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CT evaluation of underlying cause in spontaneous subcapsular and perirenal hemorrhage

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Abstract. We evaluated the CT scans of 13 patients with spontaneous subcapsular or perinephric hemorrhage (SPH) associated with these underlying causes: 4 angiomyolipomas, 2 renal cell carcinomas, 1 renal metastatic malignant melanoma, 1 ruptured renal artery aneurysm, 1 adrenal myclolipoma, 1 ruptured renal abscess, 2 ruptured hemorrhagic cysts, and 1 patient with undiagnosed coagulation disorder. Our objective was to ascertain whether an underlying cause of SPH was identifiable by CT, and to determine the extension of the hematomas. Computed tomography identified the hematoma in all 13 cases (sensitivity 100%). In all 12 cases in which there was a renal or adrenal anatomic lesion, the underlying cause was identified with CT (100%), with correct diagnosis in 11 cases (91.6%). The case in which no lesion was identified was the undiagnosed coagulation disorder. We conclude that CT is a useful technique for the initial evaluation of SPH, permitting diagnosis of hemorrhage and identification of the underlying cause.

Key words: Retroperitoneal hemorrhage – Kidney – CT

Introduction

In 1856 Wünderlich first described the clinical picture of spontaneous renal bleeding with dissection of blood into the subcapsular and/or perinephric spaces [1], with no known underlying cause (patients with a history of trauma, renal biopsy, or anticoagulant therapy were excluded). The appropriate treatment for these patients is based, firstly, on the diagnosis that a hemorrhage has occurred, and secondly, on the determination of its cause. At present, radiologic diagnosis plays an important role in the evaluation of this clinical problem.

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We report the radiologic findings and management of spontaneous perinephric hemorrhage (SPH) in a series of 13 patients with this condition.

Patients and methods

The radiologic examinations of 13 patients with SPH (10 men and 3 women, age range 28–83 years, mean age 54.5 years) were retrospectively evaluated. The presenting symptom was acute onset of flank or abdominal pain in all 13 patients. Furthermore, 2 patients had a palpable abdominal mass, 2 had gross hematuria, and 2 had symptoms and signs of shock. There were decreases in hematocrit values in 10 patients, and leukocytosis in 7 patients. The delay between the beginning of symptoms and the CT exam was 4–12 h.

Plain and intravenous contrast-enhanced CT scans had been obtained initially in all 13 patients. Six of them were studied using a contiguous 10-mm section technique; the other 7 were studied with a spiral technique (pitch 1, collimation 6.5 mm, with acquisition in the arterial phase and 10-mm contiguous scans in the venous-excretory phase). The CT scans were evaluated to determine the nature and location of the hematomas and to ascertain whether underlying renal or adrenal lesions were present. Ultrasonography was performed in 7 patients and angiography in 2 patients.

Pathologic diagnosis was available in 7 patients who underwent surgery, 1 in whom percutaneous needle aspiration was performed and 1 in whom autopsy was performed.

Results

The radiologic and pathologic findings of the 13 patients are summarized in Table 1. In our series the most common cause of SPH was renal tumor (53.8% of cases). In this group there were 4 angiomyolipomas (AML), 2 renal cell carcinomas (RCC), and 1 renal metastatic ma-

Table 1. Summary of radiologic and pathologic findings. RCC renal cell carcinoma; AML angiomyolipomas

Case no.	Age (years)	Gender	CT			Diagnostic method	Definitive diagnosis
			Spaces with blood	Diagnosis	Size		
1	45	M	Subcapsular Perinephric	RCC	3 cm	Surgery	RCC
2	50	M	Subcapsular Perinephric Intraperitoneal	Cyst	7 cm	Surgery	RCC
3	28	M	Subcapsular	Metastases of melanoma	0.5 cm	Autopsy	Metastases of melanoma
4	61	M	Perinephric Pelvic extraperitoneal Intraperitoneal	AML Tuberous sclerosis	6.5 cm	Surgery	AML
5	44	F	Perinephric intraperitoneal	AML	22 cm	Surgery	AML
6	30	M	Subcapsular Perinephric	AML	15 cm	Surgery	AML
7	68	M	Subcapsular	AML	2.5 cm	Surgery	AML
8	81	F	Perinephric Pelvic extraperitoneal	Ruptured renal artery aneurysm	1.5 cm	Arteriography	Renal artery aneurysm
9	83	M	Perinephric Intraperitoneal	Adrenal myelolipoma	6.5 cm	CT follow-up	Adrenal myelolipoma
10	57	M	Subcapsular Perinephric	Ruptured renal abscess	2.5 cm	Surgery	Renal abscess
11	63	M	Subcapsular	Ruptured simple cyst	2 cm	Percutaneous needle aspiration	Hemorrhagic material
12	40	M	Subcapsular Perinephric Intraperitoneal	Ruptured cyst	1 cm	CT: uremic acquired cystic disease	Ruptured cyst
13	59	F	Perinephric	No pathology	–	Undignosed coagulation disorder	Deficit factor X

lignant melanoma. The other underlying diseases were: 1 ruptured renal artery aneurysm, 1 adrenal myelolipoma, 1 ruptured renal abscess, 2 ruptured hemorrhagic cysts (one simple cyst and 1 patient with acquired uremic cystic disease), and 1 patient with undiagnosed coagulation disorder (deficit of factor X).

