ADRENAL LESIONS

Financial disclosure

- Nothing to declare

Introduction

- Adrenal lesions are common – 9% of the population
- Increase in detection rate
- Improvement in imaging modalities
- Resultant improvement in diagnostic rate

Adrenal lesion

Anatomy

- Adrenal
- 5 grams
- Shapes: Y/V/T
- Cortex: mesodermal origin
- Medulla: neural crest origin

Common causes

- Adenoma
- Metastasis
- Pheochromocytoma
- Hemorrhage
- Hyperplasia
Uncommon causes

- Solid lesions - Adrenocortical carcinoma, Hemangioma; angiosarcoma; ganglioneuroma
- Solid fatty - collision tumor, myelolipoma
- Cystic – Hydatid cyst, endothelial cyst

Hyperfunctioning lesion

- Cortex
  - Cushing (cortisol from zona fasciculata)
  - Conn (aldosterone from zona glomerulosa)
  - Hyperandrogenism (androgen from zona reticularis)
- Medulla
  - Pheochromocytoma

Imaging and...

- CT and MRI
- PET
- I-123 MIBG / In-111 Octreotide
- Blood / Urine analysis (plasma catecholamines, urine VMA and metanephrine)
- Biopsy
- Adrenal vein sampling

CT

- Unenhanced scan
- Portal venous phase scan
- Washout protocol
  - Unenhanced + 70 (60-80) sec enhanced scan + 10 (10-15) mins delayed scan
  - Relative WO = Enhanced HU - Delayed HU / Enhanced HU
  - Absolute WO = Enhanced HU - Delayed HU / Enhanced HU - Unenhanced HU

MR

- Utilization of chemical shift principle - T1 in-phase and T1 out-of-phase (intralesional fat content drops signal on out of phase images)
- Gad enhancement is not essential

In brief....

- Adenoma
- Metastasis
- Pheochromocytoma
- Adrenocortical carcinoma
- Collision tumor
- Conn syndrome
- Hemorrhage
Adenoma

- Most common adrenal lesion, and is benign
- About 70% are intracytoplasmic lipid rich in the adrenal cortex and 30% are lipid poor
- Lipid-rich adenomas have low HU
- Lee et al. => mean – 2.2 HU; at a threshold value of 0 HU, unenhanced CT has a sensitivity of 47% and specificity of 100%
- Boland et al. (meta-analysis) – at a threshold of 10 HU, sensitivity of 71% and specificity of 98%

Adenoma

- Rapid enhancement and wash-out
- <30 HU at 10 mins has been shown to be diagnostic
- Wash-out of >50% is specific
- At 60-80 sec HU is usually <10
  (not FDG avid)

Adenoma

- Comparison of T1 in-phase with T1 out-of-phase
- Spleen is usually taken as the reference organ
- Sensitivity 81-100%
- Specificity 94-100%
- Can be difficult for <1cm lesions due to low resolution

Adenoma

<table>
<thead>
<tr>
<th>T1 in-phase</th>
<th>T1 out-of-phase</th>
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<tbody>
<tr>
<td><img src="image1" alt="T1 in-phase" /></td>
<td><img src="image2" alt="T1 out-of-phase" /></td>
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Adenoma

<table>
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<tr>
<th>T2</th>
<th>Gad enhancement</th>
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Adenoma

- DWI
- ADC

Metastasis

- Little intracytoplasmic fat
- Lee et al => mean - 39HU
- Can have rapid enhancement but washout is usually prolonged
- Not smooth in contour; heterogeneous enhancement

Metastasis

Pheochromocytoma

- Functioning medullary tumor
- Typically unilateral and benign; well circumscribed
- 10% extra adrenal - paragangliomas
- Clinically hypertension and palpitations due to catecholamine secretion (however, <1% of hypertension cases are due to pheochromocytoma)
- Plasma catecholamines, urine VMA and metanephrine => sensitivity - 89-100% (false negative from exogenous drugs and episodic catecholamine production)

Pheochromocytoma

- Can have hemorrhage, necrosis, calcification
- Hyperenhancing; >110HU at 60-80 sec; >50% wash out
- Markedly hyperintense on T2; salt and peppertype enhancement
- Positive on I123-MIBG/In111-Octreotide – metastasis; extra adrenal lesions

Pheochromocytoma

- T2W

Adenoma
Pheochromocytoma

- T1 FS + Gad

Adrenocortical carcinoma

- Rare
- Bilateral in about 10%
- 50-80% functional ⇒ Cushing syndrome/Conn/virilization
- Usually large; necrosis, hemorrhage; calcification (30%); invasion of adjacent structures; venous extension; metastasizing
- F18-FDG avid
- AGGRESSIVE LOOKING

Adrenocortical carcinoma

- CT +

Collision tumor

- 2 Histologically different tumors in adrenal gland
- Rare
- benign/benign; benign/malignant; malignant/malignant
- Adenomas, metastasis, myelolipoma, carcinoma...
- Metastasis in an adenoma is the main entity of concern
- CT and PET; biopsy

Conn syndrome

- Primary Hyperaldosteronism (most common cause of secondary hypertension)
- 80% due to (aldosterone producing) adenoma (APA)
- 20% due to hyperplasia (unlike Cushing where hyperplasia accounts for 80%)
- Also in adrenocortical carcinoma
- Clinical symptoms, hyponatremia/hypokalemia/alkalosis
- + nodule on CT ⇒ surgery

Conn syndrome

- CT -
Hemorrhage

- Not common
- Traumatic/unilateral > non traumatic/bilateral
- Adrenal insufficiency - 90% destruction; can be catastrophic
- Anticoagulation, stress, metastasis, pheochromocytoma
- Varied appearance - CT, MR

Other...

- Adrenal lipoma
- Adrenal lipoma
- Myelolipoma
- Myelolipoma
- Myelolipoma
- Myelolipoma
- Hyperplasia
- Hyperplasia
Hydatid cyst

Algorithm to assess an adrenal lesion

In summary,

- Imperative to consider background history
- Previous imaging is extremely helpful
- MR is not always confirmatory for tiny lesions
- CT washout is the best modality for adenomas
- Simple follow up imaging should not be forgotten!

References


Thank you