The Diagnosis of UTI: Concentrating on Pyuria

Kenneth B. Roberts, MD

The term "pyuria" literally means "pus in the urine" but, in common usage, the focus is not on the presence of pus but on the number of white blood cells (WBCs) or amount of leukocyte esterase (LE) that exceeds a threshold and suggests a urinary tract infection (UTI). In this issue of *Pediatrics*, Chaudhari et al[1] share the results of a study of the impact of urine concentration on the optimal threshold in the new era of automated urinalysis. Centrifugation of urine specimens has long been standard laboratory practice, presumably performed to concentrate sediment and facilitate the detection of cellular elements and bacteria. The implied (but questionable) assumption is that the process renders 1 spun specimen comparable to another in concentration. The "enhanced urinalysis"[2] and automated urinalysis methods use analysis of unspun urine for cellular elements but have not attempted to control for concentration. The authors recognized concentration as a potential concern and demonstrated, with automated urinalysis, different thresholds for dilute and concentrated urine as having the optimal combination of positive and negative likelihood ratios: 3 WBCs/high power field in dilute urine, 6 WBCs/high power field in concentrated urine. If specific gravity is integrated with the number of WBCs in automated urinalyses, the authors' finding has both significance and a practical application.

However, for the many sites that do not have machines for automated urinalyses (virtually all office practices, for example), the most important finding in this study may well be how well LE performs regardless of urine concentration. The optimal threshold for LE is not clear, however. The authors use "small" as their threshold for LE.[1] Schroeder et al,[3] in a study of young infants with bacteremic UTI, found "any LE" (including "trace") to be more sensitive, as would be expected. Recently, Lavelle et al[4] used "moderate" LE as a threshold in specimens collected in urine bags to decrease the number of catheterizations in a busy emergency department; they were able to cut the rate of catheterizations in half. Their surveillance did not detect any missed UTIs in the >350 infants with negative screening urinalyses.

At any threshold, can a negative urinalysis be relied on to exclude the diagnosis of UTI? A "positive" culture without inflammation evident in the urine is likely due to contamination, very early infection (rare), or asymptomatic bacteriuria (AB) (positive urine cultures in febrile children can still represent AB, because the fever may be due to a source other than the urinary tract). A recent study dismissed the idea that AB could explain the apparent suboptimal sensitivity of the urinalysis because "the prevalence of asymptomatic bacteriuria is too low (<1%) to fully explain why many children with an apparent UTI lack pyuria."[5] Missing from that assessment is that the rate of UTI in that study (as in other comparable studies) was ~5%.[5] Because the 5% rate with positive cultures includes those with AB and no pyuria, the sensitivity of pyuria appears unacceptably low but is precisely what is expected

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mathematically. AB has been shown not to be harmful except during pregnancy, and children with it are better off left untreated, because antimicrobial therapy changes the virulence of the offending organism and makes a symptomatic UTI more likely.[6]

If there are, in fact, some true UTIs without evidence of inflammation from the urinalysis, are they as harmful as those with "pyuria"? Animal data demonstrate it is the inflammatory response, not the presence of organisms, that causes renal damage in the form of scarring.[7] So the role of using evidence of inflammation in the urine to screen for who needs a culture seems justified on the basis not only of practicality at point of care and likelihood of UTI, but also sparing individuals at low-to-no risk of scarring from invasive urine collection. Moreover, using the urinalysis as a screen permits selecting individuals for antimicrobial treatment 24 hours sooner than if clinicians were to wait for culture results before treating. In a recent study that compared the rates of scarring according to the duration between onset of fever and initiation of treatment, the rate increased slightly from 1 day to 1 to 2 days and 2 to 3 days, but then jumped after 3 days.[8] The urinalysis provides a practical window for clinicians to render prompt treatment. And Chaudhari et al[1] provide valuable assistance for interpreting the results of automated urinalyses.

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ABBREVIATIONS

AB: asymptomatic bacteriuria
LE: leukocyte esterase
UTI: urinary tract infection
WBC: white blood cell

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