CT findings

The CT technique led to the diagnosis of SPH in all 13 cases. The diagnostic features included subcapsular or perinephric fluid collection with high attenuation areas (40–70 HU). The fluid collection did not enhance following intravenous contrast administration. The size and extent of the hemorrhage were clearly demonstrated in the patients showing 3 subcapsular hematomas, 5 perinephric hematomas, and 5 combined subcapsular and perinephric hematomas. Of the 10 patients with affected perinephric space, 2 also had accumulation of fluid in the extraperitoneal spaces of the pelvis and 5 in the intraperitoneal spaces.

The noteworthy features of the specific cases were as follows:

1. In the 2 patients with RCC, CT identified a renal mass that was different in character from the surrounding hemorrhage. In case 1 (Fig. 1) the mass showed peripheral enhancement after endovenous contrast administration suggesting RCC. In case 2 (Fig. 2) the mass did not enhance with endovenous contrast and was interpreted to be a ruptured hemorrhagic cyst; it was, however, an RCC with 80% necrosis.
2. The four cases with renal angiomyolipoma were diagnosed on the basis of visible fat (HU negatives) within the renal mass. One patient had tuberous sclerosis and multiple, small AML (Fig. 3).
3. The case of renal metastatic malignant melanoma also had metastases in other organs. The CT technique demonstrated a small cortical space-occupying lesion adjacent to the subcapsular hematoma (Fig. 4).
4. In the case with ruptured intrarenal artery aneurysm, the aneurysm was enhanced to the same degree as the aorta on contrast-enhanced CT (Fig. 5). Arteriography corroborated the CT findings.
5. The CT technique detected fat within an adrenal mass in the hemorrhagic adrenal myelolipoma.
6. A ruptured hemorrhagic renal abscess was suspected in a patient with septic shock with a round cortical renal defect. Surgery confirmed the lesion.
7. In the 2 cases with ruptured renal cyst, CT showed a well-defined high density mass, inseparable from the he-

