PHEOCHROMOCYTOMA
Anita Chiu, MD
Kings County Hospital Center
January 13, 2011
62 year old female from Grenada with longstanding HTN, DM, CRI

Complaints of “palpitations” for years

Abdominal US obtained for vague GI complaints

Further imaging done and patient sent to endocrine 9/2010

Referred to surgery 11/8/2010 after endocrine workup
Case Presentation

- **PMH:**
  - HTN >30 years
  - DM < 1 year

- **PSH:**
  - TAH
  - Tonsillectomy

- **SH:**
  - Ex-smoker, no EtOH
  - Unemployed

- **FH:**
  - HTN – mother
  - Cervical cancer

**Meds:**
- Labetalol 200mg bid
- Nifedipine 90mg daily
- Enalapril 10mg daily
- HCTZ 25mg daily
- Januvia 100mg daily
- Glipizide 5mg daily
- Reported use of potassium replacements for hypokalemia
Case Presentation

- BP 165/90  HR 69  Wt: 165 lbs
- Gen: Middle aged well nourished female
- Neck: No cervical LAD, no thyromegaly, mild acanthosis nigrans posterior neck
- Lungs: CTA b/l
- Heart: S1 S2 RRR, no M/R/G
- Abdomen: soft, no masses
- Ext: no LE edema, + distal pulses
- Skin: not hirsute
Case Presentation

142 100 33 10.3
3.6 33 1.44

Albumin 4.3
7.6 x 6.4 x 6.3cm heterogenous soft tissue mass seen posterior to pancreatic tail in region of left adrenal mass with no hypervascular flow
CT SCAN

Enteric contrast only secondary to baseline elevated creatinine
CT SCAN
Pancreatic tail displaced anteriorly
CT SCAN
CT SCAN

Heterogenous 7.0x6.5x8.0cm craniocaudal soft tissue mass arising from left adrenal
CT SCAN

Left kidney displaced posteriorly
CT SCAN
MRI
MRI
MRI
MRI

Sekv: SE
Slice: 3 mm
Pos: 116
TR: 3146.45
TE: 100
AC: 2
Body Part:

Laterality U
FFS
FoV: 330 mm
Image no: 30
Image 30 of 56
Pulse Seq T2 AX RT - SENSE
8/6/2010, 10:37:24 AM

www.downstatesurgery.org
MRI

Left adrenal gland lesion 7.3x7.9x6.6cm with areas of enhancement and heterogeneous signal (T1/T2) which likely represents hemorrhagic debris.
MRI

Sklv: SE
Slice: 3 mm
Pos: 76
TR: 3146.45
TE: 100
AC: 2
Body Part:

Laterality U
FFS
FoV: 330 mm
Image no: 20
Image 20 of 56
Pulse Seq T2 AX RT - SENSE
8/6/2010, 10:37:24 AM
MRI

Slice: 3 mm
Pos: 68
TR: 3146.45
TE: 100
AC: 2
Body Part:

Laterality U
FFS
FoV: 330 mm
Image no: 18
Image 18 of 56
Pulse Seq T2 AX RT - SENSE
8/6/2010, 10:37:24 AM
MRI
MRI

Sekv: SE
Slice: 3 mm
Pos: 132
TR: 399.263
TE: 80
AC: 2
Body Part:

Laterality U
FFS
FoV: 330 mm
Image no: 34
Image 34 of 56
Pulse Seq T2 SPAIR AX SENSE

8/6/2010, 10:41:53 AM
MRI
MRI
MRI

Sekv: SE
Slice: 3 mm
Pos: 88
TR: 399.263
TE: 80
AC: 2
Body Part:

Laterality U
FFS
FoV: 330 mm
Image no: 23
Image 23 of 56
Pulse Seq T2 SPAIR AX SENSE
8/6/2010, 10:41:53 AM
MRI
Case Presentation

- Aldosterone – 8 ng/mL (<28)
- Cortisol – 1.08 µg/mL (AM 4-22, PM 3-16)
- Testosterone – 33.80 ng/mL (14-76)
- Estradiol – 21.04 pg/mL (11-69)
- Renin activity – 1.75 ng/mg/hr (0.25-5.82)
- DHEA sulfate – 55.97 µg/mL (0-157)
- Calcitonin - <2 pg/mL
- TSH - 1.032mIU/mL (0.35-5.50)
- T3 uptake - 32.4% (22.5-37)
- T4 - 7.9 µg/dL (4.5–10.9)
Case Presentation

