Comparison of Computerized Spiral Tomography with Ultrasonography for Detection of Ureteral Calculi

Üreteral taşları tespit etmede ultrasonografinin, spiral bilgisayarlı tomografi ile karşılaştırılması

Türkiye Acil Tıp Dergisi - Turk J Emerg Med 2010;10(1):12-14

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SUMMARY

Objectives: We aimed to compare accuracy levels of ultrasonography and spiral computerized tomography for detection of the ureteral calculi in patients admitted to the emergency department with flank pain.

Methods: The patients presented with either unilateral or bilateral flank pain to the emergency department over a four-month period and who were suspected to be renal colic were included into the study. All of the study patients with distended bladder after hydration had ultrasonography (USG) and unhanced helical computerized tomography (UHCT) performed by two independent radiologists.

Results: Of the 76 patients with flank pain, CT detected ureteral calculi in 47 out of 48 patients (97.9%) and USG detected ureteral calculi in 34 out of the 48 patients (70.83%). CT detected uretral calculi in 14 patients which was not detected by USG. CT also detected renal calculi in 7 patients which was not detected by USG. A kappa value of 0.62 ($p<0.001$) was determined, indicating a moderate concordance between CT and USG in detecting ureteral calculi. Also a kappa value of 0.65 ($p<0.001$) was determined in the overall diagnostic performance of the both imaging tools in detecting renal calculi.

Conclusions: Computerized tomography is better than ultrasonography in detecting urinary calculus in patients presented to the emergency department with flank pain. However, as a bedside, non-invasive and non-ionized tool, USG should be preffered as the first line diagnostic choice in ED for detecting urinary calculus. CT should be used as an second choice in patients with negative USG exam in ED.

Key words: Spiral computerized tomography; ultrasonography; ureteral calculi.

ÖZET

Amaç: *Acil servise yan ağrısı ile başvuran hastalarda spiral bilgisayarlı tomografi (BT) ile ultrasonografinin (USG) üreter taşını göstermedeki tanısal kesinliğini karşılaştırmayı amaçladık.*

Gereç ve Yöntem: *Dört aylık süre içerisinde acil servise tek ya da iki taraflı yan ağrısı ile başvuran ve renal kolik olduğu şüphelenilen hastalar çalışmaya alındı. Tüm hastalar hidrasyon ile mesane doluluğu sağlandıktan sonra ultrasonografi ve kontrastsız bilgisayarlı tomografi kullanılarak iki bağımsız radyolog tarafından değerlendirildiler.*

Bulgular: *Yan ağrılı 76 hastada, BT 48 üreter taşlı hastanın 47'sini (%97.9), USG ise 34'ünü (%70.8) tespit etti. BT, USG'nin tespit edemediği 14 üreter taşını ve 7 böbrek taşını tespit etmiştir. Bilgisayarlı tomografi ve USG'nin üreter taşını tespit etmede orta düzeyde uyumlu olduğu (kapa=0.62, $p<0.001$) belirledik. Her iki görüntüleme yönteminin böbrek taşlarını tespit etmedeki tanısal performansları göz önüne alındığında kapa değerini 0.065 ($p<0.001$) olarak belirledik.*

Sonuç: *Bilgisayarlı tomografi acil servise yan ağrısı ile başvuran hastalardaki üriner sistem taşlarını tespit etmede USG'den daha kullanışlıdır. Bununla birlikte, yatak başı kullanılan ve invazif olmayan USG, acil servislerde üriner taşların tespitinde ilk seçenek olarak kullanılabilir. Bilgisayarlı tomografi, ultrason sonucu negatif gelen hastalar için kullanışlı olabilir.*

Anahtar sözcükler: *Spiral bilgisayarlı tomografi; ultrasonografi; üreter taş.*

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Introduction

Renal colic is a common presentation of patients in the emergency department. The most common cause of renal colic is ureteral calculi.[1] Although ureteral calculi are the prime consideration in the differential diagnosis of flank pain, there are many other entities that can manifest with similiar signs and symptoms.[2] Unfortunately the clinical findings are nonspesific, with potential mimic of this condition including appendicitis, pelvic inflammatory disease, tubo-ovarian abcess, inflammatory bowel disease and pyelonephritis. Imaging has become an increasingly important tool in the evaluation of patients with flank pain.[3] Imaging in the evaluation of patients with acute flank pain is traditionally based on intravenous pyelography (IVP) as the standard screening tool for detecting urinary calculi.[4] IVP in the emergency department conditions is not a useful approach. Unhanced helical computed tomography (UHCT) has recently gained widespread acceptance as the imaging procedure of choice in evaluating adult patients with suspected renal colic.[5] Prior to the acceptance of CT, ultrasonography (USG) was toughted as a low risk, low cost alternative to IVP and it was shown to have a reasonable sensitivity and specificity for the depiction of calculi and acute obstruction.[6]

In this study we aimed to compare accuracy levels of USG and spiral CT in patients admitted to emergency department with acute flank pain.

