Renal cysts: Sonographic evaluation and classification in Sudanese adults

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Received: 20-03-16 Accepted: 27-07-16 Published: 02-11-16

ABSTRACT

Background: Renal cysts were common findings in the kidneys encountered in daily routine ultrasound examination. The majority is benign, but they can become complicated in the case of infection, hemorrhage, and ischemia. Sonographic evaluation plays a great role in classification and characterization of these lesions. Objective: The aim was to classify the renal cysts using ultrasound, to analyze the frequency of symptoms and signs, and to identify the significant factors. Materials and Methods: This is a cross-sectional prospective study conducted from September 2014 to December 2015. A total of 105 patients (78 males and 27 females) have been examined with ultrasound and confirm diagnosed with renal cysts. The sonographic criteria used for assessing renal cysts were wall-definition, thickness of septa, acoustic enhancement, shape and numbers of cysts, in addition to the genetic history of the family. Results: The incidence of renal cysts is significantly higher in male than female (74% vs. 26%, *P* = 0.01). Renal cysts were common in patients above 50 years old (80%). Aging was a significant factor of the renal cyst (*P* = 0.03) and size of the cysts was not significantly associated with age (*P* = 0.261). The majority of cysts was solitary (66%), unilateral (86%), and located in the right kidney (49%). The incidence of cortical simple renal was 73%, para-pelvic simple cysts was 17%, autosomal-dominant polycystic kidney disease (ADPKD) was 4.76%, and acquired cystic kidney disease (ACKD) was 4.76%. The majority of simple renal cysts were asymptomatic (75%). Hypertension and flank pain were the common symptoms of ADPKD and ACKD. Conclusion: Age and gender were significant risk factors of renal cysts. ADPKD and ACKD were less frequent among Sudanese adults. Hypertension and flank pain were the most common symptoms and signs of ADPKD and ACKD. Ultrasound plays an effective role to classify and assess renal cysts that help in management and follow-up.

Keywords: Classification, cysts, evaluation, renal, sonographic

INTRODUCTION

Renal cysts are a common finding in the kidneys and they were easily detected with conventional ultrasound. Ultrasound plays a great role in differentiation between all types of renal cystic masses. In previous studies, the frequency of renal cysts increases with age and represented approximately 40% of all individuals who were investigated with a computerized tomography scan.[1]

In literature, the prevalence of renal cysts increased with age and the other risk factors included male gender, renal dysfunction, and hypertension. In the previous study, there was association between simple renal cysts and hypertension since small cysts were likely to elevate hydrostatic pressure that compresses the surrounding renal tissue.[2] The renal cysts are asymptomatic in general, but autosomal-dominant polycystic kidney disease (ADPKD) cause pain due to enlargement and...

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hypertension is one of the most common early manifestations. There was a strong correlation of hypertension with ADPKD and is often diagnosed late in the disease course. Early detection and treatment of hypertension in ADPKD are very important since cardiac disease and renal failure are common cause of death.\[3\]

Detection and assessment of renal cysts are necessary since there were asymptomatic patients who were involved with (ADPKD) and other acquired cystic diseases which were developing silently and may result in renal failure and hypertension.

The researchers did not find in open literature enough studies conducted in Sudan regarding the same topic except which was conducted in eastern Sudan by Moawia et al.,\[6\] which concluded that the most common type of renal cystic masses was the simple cysts which were higher in male than female. In the current study, the researchers investigated renal cysts using conventional ultrasound to make classification and to understand the prevalence and see whether there were risk factors and symptoms associated with these cysts.

The purpose of this study is to assess the renal cysts and classify them according to the sonographic appearance and to find relationship with age in Sudanese subjects. The study has significant importance in clinical practice in Sudan through the output of its results in the evaluation of renal cysts, follow-up, and management specifically in patients with ADPKD and acquired kidney cystic disease (AKCD).

**MATERIALS AND METHODS**

A qualitative prospective cross-sectional study was used to evaluate the renal cysts in 105 Sudanese adults (78 males and 27 females and the mean age was 60 years old) using transabdominal ultrasound scan. The study was conducted in Shifa Al Aleel and Ibn‑sina hospitals which were major centers in Khartoum State, from September 2014 to December 2015. The sample size was selected following the nonprobability sampling technique (quota design). The inclusion criteria accommodated all adults’ patients who were referred to the ultrasound department for investigating the kidneys and patients under 20 years were excluded from the study.

The patients were scanned in the supine position using Toshiba ultrasound machines with convex probes having frequency 3.5 MHz. The patients were scanned in supine position; oblique and prone were also needed where possible. The sonographic procedure was performed by two expert sonologists who wrote the final report for every patient and there were no interobserver errors. The machine setting was adjusted and so the image parameters such as overall gain, focusing, and depth. The kidneys were scanned in sagittal, coronal, and transverse sections to the entire size and shape. Every cyst was measured in transverse and longitudinal diameters (in centimeter) to calculate the depth, length, and anterioposterior diameter. From these three measurements, the size of the cyst was estimated using the formula:

\[
\text{Depth (D) } \times \text{ Length (L) } \times \text{ Width (W)} \times 0.5. \text{[7,8]}
\]

The reference of sonographic criteria for differential diagnosis of ADPKD was as follows:\[9\]

- Existence of at least two cysts in one kidney or one cyst in each kidney in a patient younger than 30 years
- Existence of at least two cysts in each kidney in patient aged 30–59 years
- Existence of at least four cysts in each kidney for patients aged 60 years or older.

The demographic data were collected using a designed data collection sheet which included the symptoms, clinical history, and demographic information.

