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Diagnostic Accuracy of Ultrasonography Versus Computed Tomography for Ureteric Calculi Among the Adult Patients Visiting Mayo Hospital Lahore

Nasir Altaf[1], Ali Kamran[2], Bibi Naseem[3], Maida Iqbal[4], Rabbab Asif[5], Saba Farooq[6], Saba Javed[7], Syed Muhammad Yousaf Farooq[8]

[1] Student of MID, The University of Lahore www.uol.edu.pk. Contact Number: 0348-7533829. Email ID: mid8989189@gmail.com
[2] MBBS, DHMS, DCH, MS Diagnostic Ultrasound, Lecturer, The University of Lahore www.uol.edu.pk. Contact Number: 0335-5656000. Email ID: dr.alikamran55@gmail.com
[3] Student of MID, The University of Lahore www.uol.edu.pk. Contact Number: 0306-4618105. Email ID: bibinaseem23@gmail.com
[4] Student of MID. Contact number: 0322-4746991. Email ID: maidaiqbal3@gmail.com
[5] Student of MID. Contact number: 0332-4641504. E-mail ID: rababasif78@gmail.com
[6] Student of MID. Contact number: 0322-4908517. E-mail ID: aynidoll177@gmail.com
[7] Student of MID. Contact number: 03331720672. E-mail ID: ctscantobateksingh@gmail.com
[8] M.Sc Ultrasound, M.Phill Ultrasound, Lecturer, The University of Lahore www.uol.edu.pk. E-mail ID: yousafgelani@gmail.com

Corresponding Author: Nasir Altaf, Student of MID, The University of Lahore www.uol.edu.pk. Contact Number: 0348-7533829. Email ID: mid8989189@gmail.com

Abstract
Background: Uretric calculi was most commonly found associated with ureteric colic. It occurs due to low fluid intake, frequent urinary tract infections and medicines that may crystallize within the urine. Ureteric calculi are mostly composed of calcium which crystallizes in the kidney and moves down to ureter causing obstruction. The prevalence of ureteric colic is increasing everyday. Over-utilization of Computed tomography is a growing health concern because of the used of high radiation in computed tomography. Objective: To determine the diagnostic accuracy of ultrasonography versus computed tomography for ureteric calculi among the adult patients visiting Mayo hospital Lahore. Methods: This Cross-sectional descriptive study was conducted in the Department of Radiology in Mayo hospital Lahore. All patients with ureteric colic (as per operational definition) and with suspicion of ureteric calculus were included. The ct-scan machine of Hitachi (164 slices) and Ultrasound machine Siemens was used to performing this research to determine the diagnostic accuracy of ultrasonography versus computed tomography for ureteric calculi among the adult patients. Ureteric stones were diagnosed on a trans-Abdominal scan by using of 5MHz frequency. Results: Total 78 patients with sign and symptoms of ureteric calculi were imaged with ultrasonography and computed tomography, among them ureteric calculi were found in 25 (34.2%) patients with ultrasound. Ureteric calculi were found in 52(71.2%) with computed tomography scanning. The individuals of 17-75 years were mainly involved while most of them were male patients. We observed that, computed tomography scanning is batter to diagnose ureteric calculi as compared to ultrasonography.

Keywords: Ultrasound, Ureteric Calculi, Renal Stones, Hydronephrosis, Urolithiasis

Introduction

Ureteric stone is a kidney stone mostly small that normally moves down into the ureterusually composed of undissolved mineral and can easily be stuck in a narrow part of the ureter and leads to the obstruction at any point from the ureteropelvic junction (UPJ) toureterovesical junction (UVJ). These are a subset of the broader topic of urolithiasis. Urolithiasis is common in patients who present with hematuria and/or acute pain located in the flank area[i].Acute ureteric colic is one of the worst pain a patient ever experiences in his/her life[ii]. It is estimated that up to 6% of women will experience one or more renal calculi episodes in their lives with a recurrence rate of 50%. One in four patients with renal calculi has a family history of renal calculi a situation that multiplies the risk of lithiasis by three[iii]. Men are more commonly affected than women[iv]. These patients require periodic imaging studies to monitor the stone position and to assess for hydronephrosis. There is high variability in determining the choice of imaging protocols to observe the progression of ureteral calculi for following up[v]. Protocols guiding imaging use in the management of ureteral calculus disease are desirable because of the potentially harmful cumulative effects of radiation exposure to patients and the increased cost of high-resolution axial imaging moralities [vi] .
Computed tomography (CT) has become the primary imaging modality for evaluating acute flank pain and suspected renal stone disease[vii]. Because of its high sensitivity (95-97 %) and specificity (96-100 %) for urinary tract calculi detection[viii]. CT is of particular value for detecting ureteral calculi, which often are not visualized with other imaging modalities[ix].

