Renal Abnormalities in Young Healthy Individuals on Screening Ultrasonography of Kidneys

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ABSTRACT

Objective: To determine the prevalence of renal abnormalities in young healthy individuals on screening ultrasonography of kidneys.

Study Design: Cross sectional study

Place and Duration of Study: Combined Military Hospital, Hyderabad from Sep 2019 to Mar 2020.

Methodology: 2050, Young asymptomatic healthy individuals of 15-24 years age, coming to radiology department for screening ultrasound of kidneys were included in the study. The examination was performed with standard convex probe of 3.5MHz on Aloka Pro sound SSD-3500 Ultrasound machine by experienced radiologist. Both kidneys were scanned with patient in supine and lateral positions. The images were taken in both longitudinal and transverse sections.

Results: Out of 2050 cases included in the study, 112 (5.46 %) had renal abnormalities, 81 (3.95 %) had renal calculi, hydronephrosis was found in 14 (0.68%) cases, out of which ten were due to calculi, 9 (0.44%) individuals had abnormalities of size, shape and position and renal cysts were found in 7 (0.34%) cases with six simple and one septated cyst, while only 1 (0.05%) case had bilaterally echogenic kidneys.

Conclusion: The overall prevalence of renal abnormalities was 5.46% with calculi comprising the major abnormality. Early detection with ultrasound screening can prevent further damage to the kidneys in young asymptomatic healthy individuals. It is recommended to perform screening ultrasonography of kidneys, ureters and bladder in young candidates before induction in services.

Keywords: Hydronephrosis, Renal ultrasonography, Renal calculi, Renal cyst.

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INTRODUCTION

There is high prevalence of renal abnormalities especially calculi around the world.[1] Urinary calculus is a hard mass formed from aggregates of different types of crystals in urinary tract.[2] The incidence of calculi is increasing all over the world irrespective of age, gender, race and socioeconomic conditions.The incidence is more in men than women.[3] Calcium oxalate and phosphate are the most common calculi. Other types of stones are cystine stones, uric acid and urate calculi.[4,5] Stones can cause serious effects on health and quality of life. It causes morbidity in the form of pain, urinary tract infection, hydronephrosis and reduced renal function. Renal colic is one of the commonest presentations in emergency department and results in significant burden on health care resources.[6]

Hydronephrosis is the dilatation of renal pelvis and calyces due to intermittent or incomplete obstruction of urine flow. When it involves ureter it is called hydronephroureter. Hydronephrosis may be unilateral or bilateral depending on the level of obstruction. Unilateral hydronephrosis occurs due to obstruction above the level of urinary bladder.[7] Unilateral hydronephrosis or hydronephroureter is caused mainly by ureteric calculi or idiopathic pelviureteric junction obstruction. Pelviureteric junction obstruction presents with gradually increasing pain and heaviness in the loin which aggravates with fluid intake. Classic ureteric colic is flank pain radiating to groin with microscopic or gross hematuria.[8]

Abnormalities of size, shape and position are congenital. They are usually silent and detected incidentally on ultrasonography. Common abnormalities include horse shoe kidney, crossed fused ectopia, absent kidney and pelvic kidney.

Simple renal cysts are commonly found in adults and increase in both prevalence and size with age. Its prevalence is less in young population but increasing availability of ultrasound has resulted in increased number of cysts being detected in young population. There is a small fraction of renal cysts that are considered complex because they have septae and internal contents other than fluid. Complex cyst is worrisome

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even though its prevalence is very low because it is associated with risk of malignancy.[9]

Chronic kidney disease (CKD) is characterized by gradual loss of renal function. It has a high economic cost to health care systems and a global health problem worldwide. Assessment of renal cortical echogenicity by ultrasound is a strong predictor of renal function with specificity of 93.5%.[10]

A significant number of young individuals with renal colic were coming to our hospital for treatment. They usually require hospital admission and frequent visits due to recurrent renal calculi. Few cases of hydronephrosis due to Pelviureteric junction narrowing with cortical thinning were also noted. There is damage to renal parenchyma with loss of cortical thickness due to long standing calculi and hydronephrosis. A need was felt to start screening ultrasound of kidneys to identify the silent calculi and hydronephrosis in young candidates before induction in services.

Early detection and treatment will prevent further damage to kidneys. It will also reduce the burden of renal diseases in services, where health of staff and workers is a primary concern for the administrators. The aim of this study is to find out the prevalence of renal abnormalities in young asymptomatic individuals of local population of Sindh.

