THE ADRENAL GLANDS

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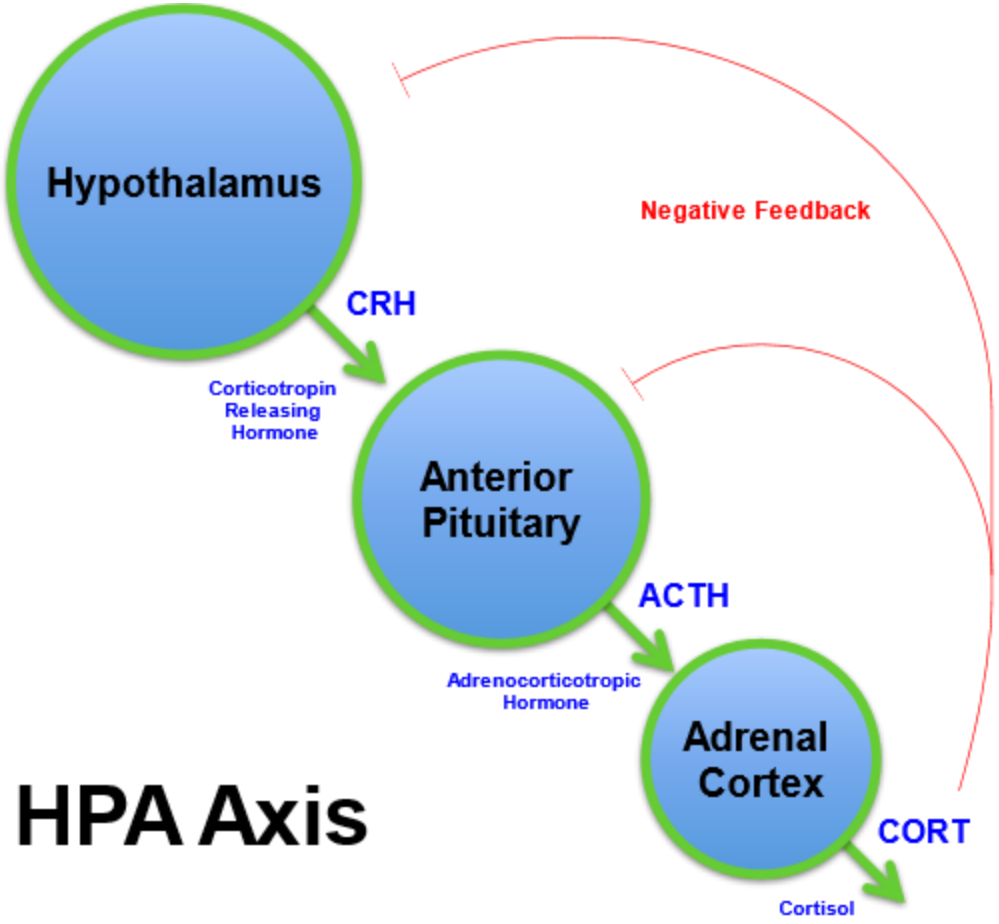
THE ADRENAL GLANDS

- Adrenal cortex:
- Zona glomerioloza… Mineralocorticoids,
- Zona fasciculata……Glucocorticoids
- Zona reticularis…….Sex Hormones
- Adrenal medulla : Adrenaline
  Noradrenaline
  Dopamine

Hypothalamic – pituitary – adrenal axis



Adrenal incidentaloma (non-functional)