However, CT entails exposure to ionizing radiation with attendant long term cancer risk,4-7 is associated with a high rate of incidental findings that can lead to inappropriate follow-up referral and treatment[x]. Although computed tomography (CT) has gained widespread acceptance as the prime investigation having several advantages over other imaging techniques (X-Ray, Ultrasound, Magnetic Resonance Imaging) [xi] . Ultrasonography (USG) can serve as an alternate for initial screening in the patients[xii]. Ultrasound (US) is pain relief. Ultrasound (US) has limited diagnostic value in the assessment of patients with suspected renal stones even when performed by experienced hands particularly in the evaluation of distal ureteric calcul. It can easily identify the stones located in the pyeloureteric and vesicoureteric junctions(VUJ), as well as the complications caused by stones such dilatation of pelvicalyceal system and / or ureter proximal to obstruction and infections[xiii]. Medium and large renal lithiasis (> 5mm) can be easily detected with 2D ultrasonography due to the different echogenicity with the adjacent parenchyma and the posterior acoustic shadowing[xiv]. Ultrasound accuracy could also be lower in specific patient subgroups, such as in obese patients, women, and in specific age groups, especially women of reproductive age [xv] . The sensitivity of the ultrasound scan is highly size dependent[xvi].However, the true sensitivity of US for renal calculi may be substantially less given evidence. Establishing the sensitivity of US for renal calculi will allow informed decisions regarding which type of imaging examination to perform for a given clinical situation[xvii]. The sensitivity of US for detecting renal calculi has been reported to be as high as 96%. For all stones, US have a sensitivity of 19–93% and specificity of 84–100%[xviii].

Methods

A Cross-sectional descriptive study was conducted in the Department of Radiology in Mayo hospital Lahore. Our sample size was 78 patients. 78 patients were included after the approval of synopsis from an institutional review board (IRB). All the adult patients younger than 75 years with suspicion of ureteric calculi were included. Ultrasound machine Siemens and CT-Scan machine of Hitachi (164 slices) were used to perform this research to determine to determine the diagnostic accuracy of ultrasonography versus computed tomography for ureteric calculi among the adult patients . Ureteric Calculi was diagnosed on a trans-Abdominal scan by using a curved array transducer of 5MHz frequency and Hitachi (164slices) CT-Scan . Figure 1 shows a trans-abdominal scan of 27 years old male in which calculus is present in the right vesico-ureteric junction . CT-scan of 36 years old male in which shows a ureteric calculus in proximal ureter in Figure 2.

Results

In this study total frequency of the patients was 73 comprising 47 males (64.4%) and 36 females (35.6%). Mean age of the patients was 37.0417±12.7 (17-75 years). Graph number 1 shows descriptive statistics of age in years. Frequency on ultrasound in Staghorn calculus was 1 (1.4%), frequency in PUJ calculus was 7 (9.6%),frequency in Hydroureter was 8 (11.0%), frequency inVUJ calculus was 10 (13.7%), frequency in Hydronephrosis was 22(30.1%) and frequency in Ureteric calculus was 25(34.2%). Demographic details of Ultrasonographic findings are given in Table-1. Graph number 2 shows descriptive statistics of findings in Ultrasound. Frequency on Computed Tomography in normal was 1 (1.4%), frequency in Renal calculus was 2 (2.7%),frequency in Hydronephrosis was 2(2.7%), frequency inVUJ calculus was 8 (11.0%), frequency inVUJ calculus was 8 (11.0%) and frequency in Ureteric calculus was 52 (71.2%). Demographic details of computed tomographic findings are given in Table-2. Graph number 3 shows descriptive statistics of findings in Computed Tomography.