- **24 hr urinary catecholamines, fractionated**
  - Total volume 1250 mL
  - Epinephrine 78 mcg/24 hr (2-24)
  - Norepinephrine 106 mcg/24 hr (15-100)
  - Total E+NE 184 mcg/24 hr (26-121)
  - Dopamine 289 mcg/24 hr (52-540)

- **24 hr urinary metanephrines, fractionated**
  - Metanephrine 3165 mcg/24 hr (90-315)
  - Normetanephrine 3128 mcg/24 hr (122-676)
  - Total M+NM 6293 mcg/24 hr (224-832)
Case Presentation

- Started on phenoxybezamine preoperatively as an outpatient
- Advised to keep hydrated
- Patient already on beta-blocker
- Surgery cancelled on 2 separate occasions due to elevated BP, phenoxybenzamine titrated
- BP normal on third appearance and patient taken to OR
Case Presentation

- Elective laparoscopic resection on 12/7/2010
- Transabdominal approach
- Adrenal vein tented against mass but easily isolated and ligated
- No BP fluctuations intra- or postoperatively
- POD#0-1 – stable, monitored in SICU
- POD#1 – transferred to floor
- Patient discharged home on POD#2 on no BP medications
Specimen
Chromogranin staining

Pathology
DISCUSSION

Pheochromocytoma: Diagnosis, Preoperative Management, Treatment
### Table 14-3. Common symptoms in patients with pheochromocytoma.

<table>
<thead>
<tr>
<th>Symptoms during or following paroxysms</th>
<th>Symptoms between paroxysms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Increased sweating</td>
</tr>
<tr>
<td>Sweating</td>
<td>Cold hands and feet</td>
</tr>
<tr>
<td>Palpitations, tachycardia</td>
<td>Weight loss</td>
</tr>
<tr>
<td>Chest pain</td>
<td></td>
</tr>
<tr>
<td>Anxiety, fear of impending death</td>
<td>Constipation</td>
</tr>
<tr>
<td>Tremor</td>
<td></td>
</tr>
<tr>
<td>Fatigue or exhaustion</td>
<td></td>
</tr>
<tr>
<td>Nausea, vomiting</td>
<td></td>
</tr>
<tr>
<td>Abdominal pain</td>
<td></td>
</tr>
<tr>
<td>Visual disturbances</td>
<td></td>
</tr>
</tbody>
</table>

Formerly known as the...

10% tumor

Familial

Malignant

Bilateral

Extra-adrenal


Genetics

- **VHL syndrome**
  - Autosomal dominant
  - Mutated tumor suppressor gene, chromosome 3
  - 20 -80% of patients have pheochromocytomas
  - Typically *bilateral*, produce *norepinephrine*

- **MEN2**
  - RET proto-oncogene, chromosome 10
  - Autosomal dominant or spontaneous new mutations
  - 20-50% of patients have pheochromocytomas
  - Typically *bilateral*, produce *epinephrine*
Genetics

- **NF1**
  - Autosomal dominant
  - Mutated tumor suppressor gene, chromosome 17
  - 2% of patients have pheochromocytomas

- **Succinate dehydrogenase mutation**
  - 4 SDH genes on different chromosomes which encode the 4 subunits of mitochondrial complex II linked to electron transport chain and Krebs cycle
  - Tendency for aggressive extra-adrenal disease
ADRENAL GLAND

A quick review

Figure 2: Adrenal Gland Cross Sections

Transverse Section

Microscopic Section

Capsule
Cortex
Medulla

Zona Glomerulosa
Zona Fasciculata
Zona Reticularis
Medulla
Diagnosis – Biochemical Tests

- Pheochromocytoma
- Virilizing or feminizing tumors
- Cushing's syndrome
- Conn's syndrome

Pheochromocytoma
Diagnosis – Biochemical Tests

Urinary metanephrines + Plasma-free metanephrines = Initial evaluation
Diagnosis – Imaging

