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Emergency Physician Performance for Hydronephrosis Diagnosis and Grading Compared with Radiologist Assessment in Renal Colic: The EPHyDRA Study

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Abstract : Study objective: Emergency physician's (EP) ability to identify hydronephrosis on point-of-care ultrasound (POCUS) has been assessed in the past using CT scan as the reference standard. We aimed to assess EP interpretation of POCUS to identify and grade the hydronephrosis in a direct comparison with the consensus-interpretation of POCUS by radiologists, and also to compare the EP and radiologist performance using CT scan as the criterion standard. Methods: Using data from a POCUS databank, a prospective interpretation study was conducted at an urban academic emergency department. All POCUS exams were performed on patients presenting with renal colic to the ED. Institutional approval was obtained for conducting this study. All the analyses were performed using Stata MP 14.0 (Stata Corp, College Station, Texas). Results: A total of 651 patients were included, with paired sets of renal POCUS video clips and the CT scan performed at the same ED visit. Hydronephrosis was reported in 69.6% of POCUS exams by radiologists and 72.7% of CT scans (p=0.22). The κ for consensus interpretation of POCUS between the radiologists to detect hydronephrosis was 0.77 (0.72 to 0.82) and weighted κ for grading the hydronephrosis was 0.82 (0.72 to 0.90), interpreted as good to very good. Using CT scan findings as the criterion standard, Eps had an overall sensitivity of 81.1% (95% CI: 79.6% to 82.5%), specificity of 59.4% (95% CI: 56.4% to 62.5%), PPV of 84.3% (95% CI: 82.9% to 85.7%), and NPV of 53.8% (95% CI: 50.8% to 56.7%); compared to radiologist sensitivity of 85.0% (95% CI: 82.5% to 87.2%), specificity of 79.7% (95% CI: 75.1% to 83.7%), PPV of 91.8% (95% CI: 89.8% to 93.5%), and NPV of 66.5% (95% CI: 61.8% to 71.0%). Testing for a report of moderate or high degree of hydronephrosis, specificity of EP was 94.6% (95% CI: 93.7% to 95.4%) and to 99.2% (95% CI: 98.9% to 99.5%) for identifying severe hydronephrosis alone. Conclusion: EP POCUS interpretations were comparable to the radiologists for identifying moderate to severe hydronephrosis using CT scan results as the criterion standard. Among patients with moderate or high pre-test probability of ureteric calculi, as calculated by the STONE-score, the presence of moderate to severe (+LR 6.3 and –LR 0.69) or severe hydronephrosis (+LR 54.4 and –LR 0.57) was highly diagnostic of the stone disease. Low dose CT is indicated in such patients for evaluation of stone size and location.

Keywords : renal colic, point-of-care, ultrasound, bedside, emergency physician
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