

CT  
 : 가 5 cm 40 60  
 CT  
 CT ) / ( CT - CT ) × 100 ]  
 60% 50%  
 : 29 ( ) 11 ( )  
 66.7%(n=29) , 21.8%(n=11)  
 가 (p .01). 1  
 50% 50%  
 60% 82.7%(24/29),  
 100%(11/11), 87.5%(35/40) 50%  
 96.5%(28/29), 100%(11/11), 97.5%(39/40)  
 : CT 5 cm  
 가 60% 50%

가 가 (6-8).

CT (CT) 10  
 [ Hounsfield Unit(HU) ]  
 (1, 2). , CT  
 (MRI) 가 (3-5). (9). ,  
 가 10 HU CT (percentage)  
 of enhancement washout 가 (10-12).  
 가 CT

1가  
 2가

2003 1 2

2003 4 4

CT (three - phase CT)  
 가 5 cm  
 41  
 (- 30 HU )  
 1  
 40 가  
 40.7 (29 - 73 )  
 가 27 , 가 13  
 CT  
 CT  
 가 6  
 가  
 CT  
 10  
 60  
 5 mm, 1:1 pitch  
 120 ml (Ultravist, Schering, Berlin,  
 Germany)  
 2.5 ml  
 60 5 mm, pitch 1:1 1:1.6  
 10  
 CT  
 Somatom plus 4 (Siemens, Erlangen, Germany)  
 120 kVp, 200 mA . CT  
 가 가  
 가 CT  
 가 CT  
 (absolute percentage of  
 enhancement washout) . [ ( CT

CT  
 CT ) / ( CT  
 ) × 100  
 60% , 60%  
 , 60%  
 (11).  
 50%  
 60%  
 CT  
 CT  
 29 ( ) 11  
 ( ) .  
 14 ( 8 , 6 ) , 26  
 (n=3),  
 (n=2), (n=2), (n=1), (n=1),  
 (n=1) , 1  
 66.7%  
 21.8%(n=11)  
 가 (t - test, p < .01).  
 가  
 50% 가  
 50%  
 가 (Fig. 1).  
 60% 60%  
 , 60%  
 82.7% (24/29),

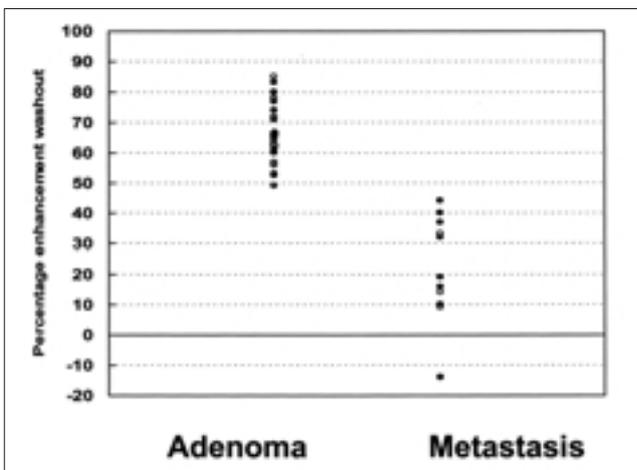


Fig. 1. Graph shows that the percentage enhancement washout value is more than 50% in all adenomas except one and less than 50% in all metastatic tumors.

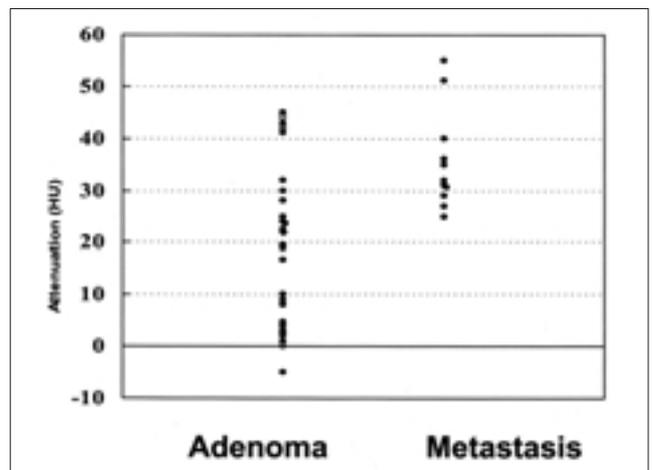


Fig. 2. Graph shows that the attenuation value of all metastatic tumors is more than 20 HU.

