To present the neglected radiographic signs of renal squamous cell carcinoma (RSCC).

Twenty-eight cases of RSCC were retrospectively reviewed. Two radiographic signs were elaborated as follows: separating nephroliths sign was defined as change of distance or orientation between two or more renal stones on comparison of two sequential radiographs, while the distorted nephroliths sign was considered positive when a single radiograph showed irregularly marginated stone fragments in a cluster or linear pattern. The incidences of these signs were studied.

Renal stones were present in 26 cases, 11 with calyceal stones, 3 with staghorn stone, and 12 with both calyceal and staghorn stones. Separating nephroliths sign was positive in 8 of 11 cases whose previous radiographs were available for comparison, and distorted nephroliths sign was seen in 3 of the remaining 15 cases. The overall positive rate was 39% among all cases of RSCC, or 42% when those 2 cases without renal stones were excluded.

The separating and distorted nephroliths signs are not uncommon among cases of RSCC and may be useful for its earlier diagnosis.

Key words: Calculi; Extracorporeal shock wave lithotripsy; Radiography; Renal tumor; Squamous cell carcinoma

Renal squamous cell carcinoma (RSCC) is a grave renal malignancy [1-6]. The diagnosis is usually delayed due to misleading clinical manifestations [5]. Although computed tomography (CT) can depict the renal tumor, it is usually performed when the disease is advanced [5, 6]. On the other hand, due to the high incidence of associated urolithiasis [5, 6], patients with RSCC are usually subjected to the treatment of extracorporeal shock wave lithotripsy (ESWL) or percutaneous nephrolithotomy (PCNL) followed up by abdominal radiography for kidney, ureter and bladder (KUB), which might provide the opportunity for earlier diagnosis. However, there are no established radiographic signs for RSCC [6]. Recently, we observed two new radiographic signs from our cases of RSCC. To our knowledge, these signs also have not been reported in the other kinds of renal tumors [7]. We would like to report these signs hoping that earlier diagnosis and better prognosis could be achieved in the future.

MATERIALS AND METHODS

From January 1986 to July 2001, we collected 28 cases of RSCC out of 630 cases of malignant renal tumors. None of these 28 patients had any evidence of malignancy of the uterine cervix or primary lung tumor. The squamous component formed the major portion of the available pathological specimen in all of these patients and transitional cell carcinomas with focal squamous differentiation could be excluded.

The radiographic studies of these 28 cases of RSCC were retrospectively reviewed to identify any radiographic signs suggestive of RSCC. CT studies were reviewed for correlation with radiographic findings. Two patients without renal stones were excluded. Among the 26 cases associated with renal stones, fifteen were diagnosed on first admission and therefore had no previous KUB for comparison; the other 11 had more than one previous KUB for correlation. For those patients not diagnosed on first admission, the durations from the first visit to the
diagnosis of RSCC were within 3 months in 3 cases, within 1 year in 2 cases, within 2 years in 3 cases and more than 2 years in 3 cases.

A separating nephroliths sign was considered positive when 2 consecutive KUBs showed a change of relationship between two or more calyceal stones (Fig. 1); while a distorted nephroliths sign was designated as irregularly margined stone fragments in a cluster pattern (Fig. 2) or linear pattern (Fig. 3) in a single KUB. The separating nephroliths sign was searched for among the 11 cases not diagnosed on the first admission and the distorted nephroliths sign among the total 26 cases.

Case illustrations for radiographic signs

Case 1

A 40-year-old male patient was admitted with the chief complaint of painless gross hematuria. He had been diagnosed as having calyceal stones in the upper moiety of a duplicated right kidney by intravenous urography (IVU, not shown) 8 years before and was treated by ESWL, but was loss of follow-up after treatment. KUB (Fig. 1A) on admission showed 2 clusters of stones supposed to be in the calyces of the upper moiety of the right kidney. A diagnosis of right ureteral stone was made to explain the symptom of gross hematuria. Retrospectively, the separation of the calyceal stones and tilting of the middle calyceal stones could be appreciated when comparing with KUB taken 4 months earlier (Fig. 1B). The right renal stones were treated with several sessions of ESWL. However, painless gross hematuria recurred 4 months later. Explosive separation of the calyceal stones on the follow-up KUB allowed immediate study of IVU (Fig. 1C) and CT (not shown). Radical right nephrectomy was performed and RSCC at the upper pole of the right kidney was proved pathologically. The patient expired 7 months after the first episode of gross hematuria.