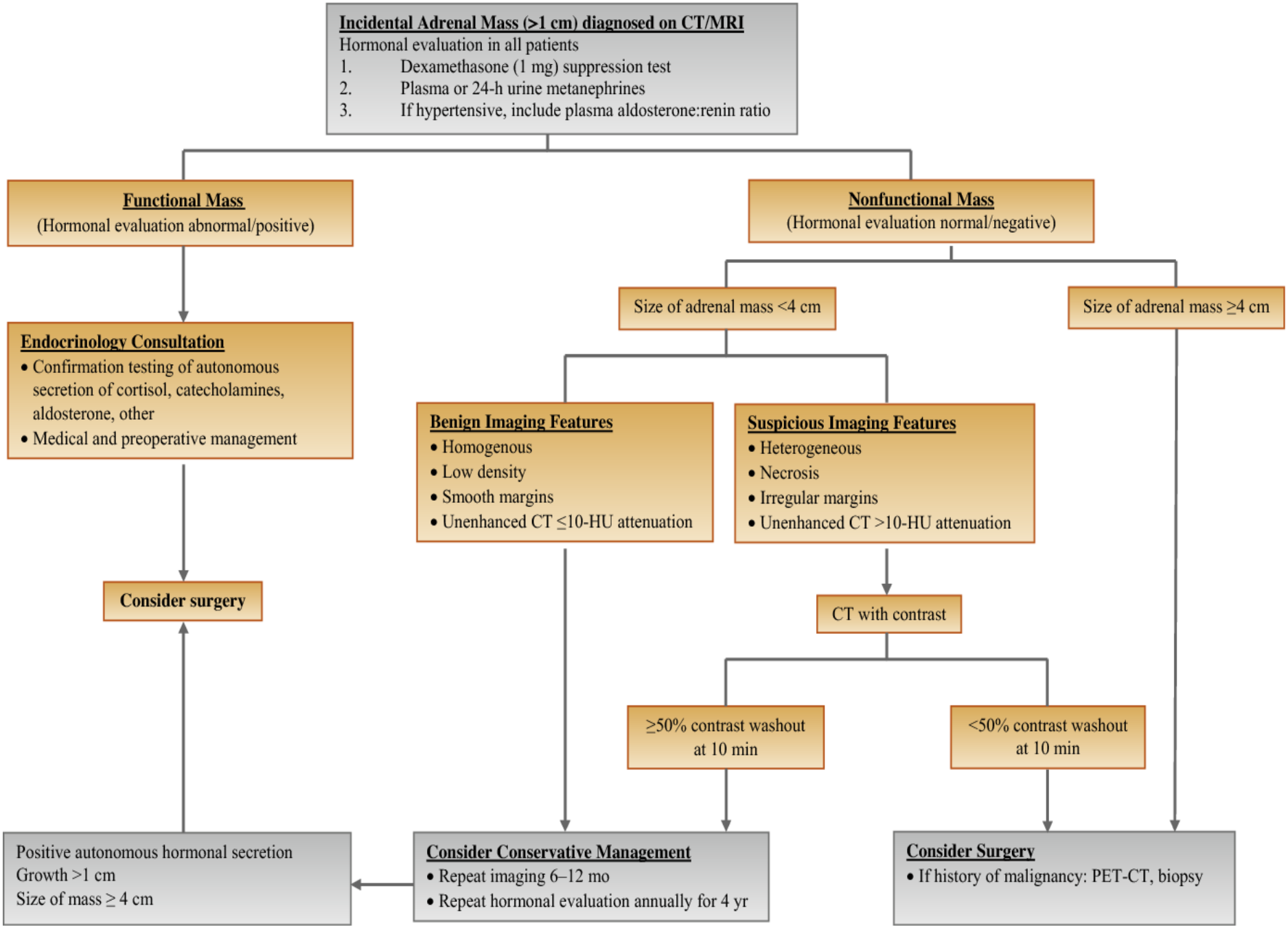
Non- functional adrenal mass

More than 1 cm

Asymptomatic

Found incidentally

Diagnosed by radiological imaging


Incidental Adrenal Mass (>1 cm) diagnosed on CT/MRI
Hormonal evaluation in all patients
1. Dexamethasone (1 mg) suppression test
2. Plasma or 24-h urine metanephrines
3. If hypertensive, include plasma aldosterone:renin ratio
Functional Mass
(Hormonal evaluation abnormal/positive)
Nonfunctional Mass
(Hormonal evaluation normal/negative)
Endocrinology Consultation
• Confirmation testing of autonomous secretion of cortisol, catecholamines, aldosterone, other
• Medical and preoperative management
Size of adrenal mass <4 cm
Size of adrenal mass ≥4 cm
Benign Imaging Features
• Homogenous
• Low density
• Smooth margins
• Unenhanced CT ≤10-HU attenuation
Suspicious Imaging Features
• Heterogeneous
• Necrosis
• Irregular margins
• Unenhanced CT >10-HU attenuation
Consider surgery
CT with contrast
≥50% contrast washout at 10 min
<50% contrast washout at 10 min
Positive autonomous hormonal secretion
Growth >1 cm
Size of mass ≥ 4 cm
Consider Conservative Management
• Repeat imaging 6–12 mo
• Repeat hormonal evaluation annually for 4 yr
Consider Surgery
• If history of malignancy: PET-CT, biopsy

