

Adrenal Incidentalomas: Can we characterize them?

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As imaging technology improves so does the detection of smaller and smaller lesions. A significant number of these lesions are of no clinical significance. Often referred to as incidentalomas. Unfortunately they contribute significantly to the headache of both imaging specialists and clinicians, as their significance and further management has to be determined. Adrenal masses are not uncommon, the incidences of Adrenal masses are considered to be in the range of 2.7% to 5 % based on abdominal CT scans and autopsy studies. Most of these adrenal masses are non functioning adrenal adenomas. The need to characterize adrenal masses arises essentially in two situations. Firstly, an adrenal mass detected on a CT study done for staging of an extra adrenal neoplasm. The adrenal mass detected may represent a metastatic deposit or an adrenal adenoma. The differentiation is very important as if it is a metastatic deposit then the tumor gets upstaged to being inoperable, if not a metastases the patient is potentially operable. Secondly if a CT has been performed for reasons other than detecting an adrenal pathology and an adrenal mass is detected. Once an adrenal mass has been detected. There are essentially three questions to be asked. Is there clinical or biochemical evidence of a hypersecretory adrenal neoplasm, such as a pheochromocytoma, conns or Cushing syndrome. If not the second question is; are there any specific characteristics of the adrenal lesion to indicate its aetiology. Lesions like adrenal cysts, adrenal myolipoma and adrenal haemorrhage have typical features. Adrenal myolipomas are benign tumors containing bone marrow elements. These are of fat density with areas of soft tissue within and occasionally calcification. The diagnosis of adrenal myolipoma is based on the demonstration of fat in the lesion. Adrenal cysts are of water density with a thin wall and occasionally peripheral calcification. Adrenal haemorrhage has HU values ranging between 50 and 80. After excluding these lesions we come to the last question, are these adrenal lesions adrenal adenomas. 70-80% of adrenal lesions are lipid rich, the remaining are lipid poor. Lipid rich adrenal adenomas are

easily demonstrated, The HU values of these lesions would be less than 10 HU on a non-enhanced CT study. 20-30 % of adrenal adenomas are lipid poor, these lesions have a HU value higher than 10. These cannot be differentiated on HU values but are differentiated from neoplastic lesions by their enhancement characteristics. Images are obtained before contrast, portal venous phase and 15 min delayed scans after administration of IV contrast medium. From these scans the percentage washout can be determined.

Wash in value: $\text{HU value at Portal venous} - \text{HU value of non enhanced adrenal mass}$.

Wash out value: $\text{HU value at Portal venous phase} - \text{HU value at delayed scan of adrenal lesion}$.

Percentage enhancement Wash out/Wash in x 100. If this value is above 60% would indicate an adenoma with a sensitivity of 98% and specificity of 92%.

In certain centers plain sections are not obtained, or very thick sections are obtained, in these cases an accurate plain CT HU value is not available. In these cases the relative percentage of enhancement can be used, this formula does not require the plain scan value.

Enhancement washout $(\text{HU portal venous phase} - \text{HU delayed phase}) / \text{HU portal venous phase} \times 100$. If the value is above 50% this would indicate this is an adrenal adenoma with a sensitivity of 93% and specificity 98%.

Chemical shift MR imaging has been also used to detect lipid rich adenomas. In the opposed phase when water and lipid molecules are out of sync there will be a drop in signal intensity confirming the presence of lipid in these mass lesions. However chemical shift imaging cannot detect lipid poor adenomas.

The ideal protocol for characterizing an adrenal lesion would be, if HU values are less than 10 on an unenhanced scan it is conclusive it is an adenoma. If the HU values

are above 10 HU, then wash out characteristics need to be determined. This would determine whether the lesion is a lipid poor adenoma or not. If not it is most likely a neoplastic lesion, adrenal cortical carcinoma, metastases or a Lymphomatous deposit. Tuberculosis is one lesion which though benign has washout characteristics of a neoplastic lesion. The appearances on imaging of a

necrotic peripherally enhancing lesion with a clinical presentation of Addison's disease usually clinch the diagnosis of adrenal tuberculosis.

CT with a proper protocol and HU values is extremely useful in characterizing Adrenal mass lesion, in nearly all cases would obviate the need for a biopsy.