Ultrasound was chosen for screening because it is widely available, cheap and no radiation hazard is involved. X Ray KUB has a low sensitivity and many renal abnormalities were not apparent on plain radiographs. Although CT scan has a greater sensitivity but it is costly,not readily available everywhere and radiation hazard is involved.

Many studies were done to estimate the prevalence of renal calculi in local population but limited work was carried out before using ultrasound as a screening tool for renal abnormalities in young population. Ultrasound was done at final stage of recruitment before joining the training, when all other requirements are complete. This study will also show the impact on recruitment and indicate the approximate number of selected candidates which will be filtered out due to renal abnormalities.

METHODOLOGY

After getting approval from the hospital ethics committee (ERC no. IERC/Radio/2019/01), this cross sectional study was conducted at Radiology Department Combined Military Hospital Hyderabad for six months, from September 2019 to March 2020.

Inclusion Criteria: Young healthy individuals of age 16-24 years, screened with Ultrasound for renal abnormalities were inlcuded in the study.

Exclusion Criteria: Patients who were prior operated cases for renal diseases were excluded from the study.

Non-probability consecutive sampling was done and 2050 young individuals were examined during the study period. Informed written consent was obtained from the study population.The examination was performed with 3.5 MHz convex probe on general purpose ultrasound machine,Aloka Prosound SSD-3500. A thermal printer recorded the images. Screening was performed by qualified radiologists with appropriate experience.

Scanning was done and two bilateral images were taken in supine and lateral positions. The images included one longitudinal and one transverse image of each kidney. The parameters that were investigated during the examination included number, size (including difference between size), shape, position and echogenicity of kidneys.

Presence of calculi, cyst, mass and hydronephrosis was also noted. Calculi of less than 4mm were not recorded because of poor sensitivity of Ultrasound for small calculi.Cysts were noted for size, septations and solid component. Small cysts less than one cm were not mentioned because they are clinically insignificant. Hydronephrosis was taken as diameter of renal sinus more than 10mm. All the data was recorded on a printed proforma and record was kept in the study file.

The data was entered in SPSS-25. The descriptive variables were analyzed and frequency of each renal abnormality was reported in the results.Point prevalence of renal abnormalities was calculated using the formula:

$$\frac{\text{Numberofcandidateswithrenalabnormality}}{\text{Totalnumberofcandidates}} \times 100 = \%\ \text{ofpopulationwithrenalabnormality}$$

RESULTS

Two thousand and fifty healthy individuals were included in this study. Out of these 112 (5.46%) cases were found positive for renal abnormalities. The percentage of different abnormalities was given in the Figure. 91 (4.43%) individuals had calculi, the break down of which was given in the Table.

In 9 (0.44%) cases abnormalities of size, shape and position was found detail of which was given. Hydronephrosis was found in 14 (0.68%) cases, out of which 5 (0.24%) were due to renal calculi, 5 (0.24%)

due to ureteric calculi and remaining 4 (0.19%) were due to narrowing at pelvi-uretericjunction. Renal cysts were found in 7 (0.34%) cases out of which 6 (0.29%) cases were of simple cyst and only 1 (0.05%) case was of 3 cm septated cyst. Only 1 (0.05%) case of bilateral echogenic kidneys was found.

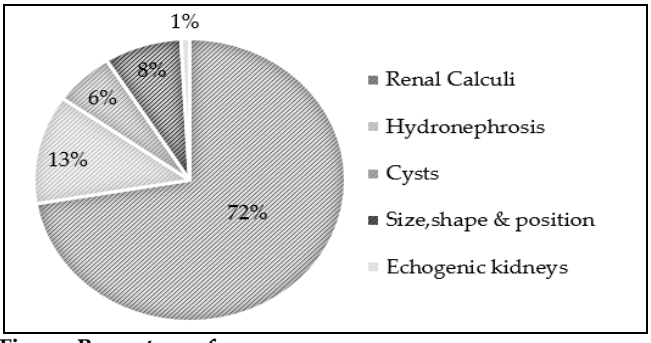

Figure: Percentage of cases.

Table-I: Frequency of renal calculi.

Abnormality	n(%age)
Single renal calculus	56 (2.73%)
Multiple renal calculi	25 (1.21%)
Calculi with hydronephrosis	10 (4.87%)

Table-II: Frequency of size, shape and position abnormalities.

Abnormality	n(%age)
Unilateral small kidney	2 (0.97%)
Horseshoe kidney	2 (0.97%)
Cross fused ectopia	1 (0.48%)
Absent kidney	2 (0.97%)
Pelvic kidney	2 (0.97%)

DISCUSSION

Renal abnormalities especially stones are a common cause of presentation in emergency and outpatient departments. Calculi cause severe pain and tend to be recurrent, therefore, results in heavy burden on health care resources.