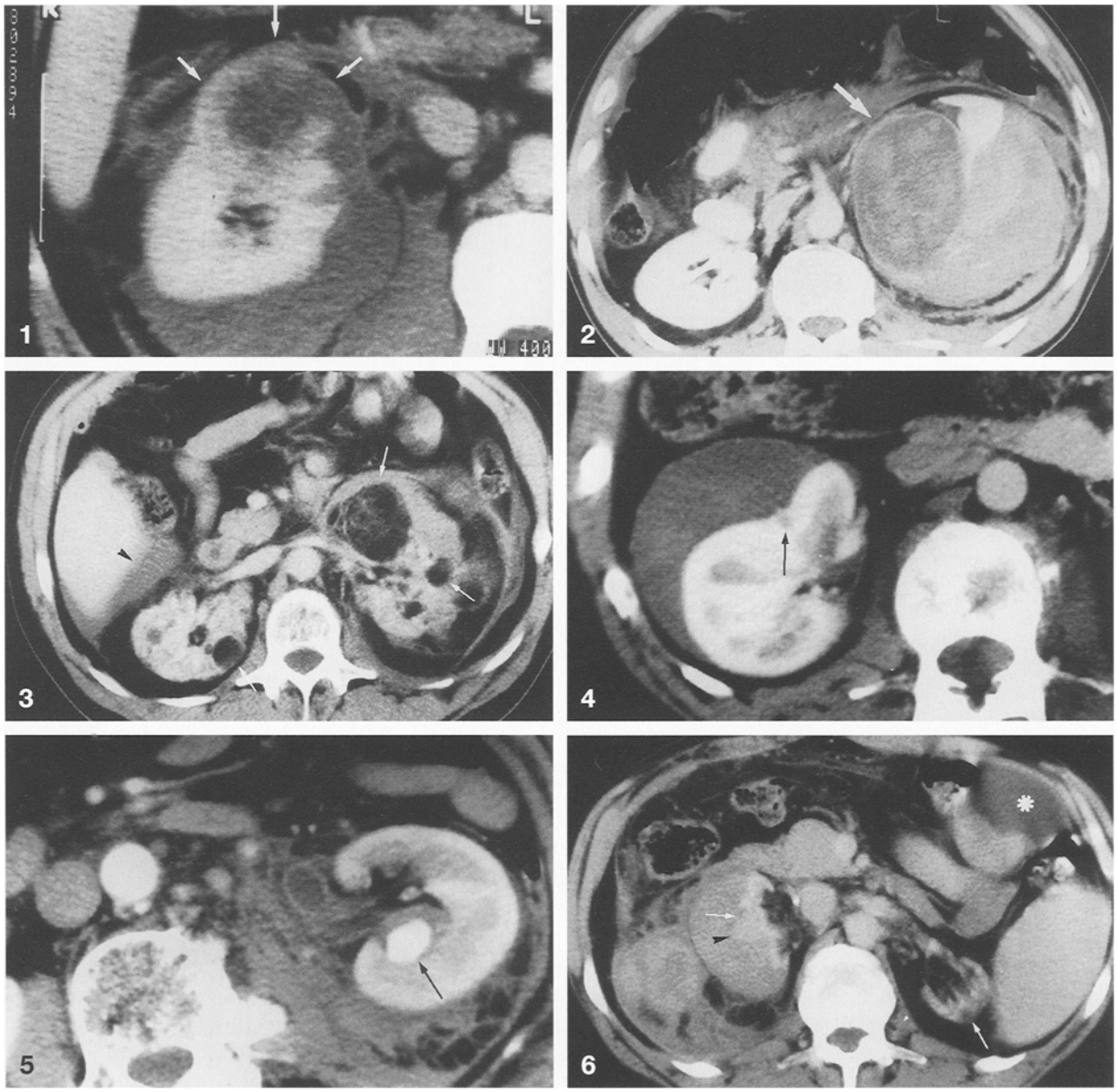

Fig. 1. Ruptured renal cell carcinoma with subcapsular and perirenal hemorrhage. Enhanced CT scan demonstrates a ruptured peripherally enhancing mass *(arrows)*

Fig. 2. Renal cell carcinoma with subcapsular and perirenal hemorrhage. Contrast-enhanced CT shows heterogeneous mass with acute hemorrhage inside *(arrow)*, surrounded by high-attenuation recent hemorrhage

Fig. 3. Bilateral angiomyolipomas with perinephric hemorrhage on the left. Enhanced CT scan reveals heterogeneous masses in both kidneys with dominant fat attenuation *(arrows)* and subhepatic intraperitoneal fluid collection *(arrowhead)*

Fig. 4. Renal metastatic malignant melanoma with subcapsular hemorrhage in a patient with clinical disseminated disease. Enhanced CT reveals a very small mass *(arrow)* with associated heterogeneous subcapsular hemorrhage

Fig. 5. Renal artery aneurysm with perirenal hemorrhage. Helical CT in arterial phase demonstrates a hyperdense mass *(arrow)* similar to the aorta consistent with artery aneurysm

Fig. 6. Acquired cystic kidney disease with subcapsular and perinephric hemorrhage. Enhanced CT shows small bilateral cysts *(arrows)* Well-defined high-attenuation circumscribed mass *(arrowhead)* inseparable from subcapsular and perinephric hemorrhage, representing a hemorrhagic cyst. Intraperitoneal fluid collection *(asterisk)*

matoma, representing a cyst with acute hemorrhage (Fig. 6).

8. The CT technique did not detect an underlying pathology in the patient with undiagnosed coagulation disorder. This case is considered to be a true negative.

In short, CT demonstrated the hematoma in all 13 cases, and helped by clinical findings (disseminated malignant melanoma, septic status in renal abscess) permitted correct diagnosis of the underlying cause in 11 of 12 patients with renal or adrenal anatomic lesions. Incorrect diagnosis was made in the case of RCC with 80 % necrosis. In our series the sensitivity of CT in identifying an underlying cause was 100 % with a correct diagnosis in 91.6 % of cases.

US findings

Ultrasound was performed in 7 patients. In all cases perinephric fluid collection with hyperechoic areas was demonstrated. It was not possible to differentiate between solid renal mass and clotted blood using this technique.

Discussion

The largest SPH series to date have been published in the urologic and surgical literature. McDougal et al. [2] reviewed the international literature in 1975, finding 74 documented cases of SPH and reporting four other cases. In this series tumors were the most common underlying disease, with an incidence of 57.7 % (33.4 % were malignant, with RCC predominant, and 24.3 % were benign, with AML predominant). Vascular disease (17.9 %) was the next most frequent underlying cause and included periarteritis nodosa, ruptured renal artery aneurysm, renal vein thrombosis, arteriovenous malformations, and renal infarction. The remaining causes were: infection (10.3 %), nephritis, blood dyscrasias, calculus, hydronephrosis, and no pathology. Pode and Caine [3] included the adrenal gland as the third cause of SPH, after renal tumors and vascular etiology. Disorders such as stressed adrenal, pheochromocytoma, myelolipoma, malignant tumors, and adrenal cysts may lead to bleeding.

