

CT Bosniak

1

: 가 (CT) Bosniak
: 28 32 (17 ,
15) CT 5mm(26)
7mm(4) CT Bosniak
가 I II , IV
IIF III 가 3mm
가 2-3mm
10-20 Hounsfield unit
CT
: 32 : I 6 가
, II 8 7 가 , III 11 7 가
IV 7 가 . Bosniak II III 가
가 2 ,
가 2 CT
93%, 88%, 91%
: Bosniak 가
가 II III

. 50 50% (7-12). 가
가 (1),
, (CT)
Bosniak
, 가 가

. 1986 Bosniak
(2),
(3-6) 가
Bosniak 1987 8 1988 8 9 ,
CT 103 , 4

28 32 (17 , 15)
(1)

CT Bosniak

가 2-3mm

(artefact)

(streaky)

가 unit(H.U.)

가 1 cm

CT

가

28

가 20 , 가 8

29-74 (52) . CT GE 8800

Advantage High Speed(General Electric Medical Systems, Milwaukee, Wisconsin, USA)

10mm

CT

32

300 (Iopromide 0.6234g/ml, 140-150cc,

가 , 15 , 17

(bolus injection)

(tubular , 1.5-6.7 cm(3.8 cm)

nephrogram) 5mm(26) 7mm(4) 28 6 (unroofing)

CT가 2 , 10 , 12

CT

(parameter)가 , 32 20

(region of interest) CT , II 8 7 가 , III 11

가 7 가 , IV 7 가

가 (Table 2). CT I (Fig. 1) 6

CT IV (Fig. 2) 7

가 II 8

CT (Fig. 3), III 11

Bosniak (Table 1) , (Figs. 4, 5) (Table 3).

I II , IV

Bosniak IIF III

/ , 가 3mm , 3cm (Fig. 3).

CT

Table 1. Bosniak Classification of Cystic Renal Lesions

Category	Description
I (Simple Benign Cyst)	1) Sharply marginated or demarcated. 2) Smooth, thin wall. 3) Homogeneous, water density (0-20 H.U.). 4) No contrast enhancement.
II (Mildly Complicated Cyst)	Bulging or totally intrarenal. 1) One or two delicate, nonenhancing thin (especially < 1 mm) septa (septated cyst). 2) Small amount of linear, delicate calcification in the wall or septa (minimally calcified cyst). 3) Hyperattenuating [hyperdense or high density] cyst (50-90 H.U.) (due to blood, protein, colloid, iodine content or infected material).
IIF(F for Follow-up)	Minimally complicated cysts that require follow-up of 3 month, then 6 month, and then one-year interval. (Some hyperdense cysts, some lesions with more calcium in the wall, or slightly more complicated lesions)
III(More Complicated Cyst or Indeterminate Lesion)	Irregular margin. Thickened (> 2-3 mm) or enhancing septa. Uniform wall thickening. Thick (> 2-3 mm), irregular calcifications. Small nonenhancing nodule.
IV(Clearly malignant)	Thickened, irregular, enhancing solid areas. Shaggy, thickened (> 3 mm) wall. Necrosis and liquefaction of a solid tumor, cysts with adjacent tumors, or tumors growing within the cyst wall : Heterogeneous.

Hounsfield Unit(H.U.) , 28 가 , II
(Fig. 3A). CT
(mural nod-
ule) , IIF (Fig. 3B).

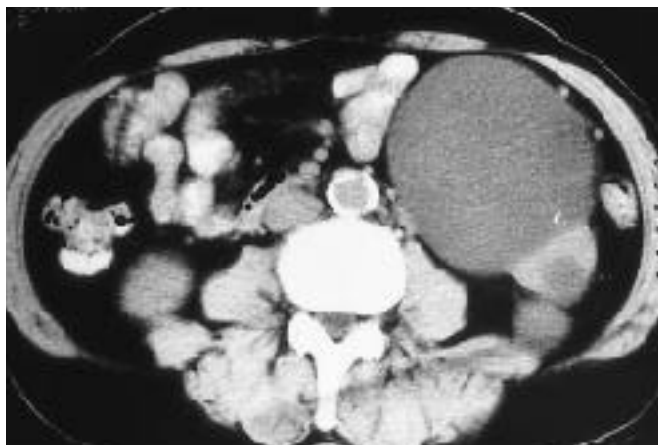
CT 가
6 CT
가 가
가

Table 2. Results of Classification of Cystic Renal Masses by the Bosniak Classification System Compared with Pathologic Ones

