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The Value of the Color Doppler Twinkling Artifact as the Diagnostic Sign for Kidney Stones

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Abstract: *The purpose of this study aims to determine the clinical effectiveness of color Doppler twinkling artifacts for diagnosis of kidney stone using unenhanced computed tomography as a reference standard. . This research was approved for retrospective investigation conducted between 2010 and 2014.The subject referred from different clinics from King Abdul-Aziz University Hospital. The study sample included 88 patients who demonstrated one kidney stone on unenhanced CT assessment of the kidneys .All the patients were examined the kidneys by B-mode and color Doppler ultrasound using ultrasound machine, and compared with the reference of non-contrast computed tomography (CT) results.*

From88 patients with solitary stone in kidney, there were 70 patients with positive stone that showed in B-mode ultrasound, while 18 patients were negative with the sensitivity of 79.5%, whereas the color Doppler twinkling artifacts showed 68 positive patients and 20 negative patients, with sensitivity of 77.3%. Combination of B-mode and color Doppler ultrasound increased the sensitivity from 79.5% to 86.4%.The results of our study indicated that the twinkling artifact is a good sign to detect smaller renal stones when using color Doppler with combination of B-mode ultrasound.

Keywords: *Computed tomography, kidney stones Ultrasound, Twinkling artifact.*

I. Introduction

Computed tomography (CT) without contrast is at the present time , which is used as the reference standard procedure for diagnosis of the urinary tract stones ,showing sensitivity and specificity close to 100% in many studies [1-3]. However, based on the literature, ultrasound can be a right alternative modality for CT in the initial assessment of renal colic, especially in the emergency setting because it is readily available, inexpensive, and no radiation in it [4-5].

Twinkling artifact is described as an artifact related with color Doppler ultrasound of urinary tract by a rapidly altering of color series (red, and blue) seen on or behind the stone with expected acoustic shadowing in the B- mode sonography [6].

Color Doppler is used in ultrasound for detecting vascular tissue, and renal stones. The artifacts produce from the color Doppler which takes into consideration as useful indicators for the diagnosis [7].

1.1 Objectives

The aim of this study is to determine whether the color Doppler twinkling artifact as a diagnostic sign could be considered to detect renal stones in ultrasound.

II. Material and Methods

Ethical approval was obtained from our institution, in addition to permission from the head of radiology department. The Research review board with reference study from medical report and approval for retrospective investigation conducted between 2010 and 2014. This data was collected at King Abdul-Aziz University Hospital, department of diagnostic radiology

The subject referred from different clinics with flank pain suspected stone in kidneys in the nature of urology department to radiology department. Of the 1619 patients of the total subjects who participated, ultrasound, CT without contrast, and X-ray found only 223(24.7%) with renal stones while the remaining 1396 were showing normal findings of renal stones. 135 out of 223 those individuals who have not undergone unenhanced CT abdomen, and ultrasounds without color Doppler were excluded from our study. However, only 88 patients (57male, 31 female their ages range from 16 to 79; mean 52) those who were examined by both B-mode ultrasound with color Doppler that described the presence of twinkling artifact and CT without contrast. In total 88 patients with known solitary kidney stone were retrospectively included in our final study to detect the effect of Doppler twinkling artifacts on stones by using a recent CT without contrast as reference standard.

All eighty eight patients their kidneys ultrasound images were obtained by B-mode and color Doppler ultrasound with ultrasound machine"IU22 Philips, Healthcare" using a convex array transducer 5-1 MHz. As well, the patients undergone non-contrast spiral computed tomography images were obtained using (CT)

Siemens "Somatom / two dual sources and two dual energies" using the following parameters: 5 mm collimation, 120 kV, 200 mAs and reconstruction at 3 mm intervals of urinary system. The period between the ultrasound and CTU examinations was less than one month.
Ultrasound and CT findings and the medical record related to the patient demographic information, including sex and age reviewed and collected in a data-collecting sheet.

2.1 Statistical analysis:

The analysis of statistics were performed using Microsoft Office Excel version 2007 software program for data collection, then SPSS(version 16) was used for data analysis. Frequency tables were used to analyze data of CT, US, Doppler twinkling artifact findings to assess the correlation between them.

III. Results

In total 88 patients with known solitary kidney stone were retrospectively included in our final study to detect the effect of Doppler twinkling artifacts on stones by using CT without contrast as a gold standard. Fifty seven (64.8%) subjects were male, while 31 (35.2%) were female, aged 16-79 years with over all mean age 51 years std. deviation 14.2 Table 1. Each patient has a solitary stone that had been seen in CT without contrast.

Table 1: The gender of total patients enrolled in the study.

