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Ultrasonography is an Adequate Initial Screening Test for Urinary Calculi

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## Ultrasonography is an Adequate Initial Screening Test for Urinary Calculi

### PRO

MORE than 3,600 emergency department (ED) visits related to nephrolithiasis occur daily in the United States.<sup>1</sup> Whether computerized tomography (CT) or ultrasonography is the best initial screening test for acute renal colic has been debated. A recent pragmatic, comparative effectiveness trial was performed at 15 centers with 2,759 participants followed for 2 years to determine whether the initial imaging method for patients with suspected nephrolithiasis should undergo CT, ultrasonography as performed by a radiologist or point-of-care ultrasonography as performed by an ED physician.<sup>2</sup> Notably, the study excluded individuals the physician considered to be at high risk for serious alternative diagnoses, including acute cholecystitis, appendicitis, aortic aneurysm or bowel disorders. As part of the pragmatic design, after the initial imaging was assigned by randomization, the provider determined subsequent medical care, including the potential need for additional imaging.

The average cumulative radiation exposures were significantly lower in both ultrasonography groups compared to those assigned to CT. There was no difference in the rate of high risk diagnoses with complications related to misdiagnoses. Among the secondary outcomes, there were no significant differences in serious adverse events, pain scores, rate of return ED visits or hospitalizations. As such, this study supports ultrasonography for the initial evaluation of acute renal colic.

As urologists, we think we evaluate all stone formers. In reality, we only see the tip of the iceberg. A secondary analysis of the trial data revealed that 14.5% of participants had a urology consultation at presentation.<sup>3</sup> Most patients are given appointments to return to the ED or to their primary care providers, and they are not specifically referred to a urologist. Patients diagnosed with stones at one ED often present to a different ED for persistent symptoms without accompanying documents or images, and additional CT scans are obtained. It is not

infrequent for urologists to see new patients who have undergone multiple CT studies for the same acute renal colic episode (despite this fact, often the urologist is often unable to personally review these studies). Therefore, these multiple ED settings represent multiple initial visits at which there were opportunities for ultrasonography to be performed first.

Proponents of CT will point to the availability of low dose protocols that maintain the high sensitivity and specificity for stone detection. However, while we routinely request these scans, in practice many patients still receive regular dose CT (frequently young women of childbearing age) and often there are questionable incidental findings<sup>4</sup> that may lead to additional investigations and treatments with their associated risks. The widespread dissemination of reduced dose CT has not happened. In a study of renal colic protocol CT from 93 institutions the reduced dose protocol (3 mSv or less) was used only in 2% of all studies.<sup>5</sup> Urologists bear the burden to advocate for reduced dose protocols at their institutions.

Combining ultrasonography with a thorough history, physical examination and urinalysis allows for an obstructing stone to be diagnosed with reasonable confidence. Notably in this study 42% of patients had a history of kidney stones, and so they recognize stone pain. Ultrasonography can consistently identify hydronephrosis, yet it is unreliable to definitively visualize mid ureteral stones. In this study the diagnostic accuracy for nephrolithiasis was determined by comparing the initial diagnosis to patient observation of stone passage or at the time of surgery. Using this criterion, ultrasonography had lower sensitivity than CT, as expected. However, on intention-to-treat analysis there was no difference in sensitivity or specificity. The majority of patients in the point-of-care ultrasonography group still avoided a subsequent CT. In other words, although ultrasonography is less sensitive for stone detection, management of a suspected stone does not require

definitive visualization of a stone. At the end of the day the diagnosis and the rates of adverse events are the same.

Point-of-care ultrasonography is an extension of the physical examination among ED providers. It is routinely performed in Europe where ultrasonography is used like the stethoscope. With sufficient training, one does not need to be a cardiologist to use a stethoscope, just as one does not need to be a radiologist to perform ultrasonography. Point-of-care ultrasonography also saves time. When a radiologist performs ultrasonography, one needs to wait for staff availability as well as patient transport to and from the ED. Among patients who had only 1 imaging study the median length of stay in the ED was 1 hour less in the point-of-care ultrasonography group than the other 2 groups.

In summary, ultrasonography should be the first diagnostic study in the evaluation of patients with suspected nephrolithiasis in the ED. It obviates the need for CT in the majority of cases and reduces ionizing radiation exposure. As we have always known, sound clinical judgment combined with a detailed review of the history, physical examination and laboratory data should guide the decision for diagnostic imaging.