Renal ultrasound is a versatile, inexpensive, readily accessible and useful examination technique for renal abnormalities.[11] It has the advantage of being readily available, fast, and easily performed. Moreover it does not involve ionizing radiation.[12]

The overall prevalence of renal calculi around the globe is about 10 %.[13] The prevalence of stones is maximum in 30-50 years of age. Our population is younger, the majority of individuals falling in 18-20 years of age group.The prevalence in them was found to be 4.43%. One local study conducted in Southern Punjab shows 3.30% of calculi in younger population of 10-19 years and 12.20% in 20-29 years of age. The prevalence is almost similar in local population of Sindh and Southern Punjab.[2] One study showed the meta-analysis to assess the stone prevalence in mainland China from 1990 through 2016. The pooled overall prevalence was 7.54%. The prevalence in age groups of 20–29 years was 3.15%, which is close to the prevalence of our stud.[6]

Renal calculi of less than 4mm were not included in this study because they are difficult to distinguish from hyperechoic renal sinus fat on ultrasound and small calculi may fail to demonstrate acoustic shadowing.[14] They usually pass spontaneously and do not cause significant clinical effect.[15] Fowler *et al*, found that ultrasound is a poor modality for identifying renal calculi smaller than 0.4 cm in diameter.[16]

In our study 14 cases of hydronephrosis were found in which 5 individuals had nephrolithiasis, 5 individuals had ureterolithiasis and 4 of them had narrowing at pelvi-ureteric junction.

Ultrasound is an effective tool for detection of congenital renal anomalies, namely horseshoe kidney, crossed fused ectopia, pelvic kidney and absent kidney. Caiulo *et al*, did ultrasound mass screening of infants for congenital anomalies. Their overall frequency was 0.96%.[1] Our study shows prevalence of 0.97% for each of horses hoe kidney, pelvic kidney and absent kidney. The prevalence of crossed fused ectopia was 0.48%.

Simple renal cysts are among the most common renal cystic lesions.[17] On ultrasound, a simple benign renal cyst appears as a well-defined, round, anechoic, thin walled structure with increased through transmission. Any other cystic lesion that does not meet the criteria for a simple cyst is considered as a complex cyst. Simple cysts are frequently found in otherwise healthy kidneys. Single simple renal Cyst of less than 1cm was not included in this study because it is asymptomatic and there, clinically insignificant. Moreover, size does not indicate malignancy in cystic renal masses and cysts less than 2 cm can be safely followed by serial imaging study.[18] In our study we found 7 cases of renal cysts, six were simple and only one was complex cyst. The prevalence was around 0.34%. Kelly *et al*, found renal cyst prevalence of 2.2% in a large 10-year cohort of children who underwent abdominal imaging.[19]

Rosi *et al*, concluded through a meta-analysis of the prevalence of renal cancer that one RCC should be detected per 1000 individuals scanned by renal ultrasonograph.[20] We did not find any case of solid renal mass mainly because we screened much younger

population and secondly ultrasound has a low sensitivity and specificity for detection of RCC, particularly for masses less than 3cm.[21]

Chronic Kidney Disease has a global prevalence of about 11%.[22] It increases with age. We find only one case of increased renal echogenicity on ultrasound with raised renal profile because we scan younger population.

Our study shows overall prevalence of 5.46% young healthy individuals with renal abnormalities. Screening ultrasound of kidneys will identify these young individuals. In turn they will have an opportunity for early detection and treatment of renal diseases. Moreover it will provide healthy individuals to serve in different government departments especially armed forces. Screening ultrasonography of kidneys should be a mandatory requirement before induction in services. After its implementation, approx. 5 in 100 young individuals will not report sick to emergency department, which in turn have a significant impact on health of troops, reduction in number of patients in service hospitals and reduced financial burden on healthcare resources.

CONCLUSION

The overall prevalence of renal abnormalities was 5.46% with calculi comprising the major abnormality. Early detection with ultrasound screening can prevent further damage to the kidneys in young asymptomatic individuals. It will also reduce the patient burden in services hospitals.It is therefore recommended to include ultrasound of kidneys, ureter and bladder as a mandatory requirement for young candidates before induction in services.

Conflict of Interest: None.

Authors' Contribution

RS: Conception, study design, acquisition of data, drafting, final approval, THB: drafting, final approval, analysis of data SA: acquisition of data, analysis of data, final approval, MMAN: conception, review and final approval, GS: interpretation of data, review of draft, final approval, SF: data compilation, review of draft, final approval.

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