100% (11/11), 87.5% (35/40)  
 50% 50%  
 , 50%  
 (28/29), 100% (10/10), 96.5%  
 97.5% (39/40)  
 CT 17.6  
 HU (n=29) 35.6  
 HU (n=11) CT  
 가 10 HU  
 55.2% (16/29) CT  
 가 10 HU  
 44.8% (13/29)  
 가 (67.2% vs. 64%,  $p >$   
 .05). CT 20 HU  
 (Fig. 2).

가 3 cm  
 가  
 CT MRI  
 CT MRI  
 10 HU CT 가  
 가  
 CT 10 HU  
 (pheochromocytoma) 가  
 5 cm 가

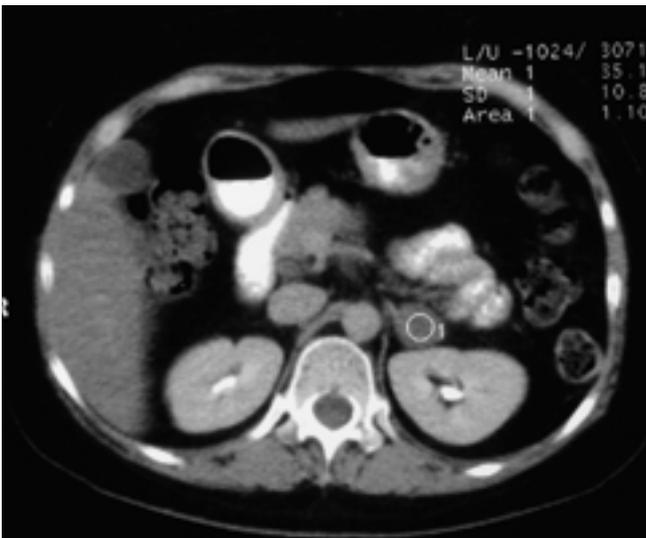
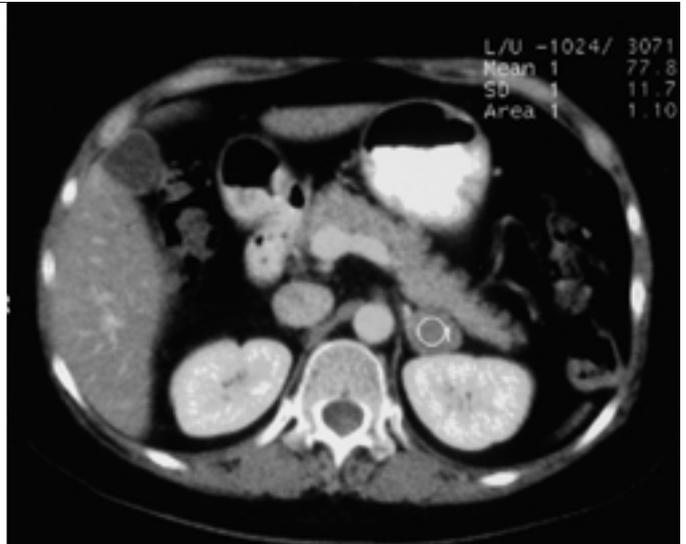
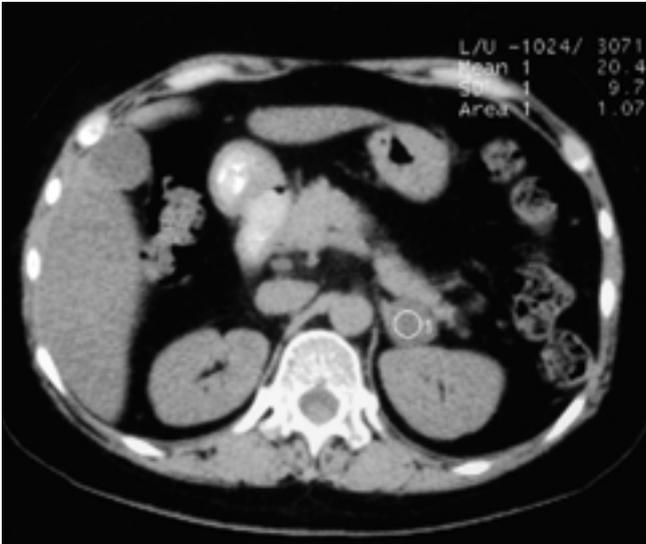
