

Analysis of renal cyst of high density containing proteinaceous fluid:report of 6 cases

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Abstract

Objective:To investigate clinical features and imageology of renal cysts of high density, containing proteinaceous fluid and increase the diagnosis and treatment level of this special type renal cyst. **Methods:**Six cases were proven to be renal cysts of high density(pathologically) from 2002 to 2007 were reviewed. Among 6 cases, 1 was in the upper pole of kidney, 4 were medial and 1 was located in the anus perineum. All were 2-5 cm in size. Ultrasonography(US) excretory urography, multiphase CT and renal angiography DSA imaging was performed for preoperative diagnosis. The preoperative diagnosis found renal neoplasms in 4 and renal cysts in 2. All of them were operated by partial nephrectomy. **Results:**All of the 6 renal high density renal masses were resected surgically, which were proved pathologically to be renal cysts; high density present. All of them contained proteinaceous fluid with benign cyst walls on histologic examination. No recurrence was seen in any of these cases during a long follow-up. **Conclusion:**CT and B-US have a higher diagnostic value, which can show the internal shape and character better. B-US or CT guided puncturing biopsy can be better applied to atypical renal cysts. Once the correct diagnosis is acquired, laparoscopic surgical treatment should be carried out.

Key words: high-density; renal cyst; diagnosis; treatment

INTRODUCTION

The simple renal cyst is common in urology, which can be easily diagnosed owing to their well-known characteristics^[1]. For these findings in simple renal cyst at US, CT imaging usually allows simple differentiation of most cysts and tumors^[2]. In the past decades, the ability to accurately characterize renal masses including renal cysts has also dramatically improved with modern imaging equipment^[3]. Diagnosis is usually accurate, however some special types of renal cysts(like high-density ones which contain matter similar to a high concentration of protein) are still difficult to diagnose. They demonstrate high attenuation on non-enhanced CT scans. Proteinaceous debris or hemorrhage is the most common cause, but renal cell carcinoma may demonstrate many similar findings. They can sometimes be confused

with well-margined renal neoplasms. In this paper, 6 high density renal masses(which did not enhance dramatically after intravenous contrast material) proved to be renal cysts containing a very proteinaceous fluid. The high protein was the reason the high attenuation values observed. The objective of this paper was to summarize the approach to the diagnosis and treatment of renal cysts of high density which contain proteinaceous fluid, and stress the limitations of diagnosis.

MATERIALS AND METHODS

This was a retrospective single-institutional study. We identified 6 adult patients(4 women and 2 men; mean age, 43 years;age range,31-68 years) with well-circumscribed, homogeneous high-attenuating(> 30HU) renal masses between Sep 2002 and Sep 2007 in PUMCH(PeKing Union Medical College Hospital). The percentage found was 3.1% of all 193 renal cysts during this period of time. In all study patients, the symptom was intermittent

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lumbar pain in 1 patient and a gross hematuria without pain in 1 patient. Another 4 patients were symptomless, who were incidentally detected during routine physical examination. No abdominal mass was palpable in all 6 patients. All of the 6 patients in this series had solitary and unilateral hyperdense renal cysts, ranging from 2 to 5 cm in diameter.

Ultrasonography(US), excretory urography, multiphase CT and renal angiography DSA imaging was performed for preoperative diagnosis. The size and attenuation coefficient(H) of the lesions and the attenuation coefficient of the adjacent parenchyma were measured. Enhancement was defined as an increasing attenuation more than 10 HU^[4]. The medical case records were also reviewed. The preoperative diagnosis was; renal neoplasms in 4 and renal cysts in 2. All of those masses were surgically resected without loss of kidney. Two of the smaller ones were operated by laparoscopy. Pathological evaluation was subsequently performed.

RESULTS

The above findings appeared round or oval with smooth contours and no visible cyst wall. They appeared predominantly hypoechoic or as irregular internal echoes on sonography with scattered internal echoes. Excretory urography was performed in all patients and showed an unenhanced round mass without further distinguish-

ing characteristics(**Fig 1**). Their cystic features were confirmed on non-enhanced and contrast-enhanced CT scans. The pre-contrast CT numbers of the 6 cases ranged from 40 to 100 H and increased by 0-10 H after contrast injection(**Fig 2A,2B** and **3A**). Angiography(**Fig 3B**) was performed in 3 patients and revealed a lack of vessels around the mass. The renal masses appeared avascular angiographically. All of the 6 renal high density renal masses were resected surgically with NSS (nephron sparing surgery) which were proved pathologically to be renal cyst of high density. All of the findings contained proteinaceous fluid with benign cyst walls on histologic examination(**Fig 4A** and **4B**). No recurrence was seen in any of these cases during a long follow-up.



Fig 1 Excretory urography showed an unenhanced round mass (arrows) without further distinguishing characteristics



Fig 2A The precontrast CT numbers of the 6 cases ranged from 40 to 100 H, Unenhanced scan reveals one hyperdense(40H) cysts (arrows) in the right kidney



Fig 2B The postcontrast CT numbers increased by 0-10 H after contrast injection, After contrast injection, the cyst (arrows) was isodense with the adjacent parenchyma



Fig 3A After contrast injection, the cyst(arrows) was isodense with the adjacent parenchyma on CT



Fig 3B Angiography reveals lack of vessels around the cysts. The renal hyper-dense(40H) cysts appear avascular angiographically



Fig 4A Renal masses resected surgically were proved pathologically to be renal cyst



Fig 4B The contents of renal cysts were proteinaceous fluid with benign cyst walls on histologic examination

