Adrenal Incidentalomas

Kiara Hennessey, PGY-5
Department of Urologic Sciences
University of British Columbia

Objectives

• Evaluation of adrenal incidentaloma (AI)
• Management
  – Indications for observation, biopsy, surgery, medical therapy
• Minimally-invasive (MIS) surgical approach
Questions- 1

• Adrenal masses larger than this size have a greater than 25% chance of portending adrenal cell carcinoma:
  • A. 4cm
  • B. 5cm
  • C. 6cm
  • D. 7cm
  • E. 8cm

Questions- 2

• What is the overall sensitivity of adrenal biopsy to detect adrenal carcinoma in pts with AI?
  • A. 10%
  • B. 25%
  • C. 40%
  • D. 50%
  • E. 70%
Questions- 3

• The most specific test for the diagnosis of Cushing syndrome is:
  • A. Salivary cortisol test
  • B. 1 mg dexamethasone suppression test
  • C. Random serum cortisol test
  • D. 24-hr urinary free cortisol
  • E. Random urinary cortisol
AI

“Adrenal lesions larger than 1cm found serendipitously during imaging studies performed for reasons other than evaluation of adrenal disease.”

“A new endocrine epidemic.”

A- adrenal
I- incidentaloma
D- discovered
S- serendipitously


Incidence and Epidemiology

• Adrenal masses are among the most common tumors in humans
  • 6-9% prevalence in autopsy series, increases with age
    – 0.2%, 20-29yrs
    – 7%, > 70yrs
  • 4-5% pts undergoing abdo CT
• Detection is increasing
  – Higher resolution imaging

Incidence and Epidemiology

• Majority of AI lesions are benign, non-secretory and clinically silent adenomas.


Incidence and Epidemiology

• Pts with no known hx of malignancy:
  • >70% lesions, benign
• Pts with hx of malignancy:
  • 50-75% lesions, mets
• 4-5% dx with primary adrenocortical carcinoma (ACC)
  • Rare: affects 1-2 per million persons per year

Incidence and Epidemiology

• Up to 20% have endocrine function
  – Cushing’s syndrome- subclinical, clinical
  – Primary hyperaldosteronism
  – Pheochromocytoma
  – Sex hormone-secreting tumor


Incidence and Epidemiology

• Why should every patient be offered testing?
  – Rule out malignancy
  – Rule out functional lesion

Clinical evaluation

• Key elements in determining appropriate management:
  • Size of lesion
  • Likelihood of malignancy
  • Appearance on imaging
  • Functionality
    – Cushing’s Syndrome: clinical, subclinical
    – Primary hyperaldosteronism
    – Pheochromocytoma (Pheo)
Clinical evaluation

- History
- Physical exam
- Biochemical evaluation
- Imaging

No diagnostic approach has been prospectively validated

History and Physical

- Goals of history and physical:
  - Signs or symptoms of functional mass
  - Malignancy
  - Familial conditions
    - Pheo: MEN 2, VHL, NF type 1, TS, Sturge-Weber
    - ACC: Li-Fraumeni, MEN I, Beckwith-Wiedemann, Carney complex
# History and Physical