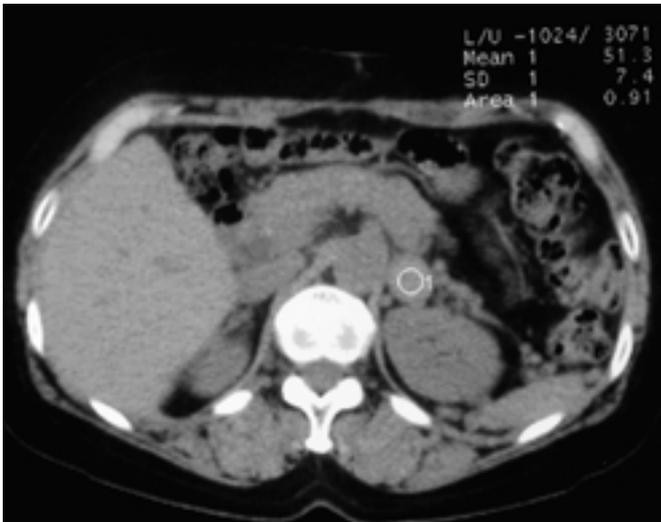
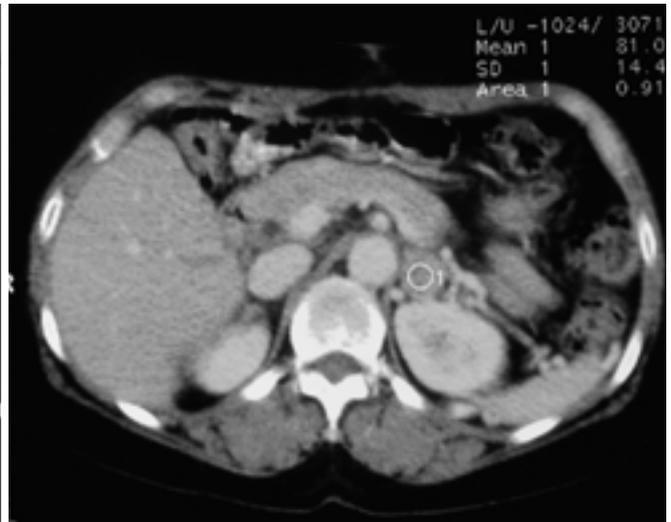


Fig. 3. 42-year-old female with adrenal adenoma.  
 A. The attenuation coefficient of left adrenal mass is 20.4 HU on unenhanced CT scan.  
 B. On portal venous phase CT scan, the mass has attenuation value of 77.8 HU.  
 C. On 10-min delayed CT scan, its attenuation value is 35.1 HU. The enhancement washout value is 74%. It was proved as cortical adenoma by surgery.