Gender of patients	Frequency	Percent
Male	57	64.8
female	31	35.2
Total	88	100.0

Of the 88 subjects with solitary stone detected by non-contrast CT, 70(79.5%) of the patients had a positive findings in B-mode ultrasound examination, while the remaining 18(20.5%) showed negative ultrasound for stones as presented in Table 2

Table2: Ultrasound findings for total patients with suspected single stone in kidneys.

ultrasound findings	Frequency	Percent
positive	70	79.5
negative	18	20.5
Total	88	100.0

The relationship between the positive and negative twinkling artifact of the 88 patients with solitary stones detected by non-contrast CT, 68(77.3%) stones have shown positive twinkling artifact and with reference to there are 20 (22.7%) negative twinkling artifact on color Doppler examinations as shown in Table 3

Table3: Relationship between the positive and negative in twinkling artifact with CT.

Twinkling Artifact	Frequency	Percent
positive	68	77.3
negative	20	22.7
Total	88	100.0

The size of the stones were classified into three groups according to their largest diameter, the stones diameter less than 0.5 cm , stones between 0.6-1cm in diameter and the stones more than 1cm in diameter. Of the 88 single stones detected by non-contrast CT, 26(29.5) stones their largest diameter is less than 0.5 cm, 41(46.6%) their sizes are in the range of 0.6-1cm and the remaining 21(23.9) for the stones their largest diameter more than 1cm, with majority of calculi detected by CTU measured 0.6-1cm as shown in Table 4

Table 4: Frequency and percentage of stone according to the size as detected by CT

Stone size	Frequency	Percent
<0.5cm	26	29.5
0.6-1cm	41	46.6
>1.0 cm	21	23.9
Total	88	100.0

From the total of the stones 68 stones showed twinkling artifacts six stones had been found with negative and were not seen in B- mode sonography table .Those 6 stones were less than 5mm in their largest diameters . Therefore twinkling could be valuable and specific for the early diagnosis of small kidney stones Table 5, 6.

Table5: US findings and Twinkiling artifacts Crosstabulation

Count		Twinkiling artifacts		Total
		positive	negative	
US findings	positive	62	8	70
	negative	6	12	18
Total		68	20	88

Table6: Correlation between ultrasound findings and stones size.

Stone size		US finding		Total
		positive	negative	
	<0.5	16	12	28
	0.6-1	35	4	39
	>1	19	2	21
	Total	70	18	88

The sensitivity of the twinkling artifacts for the stone sizes < 0.5c was 61.5% , increasing to 80.5% with increases of the stone sizes to 0.6 -1cm reaching to 90.5% Sensitivity for the stones larger than 1cm in size. The total sensitivity of the appearance of the twinkling artifacts for detection of kidney stones was 77.3% There is a correlation between the appearances of the twinkling artifacts stone with regard to size Table 7.

Table7: Twinkiling artifacts and Stone size Crosstabulation

Count		Stone size			Total
		<0.5cm	0.6-1cm	>1cm	
Twinkiling artifacts	positive	16	33	19	68
	sensitivity	61.5%	80.5%	90.5%	77.3%
	negative	10	8	2	20
Total		26	41	21	88

IV. Discussion And Conclusion

Color Doppler twinkling artifact is considered as helping artifact that formed immediately in ultrasound image in the form of fast-changing combination of red, and blue seen behind a fixed calcification like kidney stones.

A total of 88 patients (57 males and 31 females) were enrolled in this study, they have solitary stone detected by Unenhanced CT. Our present study shows the prevalence of kidney stone more in the male with the frequency of 57 and 31 female, with male to female ratio stone 1.8:1 which is higher than the results of recent studies done by Scales CD Jr, et al and Pearle MS, et al [8,9].

Unenhanced spiral CT is the gold standard, and had been confirmed to be highly sensitive and perfect procedure for the detection of urinary stones in the current study [10]. However its use is still limited by costs and more exposure to radiation. Compared with non-contrast CT, the detection sensitivity of gray scale ultrasonography is relatively low. At the present time B-mode in combination with, color Doppler ultrasound represents the first technique for the purpose of diagnosis of renal stones [11].

In a study conducted by Ripolle´ sT,nez-Pe´rezM,VizueteJ et al [12].Using ultrasound and plain abdominal film or using the color Doppler, US has significantly improved the sensitivity and specificity in detecting ureteral stones, with sensitivities of 79 %–97 % and specificities ranging between 91 % and 100 %.With reference to the study mentioned above [12] our study reached the result of sensitivity 79.5% which is almost in same range of the result reported by them [12].

In our study the positive numbers of stones viewed by twinkling artifacts were 68 out of 88 stones (77.3%). In comparison with a previous study done by Ripolle´ sT,nez-Pe´rezM,VizueteJ et al [12] which reported that a total of stones examined by color Doppler sonography showed the twinkling artifact with the sensitivity of 78% [12].The present study twinkling artifacts had sensitivity almost same as their study stated.