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cushing's syndrome</td>
<td>Patient may be asymptomatic if disease is subclinical; symptoms may include weight gain with central obesity, facial rounding and plethora, supravacular and dorsocecal fat pads, easy bruiting, thin skin, poor wound healing, purple striae, proximal muscle weakness, emotional and cognitive changes (e.g., irritability, spontaneous tearfulness, depression, and restlessness), opportunistic and fungal infections, altered reproductive function, acne, and hirsutism.</td>
<td>Hypertension, osteopenia, osteoporosis, fasting hyperglycemia, diabetes mellitus, hypokalemia, hyperlipidemia, and leukocytosis with relative lymphopenia.</td>
</tr>
<tr>
<td>Pheochromocytoma</td>
<td>Patient may be asymptomatic episodic symptoms may occur in spells (paroxysms) that can be extremely variable in presentation but typically include forceful heartbeat, pallor, tremor, headache, and diaphoresis; spells may be either spontaneous or precipitated by postural change, anxiety, medications (e.g., metoclopramide, anesthetic agents), and maneuvers that increase intraabdominal pressure (e.g., change in position, lifting, defecation, exercise, calloscopy, pregnancy, and trauma).</td>
<td>Hypertension (paroxysmal or sustained), orthostatic hypotension, pallor, retinopathy grades 1 to 4, tremor, and fever.</td>
</tr>
<tr>
<td>Primary aldosteronism</td>
<td>Hypokalemia is present, nocturia, polyuria, muscle cramps, and palpitations may be present.</td>
<td>Hypertension, mild or severe; possibly hypokalemia and mild hypokalemia.</td>
</tr>
<tr>
<td>Adrenocortical carcinoma</td>
<td>Symptoms may include mass effect (e.g., abdominal pain) and symptoms related to adrenal hypersecretion of cortisol (Cushing's syndrome), androgens (virilism, acne, amenorrhea or oligomenorrhea, oily skin, and increased libido), estrogens (gynecomastia), or aldosterone (hypokalemia-related symptoms).</td>
<td>Hypertension, osteopenia, osteoporosis, fasting hyperglycemia, diabetes mellitus, hypokalemia, hyperlipidemia, and leukocytosis with relative lymphopenia.</td>
</tr>
<tr>
<td>Metastatic cancer</td>
<td>History of an extrarenal cancer.</td>
<td>Cancer-specific signs</td>
</tr>
</tbody>
</table>

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**Da Cat?**

*Nope, I No Seen Him*
Investigations

• Biochemical evaluation
  • **Cushing’s syndrome:** 5.3% of AIs
    – Rule out exogenous steroid use
    – Screening tests
  • **Pheochromocytoma:** 4-5% of AIs, including normotensive pts
    – Stop medications that falsely elevate catecholamines
    – Screening tests
  • **Primary hyperaldosteronism:** only 1-3% of AIs
    – Differentiate causes of primary hyperaldosteronism
      • Aldosterone producing adenoma (Conn’s)
      • Bilateral adrenal hyperplasia


Biochemical Evaluation

• Cushing’s syndrome
  • 24-hour urinary free cortisol
    – Several samples, average UFC
    – <80 µg/24 hr, excludes dx
    – 5.3% false negative result
  • Dexamethasone suppression test
    – 1 mg dexamethasone 23:00, serum cortisol at 08:00
    – > 5 µg/dl, diagnostic
    – Specificity is 97%
      • Best first test for subclinical Cushing’s
      • Confirmatory testing recommended

Biochemical Evaluation

**Specificity of First-Line Tests for the Diagnosis of Cushing’s Syndrome: Assessment in a Large Series**

Francesca Pecori Giraldi, Alberto G. Ambrogio, Martina De Martin, Letizia M. Faiti, Massimo Sancesi, and Francesco Cavagnini

Chair of Endocrinology, University of Milan, Ospedale San Raffaele, Istituto Auxologico Italiano Istituto di Ricovero e Cura a Carattere Scientifico, I-20148 Milan, Italy

**Context:** The diagnosis of Cushing’s syndrome requires highly sensitive screening tests. Therefore, diagnostic cutoffs have been lowered to maximize sensitivity and identify all patients. However, few studies have investigated the impact of these refinements on the specificity of first-line tests.

**Objective:** The aim of the study was the assessment of the specificity of three widely used screening tests in a large series of Cushing’s syndrome patients referred to our endocrine service.

**Patients:** We retrospectively reviewed the results of urinary free cortisol (UFC), a 24-hour metanephrine suppression test (woodruff suppression test) and serum cortisol at midnight in 503, 357, and 364 patients, respectively, with clinic features suggestive of Cushing’s syndrome but in whom this diagnosis was subsequently excluded.

**Results:** UFC and OIP at the 5-µg/dl cutoff exhibited the highest specificities (91% [95% confidence intervals CI 90.2–92.1%] and 92% [89.4–94.8%], respectively). Conversely, midnight serum cortisol yielded 87% (95% CI 84.3–91.2%) specificity only with the 7.5-µg/dl cutoff, whereas the 1.9-µg/dl threshold resulted in an unacceptably high proportion of false positives at only 25% specificity (95% CI 16.3–34.4%). Gender and age may lead to misleading results in all three screening tests.