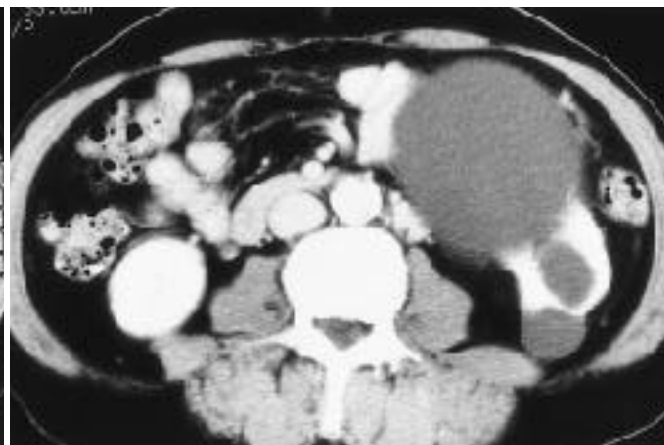
Bosniak Category	No. of Lesions	Pathology Results	
		Benign	Malignant (%)
I	6	6	0(0)
II	8	7	1(13)
III	11	4	7(64)
IV	7	0	7(100)
Total	32	17	15(47)

Table 3. Prediction of Malignancy on CT of 32 Cystic Renal Masses

		CT Diagnosis		
		Malignant	Benign	Total
Pathology	Malignant tumor	14	1	15
	Benign mass	2	15	17
Sum		16	16	32

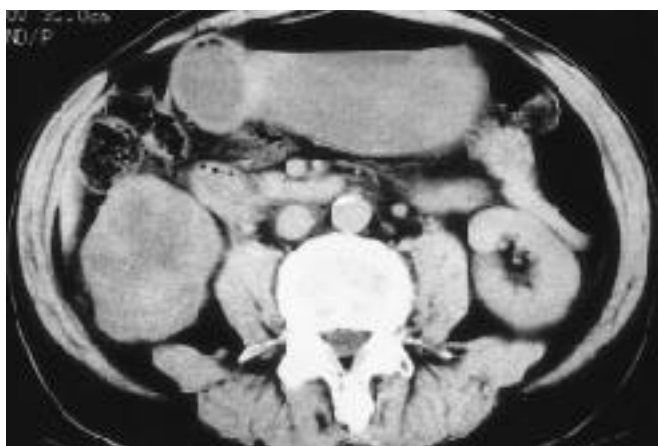


A



B

Fig. 1. A 59-year-old man with multiple simple cysts in the left kidney. Unenhanced (A) and enhanced (B) CT scans show definite Bosniak category I lesions.



A



B

Fig. 2. A 42-year-old woman with a cystic renal cell carcinoma in the right mid and lower poles. Unenhanced (A) and enhanced (B) CT scans reveal a definite Bosniak category IV lesion of enhancing shaggy thickened wall and septae, wall nodularity, and irregular thickened solid components. Pathology confirmed that the lesion was a cystic and necrotic renal cell carcinoma.

CT Bosniak

III

5.8 cm 가

CT (80-87 H.U.) 가

32 CT 가 20

(Fig. 4A). CT III 가

(Fig. 4B). 0, 92, 25.4 H.U. CT Bosniak

88%, 91% 가 93%,

III CT (Fig. 5)



A



B

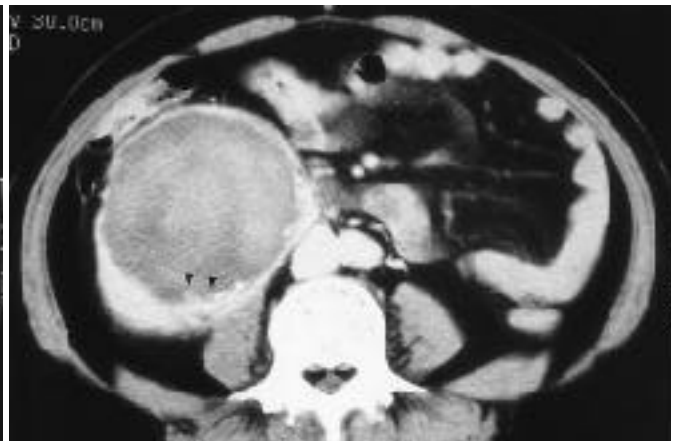
Fig. 3. A 47-year-old man with a cystic renal cell carcinoma in the left mid pole.

