ORIGINAL RESEARCH

Assessment of kidney stones using ultrasonography

[1]Dr. Shiv Mani, [2]Dr. Manvendra Singh, [3]Dr. Sarita Kumari

[1]Associate Professor, [2]Assistant Professor, [3]Senior Resident, Department of Radiology, Rajarshi Dashrath Government Medical College, Ayodhya, UP, India

Corresponding author
Dr. Sarita Kumari
Senior Resident, Department of Radiology, Rajarshi Dashrath Government Medical College, Ayodhya, UP, India

Received: 20 June, 2023 Accepted: 16 July, 2023

ABSTRACT

Background: Kidney stones, also known as renal calculi, are hard mineral and salt deposits that form within the kidneys. The present study was conducted to assess cases of kidney stones using USG.

Materials & Methods:54 cases with kidney stones of both gendersunderwent colordoppler USG performed using Toshiba machine using transmit frequency of 2.5 to 6.0 MHz. The gray-scale US appearance of urinary stones was determined for size, echo difference between stone and adjacent tissue, and posterior acoustic shadowing.

Results: Out of 54 patients, males were 24 and females were 30. Size <4 mm stones were seen in 28 and >4 mm in 26 patients. Echo findings found to be marked in 26, slight in 20 and indistinct in 8. The difference was significant (P< 0.05).

Conclusion: Echo findings found to be marked, slight and indistinct. The colordoppler improves the detection, confidence and overall accuracy of diagnosis for renal and ureteral stones with minimal loss of specificity.

Key words: Kidney stones, Ultrasound, Urinary tract

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution- Non Commercial- Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non- commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Introduction

Kidney stones, also known as renal calculi, are hard mineral and salt deposits that form within the kidneys. They can vary in size and composition and may cause significant pain and discomfort when they move through the urinary tract.[1] Ultrasound (USG) is a commonly used imaging technique in the diagnosis and evaluation of renal lithiasis, which refers to the presence of kidney stones or renal calculi.[2] USG is non-invasive, relatively inexpensive, and does not involve exposure to ionizing radiation, making it a preferred initial imaging modality for assessing kidney stones. Ultrasonography (US) is an accessible, relatively inexpensive imaging method that comes without the risks of exposure to ionizing radiation entailed by CT.[3] Ultrasound can effectively detect the presence of kidney stones within the kidneys or the urinary tract. It is particularly useful for identifying larger stones.USG can help determine the size, location, and number of kidney stones. This information is important for guiding treatment decisions.Ultrasound can reveal whether a kidney stone is causing obstruction or blockage of the urinary tract, which can lead to backup of urine and potential complications.[4]USG can identify any complications related to kidney stones, such as hydronephrosis (swelling of the kidney due to urine build -up), infection, or other abnormalities.Ultrasound can be used to monitor the movement of stones and changes in their position over time. This can be important for tracking the progress of a stone's passage through the urinary tract.[5]The present study was conducted to assess cases of kidney stones using USG.

Materials & Methods

The present study comprised of 54 cases with kidney stones of both genders. All gave their consent to participate in the study. Data such as name, age, gender etc. was recorded. All underwent color doppler USG performed using Toshiba machine using transmit frequency of 2.5 to 6.0 MHz. The gray-scale US appearance of urinary stones was determined for size, echo difference between stone and adjacent tissue, and posterior acoustic shadowing. Stone size was determined on gray-scale US alone. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant. Table I shows that out of 54 patients, males were 24 and females were 30. Table II, graph I shows that <4 mm stones were seen in 28 and >4 mm in 26 patients. Echo findings found to be marked in 26, slight in 20 and indistinct in 8. The difference was significant (P< 0.05

©2023Int. J. Life Sci. Biotechnol. Pharma. Res.