**Conclusions:** Specificity of tests for Cushing’s syndrome varies considerably, with OIP and UFC presenting the best performance, and clonidine testing being heavily impaired by lowering of diagnostic cutoffs. Indeed, the vast majority of individuals in our series presented midnight serum cortisol values greater than 1.8 µg/dl; thus, caution has to be exercised when this criterion is used to exclude Cushing’s syndrome. (J Clin Endocrinol Metab 2007; 92:4125–4129, 2007)

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**Biochemical Evaluation**

- **Pheo**
  - Plasma or urinary metanephrines
  - More sensitive assay vs. plasma catecholamines
  - Release is episodic, metabolism continuous
  - Borderline tests can be confirmed by clonidine suppression test

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Biochemical Evaluation

• Primary hyperaldosteronism
  • Syndrome: HTN, ↓ K+, alkalosis, hyponatremia
    – 40% pts normokalemic- not reliable screening test
    – Serum K+ and ARR if hypertensive
  • Aldosterone: PRA ratio (ARR), accepted screening test
    – Plasma Aldo: PRA, ambulatory in am
    – Must stop B-Blockers, diuretics, clonidine
    – ≥20, suggests dx
      • Confirm elevated aldo with an aldo suppression test
        • Na loading
        • Lateralizing studies, adrenal vein sampling


Biochemical Evaluation

• Adrenocortical carcinoma
  • 62-79% secrete hormones
    – Cushing’s syndrome, most common
    – Virilization
      • 17-ketosteroids, di-hydroepiandosterone, testosterone
    – Feminization
      • 17-β-estradiol
  • Rare
    – Routine screening for excess androgens/ estrogens
      • not necessary

### Biochemical Evaluation: summary

#### Table 2: Laboratory Evaluation of the Patient with Adrenal Insufficiency.

<table>
<thead>
<tr>
<th>Possible Diagnosis</th>
<th>Screening Test</th>
<th>Causes of False Positive Results</th>
<th>Confirmatory Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subclinical Cushing’s syndrome</td>
<td>Overnight dexamethasone (1 mg) suppression test; abnormal result: serum cortizol &lt; 10 ng per deciliter; some clinicians use a higher dose of dexamethasone (e.g., 2 mg)</td>
<td>Medications that accelerate hepatic metabolism of dexamethasone (e.g., anti-convulsants); noncompliance with dexamethasone regimen</td>
<td>Consider the following tests: serum cortisol, cortisol in a blood specimen and 24-hour urine specimen, midnight salivary measurement of cortisol, and a formal 2-day high-dose dexamethasone suppression test (the result is considered abnormal when the cortisol level in the 24-hour urine specimen is greater than the upper limit of the normal range for the local laboratory)</td>
</tr>
<tr>
<td>Primary adrenal insufficiency</td>
<td>Measurement of fractionated metanephric and catecholamines in a 24-hour urinary specimen</td>
<td>Any situation (e.g., illness requiring hospitalization) or medication (e.g., insulin) that increases endogenous production of catecholamines</td>
<td>Consider labile 123 I-metaiodobenzylguanidine scintigraphy, MRI, subcutaneous consultation, and surgery</td>
</tr>
</tbody>
</table>
Biochemical Evaluation: summary

Table 2. Laboratory Evaluation of the Patient with Adrenal Incidentaloma.

<table>
<thead>
<tr>
<th>Possible Diagnosis</th>
<th>Screening Test</th>
<th>Causes of False Positive Results</th>
<th>Confirmatory Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary aldosteronism</td>
<td>Morning measurement of the plasma aldosterone concentration and plasma renin activity, which can be performed either a saline infusion test or 24-hour urinary aldosterone excretion. The patient maintains a high sodium diet.</td>
<td>To confirm the diagnosis of primary aldosteronism, aldosterone suppression testing with either a saline infusion test or 24-hour urinary aldosterone excretion.</td>
<td>Assay and biologic variation.</td>
</tr>
</tbody>
</table>

(Definitions: Dose: the plasma aldosterone concentration and plasma renin activity ratio of ≥20 and a plasma aldosterone concentration of ≥15 ng per deciliter are positive results) (For the cutoff for a positive result is laboratory-dependent)
# Imaging

