Surgical Hypertension

Disorders of surgical importance

Dr. Naeem Zia
FCPS,FACS,FRCS

Surgical Unit I
Benazir Bhutto Hospital
Learning Outcomes

By the end the participants will be able to:

- Describe the applied anatomy and physiology of adrenal glands.
- Enumerate the different types of adrenal disorders.
- Describe adrenal disorders of surgical importance.
Screening

- Testing can be expensive and requires clinical suspicion and knowledge of limitations of different tests

- General principles:
  - New onset HTN if <30 or >50 years of age
  - HTN refractory to medical Rx (>3-4 meds)
  - Specific clinical/lab features typical for dz
    - i.e., hypokalemia, epigastric bruits, differential BP in arms, episodic HTN/flushing/palp, etc
Causes of Secondary HTN

- **Common**
  - Intrinsic Renal Disease
  - Renovascular Dz
  - Mineralocorticoid excess/ aldosteronism
  - ? Sleep Breathing d/o

- **Uncommon**
  - Pheochromocytoma
  - Glucocorticoid excess/ Cushing’s dz
  - Coarctation of Aorta
  - Hyper/hypothyroidism
Catecholamine Producing Tumors

Neural Crest

↓

Sympathoadrenal Progenitor Cell
(Neuroblasts)

→ Neuroblastoma

Chromaffin Cell

Sympathetic Ganglion Cell

→ Ganglioneuroma

Intra-adrenal
Extra-adrenal
Pheochromocytoma

Ganglioneuroma
Anatomy

- Flattened yellowish
- Less than 10 gm
- Pyramidal and crescentic
- Rich blood supply
Historical background

- Eustachius: anatomic account of the adrenals in 1563.
- Anatomic division of the adrenals into the cortex and medulla was described much later, by Cuvier in 1805.
- Thomas Addison in 1855 features of adrenal insufficiency, which still bear his name.
- Pheochromocytomas were first identified by Frankel in 1885, but were not named as such until 1912 by Pick, who noted the characteristic chromaffin reaction of the tumor cells.
- Adrenaline was identified as an agent from the adrenal medulla that elevated blood pressure in dogs and was subsequently named epinephrine in 1897.
- The first successful adrenalectomies for pheochromocytoma were performed by Roux in Switzerland, and Charles Mayo in the United States.
Right adrenal gland

Left adrenal gland

Cortex

Medulla
Applied Physiology

- Essential for life
- Cortex secretes steroid hormones synthesized from cholesterol
- Zona glomerulosa produce mineralocorticoid aldosterone
- Zona fasciculata and reticularis synthesize glucocorticoids, androgens and oestrogens
- Adrenal medulla secretes catecholamines, adrenaline, noradrenaline and dopamine
Adrenal Cortex

Hypocorticism

i. Acute (Adrenal apoplexy of the newborn)

ii. Chronic (Addisons Disease)

Hypercorticism

i. Infantile

ii. Prepubertal

iii. Adult (Cushings Syndrome)

iv. Postmenopausal

v. Primary Aldosteronism
Adrenal Medulla

Tumours

i. Ganglioneuroma
ii. Neuroblastoma
iii. Phaeochromocytoma
Disorders of Surgical Importance

- Primary Aldosteronism
- Tumours of adrenal Medulla
Primary Aldosteronism
primary hyperaldosteronism PHA

- Conn’s Syndrome
- Surgically Correctable type of Hypertension
- (1-2%) of all
Primary Aldosteronism
Pathology

- Hyperaldosteronism may be secondary to stimulation of the renin-angiotensin system from renal artery stenosis and to low-flow states such as congestive heart failure and cirrhosis.
- Autonomous Excessive Aldosterone Secretion.
- 80% of patients with PHA have unilateral adrenocortical adenoma (Conn’s syndrome). Remainder have bilateral hyperplasia.
Primary Aldosteronism

- \([\text{Na}^+]\)
- \([\text{K}^{++}]\)
• $[\text{Na}^+]$

• $[\text{K}^{++}]$
Primary Aldosteronism

Clinical Features:
Characterized by hypertension and hypokalemia

1) Muscular Weakness
2) Polyuria
3) Polydypsia
4) Hypertension
5) Edema
Primary Aldosteronism

Investigations:

- S. potassium is low
- Elevated urinary potassium
- CT
- MRI
Primary Aldosteronism