Data were interpreted and analyzed using SPSS software program version 21 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics and nonparametric test were used to analyze the variables. Chi-square test was applied to obtain the significance between age and size of renal cysts. The statistical significant value was considered to be \( P < 0.05 \).

The study was approved by the ethics committee of the faculty of radiological sciences in Alzaeim Al‑azhari University. Informed consents were taken from patients who were aware of the importance and participation in the study and no names or identity will be mentioned and all personal data had been kept confidentially. Finally, patients signed the consent form and they agreed to the use of collected data for research purposes.

**RESULTS**

A total of 105 patients (78 males, 74.3%) and 27 females (25.7%); were scanned with ultrasound and diagnosed with renal cysts. The distribution of gender was shown in Figure 1 and it was observed that male was significantly higher than female. The mean age of the study population was 60 years. The age was categorized into three groups summarized in Table 1 and most of the patients were above 50 years old. Table 2 summarizes most of the study variables such as gender, site, and number of the cysts. The common site of the cysts was the right kidney (49%) and 37% in left kidney. Figures 2-4 were ultrasound images of kidneys demonstrating type, location and number of renal cysts. The majority of renal cysts were solitary (66%) whereas 11% were multiple. Most of the renal cysts were located unilateral (86%) and bilateral was 14%. The types of renal cysts are summarized in Table 3. It was observed that simple cysts (cortical and para‑pelvic) were the most common type which had been detected (73% cortical and 17% para‑pelvic). Hence, the total number of simple cysts was 90% among the study population. The incidence of ADPKD was 4.76% and also the AKCD was 4.76%; they were less frequent common.

The association between age and size of the renal cysts is summarized in Table 4. The largest size was observed in the age group above 50 years old (23.8%). The \( P \) value was 2.61%. The symptoms are summarized in Table 5. Most of the patients were asymptomatic (75.24%); flank pain (9.52%), dysuria (4.76%), hematuria was present in only one case (0.95%) and hypertension was found in 9.52%.

**DISCUSSION**

In this study, the researchers used ultrasound to assess the renal cysts and classify them relying on the sonographic appearance.
Detection of renal cysts is very important in health since it helps to prevent progression of renal failure and useful in differential diagnosis of renal cancer. For instance, ADPK slowly progresses and results in the end stage of renal disease and has no effective therapy. In the previous study, the prevalence of simple renal cysts was common in patients above 50 years old, were 89% and there was a significant relation (P = 0.03). This result is consistent with Chang et al. who studied the prevalence and clinical characteristics of the simple renal cyst. He reported that the overall prevalence of simple renal cysts was common in the seventh or later decade of life and the prevalence increased with age (P < 0.001). This indicates that advancing age is a risk factor of renal cysts. The present study revealed that renal cysts were common in male more than female (74% vs. 26%). This result is also agree with Chang et al. who found that male-to-female ratio was 2.81 (15.14% vs. 5.38%; P < 0.001). Ozveren et al. concluded that renal cysts were more common in males and elders, and associated with diabetes. This finding confirms that gender is significantly associated with the prevalence of simple renal cysts.

The current study revealed that the incidence of solitary cysts were more common than multiple cysts (66% vs. 11%). This finding was agreed with a study conducted by Chang et al. who reported that the majority of renal cysts were solitary (82.3%). In this study, the size of renal cysts was measured and compared with age. The cysts were gradually increased in size as the age advancing. We observed the large cysts (8–13 cm) were present in patients above 50 years old and cysts lesser than 3 cm were common in 20–40 years old. Although there was no significant association between the size of cysts and age (P = 0.261), these findings were generally agreed with Terada et al. who concluded that the majority of renal cysts increased in size and number. He reported that cysts grew more rapidly in patients younger than 50 years than those in patients 50 years old and older, at a rate of 3.94 and 1.84 mm. In the present study, the researchers analyzed the frequency of symptoms of renal cysts. It was noted that the incidence of ADPKD and acquired cystic kidney disease (ACKD) was 4.76% and 4.76%, respectively. The clinical importance of these cysts that they cause hypertension and flank pain which is a common feature in patients with ADPKD and is difficult to control and manage. Miskulin et al. studied health-related quality of life in patients with ADPKD and cystic kidney disease (CKD) stages, and concluded that pain is an early common symptom in the course of ADPKD. This result is agreed with our finding that pain was the main symptom. The pain is attributed to the expansion of the cysts and enlargement of the kidneys which led to severe flank pain.
majority of ADPKD and relates to progressive enlargement of the kidneys. In the present study, the hypertension is mainly attributed to ADPKD. In previous studies, there was association existed between renal cysts and hypertension. Hong et al.[19] assessed the impact of simple renal cysts on hypertension and evaluated the prevalence of these cysts and their relation with hypertension. They concluded that number of cysts, size, and location are important features related to hypertension. There were other diseases associated with simple renal cysts. Recent studies established an association of simple renal cysts with abdominal aortic aneurysm and aortic dissection.[20] Hence, sonographic characterization of renal cysts is necessary, and ultrasound should be used as diagnostic tool to screen the population to control hypertension and pain. This will improve health-related quality of life, especially in patients with ADPKD and CKD.

CONCLUSION

Simple cysts were more common than other types of renal cysts, and the majority arose from the renal cortex. The incidence of simple solitary cysts was higher than multiple cysts, and the prevalence of renal cysts was higher in male than female. The ADPKD and ACKD were less common in Sudanese adults. Age and gender were common risk factors associated with renal cysts. Routine ultrasound screening for adults is advisable to detect the renal cysts and avoid the progression of complications.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

Gameraddin and Babiker: Renal cysts; sonographic evaluation and classification in Sudanese adults

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