## Table 3. Characteristics of Adrenal Incidentalomas on Imaging (Imaging Phenotype)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adrenocortical Adenoma</th>
<th>Adrenocortical Carcinoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Small, usually ≤3 cm in diameter</td>
<td>Large, usually &gt;4 cm in diameter</td>
</tr>
<tr>
<td>Shape</td>
<td>Round or oval, with smooth margins</td>
<td>Irregular, with unclear margins</td>
</tr>
<tr>
<td>Texture</td>
<td>Homogeneous</td>
<td>Heterogeneous, with mixed densities</td>
</tr>
<tr>
<td>Laterality</td>
<td>Usually solitary, unilateral</td>
<td>Usually solitary, unilateral</td>
</tr>
<tr>
<td>Attenuation (density) on unenhanced CT</td>
<td>≤10 Hounsfield units</td>
<td>&gt;10 Hounsfield units (usually &gt;25)</td>
</tr>
<tr>
<td>Vascularity on contrast-enhanced CT</td>
<td>Not highly vascular</td>
<td>Usually vascular</td>
</tr>
<tr>
<td>Rapidity of washout of contrast medium</td>
<td>≥50% at 10 minutes</td>
<td>&lt;50% at 10 minutes</td>
</tr>
<tr>
<td>Appearance on MRI</td>
<td>Isointense in relation to liver on T&lt;sub&gt;1&lt;/sub&gt;-weighted image</td>
<td>Hyperintense in relation to liver on T&lt;sub&gt;1&lt;/sub&gt;-weighted image</td>
</tr>
<tr>
<td>Necrosis, hemorrhage, or calcifications</td>
<td>Rare</td>
<td>Common</td>
</tr>
<tr>
<td>Growth rate</td>
<td>Usually stable over time or very slow (&lt;1 cm per year)</td>
<td>Usually rapid (&lt;2 cm per year)</td>
</tr>
</tbody>
</table>
**Imaging**

**Table 3. Characteristics of Adrenal Incidentalomas on Imaging (Imaging Phenotype).**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Phaeochromocytoma</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Large, usually &gt;3 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Round or oval, with clear margins</td>
</tr>
<tr>
<td></td>
<td>Heterogeneous, with cystic areas</td>
</tr>
<tr>
<td></td>
<td>Usually solitary, unilateral</td>
</tr>
<tr>
<td></td>
<td>&gt;10 Hounsfield units (usually &gt;25)</td>
</tr>
<tr>
<td></td>
<td>Usually vascular</td>
</tr>
<tr>
<td></td>
<td>&lt;50% at 10 minutes</td>
</tr>
<tr>
<td></td>
<td>Markedly hyperintense in relation to liver on T&lt;sub&gt;1&lt;/sub&gt;-weighted image</td>
</tr>
<tr>
<td></td>
<td>Hemorrhage and cystic areas common</td>
</tr>
<tr>
<td></td>
<td>Usually slow (0.5 cm to 1.0 cm per year)</td>
</tr>
</tbody>
</table>

**Table 3. Characteristics of Adrenal Incidentalomas on Imaging (Imaging Phenotype).**

| Variable                   | Metastasis                                                                 |
|----------------------------|                                                                          |
|                            | Variable, frequently <3 cm                                               |
|                            | Oval or irregular, with unclear margins                                   |
|                            | Heterogeneous, with mixed densities                                       |
|                            | Often bilateral                                                          |
|                            | >10 Hounsfield units (usually >25)                                        |
|                            | Usually vascular                                                         |
|                            | <50% at 10 minutes                                                        |
|                            | Hyperintense in relation to liver on T<sub>1</sub>-weighted image         |
|                            | Occasional hemorrhage and cystic areas                                    |
|                            | Variable, slow to rapid                                                   |
Imaging

• PET-CT
  • Highly sensitive
  • 16-20% benign adrenal lesions will show uptake
    – Poor for screening
  • Useful if pts with hx of malignancy