Results

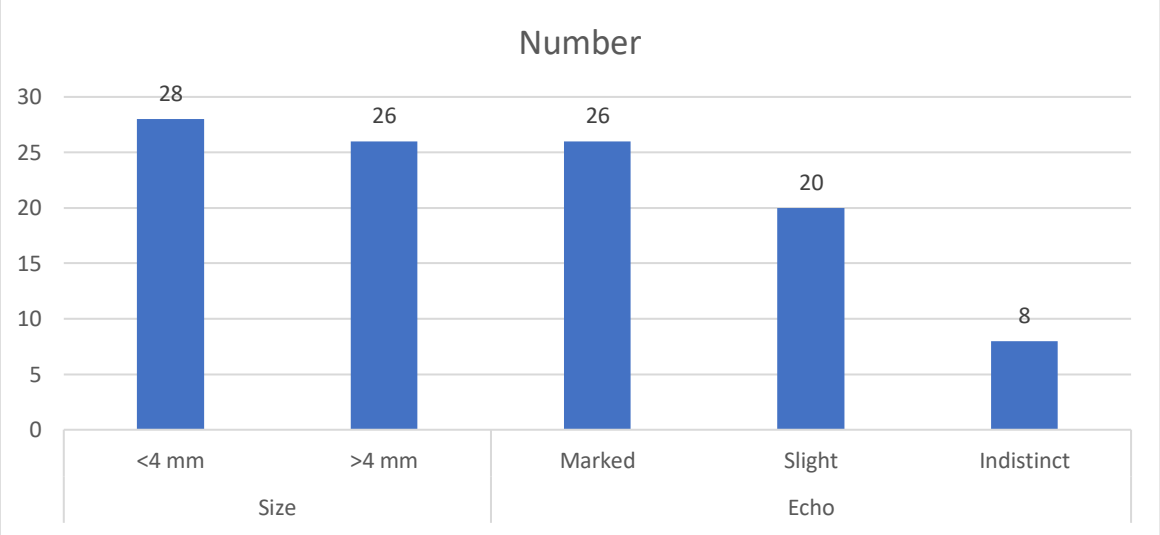
Table: I Distribution of patients

Total- 54		
Gender	**Males**	**Females**
Number	24	30

Table: II Assessment of parameters

Parameters	Variables	Number	P value
Size	<4 mm	28	0.42
	>4 mm	26	
Echo	Marked	26	0.17
	Slight	20	
	Indistinct	8	

Graph: I Assessment of parameters



Discussion

Renal stones are common disease in both developed and developing countries. This pathology has become more common over the past few decades as a result of the rapid variations in dietary habits and the increasing standard of living.[6] Changes in socioeconomic conditions over time have affected not only the incidence but also the site and chemical composition of calculi.[7] Renal stones, composed of ammonium urate and calcium whereas renoureteralcalculosis featuring mainly calcium oxalate and phosphate is currently more frequent in economically developed countries. Chronic kidney disease (CKD) is becoming a major public health problem worldwide.[8]Studied reported the ability to detect stones as small as 2 mm using US imaging in a porcine model more than 30 years ago. With an ability to demonstrate radiopaque and radiolucent stones, hydronephrosis, renal inflammation, ruptured fornices, ureteric jets and resistive index, US can provide valuable clinical information.[9,10]The present study was conducted to assess cases of kidney stones using USG. We found that out of 54 patients, males were 24 and females were 30.Ganesan et al[11] examined 552 cases of nephrolithiasis using US and CT. Overall, US scored 54 and 91% in sensitivity and specificity. US sensitivity was significantly correlated with stone size but not with stone location. US substantially exaggerated the size of stones between 0 and 10 millimeters. Theydiscovered that in 14% (54/384) of situations where CT would propose observation, US would result in a recommendation for intervention. This is assuming that patients with stones 0–4 mm in size will be chosen for observation and those with stones 5 mm could be counseled on the alternative of observation. In contrast, 39% (65/168) of situations where CT results would have suggested management by intervention, US would have suggested care by observation. A median 22% (119/552) of patients may have received incorrect counseling. The likelihood that US-classified stones between 5 and 10 mm in size would undergo a change in management was highest (43% [41/96]). The sensitivity is increased (78%) by using a simple abdomen film of the kidney, ureter, and bladder along with an ultrasound, however 37% (13/35) of patients may still receive unwarranted advice to undergo observation. We observed that size <4 mm stones were seen in 28 and >4 mm in 26 patients. Echo findings found to be marked in 26, slight in 20 and indistinct in 8.Out of 40 patients in Hanchate et al.'s[12] study, 22 were men and 18 were women. The

©2023Int. J. Life Sci. Biotechnol. Pharma. Res.

