she said.

Thus, patients should be treated with a third- or fourth-generation cephalosporin.

"The dose of cefepime through the years has gone up a bit to make sure that it adequately penetrates the blood-brain barrier," she said, noting that it’s now 2 g every 8 hours.

"[Alternatively] many of us are still using ceftriaxone at 2 g every 12 hours, or cefotaxine at 3 g every 4 hours. In addition to whichever of these drugs you choose, add vancomycin at 45 to 60 mg/kg per day in an 8-hour dosing interval, she said.

Other medications may be needed depending on possible causes of the illness. "You’re going to add dexamethasone if you’re in an area where Rocky Mountain spotted fever is a concern," said Dr. Roos. "Patients with fever and headache, we want to add acyclovir [30 mg/kg every 8 hours] because it could be herpes simplex virus encephalitis."

If the patient may have listeria, also give ampicillin. Risk factors for listeria include age over 55, chronic illness, organ transplant, pregnancy, malignancy, and an immunosuppressive state or therapy.

Metronidazole is recommended for patients who may have an anaeureobe, but Dr. Roos cautioned against assuming that anaerobes are on the rise. "Anaerobes cause more and more CNCS infections, but for only one reason, and that’s because we can test for anaerobes better," she said. "In patients who have the predisposing conditions of otitis, mastoiditis, or sinusitis, you’re going to add metronidazole."

Finally, give dexamethasone. "If you think you have bacterial meningitis, you want to use dexamethasone," she said. "Reaching a place where they are able to. You want to start it sooner rather than later, and you can begin it with or right before antibiotics. If the antibodies are there, start them; if dexamethasone is there, start it."

Once the drugs are started, "now you have time to work the patient up," Dr. Roos said. A lumbar puncture will provide fluid for a Gram stain and several polymerase chain reaction (PCR) tests, starting with the reverse transcribe PCR for enteroviruses. "This should, in your hospital, have about a 4-hour turnaround time," she said.

Other useful PCR tests are herpes simplex virus (HSV)-1 and -2, given that HSV-2 is a common cause of viral meningitis. If it’s available, also get the 16S ribosomal DNA broad-based bacterial PCR test. "The number of labs doing it across the country has accelerated in the past few months," said Dr. Roos. "Keep watching this, and keep plugging away at getting your lab to get it for you."

Other new options include meningeal pathogen-specific PCR tests, which cost $100 a piece, but most hospitals aren’t using them yet. "I think this will be something for the future," she said.

The most important information from the spinal fluid analysis, however, will be the glucose concentration. "That’s the number to worry you the most," said Dr. Roos. A low glucose concentration is a bad sign, but it doesn’t necessarily mean the patient has bacterial meningitis. Posterior fossa syndrome and medication-induced meningitis, types of "aseptic meningitis," can both cause decreased glucose concentrations in spinal fluid.

Obviously, a recent surgical procedure on the posterior fossa would be a good indication of the syndrome, and medication-induced meningitis can result from many different drugs, including cephalosporins, penicillin, ciprofloxacin, and NSAIDs, among others. "IVIG [intravenous immunoglobulin] is a big one," said Dr. Roos. Patients with medication-induced meningitis can be confused or even comatose.

Viral meningitis, on the other hand, causes headache, fever, and stiff neck, with no altered consciousness. "The best way to tell a patient with viral meningitis from a bacterial meningitis patient clinically is the patient with viral meningitis is sitting on the side of the stretcher screaming in pain from their headache and the patient with bacterial meningitis is getting increasingly sleepy," Dr. Roos said.

Enteroviruses are the most common cause of viral meningitis. Other common causes include HSV-2, HIV, and arthropod-borne viruses.

Crossword Words

(Puzzle on page 4)

Answer: Vorapaxar and himbacine


When we started, we told them we would guarantee to fund them for 5 years," Dr. Crook said. "Things are kind of reaching a place where they are able to keep going on their own, I think, which is really the goal."

In 2012, ACP’s New Mexico chapter gave Dr. Crook its 2012 Community Service and Volunteersm Award, an honor he discussed with modesty.

"We were lucky in that we knew good people at the local level to begin with. That’s sort of critical, and we had that in place when we started the foundation, which is really what has made it work," Dr. Crook said.