Imaging

• Metaiodobenzylguanidine (MIBG):
  • Assess for extra-adrenal pheo extension
    – Malignant
    – Familial
    – Peds
  • “Silent Pheo”
    – High clinical suspicion yet normal biochemical evaluation or imaging
Role of Biopsy

• Benign vs. metastatic
  • Known extra-adrenal malignancy
    – 70.6% malignancy detected
  • Sensitivity for ACC is poor
    – 50%
  • Must perform biochemical assessment first
    – Risk hypertensive crisis, exclude pheo

Size of lesion is strongest single predictor of malignancy

Management

• Observation
• Resection
• Medical therapy

• Determinants:
  – Lesion size
  – Functionality
  – Malignant potential
  – Health status, candidacy for surgery
Management

• Lesion size:
  – <4cm
    • >60% benign
    • <2% primary ACC
  – 4-6cm
    • 6% primary ACC
  – >6cm
    • 25% primary ACC
    • All lesions >6cm considered malignant
      • Surgical resection


Management

• Lesion size:
  – <4cm, non-functional, benign imaging
    • Observe
  – 4-6cm non-functional lesions:
    • Factors to consider:
      • Imaging: necrosis, calcifications, washout
      • Patient age and co-morbidities
      • Need for continued surveillance
  • CT may underestimate size in 20-47% cases
    • ? Discuss exploration
      • if ≥ 5cm; ≥ 3- 4cm +/- age consideration

Management

- Functionality
  - Resection or medical management
    - prevent long-term adverse effects
    - monitor for adrenal insufficiency


Management

- Functionality
  - Glucocorticoids
    - Resect to prevent long-term adverse effects
    - HTN, obesity, DM
  - Non-operative candidates
    - Aminoglutethimide, metyrapone, ketoconazole
    - Monitor for adrenal insufficiency

Management

- Functionality
  - Catecholamines
    - Resect all to prevent long-term adverse effects
    - CHF, CM, CVA, MI
    - 10% risk of malignancy
    - Medical preparation for surgery required
      - No RCTs to compare different approaches
      - No validated algorithm


Management

- Peri-op pheo mgmt
  - Control hypertension, volume expansion
    - α-blockade: normalize BP and expand blood volume
      - Phenoxybenzamine- long acting, irreversible, non-specific
    - Others: selective α-1 blockade, yet incomplete
    - Goal: 120/80mmHg, seated; sBP >90, standing
    - Duration: 7-14 days, longer if cardiac disease
    - Encourage high sodium diet (>5g/day)
    - IV hydration pre-op
Management

- Peri-op pheo mgmt
  - Control hypertension, protect against arrhythmia
    - B-blockade
      - Initiate only after α-blockade established
        - Prevent excessive unopposed alpha-adrenergic stimulation
      - Start low and titrate slowly
        - Risk CHF 2° to CM
      - Goal: HR 60-80bmp

Management

- Intra-op mgmt
  - Experienced surgeon/anaesthesiologist
  - Monitor cardiovascular and hemodynamic variables
    - Arterial line
    - Central line
    - Swan-ganz catheter if severe CHF, cardiac reserve
  - Induction with IV agent (ex. Thiopental) and maintenance with inhalational agent (ex. Isoflurane)
    - Know anesthetic drugs to be avoided
Management

• Intra-op pheo mgmt
  – Hypertensive crisis
    • Risk factors
      • Higher plasma norepinephrine
      • Tumor > 4cm
      • Pronounced (> 10mmHg) postural BP drop after α-blockade
    • Medications: Nitroprusside (nitrate), Phentolamine (non-selective α-blocker), Nicardipine (CCB)
  – Arrhythmias
    • Medications: Esmolol, propranolol, lidocaine

Management

• Functionality
  – Aldosterone
    • Resect to prevent long-term adverse effects
      • HTN, end-organ damage, electrolyte imbalance
      • Proven unilateral hypersecretion
        • Post-op HTN cure rate is 33-72%
    • Poor operative candidates
      • Spironolactone

Management

- Malignant potential:
  - Surgery
    - Primary potentially curative treatment
    - High risk occult micro-metastases at dx
    - 40% Stage I-III, distant mets at 2 yrs
    - En bloc resection adrenal and involved organs
    - Regional Lymph node resection
    - IMA to crus of diaphragm
    - Maximal debulking, esp if functional
    - Controversial
    - Unresectable and untreated: 3-9 mos survival
    - Avoid tumor spillage, capsule disruption