Figure- 1

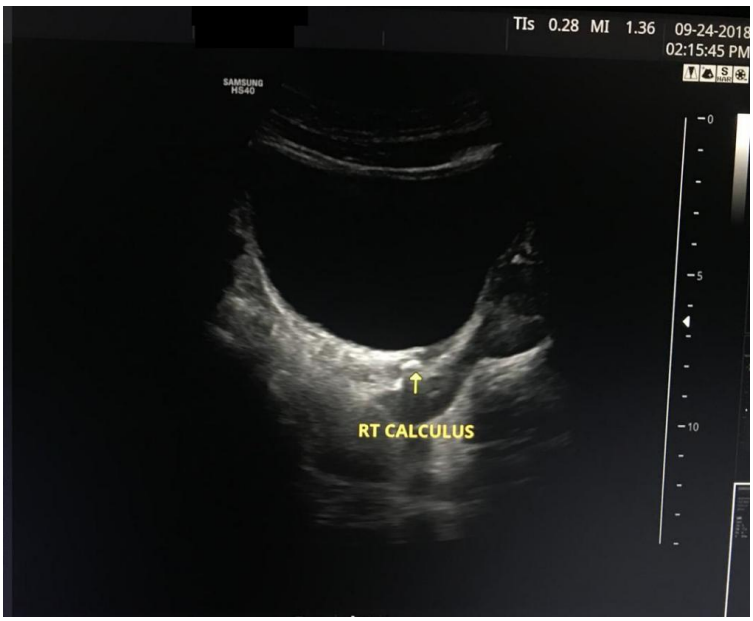
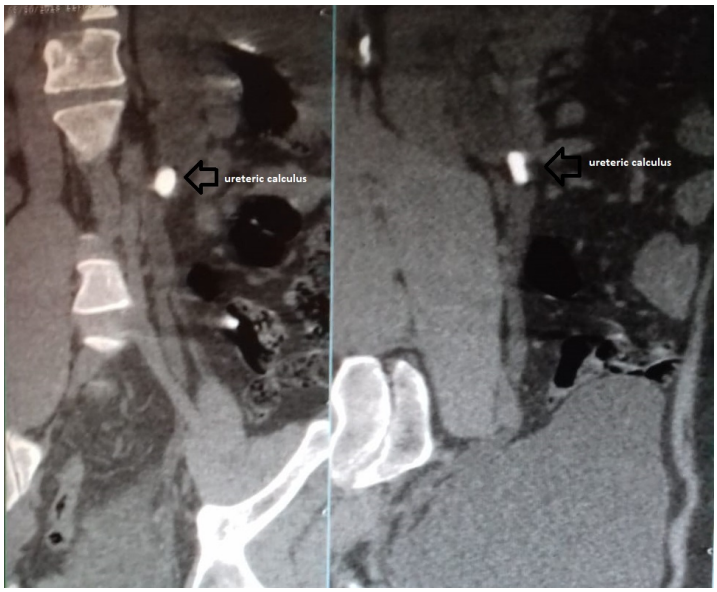


