Editorial

Use of computed tomography (CT) for urolithiasis in pediatric patients

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Abstract: Numbers of annual CT examinations have been increasing incrementally each year during the last 10-20 years. Use of unenhanced CT has been increasingly used for evaluation of urolithiasis, and concerned had been raised about the risks of increased radiation exposure in pediatric patients. Sensitivities and specificity for ureteral stones on conventional CT have been reported up to 98-100%, respectively. Low dose protocols have been developed with the goal of reducing radiation dose with adequate image quality. Although the sensitivity and the specificity of CT is the highest, many can be diagnosed with combination of KUB and ultrasound. CT can be utilized in equivocal cases. Low-dose radiation CT protocols have been reported with high sensitivity and specificity and should be used in pediatric patients when a CT scan is needed.

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The plethora of diagnostic imaging that exists today is essential in making complex diagnoses, but it also has the potential of being overused. Numbers of annual CT examinations have been increasing incrementally each year during the last 10-20 years (1). CT now appears to account for 50% or more of the annual collective dose from medical imaging in developed countries (2). The National council on Radiation Protection and Measurements Report of 2009 estimates that approximately 8-10% of CT examinations in the USA were performed on children and concerned had been raised about the risks of increased radiation exposure in pediatric patients (3). Improper use of diagnostic imaging has few short-term consequences; however, it is the long-term consequences that are noteworthy. This subject has been extensively reviewed in the literature and in the press (4). In 2001, an article was published in the front page of "*USA Today*" that stated that based on an estimate of 1.6 million pediatric CTs per year "about 1,500 of those children will die later in life from radiation induce cancer" (5). Providers should be aware of the amount of radiation exposure and the child's overall exposure, as well as the possibility of future exposures when ordering radiologic tests (6).

Use of unenhanced CT has been increasingly used for evaluation of urolithiasis in pediatric and adult patients. In the ER setting, there is typically preference for CT based on speed, high sensitivity, and accuracy for renal and ureteral stones, as well as its ability to diagnose alternative pathologies (7,8). Sensitivities and specificity for ureteral stones on conventional CT have been reported up to 98-100%, respectively. CT has also been used to measure stone size and differentiate stone composition (uric acid, calcium, etc.). Low dose protocols have been developed with the goal of reducing radiation dose with adequate image quality (8). Estimated effective dose have been reported as low as 0.5 mSv (9). Image qualities are not as good as with conventional CT, but reported studies have yielded good results, with high sensitivity and accuracy for stone disease (8,9). Disadvantages of low dose protocols include a lower detection rate for smaller ureteral stones, less precise stone size measurements and inadequate images in obese patients (8).

US is an excellent tool for diagnosis of nephrolithiasis in the acute setting. It is useful in the diagnosis of hydronephrosis and has the additional advantages of wide availability, speed, noninvasiveness, lack of ionizing radiation, and ability to define aspects of the urinary tract. Disadvantages include being operator-dependent and

problems with the diagnosis of lower ureteral calculus. However, with a good history and physical and a renal and bladder ultrasound with indirect signs (hydronephrosis, absent ureteral jet) all the information is present to make an accurate diagnosis. KUB provides size measurement and is useful in follow-up of patients with nephrolithiasis. Studies using a combination of US and KUB have been reported with high sensitivity (79%) for direct detection and 100% sensitivity for indirect signs (9,10). False negatives on combined US and KUB were reported as been small ureteral stones (less than 5 mm) in mid and distal ureter that have had spontaneous passage (10). Although the sensitivity and the specificity of CT is the highest, many can be diagnosed with combination of KUB and ultrasound. CT can be utilized in equivocal cases. Fevers, an unstable patient, or an unclear clinical picture may call for further diagnostic imaging. However for the majority of patients the clinical picture is clear and the need for CT is minimal.

In this number of pediatrics, Tasian *et al.* (11) reviewed the prevalence of initial CT utilization as the first imaging study for children with nephrolithiasis. They reported that 63% of children underwent initial CT study for nephrolithiasis. They also reported regions in the USA where CT is highly used. There is a discrepancy in utilization, where patients in the East South Central US census division (MS, AL, TN, KY) were most likely to receive CT for initial screening, and the lowest odds existed in the New England states (ME, MA, CT, NH). These practices are deviated from the current guidelines, which recommend the initial screening study be ultrasound for a differential including nephrolithiasis (12,13). Many providers are not taking these considerations when ordering CT scans on children with a differential diagnoses that includes nephrolithiasis.

There may be multiple factors that contribute to overuse of radiologic testing. At initial encounter many physicians develop a vast differential and order studies in an effort to rule in and or out all diagnoses. The legal climate of medicine today may also guide physicians to overuse diagnostic imaging in order to avoid missing any aspect of a diagnosis. With busy emergency rooms, overbooked clinics and overworked physicians, time is very precious and a luxury that many do not have. Although these are unavoidable truths in modern day medicine, pediatric patients should not fall victim to these issues. Children with nephrolithiasis grow up to be adults with nephrolithiasis; indicating that their future is likely to include multiple radiation exposures in the form of CT scans, with cumulative radiation exposure.

Conclusions

Although there is and increased awareness of the potential risks of ionizing radiation in pediatric patients, conventional CT is still over utilized in patients with stone disease. Combination of KUB and US should be more routinely considered in pediatric patients with renal colic or suspicious of nephrolithiasis. Providers should consider alternatives to conventional CT, follow up studies or stone recurrence episodes are common in these patients. Low-dose radiation CT protocols have been reported with high sensitivity and specificity and should be used in pediatric patients when a CT scan is needed.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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