Management

- Malignant potential:
  - Mitotane
    - Primary therapy
      - Poor surgical candidate
      - Stage IV
        - +/- debulking surgery
      - Tumor regression, 25% of pts, ↓ hypersecretion, 75% pts
      - Survival not prolonged
    - Adjuvant therapy
      - ? Improved recurrence-free, and overall survival

Management

• Malignant potential:
  – Survival is stage-dependent
  – 5-year overall survival low (15-38%)
  – Median survival with metastases <12mos

Fassnacht. J Clin Endocrinol Metab. 2006;91:4501;
Management

• Surgical approaches
  • Open
  • Lap
  • Robotic
Management

• Open adrenalectomy
  – Traditionally, only approach for primary ACC
    • ↑ risk locoregional recurrence
    • Risk carcinomatosis, port site mets
  – Recent series, if resection feasible
    • MIS equivalent local recurrence and survival
  – Still Indicated
    • Larger or invasive tumors, vein involvement
      • Higher rate local/ distant recurrences
      • Careful handling tumor capsule
      • Emergent open surgical conversion


Management

• Open adrenalectomy
  – Approaches:
    • Flank retroperitoneal
    • Lumbodorsal posterior
    • Subcostal anterior
    • Thoracoabdominal
Management

• Laparoscopic adrenalectomy
  – First described, 1992
  – Now, standard of care for benign adenomas
    • Lower 30-day morbidity rate, less pain
    • Shorter recovery time
    • Improved pt satisfaction
    • Less cost
  – Comparable results for malignant lesions
  – Size threshold continually challenged (10-15cm)
  – Equal safety for pheos


Management

• Laparoscopic adrenalectomy
  – Approach:
    • Transperitoneal
      • Flank, supine
        • Needlescopic, 2mm instruments
    • Retroperitoneal
      • Flank, prone semi jack-knife
  • Both well tolerated and effective
    • Surgeon preference
    • Pt factors
      • Prior abdominal surgery, morbid obesity

Management

- Laparoscopic adrenalectomy - transperitoneal
  - Port placement


Management

- Laparoscopic adrenalectomy - transperitoneal
  - Port placement

Campbell-Walsh Urology 9th ed.
Management

- Laparoscopic adrenalectomy
  - Technique:
    - Mobilization of surrounding structures
      - colon (L > R), spleen, liver, duodenum
    - Early ligation of adrenal vein
      - Clips, Ligasure
    - Circumferential mobilization and division of vascular supply


Management

- Laparoscopic adrenalectomy- retroperitoneal
  - Advantages:
    - Direct, fast access to adrenal gland
    - Avoid intra abdominal dissection, adhesions
    - No difference in morbidity or mortality
  - Disadvantages:
    - Unfamiliar anatomy
  - Positioning:
    - Prone, semi jack-knife
    - Flank

Management

• Laparoscopic adrenalectomy - retroperitoneal
  • Port placement


Management

• Laparoscopic adrenalectomy - retroperitoneal
  • Prone port placement
Management

Posterio retroperitoneoscopic adrenalectomy—results of 560 procedures in 520 patients

Martin K. Wala, MD,* Fierro F. Alcaina, MD,* Frank A. Wenger, MD,* Anastasios Deligiannis, MD,* Ettore Bonetta, MD,* Stephan Petersen, MD,* Andreas Ossner, MD,* Harald Goeben, MD,* Klaus Petigny, MD,* Otto E. Jansen, MD,* Thomas Philipp, MD,* Hartmut P. H. Neumann, MD,* Kurt W. Schmidt, MD,* and Klaus Mann, MD,* Essen and Freiburg, Germany

Background. The posterior retroperitoneoscopic adrenalectomy is less popular than the laparoscopic transabdominal method. Due to the direct approach to the adrenal glands, however, the posterior retroperitoneal access is easy to use and may offer advantages not available with other endoscopic procedures for adrenalectomy.

