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Differential diagnosis of asymmetrical renal cortex thickening and solid renal tumours

Small, incidental renal tumors are discovered more often in the current era with modern imaging modalities. Most of these small masses are believed to represent low-stage renal cell carcinoma (RCC) (2, 7).

Previously, it had been quite difficult to detect RCC in the early stage because there had been no available screening method to detect RCC in cases without symptoms. Almost all cases of RCC detected were those in which the patients visited the hospital with obvious symptoms at a considerably advanced stage (2, 10, 11). Nowadays the number of asymptomatic, incidental tumors being detected increased as a result of the widespread use of noninvasive abdominal imaging modalities, including ultrasound and computed tomography (CT) and magnetic resonance imaging (4, 7, 9, 10).

The aim of the study is to analyze the atypical, complex morphologic changes and anatomical variants of renal structure, with tumor-like appearance. This is especially important in screening revealing tumors in asymptomatic patients or in patients with atypical symptoms.

MATERIAL AND METHODS

Material comprises a group of 186 patients in which the US examination was performed between 1996 and 2002, in 2nd Department of Radiology, Medical University of Lublin.

In 20 patients the local thickening of renal cortex was found, protruding from the surface of the kidney, so-called "renal gibbus", constituting the anatomical variation (Fig. 1). Renal gibbus was found in 12 patients in the lateral aspect of the left kidney. In six patients the segmental thickening of the renal cortex was seen, without distorting the renal outlines (Fig. 2). In eight cases the cortex thickening suggesting the presence of the renal gibbus, proved to be renal tumors (Fig. 3). Diagnosing of small asymptomatic tumors, less than 3 cm in diameter, was difficult. They have appearance of protruding cortex thickening distorting the renal outlines. The assessment of renal outlines was an important morphologic factor.

Small renal tumors showed appearance of anatomical anomaly (Fig. 4). In five cases, mixed, inhomogeneous reflectivity suggested the presence of proliferative process (Fig. 5).

Regular tumor shape was rarely seen in larger tumors. So the diagnostic difficulties were present with tumors smaller than 3 cm.

The normal renal shape was often seen in small tumors, while the large mass produces irregular distortion of renal outline. Small tumors below 3 cm were well circumscribed, like anatomical anomalies.

In four cases the oblique section of the renal pyramid form within the central part of kidney the appearance of oval pseudo-tumor (Fig. 6).

Fig. 1. Anatomical oval cortical thickening, protruding from the surface of the kidney

Fig. 2. Focal cortical thickening with distinct margins, not distorting renal shape

Fig. 3. Oval renal tumor, normoechogenic, suggesting the presence of the renal gibbus

Fig. 4. Oval cortical thickening with regular margins, that proved to be small renal tumor

Fig. 5. Oval heteroechogenic renal tumor, with appearance of anatomical anomaly

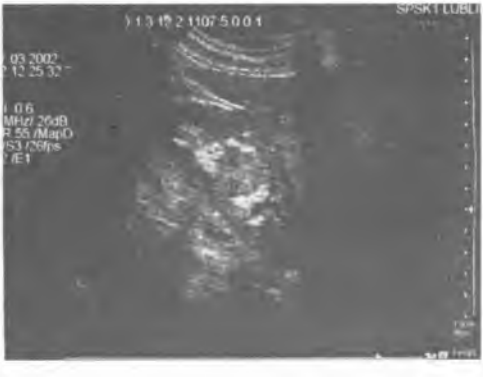

Fig. 6. Oval structure within the central part of the kidney

DISCUSSION

Because ultrasonography is noninvasive and relatively inexpensive, it is widely used in the initial radiologic evaluation of abdominal pathology. A large proportion (40–70%) of incidental renal cancers is diagnosed by ultrasound imaging. Clinically relevant renal masses are detected in approximately 1% of asymptomatic patients undergoing ultrasonography. CT is a highly sensitive method for detecting renal tumors and is the diagnostic modality of choice.

Enhancement of a renal mass on CT scans obtained after intravenous administration of contrast material is diagnostic for renal cell carcinoma. Magnetic resonance imaging may be equally sensitive and may be especially helpful in diagnosing atypical (hypovascular, cystic, or hemorrhagic) renal tumors. However, imaging studies cannot clearly differentiate benign from malignant tumors. Further, the ability to detect extrarenal spread-up to 30% of renal masses may be metastatic at the time of detection and is limited by the sensitivity of the imaging techniques (9).