CT  MRI

FDG-PET  MIBG

 Confirm & Localize

www.downstatesurgery.org
## Preoperative Management

<table>
<thead>
<tr>
<th>Drug</th>
<th>Starting Dose</th>
<th>Maximum Dose</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenoxybenzamine</td>
<td>10 mg PO BID at time of diagnosis</td>
<td>2 mg/kg/day</td>
<td>May increase to 10 mg PO TID over 10 to 14 days; goal is postural hypotension; nonselective α-blocker</td>
</tr>
<tr>
<td>Prazosin</td>
<td>1 mg PO BID at time of diagnosis</td>
<td>15 mg/day</td>
<td>May increase to TID dosing; goal is postural hypotension; selective α-blocker</td>
</tr>
<tr>
<td>Doxazosin</td>
<td>1 mg PO daily</td>
<td>16 mg/day</td>
<td>May increase weekly; at time of diagnosis, goal is postural hypotension; selective α-blocker</td>
</tr>
<tr>
<td>Terazosin</td>
<td>1 mg PO qHS at time of diagnosis</td>
<td>20 mg/day</td>
<td>May use BID dosing; goal is postural hypotension; selective α-blocker</td>
</tr>
<tr>
<td>Verapamil</td>
<td>80 mg PO TID</td>
<td>480 mg/day</td>
<td>Calcium channel blocker used for paroxysmal hypertension</td>
</tr>
<tr>
<td>Amlodipine</td>
<td>5 mg PO daily</td>
<td>10 mg/day</td>
<td>May increase after 1–2 weeks; calcium channel blocker used for paroxysmal</td>
</tr>
</tbody>
</table>
# Preoperative Management

<table>
<thead>
<tr>
<th>Drug</th>
<th>Starting Dose</th>
<th>Maximum Dose</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nifedipine</td>
<td>30–90 mg PO daily</td>
<td>120 mg/day</td>
<td>May increase after 1–2 weeks; calcium channel blocker used for paroxysmal hypertension</td>
</tr>
<tr>
<td>Labetalol</td>
<td>100 mg PO BID</td>
<td>2400 mg/day</td>
<td>May increase in 100 mg increments every 2–3 days; used after α-blockade for rebound tachycardia with a goal of resting HR 60–80 beats/min; has α-blocking properties</td>
</tr>
<tr>
<td>Atenolol</td>
<td>50 mg PO daily</td>
<td>100 mg/day</td>
<td>May increase after 7–14 days; used after α-blockade for rebound tachycardia with a goal of resting HR 60–80 beats/min</td>
</tr>
<tr>
<td>Metoprolol</td>
<td>50 mg PO BID</td>
<td>450 mg/day</td>
<td>May increase dose 50 mg every week; used after α-blockade for rebound tachycardia with a goal of resting HR 60–80 beats/min</td>
</tr>
<tr>
<td>Metyrosine</td>
<td>250–750 mg PO QID</td>
<td>4 g/day</td>
<td>For refractory hypertension</td>
</tr>
</tbody>
</table>

www.downstatesurgery.org
Resection

- **Open**
  - Generally reserved for larger (>6cm) pheochromocytomas and for paragangliomas in locations that make laparoscopy difficult

- **Laparoscopic**
  - Posterior retroperitoneoscopic adrenalectomy
  - Transabdominal laparoscopic adrenalectomy – gold standard
  - Studies advocate laparoscopic approach even for tumors >6cm

Remember…

1. LEFT ADRENAL DRAINS INTO LEFT RENAL VEIN
2. RIGHT ADRENAL GOES INTO IVC
Intraoperative Management

Hypertensive crisis and/or tachyarrythmia

Acute hypotension following adrenal vein ligation
Postoperative Management

- 12 to 24 hours postop require monitoring in a step-down or ICU
- Laparoscopic resections are usually discharged home on POD#2
- No BP medications on discharge
Summary

1. Diagnosis
   - Urinary Catecholamines, VMA, Metanephrines

2. Localization
   - CT
   - MRI
   - MIBG

3. Preoperative Preparation
   - Phenoxybenzamine ± Propranolol
     or
   - α-Methyldopa

4. Surgery
   - Exploration and resection

5. Recurrent or Metastatic Pheochromocytoma
   - Antihypertensives
   - Resection
   - $^{131}$I-MIBG
References