A. Unenhanced CT scan shows a 3-cm sized round Bosniak category II cyst (28 H.U.) with linear, delicate calcifications in the wall.

B. Enhanced CT scan reveals no contrast enhancement of inner content of the mass, suspicious nonenhancing (white arrow) or slightly enhancing mural nodules (white arrowhead), and associated small cortical cysts (black arrowheads) in both kidneys. So this mass was classified as a Bosniak category IIF lesion. An ultrasound examination (not shown here) confirmed the cystic nature of the lesion without definitely demonstrable mural nodules. At operation, however, the lesion was found to have malignant cells in some portions of the cystic wall.



A



B

Fig. 4. A 39-year-old man with a huge calcified hemorrhagic cyst in the right kidney.

A. Unenhanced CT scan shows a large Bosniak category III cyst with hyperdense content (80-87 H.U.), thick calcifications and slightly irregular border.

B. Enhanced CT scan reveals no enhancement of internal content, irregular borders, uniform wall thickening, and some mural nodules of questionable enhancement (arrowheads). So this cystic lesion was considered as a probably malignant lesion. At operation, however, the lesion was a benign calcified hemorrhagic cyst.

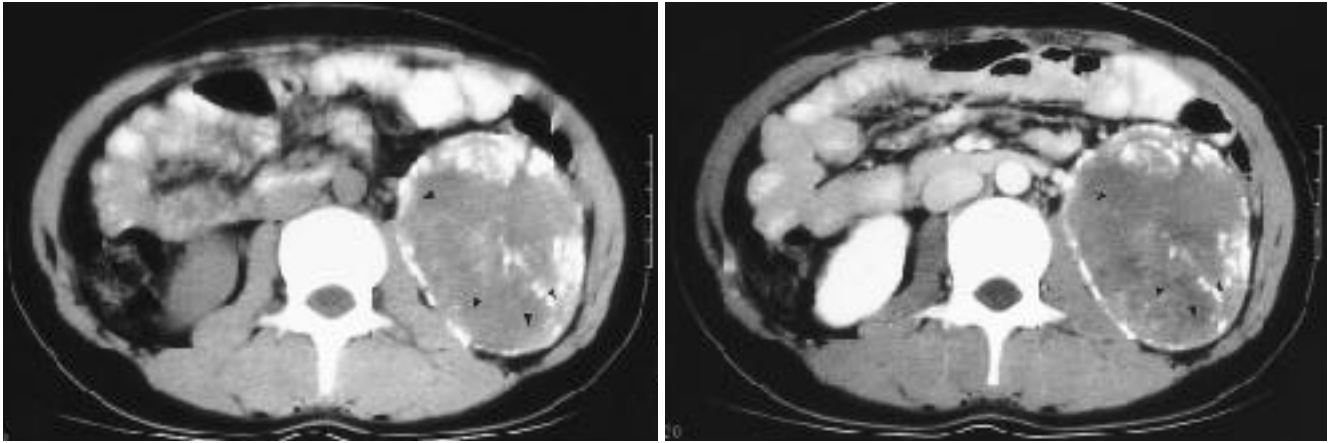


Fig. 5. A 46-year-old woman with a huge calcified hemorrhagic cyst in the left kidney. Unenhanced (A) and enhanced (B) CT scans show a Bosniak category III cyst with multiple irregular, thick, chunky calcifications in the wall, unenhanced fluid content, and suspicious nonenhancing mural nodules (arrowheads). The benignity or malignancy of this lesion was uncertain. At operation, however, the lesion was a benign calcified hemorrhagic cyst.