Many of these lesions represent benign pathologic findings. The increased number of small, incidentally discovered renal tumors is very important to management decisions, because many of our treatment recommendations have been based on data from before the widespread use of modern imaging in which only 13%–26% of renal masses were discovered incidentally. S m i t h et al. proposed that small (less than 3.0 cm), incidentally discovered, well-marginated masses could be observed. Small renal tumors suspicious for RCC are being detected with a greater incidence today compared with in the past. We found a greater frequency of benign pathologic findings in tumors 4 cm or less in the current era than previously reported. However, the risk of growth and metastasis still mandates a surgical approach (2).

Malignant tumors of the kidney comprise 2% of the cancer incidence. More than 80% of these tumors will arise in the renal parenchyma, and the vast majority will be adenocarcinomas. The incidence of renal cell carcinoma (RCC) at autopsy has been reported to be approximately 2% (4, 7).

The classic triad of symptoms in the presentation of renal cell carcinoma – flank pain, flank mass, and hematuria – has been found historically in up to 10% of cases (4).

The knowledge of the US features of RCC is very important in early detection. The internal echo pattern can be classified into four types of patterns: the homogeneous and hyperechoic type; the homogeneous and hypoechoic type; the heterogeneous type (mosaic pattern); the cystic type with solid component.

Among the RCCs smaller than 25 mm in diameter about 50% are homogeneous and hyperechoic, about 20% are homogeneous and hypoechoic and 28% are heterogeneous. Among the tumors 26–50 mm in diameter, 31.9% were homogeneous and hyperechoic, 13.0% were homogeneous and hypoechoic, and 47.8% were heterogeneous. On the other hand, 94.3% of the tumors more than 51 mm in diameter were heterogeneous. It appeared that the tumors became heterogeneous as they grew. This change was due to degeneration of the tumor. Cystic type tumors are rare (10).

A marginal hypoechoic zone is one of the most important findings with respect to RCC. This finding is indicative of the capsule of the tumor. A marginal hypoechoic zone was evident in 20.9% of RCC detected, 28.8% of homogeneous and hyperechoic tumors, 20.5% of heterogeneous tumors, but only 4.3% of homogeneous and hypoechoic tumors. Particularly, a marginal hypoechoic zone was frequently evident in cases in which small tumors less than 50 mm in diameter were found (10).

An anechoic component in a tumor is another important finding with respect to RCC, indicative of a form of necrosis in the tumor. Anechoic components were evident in 23.4% of RCC detected, in 21.7% of homogeneous and hypoechoic tumors, 33.7% of heterogeneous tumors, but only 7.7% of homogeneous and hyperechoic tumors. The frequency of occurrence of anechoic components in the tumors appeared to increase with size, and such anechoic components were particularly evident in those more than 50 mm in diameter (10).

Moreover, a tumor protruding from the surface of the kidney is one of the most important findings with respect to RCC. This was evident in 85.4% cases of RCC detected, 71.2% classified as T1 type, 90.6% in which the tumor was 26–50 mm in diameter and all cases in which the tumor was over 51 mm in diameter. It is not so difficult to detect small RCCs when the investigator is well aware of these US features (9, 10).

US screening enabled us to detect RCC in an early stage. In cases of incidental detection of RCC, the patients showed no characteristic symptoms (hematuria, pain, or tumor palpation), the tumor size was small, and most of them were in an early stage, without vena cava involvement. US screening is extremely useful for early detection of RCC, not only in routine medical health examinations, but also in clinical examinations in the hospital. It is known that the outcome in patients with asymptomatic RCC, including incidentally detected cases, is very good, and the survival rate is higher than that in patients with symptomatic RCC (1, 8, 10).