Materials and Methods

This prospective study was done in the Emergency Department of Yeditepe University Hospital over a 4 month period. Hospital is a university-based one with 120 inpatients beds and 50 emergency department admittance in a day. During 4 months, 75 patients consecutively referred from our emergency department for evaluation of renal colic were prospectively enrolled into our study. All patients with unilateral or bilateral acute flank pain and hematuria were included in the study. Patients refusing consent, pregnant patients, and patients less than 18 years old were excluded from the study. Nonenhanced helical CT followed by renal USG was performed in 76 patients. USG and UHCT were completed by two independent radiologists. All patients were hydrated with either intravenously or orally administered fluids, and both CT and USG were performed with each patient having full bladder distention. USG was performed by using GE Logic 9 machine. Only one radiology specialist performed all USG studies. Kidneys, ureters and urinary bladder of all patients were examined. USG diagnosis of ureteral calculi required the demonstration of an intraluminal hyperechoic structure causing acousting shadowing. The presence of hydronephrosis and perinephritic fluid were noted. CT was performed by using Philips Brilliant 64 machine. CT images were obtained from the upper renal poles to the bladder base. The section thickness and interval were 1 mm. No oral or intravenous contrast substance was administered. CT were evaluated by another radiology specialist. CT images were evaluated for the presence of ureteral calculi, perinephritic or periureteric fluid and hydronephrosis. The presence of the other pathologies were also noted.

Consistency of the spiral CT and USG for detecting urinary stones were calculated. A p value of less than .05 was considered to indicate a statistically significant difference.

Results

There were 49 men (64.5%) and 27 women (35.5%). The mean age was 48.3±13.00 (18-69). Twelve of the 76 patients described bilateral (16%), and 64 (84%) had unilateral flank pain. Fourty eight of the 76 patients (63.15%) had ureteral calculi. Seventeen of the 76 patients (22.36%) had renal stone. Eleven of the 76 patients (14.47%) had other intraabdominal pathologies such as acute appendicitis, ovarian cysts, acute pyelonephhritis, cholelithiasis and ureteropelvic junction obstruction. CT detected ureteral calculi in 47 out of 48 patients (97.9%) (28 distal, 13 middle and 6 proximal). USG detected ureteral calculi in 34 of the 48 patients (70.83%). CT detected uretral calculi in 14 patients which was not detected by USG. CT also detected renal calculi in 7 patients which was not detected by USG. When diagnostic compatibilities of CT and USG in detection of ureteral calculi were analyzed substantial consistency were observed (kappa=0.62, $p<0.001$). When diagnostic compatibilities of CT and USG in detection of renal calculi were analyzed substantial consistency were observed (kappa=0.65, $p<0.001$). Acute appendicitis (n=3), acute pyelonephhritis (n=2), ureteropelvic junction obstruction (n=2) were diagnosed with CT. Ovarian cysts (n=3) and cholelithiasis (n=1) were diagnosed with USG.

Discussion

Besides routine history and clinical examination, investigation of patients with suspected renal colic traditionally included plain abdominal radiography, gray-scale ultraso-

nography and intravenous pyelography.[7] Recent studies have shown that non-contrast spiral CT is an excellent method for demonstrating ureteral calculi in patients with suspected renal colic.[8] The sensitivity and specificity of helical CT in the setting of acute renal colic have been reported to be 96-98%. In addition nonenhanced CT depicts extraurinary abnormalities in 10-16%.[9] In literature sensitivity of USG to detect calculi is 37-64% and to identify acute obstruction is 74-85%.[6,10] In our study we found that 98% of the ureteral stones could be detected by CT and 70% by USG. We also found moderate compatibility between the efficiacies of both methods in detection of ureteral and renal calculi.

Despite a lower sensitivity for calculus detection than CT, USG is noninvasive, quick, portable, repeatable and relatively inexpensive. Moreover the avoidance of ionizing radiation makes it attractive screening modality in pregnancy.[7] Acute flank pain is a common reason for patients to admit emergency department. Even though it is mostly due to renal causes, other entities like ruptured aortic aneurysms can also cause acute flank pain.[11] CT has been found to be very reliable for the detection of urinary stones and may reveal additional pathology such as abdominal aortic aneurysm, small bowel obstruction, biliary and vascular causes.[12] An important limitation of non-enhanced CT is the fact that it does not permit functional evaluation of the kidney and the degree of obstruction.[13] Radiation exposure is another concern, particularly in the younger population and pregnant women.[7] USG is noninvasive, inexpensive and radiation free, however micro calculi also couldn't be detected by USG.[3]

Our study was carried out in a single center with a small study group. Multicenter studies with high patient population will better reveal reliabilities of CT and USG in diagnosis.

Conclusion

We found moderate compatibility between USG and CT in our study. Although sensitivity and specificity of USG were reported lower than those of CT in literature, we believe that USG could be first choice in patients suspected as having renal or ureteral calculi due to disadvantages of CT. If USG can't detect calculi and patient is still considered having ureteral calculi, CT would be ordered as an advanced diagnostic method.

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