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## CON

Winston Churchill is quoted as saying, "What is adequacy? Adequacy is no standard at all." I admit that when I hear the word adequate I cannot help but think of those satisfaction surveys for which you fill in the middle of the bubble: not bad, but not great either. That pretty much sums up how useful ultrasound is for diagnosing urolithiasis. Is ultrasound an adequate screening test for urinary calculi? In the sense that it can be applied to a large number of people and does not usually diagnose a stone but may identify individuals who require further evaluation, then yes ultrasound is a reasonable screening test. However, the best screening test is one that is highly sensitive and specific, which is something ultrasound is not. Kanno et al reported a sensitivity of 100% for CT and only 70% for ultrasound for the detection of renal stones.<sup>6</sup> There was also a 21.1% chance of missing a stone altogether on ultrasound, and these were stones in the kidney, which arguably are much easier to identify than ureteral stones. Why are we even having this debate?

Smith-Bindman et al recently concluded that in patients presenting to the ED with suspected nephrolithiasis initial ultrasonography was associated with lower cumulative radiation exposure than initial CT without significant differences in high risk diagnoses with complications, serious adverse events, pain scores, return emergency department visits or hospitalizations.<sup>2</sup> Limitations of this study were the exclusion of obese patients, who represent a large population with nephrolithiasis and in whom ultrasound is notoriously poor, and lack of a standard CT protocol leading to great variability in radiation exposure. In 40.7% of patients in the point-of-care ultrasound group and 27% in the radiology ultrasound group, further CT imaging was performed.

I readily concede that ultrasound spares the patient radiation exposure compared to CT but the real issue is whether ultrasound provides enough information to adequately treat the patient. Whether ultrasound is an effective test in the evaluation of patients with renal colic, I suppose depends on your goals of care. If you are an ED physician and the primary emphasis is determining the appropriate disposition for the patient rather than making a confirmatory diagnosis, then ultrasound may be a quick bedside test that permits the all too common "treat and street." The problem is that hydronephrosis, in the absence of confirmed stone on ultrasound or film of the kidneys, ureters and bladder, may be secondary to many other conditions such as ureteropelvic junction obstruction, ureteral stricture and urothelial malignancy, to name a few.

Anecdotally, I can tell you that nothing frustrates me more than seeing a patient in followup from the ED who was seen for flank pain and all we have is an ultrasound report. If the ultrasound showed hydronephrosis, then you still do not know if the hydronephrosis is really from a stone, or the size or location of the stone. If the ultrasound did not show hydronephrosis and the patient is still having pain, now you really do not know what is wrong. So, what do we usually do next? CT. Even in patients who we know have ureteral stones on CT with hydronephrosis, quite often a followup ultrasound shows resolution of the hydronephrosis and yet the stone is still there.

Sternberg et al examined this issue in 144 patients who underwent renal ultrasound and CT on the same day for the evaluation of acute renal colic.<sup>7</sup> Hydronephrosis on ultrasound did not accurately predict the presence or absence of a ureteral stone on CT in 25% of patients. In 11.1% cases ultrasound showed no hydronephrosis yet CT demonstrated the presence of a ureteral stone. A more disturbing statistic is that even among patients definitively

diagnosed with a stone in the ED setting, only 44.8% ever returned for outpatient urological followup.<sup>7</sup> Is the primary goal to make the correct diagnosis or determine disposition?

CT has many advantages over ultrasound not only for the diagnosis, but also treatment selection for patients with urolithiasis. It can tell you stone size and location, both of which we recognize as significant predictors of stone passage. This information is crucial in determining who is appropriate for trial of passage and medical expulsive therapy versus those who will require surgical intervention. Furthermore, CT is often useful in determining stone composition based on Hounsfield unit density as well as predicting outcomes of therapy such as skin-to-stone distance for shock wave lithotripsy.<sup>8</sup>

We can have our cake and eat it too. We do not have to settle for the inadequacies of ultrasound nor do we have to accept the high price of excessive radiation exposure with conventional CT. Low dose CT is the answer. Kilkarni et al have shown that you can reduce the mean radiation dose for the

evaluation of urolithiasis down to 1.8 mSv without compromising diagnostic accuracy, and for patients weighing less than 200 pounds the dose can be as low as 1.3 mSv which is a radiation dose similar to a 2 shot film of the kidneys, ureters and bladder.<sup>9</sup> My opponents will say that sure this is all well and good but most centers are not performing low dose CT. I counter simply with the question “why not?”, as I think we need to challenge our institutions and our radiology colleagues to adopt low dose CT protocols. Going back to the definition of screening test, low dose CT is arguably superior as it is simple, highly sensitive and specific, reduces disease morbidity by early detection and, finally, makes the diagnosis with minimal radiation exposure to the patient. Plainly stated, why would we settle for anything less?

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