The differential diagnosis of an incidentally detected renal mass includes both benign and malignant processes. Malignant renal masses include RCC, sarcoma, lymphoblastoma, metastatic disease (especially lung, breast, prostate, colon, testes), and urothelial-based tumors of the pelvis and collecting system. Of these, RCCs account for most of such masses. Conventionally, there have been four main histologic subtypes of RCC: clear cell, granular cell, tubulopapillary cell, and sarcomatoid cell. Given these limitations, renal biopsy is not recommended for the incidental renal mass, and in most cases, a biopsy would not obviate the need for a surgical procedure. If clinical or radiographic evidence exists to suggest a diagnosis other than primary RCC, a biopsy may be considered. As more small, incidentally detected RCCs are being discovered in elderly patients or in patients with extensive comorbidities, a "watchful waiting" approach becomes a viable option in select patients. This approach is based on experience accumulated in studying the growth rate and behavior of small, incidentally found renal tumors. In a series of 40 patients with 43 small renal tumors, all of which were smaller than 3.0 cm, none developed metastases, with an average follow-up of 3.5 years. Although the natural biology of RCC is inherently unpredictable, these results suggest that many well-marginated, small tumors grow slowly and do not metastasize until they are larger (7).

One of the most difficult matters is to distinguish hyperechoic RCC from angiomyolipoma. Almost all of the angiomyolipoma tumors are hyperechoic and sometimes indistinguishable from hyperechoic RCC tumors. The internal echogenicity of the tumors is an important point of differential diagnosis between RCC and angiomyolipoma. The internal echogenicity of angiomyolipoma tumors was found to be higher than that of RCC tumors, and higher than that of the central echo complex of the kidney. Conversely, the internal echogenicity of RCC tumors was found to be lower than that of the central echo complex. It appears that the difference in echogenicity was due to the fat component in the tumors. That is, according to the results of pathological analysis, the fat component is abundant in angiomyolipoma tumors. Conversely, in the case of almost all RCC tumors, no fat component can be seen. In our present investigation, the same tendency could be seen in the echogenicity levels. However, in some cases, it was quite difficult to distinguish RCC tumors from angiomyolipoma tumors only by US findings, particularly in small renal masses. When it is difficult to tell the difference, particularly in small renal masses, it is very important to have follow-up of the size and findings of the tumor by US examination periodically; for example, once or twice a year. CT examination is available for detecting whether the fat component exists or not, and quite useful for differential diagnosis of renal masses, as well. It is necessary to use US and CT examination according to the circumstances (10).

RCC has been considered to be an incurable form of cancer for a long time. However, US screening enabled us to detect RCC in an early stage. It is well known that the outcome in patients with asymptomatic RCC, including incidentally detected cases, is very good, and the survival rate is higher than that in patients with symptomatic RCC (These data suggest that the outcome of RCC detected by US screening is extremely good (10).

The only parameter for the indication of nephron-sparing surgery that is generally available preoperatively is tumor size, and therefore, this parameter is the most important one. During the past few years, many other parameters have been investigated for their predictive value. In cases without infiltration of the renal capsule, no penetration into the perinephric fat, no lymph node metastases, and no distant metastases in tumors smaller than 2.5 cm, we support the opinion that nephron-sparing surgery under elective indications is justified for tumors smaller than 2.5 cm. The tumors smaller than 2.5 cm are suitable for nephron-sparing surgery using the commonly accepted staging variables and prognostic parameters.. Multifocality is the only parameter for a worse prognosis appearing in tumors smaller than 2.5 cm that should be regarded (6).

Tumor size is an important prognostic factor, and a survival advantage has been attributed to smaller tumors (9). The decision to undertake partial nephrectomy is based largely on the radiographic tumor size (3). Some authors have suggested 4 cm as a threshold; others have suggested 3 cm. Nephron-sparing surgery is a reasonable approach for treating small, localized solitary renal cell carcinomas (5, 9).

The updated 1997 TNM classification of renal tumors redefines the size of T1 tumors from 2.5 cm to 7.0 cm in the greatest diameter, suggesting that tumors greater than 4 cm and confined to the kidney might be candidates for partial nephrectomy (3, 11). Some investigators have advocated that T1 should be further divided into T1a and T1b for tumors smaller or larger than 4 cm (11).

Staging of renal cell carcinoma depends on the size of the tumor. Tumor size is also an important prognostic indicator, especially for patients with tumors confined to the kidney (11).

CONCLUSIONS

The differentiating of oval cortex thickenings protruding from the lateral renal margin – presenting "renal gibbuses" – and small renal tumors is difficult and requires supplementary helical CT examination with spatial reconstructions. Dynamic CT with early bolus of contrast agent and late sections is indicated.

The lesion sizes, regularity of its margins, distortion of renal shape, echogenicity similar with the normal renal cortex were important in US examination.

MR enhanced with DTPA and CT guided biopsy enables definite diagnosis.