Case 2

A 71-year-old male patient visited our hospital complaining of left flank soreness for 2 years. He had received PCNL for left staghorn stone 3 months previously. Urinalysis revealed 55 to 60 red blood cells per high power field. KUB showed multiple intact stones in the upper and middle calyces as well as a large cluster of disintegrated stones at the lower pole of the left kidney (Fig. 2A). In contrast to the smooth lateral margin of the disintegrated stones, its irregular medial border suggested a destructive process at this region.
IVU (not shown) showed a nonfunctioning lower pole of the left kidney, suggesting the presence of tumor. CT confirmed the presence of an infiltrative mass at the lower pole of the left kidney (Fig. 2B). RSCC was

Figure 2. a. Case 2. Close-up view of KUB shows a large cluster of disintegrated stones at the lower pole of the left kidney. In contrast to the smooth margins at the lateral aspect (arrowheads), an irregular medial borders (arrows) suggests a surrounding destructive process. b. CT shows an infiltrative mass surrounding the clustered stones at the lower pole of the left kidney. The irregular medial borders (arrows) and the smooth lateral margins (arrowheads) of the stones are elucidated.

Figure 3. a. Case 3. Scout film of retrograde pyelography shows distorted stonestreet (arrows) supposed to be within the distorted lower calyces of left kidney and is too close to the left psoas muscle shadow. b. CT shows an infiltrative tumor (arrowheads) as well as the irregularly margined and eccentrically located stones (small arrows) at the lower pole of the left kidney. The solid stone (large arrow) shows a relatively smooth outline.
proved pathologically after radical nephrectomy. The patient expired 4 months after operation.

Case 3

A 52-year-old man visited our hospital complaining of painless gross hematuria off and on for 5 months. He had received several sessions of ESWL treatment for left renal stone at another hospital. Scout film of retrograde pyelography showed a distorted stonestreet close to the medial border of the lower pole of the left kidney (Fig. 3A). This finding was considered a clue to suggest an infiltrating tumor that was subsequently confirmed by CT (Fig. 3B). RSCC was proved pathologically after radical nephrectomy. He remained well during 7 years follow-up.

RESULTS

Among the 26 patients associated with renal stones, 12 patients had calyceal stones, 3 had staghorn stone and 11 both calyceal and staghorn stones. From the 11 patients not diagnosed on the first visit, the separating nephroliths sign was found in 8, while the distorted nephroliths sign in 3 of the remaining 15 patients. The total incidence of a positive radiographic sign was 39% in all cases of RSCC and 42% in those cases associated with renal stones. The incidence of separating nephroliths sign was 73% in patients with previous KUBs available. In the 15 patients of RSCC diagnosed on the first admission, splaying of renal stones suggestive of a space-occupying lesion was suspected in 4. This finding did not meet the criteria for separating nephroliths sign since no previous KUB was available for comparison.

DISCUSSION

The incidence of RSCC among all malignant renal tumors in our series was 4.4%, which is much higher than that of 0.5% reported in the literature [6]. This difference may be explained by the fact that our hospital is located in an endemic area of urolithiasis of our country. Chronic inflammation and infection are usually associated with longstanding urolithiasis and are believed to be etiological factors of RSCC [6]. RSCC has a grave prognosis due to misleading clinical presentations and difficulty in early diagnosis [1-6]. In our study, 26 out of 28 patients with RSCC had coexisting renal stones. Clinically, some patients may present with fever and flank pain that might be presumed to be the symptoms of pyonephrosis caused by urolithiasis. Occasionally, painless gross hematuria, a common manifestation of renal tumor, may also be confused with the sequela of ESWL treatment of urolithiasis. The difficulty in clinical diagnosis of renal tumor in the presence of urolithiasis was stressed by Wang who reported 6 cases of renal transitional cell carcinoma (RTCC) and 4 cases of RSCC suspected during the procedures of PCNL [8]. The diagnosis of RSCC might be difficult even during operation if not suspected preoperatively. Of the present patients, one underwent PCNL and another patient nephrolithotomy 3 months before diagnosis while RSCC was not suspected during the operations. Despite CT having been reported as a useful tool for revealing RSCC [5, 6], routine screening for RSCC in patients with urolithiasis is not the praxis and the diagnosis is usually delayed.