Treatment

Medical

Surgical

Unilateral Adrenalectomy
Neuroblastoma

- Neural Crest Cells

- Location

  \( \frac{3}{4} \) abdomen
  \( \frac{1}{2} \) of them in adrenals
Neuroblastoma

Clinical Features:

- **Age:**
  
  90% < 8yrs

- **Abdominal Mass**
  - Weight loss
  - Abdominal Pain
  - Distension
Neuroblastoma

- Metastasis:

  50% of infants
Neuroblastoma

Investigations:

- Urine
- Abdominal Ultrasound
- CT Scan
Neuroblastoma

Treatment:

- Surgical Excision
- Neoadjuvant Chemo/radiotherapy
Pheochromocytomas
Pheochromocytomas

Definition

Pheochromocytomas are neoplasms derived from the chromaffin cells of
- adrenal medulla (90%)
- extra-adrenal paraganglia (10%)

result in unregulated, episodic oversecretion of catecholamines
Phaeochromocytoma, unilateral or bilateral occurs in association with following hereditary syndromes:

- Multiple endocrine neoplasia type 2 (Sipple’s syndrome)
- Von Hippel-Lindau (VHL)
  - Renal cell carcinoma
  - CNS and retinal haemangioblastoma
- Neurofibromatosis type 1
- Familial paraganglioma syndrome
Pheochromocytoma: location

- Virtually all (99%) arise within the abdomen

- Adrenal medulla: 90%
- Extra-adrenal: 10%
Pheochromocytomas

- Uncommon neoplasms
- 0.1% to 0.3% of all hypertensive patients
- Surgically correctable form of hypertension
Phaeochromocytoma

THE 10% TUMOUR
10% extra-adrenal
children
familial
bilateral
malignant
Clinical Features

- Usually present before the age of 50 years
  Commonly 3\textsuperscript{rd} to 5\textsuperscript{th} decades

- Male = Female

- Manifests by effects of adrenaline and noradrenaline excess
Classical Presentation

- Paroxysms manifesting as a triad of:

  - Headache
  - Sweating
  - Tachycardia
Classical Presentation

- Additional symptoms during an attack:
  - Blood pressure may rise to 200/100 mmHg
    - Paroxysmal hypertension in 50% patients
  - Palpitations
  - Extreme anxiety
  - Tremors
  - Paresthesias
  - Chest or abdominal pain
  - Nausea, vomiting
  - Dyspnea
Other Presentations

- Persistent Hypertension
  - All young hypertensive patients should be screened for a catecholamine-secreting tumor
  - Surgically correctable
Catecholamine crises

- Sudden and severe increase in blood pressure
- Can lead to
  - Heart failure
  - Pulmonary edema
  - Arrhythmias
  - Intracranial hemorrhage
24 Hours Urinary Catecholamines

- 24 hours urine collection
- Analyzed for catecholamines and their metabolites:
  - Adrenaline and Noradrenaline
  - Metanephrines
  - Vanillylmandelic acid (VMA)
- Diagnostic values:
  > 2-3 fold elevation
Localization: Imaging

- CT abdomen
Localization: Imaging

- MRI
  - More sensitive for extra-adrenal pheochromocytoma
Localization: Imaging

- MIBG (\(^{131}\)I-meta-iodobenzylguanidine) Scintigraphy
Preoperative Preparation

- Surgery without preoperative preparation is dangerous
  - Risks:
    - Peroperative hypertensive crisis
    - Post excisional hypotension
The patient should come to operation with

- Blood pressure and pulse rate controlled
- Adequate hydration
• Preoperative control of blood pressure
• α-adrenergic blocker
• B-blockers
Preoperative Preparation

- Volume expansion to avoid post-excision hypotension
  - Liberal oral salt and water
  - Intravenous hydration night before surgery
Measures to avoid cardiovascular instability during surgery

- Continuous monitoring
  - ECG
  - Arterial line
  - CVP line / Swan-Ganz catheter
- Avoid excessive tumor manipulation, which can result in catecholamine release
• Operative mortality prior to 1950: 24 - 50%

• Current operative mortality: 0 - 2.7%
Operative Procedures

- Adrenalectomy
  - Open
  - Laparoscopic
- Excision of extra-adrenal paraganglioma
Operative Procedures

- Open Adrenalectomy
Operative Procedures

- Laparoscopic Adrenalectomy
Any Questions
Thanks