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SUMMARY

Nowadays the number of asymptomatic, incidental tumors being detected increased as a result of the widespread use of noninvasive abdominal imaging modalities, including ultrasound and computed tomography (CT) and magnetic resonance imaging.

The aim of the study is to analyze the atypical, complex morphologic changes and anatomical variants of renal structure, with tumor-like appearance. This is important especially in screening revealing tumors in asymptomatic patients or in patients with atypical symptoms. Material comprises a group of 186 patients in which the US examination was performed between 1996 and 2002, in 2nd Department of Radiology, Medical University of Lublin. In 20 patients the local thickening of renal cortex was found, protruding from the surface of the kidney, so-called "renal gibbus", constituting the anatomical variation. In eight cases the cortex thickening suggesting the presence of the renal gibbus, proved to be renal tumors. Diagnosing of small asymptomatic tumors, less than 3 cm in diameter, was difficult. They have appearance of protruding cortex thickening distorting the renal outlines. The assessment of renal outlines was an important morphologic factor. Small renal tumors showed anatomical anomalies. Regular tumor shape was rarely seen in larger tumors. The normal renal shape was more often seen in small tumors, while the large mass produces irregular distortion of renal outline. In four cases the oblique section of the renal pyramid has within the central part of kidney the appearance of oval pseudo-tumor. The differentiating of oval cortex thickenings protruding from the lateral renal margin – presenting "renal gibbuses" – and small renal tumors is difficult and requires supplementary helical CT examination with spatial reconstructions. Dynamic CT with early bolus of contrast agent and late sections is indicated. The lesion sizes, regularity of its margins, distortion of renal shape, echogenicity similar with the normal renal cortex were important in US examination. MR enhanced with DTPA and CT guided biopsy enables definite diagnosis.

Różnicowanie asymetrycznego pogrubienia kory i litych guzów nerki

Obecnie częstość bezobjawowych, przypadkowo wykrytych guzów nerek wzrasta jako wynik wprowadzenia do powszechnego użycia nieinwazyjnych metod obrazowania, jak USG, TK czy MR. Celem pracy jest ocena atypowych, złożonych morfologicznie zmian i anomalii anatomicznych struktury nerek, przypominających guzy. Jest to istotne szczególnie w skriningu wykrywającym guzy u bezobjawowych pacjentów i pacjentów z atypowymi objawami. Materiał stanowi grupa 186 pacjentów, u których wykonano badanie USG w okresie 1996–2002 w II Zakładzie Radiologii Lekarskiej AM w Lublinie. U 20 pacjentów stwierdzono odcinkowe pogrubienie kory nerki, z uwypukleniem zarysu o charakterze garbu nerki, który stanowił anatomiczną anomalię budowy. W ośmiu przypadkach uwypuklenie zarysu bocznego, sugerujące anomalię budowy o charakterze garbu nerki, okazało się guzem. Trudności diagnostyczne sprawiły guzy małe, średnicy poniżej 3 cm, niedające objawów klinicznych. Miały charakter egzofitycznej wypukłości zniekształcającej zarysy nerki. Ocena zarysów należała do istotnych kryteriów morfologicznych. Małe guzy nerki wykazywały strukturę stwierdzanych anomalii anatomicznych. Regularny kształt guza był tym rzadszy, im był większy. Prawidłowy kształt

nerki był częstszy w guzach małych, gdy duża masa ogniskowa powiększała nieregularnie obrys nerki w swym obszarze. W czterech przypadkach przekrój skośny piramidy nerkowej tworzył w obrębie centralnego echa obraz guza rzekomego o kształcie kulistym. Diagnostyka różnicowa owalnych pogrubień kory, uwypuklających boczne zarysy nerki, odpowiadająca obecności garba nerki z guzami nerki, jest trudna i wymaga uzupełniającego badania spiralnego TK z rekonstrukcjami przestrzennymi. Dynamiczne badanie TK z wczesnym bolusem kontrastu i skanami opóźnionymi jest wskazane. Rozmiar zmiany, regularność zarysów, zaburzenie kształtu nerki, echogeniczność podobna do echogeniczności normalnej kory nerkowej były ważne w badaniu USG. MR wzmocniony dynamicznie DTPA i aspiracyjna biopsja cienkoigłowa monitorowana TK rozstrzyga ostatecznie wątpliwości diagnostyczne.