Methods. Between July 1994 and March 2006, we performed 560 adrenalectomies (right side: n = 258; left side: n = 302) by the posterior retroperitoneoscopic approach in 520 patients (200 male, 320 female; age: 10 to 83 years). Of the 520 patients, 21 suffered from Cushing’s disease, 499 patients had adrenal tumors (137 Conn’s adenomas, 128 phaeochromocytomas [13 bilaterally], 110 Cushing’s adenomas [6 bilaterally], and 112 other tumors). Tumor size ranged from 0.5 to 10 cm (mean, 2.9 ± 1.7 cm). The procedures were performed with the patients in the prone position usually with 3 trocars.

Results. Mortality was zero. Conversions to open or laparoscopic lateral surgery were necessary in 9 patients (1.7%). Major complications occurred in 1.5% of patients, minor complications in 14.4%. Mean operating time was 61 ± 46 min and declined significantly (P < .001) from the early procedures (106 ± 46 min) to the later operations (40 ± 15 min).

Conclusions. The posterior retroperitoneoscopic adrenalectomy is a safe and fast procedure. In experienced hands, this method represents the ideal approach in adrenal surgery.

(Surgery 2006;140:943-50.)
Management

• Robotic adrenalectomy
  – Safe, technically feasible
  – Potential Advantages:
    • 3D, magnified operative view
    • Comfortable sitting position
    • Elimination of tremor
    • Increased DOFs of instruments


Management

• Robotic vs. laparoscopic adrenalectomy
  – Short-term outcomes comparable
    • Intra-op complications
    • Conversion to open, ~7%
      • ↓ with increased experience
    • LOS
      • Short convalescence
      • Quality of life, post-op pain

Management

• Robotic VS Lap adrenalectomy
  – Draw backs:
    • ↑ operative and resection times
    • ↑ cost
    • no quantitative significant advantages

<table>
<thead>
<tr>
<th>Variable</th>
<th>RALA</th>
<th>TLA</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robotic setup time (min)</td>
<td>20.0 ± 5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total op time (min)</td>
<td>188.0 ± 30.5</td>
<td>131.4 ± 29.0</td>
<td>0.022</td>
</tr>
<tr>
<td>Resection time (min)</td>
<td>168.0 ± 30.7</td>
<td>131.4 ± 29.0</td>
<td>0.05</td>
</tr>
<tr>
<td>Blood loss (mL)</td>
<td>90.0 ± 54.8</td>
<td>85.7 ± 37.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Postop hospital stay (d)</td>
<td>4.0 ± 0.7</td>
<td>3.4 ± 0.5</td>
<td>0.148</td>
</tr>
<tr>
<td>Postop follow-up (month)</td>
<td>15.2 ± 1.9</td>
<td>14.6 ± 2.0</td>
<td>0.564</td>
</tr>
</tbody>
</table>


Management

• Robotic adrenalectomy
  – No quantitative significant advantages
    • Independent predictors of operative time
      • surgeon experience
      • trainee level
      • tumor size
    • Variables should be considered when approach is evaluated

Management

• Minimally invasive adrenal sparing surgery
  – Lap: favorable long-term outcomes
  – Robotics: small series
  – Indications:
    • Small and bilateral tumors
    • Familial conditions, VHL, MEN2A
    • Solitary gland
  – Contraindications:
    • Large lesion (>3cm)
    • Central lesion or attachment to adrenal vein
    • Suspicious for malignancy


Management

• Minimally invasive adrenal sparing surgery
  – Technique:
    • Preservation of primary adrenal vein on either side
      • Middle adrenal (right) or lower adrenal (left)
      • Can clamp variable arterial supply during resection
    • Lap U/S useful to plan resection and confirm vasculature
  – Thermoablation
    • RFA, cryotherapy- described for small lesions
      • Rule out pheo

Follow-up

• Timing
  – Small, non-functional AIs:
    • Repeat imaging 6, 12 mos, 24 mos
      • If stable size on 2 images, no further imaging required
    • Functionality reassessment yearly x 4 yrs
      • Unless stable size on 2 imaging studies (?)
  – Adrenocortical carcinoma
    • Chest, abdo/ pelvis at 3 mos intervals x 2 yrs
    • Increase interval yet continue for 5 yrs
    • PET- role not well defined


