benefits of either strategy are lacking at this time. As for antibiotic suppression after a single episode of cystitis, a Cochrane review in 2015 identified only one study of 200 patients. There was no difference in recurrence rates of cystitis between those who received daily suppression with nitrofurantoin and close outpatient surveillance compared with close outpatient surveillance alone. Due to the paucity of data, the authors were unable to make conclusions regarding optimal management (43).

There is insufficient evidence to guide management after recurrent UTI in pregnancy. After treating a recurrent acute infection, clinicians may consider initiating antimicrobial urinary suppression for the remainder of the pregnancy, preferably using a lower single daily dose of an antibacterial drug to which the bacterium isolated was susceptible.

Recurrent UTI is defined as having two or more UTIs diagnosed during pregnancy (44) and occurs in 4–5% of pregnancies (1). Given the risks associated with UTI in pregnancy, clinicians may decide to recommend initiation of antibiotic prophylaxis after a recurrence. As discussed above, there are limited data regarding management in this setting. Studies in nonpregnant women have found that antibiotic prophylaxis reduces recurrence rates compared with placebo in patients with more than two UTIs per year (45).

If prophylaxis is initiated, there are two common strategies available: postcoital or continuous prophylaxis for the remainder of the pregnancy. For patients for whom the postcoital option is selected, antibiotics are taken before or after vaginal intercourse. This strategy has been associated with a decrease in adverse events related to antibiotic use (46, 47). With continuous prophylaxis, antimicrobials are taken once daily. Although the optimal dose of prophylactic antibiotic has not been established, using a lower single daily dose of an antibiotic to which the bacterium isolated was susceptible should be considered in efforts to reduce antibiotic resistance. Common suppressive regimens include nitrofurantoin 100 mg orally daily or cephalexin 250–500 mg orally daily.

PYELONEPHRITIS

Diagnosis

Pyelonephritis should be suspected in the presence of fever of 38.0° C or higher and urine studies suggesting UTI, with additional symptoms of upper genitourinary tract infection, such as flank pain or costovertebral angle tenderness, supporting the diagnosis.

Pyelonephritis is an infection of the kidney that is thought to arise from bacteria ascending from the bladder to the upper urinary tract. Acute cystitis and pyelonephritis both have findings of infection on urine studies, as described previously. Differentiating between symptomatic UTI and pyelonephritis is based on history and physical examination. Pyelonephritis presents with signs of infection, such as fever, nausea, and vomiting. Systemic symptoms are accompanied by physical examination findings localizing to the upper urinary tract, such as flank pain, costovertebral angle (CVA) tenderness, or abnormalities on renal ultrasonography (11). Complete blood count may show leukocytosis, bandemia, thrombocytopenia, or anemia. Abnormalities in multiple cell lines are highly correlated with adverse outcomes, such as the need for intensive care unit admission (48). A common presentation that should prompt timely initiation of antibiotic treatment is abnormal urinalysis, fever, flank pain, and CVA tenderness. When only some of these symptoms are present (for example, fever and UTI but no CVA tenderness or UTI and CVA tenderness but no fever), clinical suspicion for early or evolving pyelonephritis should be high. Clinicians must remain vigilant for worsening clinical symptoms until a diagnosis of pyelonephritis can be excluded (48). Pyelonephritis may also present with more serious sequelae, such as preterm contractions or labor, as well as sepsis, acute renal insufficiency, and ARDS (16, 48, 49). The differential diagnosis of these symptoms in pregnancy can also include nephrolithiasis, renal abscess, urosepsis without pyelonephritis, and chorioamnionitis.

Pregnant patients suspected of having pyelonephritis should have a midstream or catheterized urine specimen collected for urinalysis, urine microscopy, and culture. This specimen should be obtained before antibiotics are initiated, but treatment should not be delayed while awaiting culture results. Blood cultures, although frequently obtained in these patients, may not be clinically useful. One study showed that blood culture results were positive in 21% of patients but rarely changed clinical management (50). Bacteriology was concordant between urine and blood cultures, and duration of treatment is not affected by bacteremia (50).

Treatment

Clinicians initially should manage pyelonephritis in pregnancy in the inpatient setting. Empiric antibiotic therapy should have adequate renal tissue penetration and be targeted against the most likely pathogens. Antibiotic therapy should be adjusted as needed based on urine culture and sensitivity. Parenteral antibiotics should be continued until the patient is clinically improving. Patients should complete a total of 14 days of antibiotic therapy.

Pyelonephritis is one of the most common reasons for hospitalization in pregnancy. Untreated pyelonephritis can lead to severe maternal and obstetric complications,