Functional Adrenal Abnormalities

- *Benign or malignant tumors or hyperplasia*
- ***Cortex** : Cortical tumors :*
    - *Cortisone secreting tumors-Cushing's Syndrome*
    - *Aldosterone secreting tumors- Conn's Syndrome*
    - *Sex hormone secreting tumors- Virilisation or Feminization.*

Diffuse Hyperplasia

- *Primary or a consequence of stimulation by trophic hormones leading to hypercortisism, Conn's disease or Adrenogenital syndrome*

Medulla

- Tumors secreting adrenaline/nor-adrenaline
  (Phaeochromocytoma)

Cushing's Syndrome

=Primary adrenal disease:

- **Adenoma**
- **Carcinoma**
- **Primary adrenal hyperplasia " ACTH independent**

=Secondary adrenal disease:

- Primary pituitary micro-adenoma

-Non pituitary source " Ectopic ACTH syndrome "

Cushing's Syndrome

- ***Definition:***

  Excess circulating cortisol that occurs as a result of endogenous steroid hyper secretion, due to:

  ACTH dependent or

  ACTH_ independent disease

  Or exogenous steroid medication.

ACTH-Dependent

1. Pituitary microadenoma.
2. Ectopic ACTH secretion:

    Small cell carcinoma.

    Fore gut carcinoid.

    Ectopic CRH Syndrome:

    Medullary thyroid tumor.

    Pancreatic neuro-endocrine tumors

ACTH Independent

- Adrenocortical Adenoma
- Bilateral nodular hyperplasia
- Adrenal carcinoma.

Cushing's Syndrome

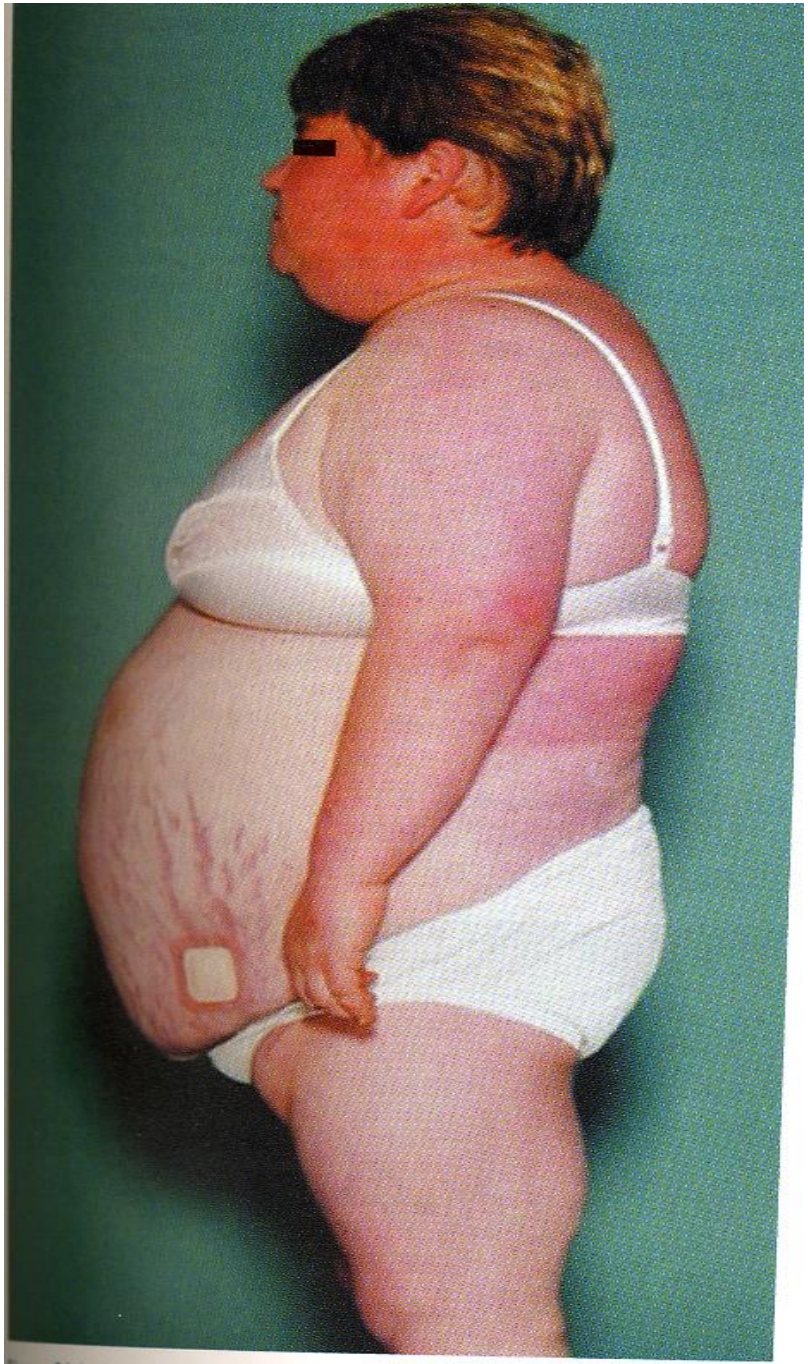
- Physiological and bodily changes caused by excess of circulating cortisol:
- Commonest cause is iatrogenic: *administration of steroids for the treatment of other diseases*