The sensitivity of B-mode and color Doppler in our study results was higher than most of the previous studies, because the sign of twinkle artifact could be affected due operating machine setting, size of stone, and skills of operator which matching with the study of Ripolle´ sT,nez-Pe´rezM,VizueteJ et al [12], and in agreement with Simeone Andrulli et al who reported that the appearance of the twinkling artifacts strongly dependent on the type of the ultrasound machine and the way of its presenting [13].

The color Doppler twinkling artifact direct related to the size of a stone. The sensitivity of the twinkling artifacts for the stone sizes < 0.5cm was 61.5%, increasing to 80.5% with increases of the stone sizes

to 0.6 -1cm reaching to 90.5% sensitivity for the stones larger than 1cm in size. The overall sensitivity of the appearance of the twinkling artifacts for detecting kidney stones in the current study was 77.3%. There is a correlation between the appearances of the twinkling artifacts and stones with regard to size.

The use of color twinkling artifact showed tendency to aid the detection of small stones with a diameter of less than 5mm, which cannot be seen in B-mode. The total numbers of negative stones of B-mode ultrasound finding, our present study found 6 stones of them were identified by color Doppler twinkling artifact. When those stones added to the positive stones in B-mode the sensitivity increased from 79.5% to 86.4%, this means that the combination of B-mode and color Doppler ultrasound will improve the detection of stones, thus the test sensitivity. This had been supported by the previous study reported by Tublin ME, Murphy ME, Delong DM et al who demonstrated that the detection of smaller kidney stones by twinkling increased specificity in the positive B-mode cases and increased sensitivity in the negative B-mode cases, therefore the twinkling can be used to increase the sensitivity of the B-mode ultrasongraphy [14].

In conclusion, although the sensitivity of the color Doppler twinkling sign is low, but it's a helpful additional finding for the detection of small stones especially that could not be detected by B-mode ultrasound alone and to be considered as good sign for improving the diagnostic performance when combine with gray scale of ultrasound.

4.1 Limitation

The number of patients is limited because the CT and the color Doppler examinations were not done in most cases; so many patients were excluded from the study for this reason. A large prospective study using B-mode and color Doppler examination is suggested for further studies.

References

[1]. Smith RC, Verga M, McCarthy S, Rosenfield AT (1996) Diagnosis of acute flank pain: value of unenhanced helical CT. AJR Am J Roentgenol 166(1):97–101

[2]. Boulay I, Foley WD, White B, Begun FP (1999) Ureteral calculi: diagnostic efficacy of helical CT and implications for treatment of patients. AJR Am J Roentgenol 172:1485–1490

[3]. Dalrymple NC, Verga M, Anderson KR, et al. (1998) The value of unenhanced helical computerized tomography in the management of acute flank pain. J Urol 159(3):735–740

[4]. Catalano O, Nunziata A, Altei F, Siani A (2002) Suspected ureteral colic: primary helical CT versus selective helical CT after unenhanced radiography and sonography. Am J Roentgenol 178:378–387

[5]. Ripolle´s T, Errando J, Agramunt M, Martı´nez MJ (2004) Ureteral colic: US versus CT. Abdom Imaging 29(2):263–266.

[6]. Rahmouni A, Bargoin R, Herment A, et al. Color Doppler twinkling artifact in hyperechoic regions. Radiology 1996; 199:269–271

[7]. Kim H,YangD,JinW,KyuRyuJ,Shin H. Color Doppler Twinkling Artifacts in Various Conditions During Abdominal and Pelvic Sonography. The American Institute of Ultrasound in Medicine .Med 2010; 29:621–632.

[8]. Scales CD Jr, Curtis LH, Norris RD, et al. Changing gender prevalence of stone disease. J Urol. 2007;177(3):979-982

[9]. Pearle MS, Calhoun EA, Curhan GC. Urologic diseases in America project: urolithiasis.

[10]. Dubinsky TJ, Sadro CT. Acute onset flank pain – suspicion of stone disease. Ultrasound Q 2012; 28:239–40.

[11]. Ulusan S, Koc Z, Tokmak N. Accuracy of sonography for detecting renal stone: comparison with CT. J Clin Ultrasound 2007; 35:256–61.

[12]. Ripolle´ sT,nez-Pe´rez M, VizueteJ, Miralles S, Delgado F,Pastor-Navarro T. Sonographic diagnosis of symptomatic ureteral calculi: usefulness of the twinkling artifact .Abdomen Imaging .2012;7:261-012.

[13]. Simeone Andrulli, Alberto Turrin, Maria Carla Bigi, Pietro Ravani, Alberto Trinchieri and Francesco Locatelli. Colour Doppler twinkling in kidney stones: artefact or sign? NDT Plus (2010) 13 October 2009. 3: 151-154.

[14]. Tublin ME, Murphy ME, Delong DM et al. Conspicuity of renal calculi at unenhanced CT: effects of calculus composition and

[15]. size and CT technique. Radiology 2002; 225: 91–96