DISCUSSION

The preoperative diagnosis of renal mass was not confirmed easily because something like high-density renal cysts can occasionally be confused with renal cell carcinoma. Simple renal cysts typically have attenuation values ranging from -10 to $+10$ H, lack contrast enhancement on a thick wall, and form a smooth, sharp interface with the surrounding parenchyma. The normal renal parenchyma usually measures $30-40$ H on scans. Yet, the absolute attenuation coefficients of hypodense renal cysts (with a greater the adjacent parenchyma, high protein content) is known to increase cyst CT numbers above water (which is probably secondary to old hemorrhage or something else)^[5]. In a case report which described a “hyperdense” renal cyst with a high protein content^[6] contents of renal cyst of high density containing proteinaceous fluid was found to be either fluid or firm. Their hyperdensity may not only be due to an increased content of iron from old hemorrhage (calcium) but also something like protein. The precontrast attenuation value of this cyst (35 H) was comparable to adjacent renal parenchyma ($30-38$ H), in contradistinction to the cysts discussed here, which were all denser than unenhanced kidney. The reason for this discrepancy may be the results of reabsorption of the blood or infectious products.

High density renal cysts are more difficult to diagnose definitively because clinical symptoms and auxiliary examination findings are less characteristic. In our study, the preoperative diagnosis found renal neoplasms in 4 high dense renal cysts.

Sonography usually shows small, hyperechoic kidneys with cysts of high density containing proteinaceous fluid. Cyst wall calcification may be visible, but it is more readily seen on CT. Renal cysts of high density should be suspected if sonographic examination shows internal echoes or a thickened wall. In this case cyst puncture can be used to confirm the diagnosis.

Almost all of the high density renal cysts are discovered incidentally during abdominal computed

tomography (CT). These lesions can easily be confused with well-margined renal neoplasms. The most important criteria to classify the two, is to determine the vascularity of the lesion. The extent of enhancement of a renal mass on a CT scan is mainly dependent on the nature of the tissue and the level of contrast medium at the moment of scan. Some masses with more vascularity will enhance substantially, others are hypovascular and will enhance much less. In general, renal parenchyma has CT numbers of $30-34$ H, which is less than high density cysts. High-density cysts do not enhance with intravenous contrast material and maintain almost the same attenuation as they are avascular. Renal neoplasms can be enhanced with contrast medium^[1]. There were no problems in differentiating high density renal cysts from most renal neoplasms, which are vascular enough to enhance noticeably.

One problem in hypovascular lesions provides a potential pitfall in using single diagnostic tool. US can be used for the differentiation as an important method, however when sonography is performed, the mass is usually cystic but occasionally doesn't not present all the sonographic criteria of a simple cyst. In these cases internal absence of posterior wall trough-transmission are frequently found. Sonography is helpful only for the larger hyperdense cysts measuring more than 15 mm in diameter. The difficulty of seeing small renal lesions with sonography is well known. US examination might be helpful in diagnosing, but findings are usually not definitive because of the presence of echogenic material within high density renal cysts^[7].

CT is probably better at demonstrating and characterizing small lesions in particular and examination may identify cyst wall thickening in cases with proteinaceous fluid. Precontrast scans are important as well, because small hyperdense cysts can be overlooked or mistaken for renallobulations or scars. Renal tumors are usually characterized by internal heterogeneity before or after intravenous contrast injection, enhancement on postcontrast scans, and irregular interfaces with renal

parenchyma. However, there are many reports of encapsulated papillary renal cell carcinoma that mimicked a cyst on CT, except for its high CT number of 40 H^[8]. Vascularity on renal arteriography has been proposed as a criterion for a more conservative surgical approach to some lesions. In our 3 cases, the hyperdense cysts appeared avascular angiographically. However, arteriography is not necessary for all diagnosis. Firstly, there is a likelihood of observing neovascularity or tumor blush observed by arteriograph. Secondly, it is well known that avascularity of a renal mass on an angiograph does not constitute proof of its benignity. Thirdly, angiography also has its own potential complications.

CT-guided renal mass puncture may be helpful for diagnosing the larger proteinaceous fluid-containing hyperdense cysts^[9]. However it is unlikely to help if the cyst contains a firm coagulum or in those cases with multiple hyperdense cysts smaller than 10 mm. Differentiation of hyperdense cysts in polycystic kidneys from tumors or abscesses still remains a most difficult task. In general, a hyperdense renal cyst can be considered benign if it is sharply marginated or homogeneous or demonstrates a hematocrit effect (on a nonenhanced and contrast-enhanced scan) and demonstrates no significant enhancement on post-contrast scans. If the density of the mass is greater than 70 HU on unenhanced CT images and the mass is homogeneous, the mass is more like benign hyperdense renal cyst than a renal cell carcinoma. In this instance percutaneous drainage may not be effective for a renal cyst of high density containing proteinaceous fluid. Therefore laparoscopic surgical drainage or partial nephrectomy should be considered.

Once the correct diagnosis is acquired, laparoscopic surgical treatment should be carried out. Nephron sparing surgery (NSS) should be done as soon as is possible. Initially, partial nephrectomy was performed with an open surgical approach; more recently and with increasing frequency, a laparoscopic approach has been used in selected cases. The possible complications of partial nephrectomy include vascular, collecting system etc^[10]. In conclusion, with US and CT, hyper-dense cysts may

be differentiated reliably from other renal lesions. DSA and Cyst punctures can also be helpful in diagnosing if necessary. However, because the number of reported cases is still small, more evidence will probably be required, especially for solitary lesions measuring more than 3 cm. Such confirmation is very important to patients, because it is related to the mode of surgery. Sometimes, the confirmation could come from follow-up at intervals. More experience is required because of a lack of experience with these types of high density renal cysts, probably leading to improper radical nephrectomy.

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