distinction was not statistically significant (P > 0.05). There were 28 ureteral stones and 18 renal stones under 4 mm in size. There were 20 renal stones larger than 4 mm and 6 ureteral stones. 60% of stones under 4 mm in size and 80% of stones over 4 mm were found by gray scale USG. 95% of stones under 4mm and 100% of stones over 4mm were found by color doppler USG. The difference was substantial. Compared to ureteral stones, which were marked (13), slight (3), and indistinct (8), renal stones showed a marked (30), slight (4), and faint (14) echo difference. The difference was substantial. 30 renal stones exhibited a strong intensity and showed substantial posterior shadowing. Mitterbergeret al[13]compared the detection of urinary stones using standard gray scale ultrasound for diagnostic accuracy using the color Doppler "twinkling sign". The study consisted of forty-one patients who demonstrated at least one urinary stone on unenhanced CT evaluation of the kidneys or ureters. Each patient was evaluated using gray scale ultrasound and color Doppler imaging by an observer who was blinded to the CT results.Seventy-seven stones were present in 41 patients, including 47 intrarenal stones, 5 stones in the renal pelvis, 8 stones at the ureteropelvic junction, 5 ureteral stones and 12 stones at the ureterovesical junction. Based upon gray scale sonography the diagnosis of stone was made with confidence in 66% (51/77) of locations. Based upon Doppler sonography using the twinkling sign, the diagnosis of stone was made with confidence in 97% (75/77) of locations. Clustered ROC analysis demonstrated that the Doppler twinkling sign (Az = 0.99) was significantly better than conventional gray scale criteria (Az = 0.95) for the diagnosis of urinary stones

Conclusion

Authors found that echo findings found to be marked, slight and indistinct. The colordoppler improves the detection, confidence and overall accuracy of diagnosis for renal and ureteral stones with minimal loss of specificity.

References

1. Frymoyer PA, Scheinman SJ, Dunham PB, Jones DB, Hueber P, Schroeder ET. X-linked recessive nephrolithiasis with renal failure. N Engl J Med. 1991; 325: 681-6.
2. Leumann EP. Primary hyperoxaluria: an important cause of renal failure in infancy. Int J Pediatr Nephrol 1985; 6: 13-6. 5. Gambaro G, Favaro S, D'Angelo A. Risk for renal failure in nephrolithiasis. Am J Kidney Dis 2001; 37: 233-43.
3. Foley RN, Collins AJ. End-stage renal disease in the UnitedStates: an update from the United States Renal Data System. JAm Soc Nephrol. 2007; 18: 2644-8.
4. Pinto A, Caranci F, Romano L, Carrafiello G, Fonio P, Brunese L: Learning from errors in radiology: a comprehensive review. Semin Ultrasound CT MR. 2012; 33: 379-82.
5. Lee JY, Kim SH, Cho JY, Han D: Color and power Doppler twinkling artifacts from urinary stones: clinical observations and phantom studies. AJR Am J Roentgenol. 2001; 176: 1441-5.
6. Sheafor DH, Hertzberg BS, Freed KS, Carroll BA, Keogan MT, Paulson EK, et al. Nonenhanced helical CT and US in the emergency evaluation of patients with renal colic: prospective comparison. Radiology. 2000; 217: 792-7.
7. Aytac SK, Ozcan H: Effect of color Doppler system on the twinkling sign associated with urinary tract calculi. J Clin Ultrasound. 1999; 27: 433-9.
8. Kane RA, Manco LG: Renal arterial calcification simulating nephrolithiasis on sonography. AJR Am J Roentgenol. 1983; 140: 101-4.
9. Ramello A, Vitale C, Marangella M. Epidemiology of nephrolithiasis. J Nephrol. 2000; 13:45-50.
10. Coresh J, Selvin E, Stevens LA, Manzi J, Kusek JW, Eggers P, et al. Prevalence of chronic kidney disease in the United States. J. Amer. Dent. Assoc. 2007; 298: 2038-47.
11. Ganesan V, De S, Greene D, Torricelli FC, Monga M. Accuracy of ultrasonography for renal stone detection and size determination: is it good enough for management decisions?. BJU international. 2017 Mar;119(3):464-9.
12. Hanchate V. Twirkling sign in detection of renal and ureteral stone: A clinical study. J Adv Med Dent Scie Res 2017;5(1):146-148.
13. Mitterberger M, Aigner F, Pallwein L, Pinggera GM, Neururer R, Rehder P, Frauscher F. Sonographic detection of renal and ureteral stones: value of the twinkling sign. International braz j urol. 2009;35:532-41.

©2023Int. J. Life Sci. Biotechnol. Pharma. Res.