(7-12). 1989
Brown 16 CT
가 , Bosniak I 2
(), II가 4 (), III 12 (9
(scar), 가 , 가 , 3 (), IV가 6 (2 가 , 4
) (7). 1991 Aronson Bosniak
16 CT US
II 4
(), III 7 (3 가 , 4)
IV 5 () (8).
가 , 가 , Bosniak
가 ()
CT ,
1992 II Hartman CT Bosniak
2.5 cm 가
(9).
2-3 CT
가
frond가 ,
CT
5-mm CT
(parameter)가
(8-12). 1-cm CT가
(partial
volume averaging) (perception)
5-mm CT
가 , CT
(6).
(15) CT
(1) CT
Bosniak
26.8 H.U.
6.3, 2.3, 27.6 H.U.
II, III, IV
20 24
CT Bosniak
(10). 24
, 5 II
III 6
. 2
II, III, IV
27.6 H.U.

: CT Bosniak
 Bosniak 가) 가 .
 II, III, IV (10 H.U.).
 II, III 가 (13). Ooi 11
 1996 Fisher 46 , ,
 68 3 CT I (72.2%)가
 (11). , Bosniak (15).
 가 (II III) .
 1997 Siegel 70 II III
 CT 3 CT , 가 (12).
 (12). 3 CT , 22 I(0%) , 8 II(13% 1993 Bosniak IIF (F follow-
), 11 III(45%), 29 IV(90%) up) 가
 Bosniak (4). IIF II
 , , II III
 가 6
 , kappa 가 Bosniak 가 가
 ROC(receiver operating characteristics) 가 (exploration)
 0.571 0.477 . IIF 6
 Bosniak 32 3 CT 가
 29 (91%) CT 가
 I IV 6 7 (100%)
 CT (12.5%) IIF (Fig. 3) 2 (18%) III
 (Figs. 4, 5) CT (Fig. 3).
 CT IIF(Fig. 3) III(Fig. 4)
 2 , II III 가 가 가
 가 Bosniak Bosniak (9, 11, 16,
 : I IV 17), , ,
 , II III 가 (17).
 가가 CT 가 CT
 (3). Bosniak CT
 가 , , Bosniak CT
 () / 가
 Siegel (12) 가
 (complicated) (13). , 32 21 (66%) ,
 10% CT (bias)가 가
 , 가 가
 () (

가

Bosniak

가

가

II

III

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Usefulness of the Bosniak Classification in Cystic Renal Mass on CT¹

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Purpose : To assess the clinical usefulness of the Bosniak classification system for characterizing cystic renal masses by computed tomography (CT).

Materials and Methods : The CT scans of 28 patients with 32 pathologically proven cystic renal masses (17 benign, 15 malignant) were reviewed retrospectively by two radiologists, who reached a consensus. Both unenhanced and enhanced CT scans were obtained using thin sections with 5-mm or 7-mm collimation in 26 and four patients, respectively. Renal masses were categorized using the Bosniak classification system; category I and II masses were considered benign, and category IV, malignant. Masses in category IIF or III were considered malignant when their wall thickness was more than 3 mm, their inner wall was irregular or nodular, their septae were irregular, nodular or thick (more than 2-3 mm), calcification was extensive, nodular or thick (more than 2-3 mm), and/or solid portions were enhanced more than 10-20 Hounsfield unit. They were then correlated with their pathologic findings.

Results: For cystic renal masses, the final pathologic results were as follows : all seven category I lesions were benign, as were seven of eight category II lesions ; seven of 11 category III lesions were malignant, as were all seven category IV lesions. Distinguishing category II and III lesions by the Bosniak classification was difficult in two cases. One malignant tumor was interpreted as benign, and two benign tumors as malignant. With regard to prediction of the malignancy of 32 cystic renal masses, as seen on CT, sensitivity, specificity, and accuracy were 93%, 88%, and 91%, respectively.

Conclusion: Overall, the Bosniak classification system is useful for the evaluation and management of cystic renal masses; however, with regard to the distinction between category II lesions requiring conservative management and surgical category III lesions, some difficulties still remain.

Index words : Kidney, CT
Kidney neoplasms, CT
Kidney, cysts

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