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URINE CULTURES IN PYELONEPHRITIS: AN OVERSTATED REQUIREMENT

Brit Long, MD
Department of Emergency Medicine
San Antonio Uniformed Services Health Education Consortium
Fort Sam Houston, TX

Alex Koyfman, MD
Department of Emergency Medicine
The University of Texas Southwestern Medical Center
Dallas, TX

Michael D. April, MD, DPhil
Department of Emergency Medicine
San Antonio Uniformed Services Health Education Consortium
Fort Sam Houston, TX

Pyelonephritis involves infection of the upper urinary tract, including the renal parenchyma and pelvis. This disease process is distinct from simple cystitis, or bladder infection, and requires distinct management strategies. The Infectious Diseases Society of America guidelines for urinary tract infections in adult women recommend obtaining urine cultures for pyelonephritis, with initial empiric treatment adjusted according to the uropathogen isolated.[1] However, the guidelines fail to incorporate consideration of patient clinical status.[1] For patients with severe pyelonephritis and toxic appearance, we agree that intravenous antibiotics, hospital admission, and cultures of blood and urine are necessary. Conversely, we argue that urine cultures are not necessary for patients with simple pyelonephritis in the absence of severe toxicity, recent antimicrobial use, and recent hospitalization.[2,3]

Our position principally arises from the predictability of the infectious organisms resulting in pyelonephritis. Enterobacteriaceae species such as *Escherichia coli* account for greater than 80% of pyelonephritis infections.[2,3] The Infectious Diseases Society of America guidelines recommend fluoroquinolones as the mainstay of empiric antibiotic treatment for pyelonephritis.[1] Multiple studies highlight that the majority of *E coli* organisms are susceptible to these agents, with resistance rates less than 5%.[4,5] Non–*E coli* organisms in these studies exhibited similar susceptibility to fluoroquinolones. Although these guidelines suggest that β-lactam agents are less effective in treating pyelonephritis, the literature suggests that failure rates for treatment with cefdinir approximate 1%.[5]

Another argument against the routine collection of urine cultures among these patients is the limited utility of the resulting sensitivity data. Urine cultures report an organism and minimum inhibitory concentration, which is a measurement of reported in vitro microbe blood resistance to an antibiotic. This measure does not consider patient factors, in vivo medication levels and effects, or urinary drug concentrations.[6,7] In vivo resistance assesses microbe resistance at the site of activity (ie, the upper urinary tract in pyelonephritis). Antimicrobials possess greater in vivo activity than predicted by urine culture minimum inhibitory concentration, an in vitro evaluation.[7,8] One study highlighting this discordance between in vitro and in vivo activity examined patients with acute pyelonephritis and found that cefuroxime is effective in patients according to clinical improvement, regardless of whether the urine culture minimum inhibitory concentration was consistent with microbe susceptibility or resistance to this antibiotic.[9] This study demonstrated that urine culture minimum inhibitory concentration does not equate to antimicrobial inefficacy.[9]

These issues related to urine culture testing similarly speak to the limitations of using these data at the population level by constructing antibiograms with culture data to drive antibiotic choices.[6,7] The Infectious Diseases Society of America guidelines recommend use of these data inasmuch as they recommend using an antimicrobial with less than 20% in vitro resistance (<10% for fluoroquinolones).[1] Yet, to reiterate, in vitro resistance does not accurately portray clinical antimicrobial activity and so may overestimate uropathogen antibiotic resistance.[6,7] A study evaluating ciprofloxacin for pyelonephritis in a setting with high resistance (approximately 15%) found clinical cure rates to be statistically equivalent at 3 days in individuals with predicted susceptible versus resistant organisms, with no increase in the incidence of complications.[10] Ultimately, fluoroquinolones and cephalosporins such as ceftriaxone and cefdinir are effective in simple pyelonephritis because of antimicrobial concentrations and efficacy at the site of infection.[2,9] Reliance on antibiogram data to drive therapeutic decisions may hence lead to the unnecessary selection of more expensive agents with less favorable adverse effect profiles. Meanwhile, urine culture testing comes at increased population costs, ranging from $13 to $247, depending on the region and location; the cost-effectiveness of these expenditures is unclear.

The increased cost of urine culture testing is justifiable despite its limitations in patients at high risk for resistant organisms or poor outcomes. Such patients include those older than 60 years or who have hematologic disease, neurologic disease, chronic renal disease, urinary tract infection history, urinary catheter, and recent hospitalization or antimicrobial use (<3 months).[1] Yet for

patients who are well appearing and without these risk factors, urine cultures in acute pyelonephritis are unlikely to change management, even in communities with suspected resistant organisms. Such patients should undergo empiric therapy with a plan for reevaluation and return precautions. Providers must balance the risks and benefits of fluoroquinolone therapy in particular because the Food and Drug Administration warns that fluoroquinolones may result in tendon rupture, hypoglycemia, depression or anxiety, rash, diarrhea, and aortic aneurysm or dissection.[11] A cephalosporin can be used instead, with either an initial parenteral dose followed by oral therapy or oral therapy alone. This treatment strategy is highly likely to achieve clinical cure while avoiding further, unnecessary testing.

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