Action of glucocorticoids

- Glucose metabolism
- Peripheral glucose utilization
- Lipid metabolism
- Cells of immune system
- Mediators of inflammation
- Bone and minerals metabolism
- Soft tissue and skeletal growth
- Fluid and electrolytes homeostasis
- C N System

Clinical presentation

- Obesity
- Loss of connective tissue
- Hirsutism and Virilism
- Muscle weakness
- Osteoporosis
- Hypertension
- Glucose intolerance
- Psychological changes



Ectopic ACTH Secretion

- Rapid evolution of the Cushing;s
- Symptoms of the primary disease:
  - -Small cell carcinoma of the lung
  - -Carcinoid
  - -Medullary Ca of Thyroid
  - -Other primary carcinomas

Investigations:

- 1 : Biochemical diagnosis
- Persistent increase in cortisol concentration.
- Cortisol suppression by dexamethasone
- Resistancy to insulin administration
- 2 : Establishment of the cause
- Low ACTH = Adrenal disease
- High ACTH = Extra- adrenal cause.

Anatomical details

- Pituitary: Skull X ray

  C T

  M R I

- Adrenals: U S

  C T

  M R I

- Scintigraphy - cholesterol scan

  - N P 59 scan

- Search for ectopic ACTH source

  C T chest

  Angiography

Plan of Management

- Pituitary adenoma : Microadenectomy
- Hyperplasia : Bilateral adrenalectomy
- Solitary ademoma: Unilateral adrenalectomy

Perioperative Care

Adrenocortical Carcinoma

- Rare
- Any age 4-5th decades
- 60% : no important secretory function
- Benign or Malignant ? Pain

  Weight loss

  Weakness

  Fever
- Functional tumors present depending on their type of secretion .

Treatment

- When possible Surgical resection
- Radiotherapy
- Chemotherapy

Aldosteronism
* Conn's Syndrome*

- **Primary due to : tumor (Adenoma)**

  nodularity

  hyperplasia

Secondary due to:Excess stimulation by Angiotensin

Commonest cause is :

"Aldosterone producing Adenoma "

Incidence: Females more than males

30—60 years of age

1% of patients investigated for hypertension

Pathophysiology

- Aldosterone :

  Promotes sodium absorption

  Promotes water retention

  Increase potassium secretion

Clinical features

Clinical suspicions should be raised when Hypertension occur with hypokalemia.