Figure- 2



Graph-1 Descriptive statistics of age in years

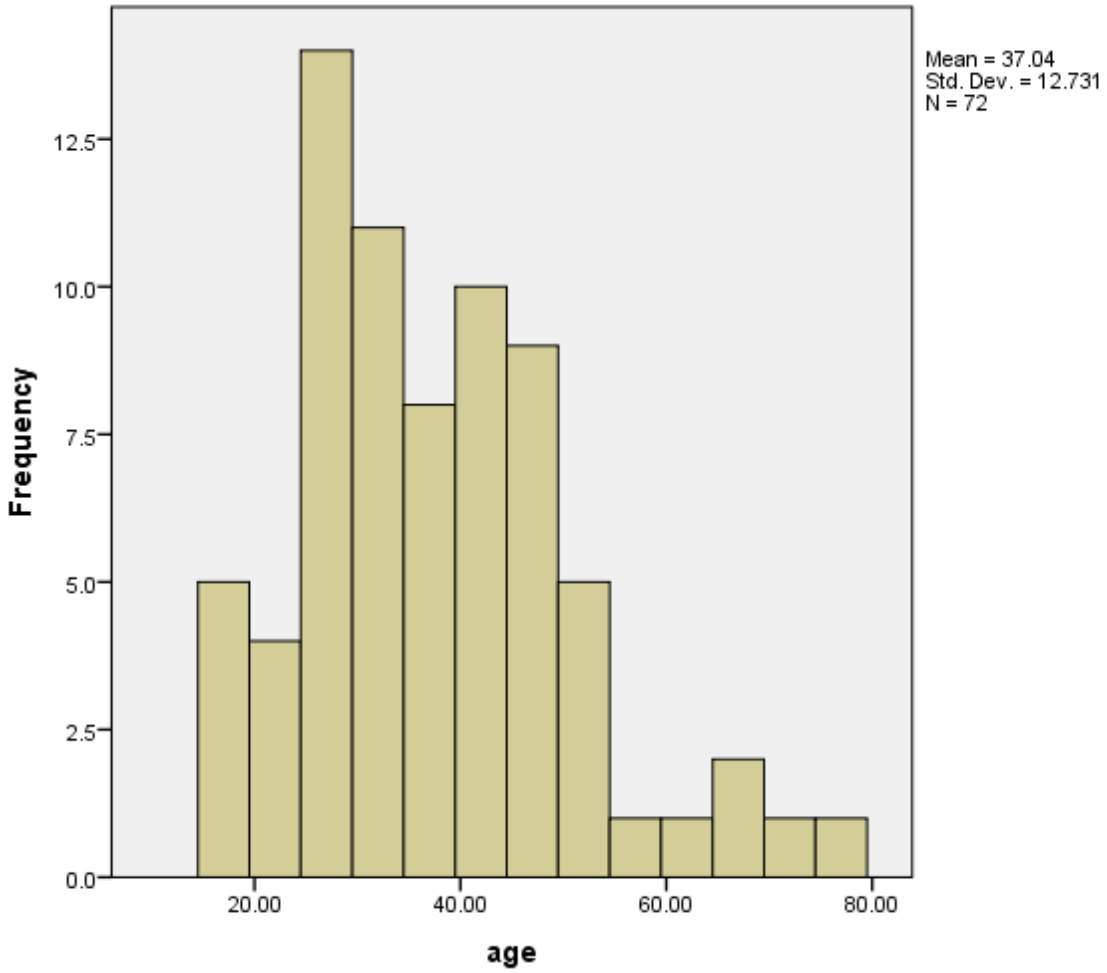


Table-1 ultrasonographic findings

USG findings

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hydronephrosis	22	30.1	30.1	30.1
	Hydroureter	8	11.0	11.0	41.1
	PUJ calculus	7	9.6	9.6	50.7
	Staghorn calculus	1	1.4	1.4	52.1
	Ureteric calculus	25	34.2	34.2	86.3
	VUJ calculus	10	13.7	13.7	100.0
	Total	73	100.0	100.0	

Graph-2 Descriptive statistics of diagnosis of Ultrasound.