Follow-up

• Non-functional AIs
  – Lesion size
    • Increase ≥ 1cm, consider surgery
      • Typically, ACC rapid growth (>2cm per yr)
    • 5-25% increase by >1cm over 4 yrs
      • Risk of non-metastatic malignancy on f/u is 1 in 1000
  – Imaging characteristics
  – Functional status
    • Up to 20% will develop functionality over time
      • Majority, hypersecretion of cortisol
      • >3cm, more likely

Follow-up

- Summary: current recommendations

<table>
<thead>
<tr>
<th>Publication</th>
<th>Hormonal tests</th>
<th>Frequency</th>
<th>Duration (years)</th>
<th>Imaging</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIH Consensus statement 2002 (1)</td>
<td>1 mg DXT, plasma-free metanephrines, K and renin/ald in those with hypertension</td>
<td>Annual</td>
<td>4</td>
<td>Monitor those &lt; 4 cm, use additional criteria in those 4-6 cm</td>
<td>Two CTs, at least 6 months apart, no data to support continued imaging if no increase in size CT at 6, 12 and 24 months</td>
</tr>
<tr>
<td>Young, NEJM 2007 (2)</td>
<td>1 mg DXT, urinary metanephrines and catecholamines, K and renin/ald in those with hypertension</td>
<td>Annual</td>
<td>4</td>
<td>Monitor those &lt; 4 cm</td>
<td>CT at 6, 12 and 24 months</td>
</tr>
<tr>
<td>UpToDate, Feb 2008 (3)</td>
<td>1 mg DXT, urinary metanephrines and catecholamines, K and renin/ald in those with hypertension</td>
<td>Annual</td>
<td>4</td>
<td>Monitor those &lt; 4 cm</td>
<td>CT at 6, 12 and 24 months</td>
</tr>
<tr>
<td>Combined strategy</td>
<td>1 mg DXT, urinary (or plasma) metanephrines and catecholamines, K and renin/ald in those with hypertension</td>
<td>Annual</td>
<td>4</td>
<td>Monitor those &lt; 4 cm</td>
<td>One to three follow-up CTs (median 3, average 2.3)</td>
</tr>
</tbody>
</table>


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REVIEW

Recommended evaluation of adrenal incidentalomas is costly, has high false-positive rates and confers a risk of fatal cancer that is similar to the risk of the adrenal lesion becoming malignant; time for a rethink?

T J Caywood, P J Hunt, D O'Shea, D Cole and S Soule

Department of Endocrinology, Christchurch Hospital, Private Bag 4710, Christchurch, New Zealand and Department of Endocrinology, St Vincent's University Hospital, Dublin, Ireland

(Correspondence should be addressed to T J Caywood. Email: tom.caywood@cdhb.govt.nz)
Follow-up

• “Primum non nocere”?
  – Endocrine functionality low (10-20%)
  – Malignancy lower (5%)
  – Majority functional lesions- subclinical Cushing’s
    • ? clinical importance
  – If initially benign and non-functional, subsequent functionality
    or malignancy is low
  – Chances of false- positive tests >>> chance of a true-positive result
  – Chance of detecting malignancy, similar to the chance of
    inducing fatal cancer by CT radiation.

Summary: Algorithm

Questions- 1

- Adrenal masses larger than this size have a greater than 25% chance of portending adrenal cell carcinoma:
  - A. 4cm
  - B. 5cm
  - C. 6cm
  - D. 7cm
  - E. 8cm
Questions- 2

• What is the overall sensitivity of adrenal biopsy to detect malignancy in pts with AI?
  • A. 10%
  • B. 25%
  • C. 40%
  • D. 50%
  • E. 70%


Questions- 3

• The most specific test for the diagnosis of Cushing syndrome is:
  • A. Salivary cortisol test
  • B. 1 mg dexamethasone suppression test
  • C. Random serum cortisol test
  • D. 24-hr urinary free cortisol
  • E. Random urinary cortisol
Thank you

http://www.websurg.com/ref/
Laparoscopic retroperitoneal right adrenalectomy in an obese patient-
vd01en1798.htm