Because of the high incidence of associated renal stones, patients with RSCC are usually subjected to IVU to confirm the diagnosis and document the patency of urotract. IVU may reveal only urinary stones initially, while RSCC can develop insidiously during the long course of renal stone treatment. In general, the overall urographic findings, despite being suggestive in some instances, are usually not very helpful for the diagnosis of RSCC. Once the treatment for renal stone is initiated, often only KUB is applied to follow up the size and location of the residual stones. The RSCC may not be suspected until repeated episodes of gross hematuria occur.

Careful reading of KUB may detect a bulging renal contour which is suggestive of a renal cell carcinoma or other space-occupying lesions, but not of RSCC. Up to now, no specific radiographic sign of RSCC has been reported [1-6]. RSCC may present as a tumor either infiltrating the renal parenchyma or growing within a hydronephrotic sac [5]. The reniform contour of the kidney is usually preserved and the RSCC is hard to be appreciated from the KUB. Because of the associated renal stones, many of our cases were treated by ESWL or PCNL. Despite periodical follow-up for these patients, delayed diagnosis was common until the appreciation of these new radiographic signs.

The separating nephroliths sign documents the dynamic enlargement of the tumor. The renal stones are displaced by the tumor. But since the tumor cannot be seen directly, it looks like active separation of the stones when observing the sequential films. This phenomenon is easy to understand, but the appreciation of separating nephroliths sign depends on careful review of consecutive radiographic studies, detailed comparison of the orientations and inter-calculus distance of renal stones. Comparing the whole series of follow-up films may be rewarding. Too long a follow-up interval may lead to unreliability for reading the separating
nephroliths sign, since spontaneous pass-out of the pre-existing stone and formation of a stone in the other collecting system may occur. Because the separating nephroliths sign is a finding by comparing consecutive KUBs, any previous films should be carefully reviewed during the first visit of the patient. When a mass effect is suspected, further study by CT should be done.

The distorted nephroliths are irregularly outlined stone fragments in a cluster or linear pattern. This phenomenon reflects small stones restrained within a destructed collecting system by the surrounding tumor. This is analogous to the irregular linear microcalcification of intra-ductal carcinoma of the breast despite the mechanisms of calcification and the sizes of tumors being different. The distorted nephroliths sign can be appreciated on a single radiograph. However, this sign is only applicable for those patients with numerous small calyceal stones or stonestreet following ESWL or PCNL treatment of staghorn stone, a solid intact renal stone is resistant to the erosion or distorting effect of the surrounding infiltrative tumor.

The separating nephroliths and distorted nephroliths signs may also occur in high-grade RTCC, but since the incidence of associated renal stone (60 out of 415 registered RTCC in our hospital, unpublished data) is much lower than that of RSCC despite of the higher incidence of RTCC itself, the significance of these signs in suggesting the presence of renal TCC needs further investigation. The separating nephroliths sign may also be observed in cases of renal cell carcinoma, but the tumor is more easily identified by the bulging renal contour.

Although the prognosis of RSCC is generally poor, the outcome of patients without lymph nodes or distant metastasis may not be so grave. One of our patients (case 3) with a positive distorted nephroliths sign has been well during seven years follow-up after nephrectomy. Earlier diagnosis is still the key to achieve better prognosis. We believe that these new subtle radiographic signs may offer an opportunity for earlier diagnosis of RSCC. Because these signs are not invariably present, high index of suspicion is still the key to make earlier diagnosis. When gross hematuria is present, sonography or CT should be performed without delay to detect and stage the tumor.

REFERENCES
腎扁平細胞癌之腎結石分離及變形徵象

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腎扁平細胞癌是一種預後很不良的少見癌症，雖然電腦斷層攝影可以很容易辨認腎腫瘤，卻因臨床表徵之非特異性而常被延誤使用及診斷。為此，我們研究本院之病歷並報告所得之X光攝影徵象，希望能提早診斷。

從28病例之研究中，共發現兩個X光攝影徵象：腎結石分離定義為在兩次造影檢查中，兩個以上腎結石改變其距離或方向；而腎結石變形則定義為腎結石堆積排列成不規則之外形。

在28病例中，結石有26例，11例腎盂結石，3例鹿角結石，12例兩者兼具。腎結石分離在11例具備舊片比較者中，發現8例；而腎結石變形則在其餘15例中發現3例。整體之陽性率為39%，但如扣掉2例非結石者，陽性率為42%。

從本研究中可知，腎結石分離及變形之X光攝影徵象在腎扁平細胞癌中並非少見，並可能對其較早期診斷有所幫助。

關鍵詞：結石，震波碎石，X光攝影術，腎腫瘤，扁平細胞癌。