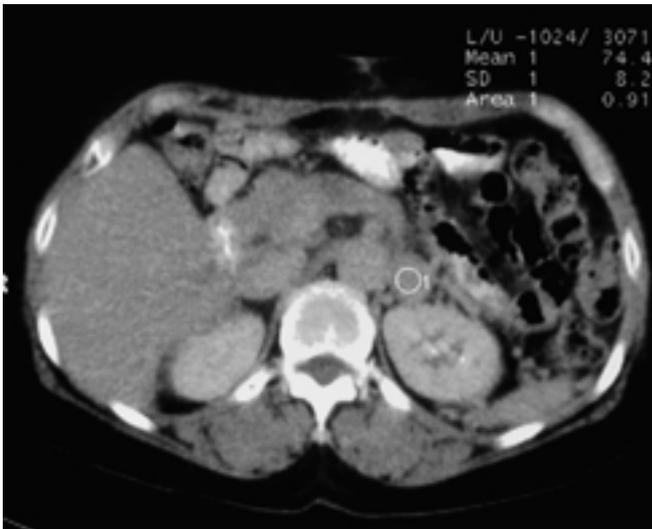
CT  
가  
가  
가 (10, 11).  
. CT 가 (11,  
20 HU  
20 HU CT 13).  
CT  
가 10 HU 가 5 cm CT  
CT 100 CT  
CT (2, 12, CT  
13). 60%  
40 50%  
3, 4). (Fig. (10, 11).



A



B



C

Fig. 4. 57-year-old female with metastatic adrenal tumor.  
A. The attenuation coefficient of left adrenal mass is 51.3 HU on unenhanced CT scan.  
B. On portal venous phase enhanced CT scan, the mass has attenuation value of 81.0 HU.  
C. This lesion shows attenuation value of 74.4 HU on 10-min delayed enhanced CT scan. The enhancement washout value is 37%. It was confirmed as metastasis from hepatocellular carcinoma by open biopsy.



## Usefulness of Percentage Enhancement Washout Value Calculated on Unenhanced, Contrast-Enhanced, and Delayed Enhanced CT in Adrenal Masses: Adenoma versus Metastasis<sup>1</sup>

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**Purpose:** To determine the usefulness of percentage enhancement washout value calculated on unenhanced, enhanced and delayed enhanced CT scans for the characterization of adrenal masses.

**Materials and Methods:** Forty adrenal masses less than 5 cm in size were assessed using a protocol consisting of unenhanced CT, enhanced CT 60 seconds after intravenous administration of contrast material, and delayed enhanced CT at 10 minutes. The CT attenuation value of adrenal tumors was estimated on each scan, and percentage enhancement washout value was calculated as follows:  $\{ (\text{attenuation value at enhanced CT} - \text{attenuation value at delayed CT}) / (\text{attenuation value at enhanced CT} - \text{attenuation value at unenhanced CT}) \times 100 \}$ . An adrenal mass was considered benign if its percentage enhancement washout value was at the threshold value, set to 60% and 50%, or higher. The accuracy of the procedure was determined by comparing its findings with the final clinical diagnosis.

**Results:** Twenty-nine masses were benign and 11 were malignant. The mean percentage enhancement washout value of the former was significantly higher than that of the latter (66.7% vs. 21.8%;  $p < 0.01$ ). All adenomas except one had a washout value of more than 50%. With a percentage washout threshold of 60%, 35 of 40 lesions were correctly characterized as benign or malignant [ sensitivity 82.7% (24/29), specificity 100% (11/11), accuracy 87.5% (35/40) ]; with a threshold of 50%, 39 of 40 lesions were correctly characterized [ (sensitivity 96.5% (28/29), specificity 100% (11/11), accuracy 97.5% (39/40) ].

**Conclusion:** Percentage enhancement washout values are useful for characterizing an adrenal mass as benign or malignant. For characterization, a threshold value of 50% was more accurate than one of 60%.

**Index words :** Adrenal gland  
Adrenal gland, tumor  
Adrenal gland, CT

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