In our series of 13 patients, AML was the most frequent cause of SPH and had a much higher incidence (30.7 %) than that cited by McDougal (11.5 %) [2]. Angiomyolipomas are benign tumors composed of fat, smooth muscle, and blood vessels [4]. Because of their high vascularity, these lesions are prone to spontaneous hemorrhage. Fifteen percent of AML present with SPH, and 51 % larger than 4 cm bleed [3]. There appears to be a heightened tendency to bleed during pregnancy [3]. Fifty percent of AML were associated with tuberous sclerosis. In these cases the renal lesions are usually bilateral, small, and multifocal [5]. In cases without tuberous sclerosis, AML occurs mainly in women, and the renal lesion is unilateral, unifocal, and large in size [6–8]. The CT technique can provide a specific diagnosis when fat is demonstrated within the tumor.

Renal cell carcinomas have a low incidence of spontaneous hemorrhage, but because of its relative frequency, this pathology was the most common malignant tumor associated with SPH in the published series [1–3, 9–11]. In our series there were 2 cases with underlying RCC.

In the group of malignant tumors we also had one case of renal metastatic melanoma. The metastases that tend to bleed are choriocarcinoma, melanoma, and carcinoma of the lung.

The incidence of renal artery aneurysm rupture appears to be relatively low, but high mortality rates are associated with this factor [12]. In our series the diagnosis of rupture of the renal artery aneurysm was made with helical CT with image acquisition in the arterial phase.

Spontaneous adrenal hemorrhage in the adult may involve one or both glands. The hemorrhage is usually confined to the gland itself, but may involve the adjacent perinephric space, causing SPH. Bilateral adrenal hemorrhage is usually associated with prolonged or severe stress (sepsis, surgery, burns, complicated pregnancy or delivery). Unilateral adrenal hemorrhage is most often caused by adrenal masses including cysts, carcinomas, adenomas, pheochromocytomas, and myelolipomas [3, 13]. In our series there was 1 case with an underlying adrenal myelolipoma. Myelolipoma is a benign neoplasm composed of mature fat and myeloid tissue. Most are asymptomatic, but SPH is a potential complication. The diagnosis of adrenal myelolipoma is based on the identification of fat within the mass by CT [13, 14].

We found one renal cortical abscess that developed SPH. The bleeding was most likely a result of erosion of the abscess into the renal vasculature [15]. Subcapsular or perinephric hemorrhage due to rupture of a cyst is uncommon, and in large series, such as McDougal et al.'s [2], cysts were not included as a cause. Renal cysts usually rupture into the pyelocaliceal system, rather than into the perirenal space [16]. In our series there was 1 case of ruptured simple cyst and 1 case of ruptured cyst in a hemodialyzed patient with uremic acquired cystic disease. Patients with end-stage kidney disease have more tendency to bleed because of severe arterial intimal fibrosis, hemodialysis with systemic heparinization, and qualitative platelet disturbance [17].

In our experience, CT identified the hematoma in all 13 cases (sensitivity 100 %). The underlying cause was identified in the 12 cases with anatomic renal o adrenal pathology (100 %) with correct diagnosis, helped by clinical findings, in 11 cases (91.6 %). In the case in which no renal lesion was identified, the patient had undiagnosed coagulation disorder. In contrast, US imaging in all 7 patients in which it was performed did not enable differentiation betwen solid renal mass and clotted blood; CT was necessary for diagnosis.

The underlying cause of SPH may be obscured in the acute phase by the perirenal blood, but on delayed serial CT the attenuation of the collection decreases and the underlying cause can be more apparent. Belyille et al. [9], Zagoria et al. [10], and Bosniak [18] suggest that in patients with SPH in whom no mass is seen initially and angiography rules out vascular cause, serial CT examinations may be a viable approach to treatment. Angiography can diagnose vascular causes not disclosed by CT and embolization can be used for treating benign diseases (AML). In light of the good results found with CT in our experience, we concur with this proposal. Therefore, if no renal mass is detected radiologically and the patient can be stabilized medically during the acute phase of SPH, we recommend deferring nephrectomy and performing serial CT to detect causative lesions. Thus, nephrectomy may be avoided in patients with benign disease or no disease.

We conclude that CT is a useful technique for the initial evaluation of SPH, permitting diagnosis and location of the hemorrhage and identification of the underlying cause.

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