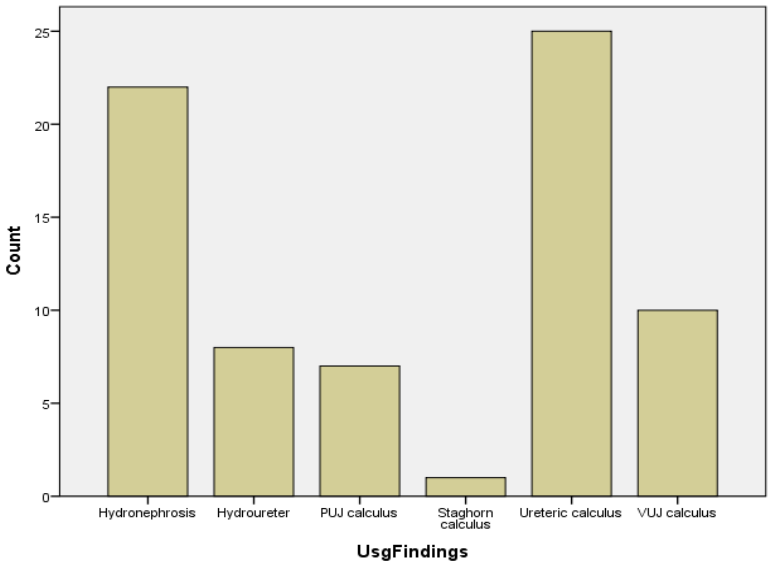
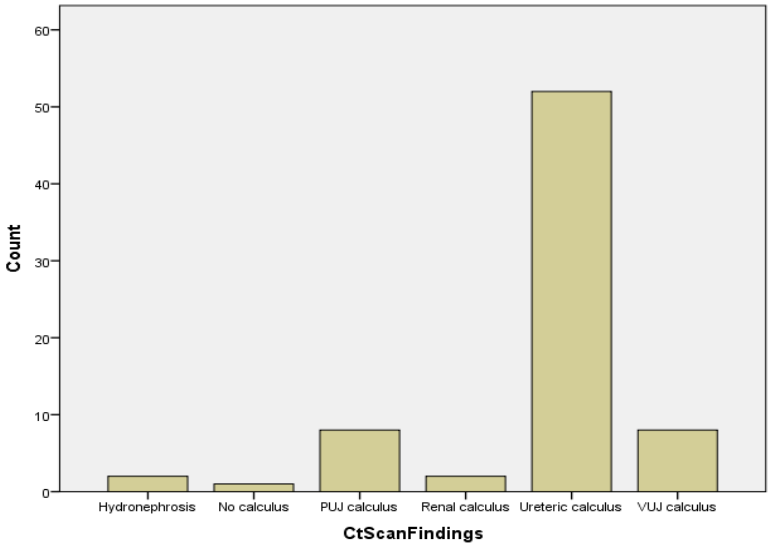


Table-2 Computed Tomographic findings

CT Scan Findings

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hydronephrosis	2	2.7	2.7	2.7
	No calculus	1	1.4	1.4	4.1
	PUJ calculus	8	11.0	11.0	15.1
	Renal calculus	2	2.7	2.7	17.8
	Ureteric calculus	52	71.2	71.2	89.0
	VUJ calculus	8	11.0	11.0	100.0
	Total	73	100.0	100.0	

Graph-3 Descriptive statistics of diagnosis of Ultrasound.



Discussion

In the current study it was noted that, a study was performed by Viprakasit DP et al in 2011 Limitations of renal Ultrasound in the evaluation of Urolithiasis: A co-relation with Computed Tomography . Urolithiasis is a common finding in patients who present with acute flank pain or hematuria. The prevalence of urolithiasis is increasing everyday .ureteric colic associated with ureteric calculi a severe and complex clinical problem. Radiological studies have an important role in early diagnosis of ureteric calculi.the discrepancy between CT and ultrasound imaging is high (39%) in the evaluation of urolithiasis. In our cohort, 20% of studies exhibited significant differences which could have led to alternative management practices. Despite continued concern for excessive lifetime radiation exposure with CT, urologists should recognize limitations of imaging such as ultrasound in the evaluation of urolithiasis though RUS remains useful for detecting hydronephrosis/obstruction[xix].

A systematic review of studies was carried out at King Edward Medical University in 2015 to compare the sensitivity and specificity of computed tomography and ultrasound, to diagnose ureteral colic in 250 patients presented with lumber pain. They concluded computed tomography the best and reliable technique to detect renal calculi however, ultrasound was found a preferred substitute to computed tomography to lessen radiation dose. Ultrasound has limited value for accurate detection of stone in the ureter. Any patient presenting with renal colic had to undergo plain CT (KUB) because ultrasound is operator dependent. Factors like patient compliance or obesity limit the ultrasound investigation of renal calculi[xx].

Another study was accomplished by Noreen A, Javed AM in 2016. Found sensitivity of ultrasound is not efficient but it is readily available and reliable in investigating the patients with flank pain with 100% specificity, sensitivity 95% and no harmful X rays. They concluded CT should be used as follow-up and investigative tool[xxi].

Conclusion

We observed that, Computed Tomography is batter imaging modality as compared to ultrasonography for diagnosis of ureteric calculi. Ultrasound has shown limitation for certain conditions or ultrasound accuracy was also lower in specific patient subgroups

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