- Moderate to severe hypertension
- Hypokalemia
- Muscle weakness
- Malaise
- polydipsia

Investigations

- Blood : Hypokalemia

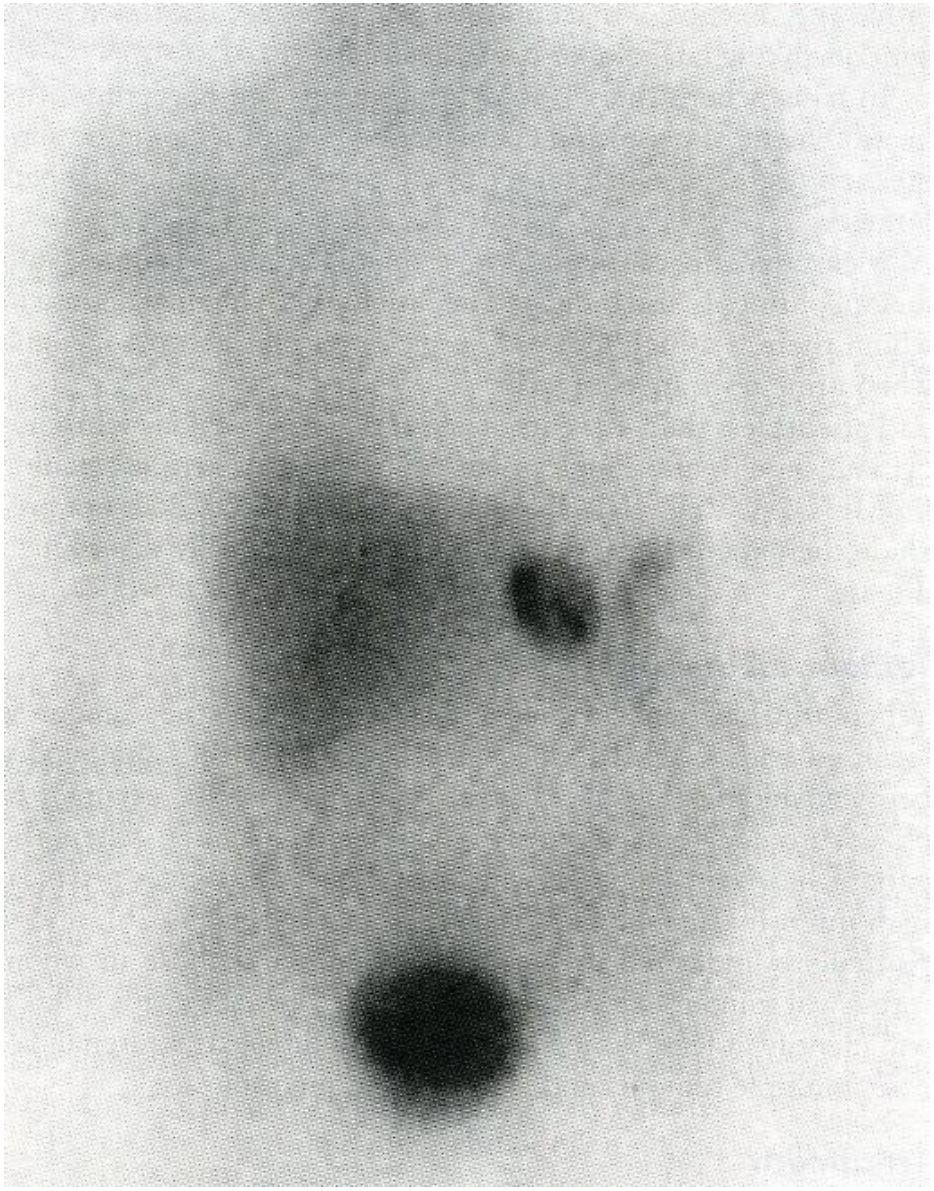
  Plasma aldosterone
- Urine : Increase urinary potassium
- Imaging : U S

  C T

  M R I

  Iodocholesrerol isotope scan

  Adrenal vein sampling



Treatment

- Spironolactone
- Adrenalectomy

Phaeochromocytoma

Phaeochromocytoma
Neuroblastoma

Paraganglioma

Ganglioneuroma

Are derived from the neural crest

Phaeochromocytoma

- 90% ---solitary – adrenal
- 5 –10% bilateral
- 10%---Exrta-adrenal
- 0.1% of patients investigated for hypertension
- Average size is 5 cm
- Discovered early because of catecholamines effects
- 10% are malignant
- Mostly secrets adrenaline

Symptomatology

- Palpitation
- Hypertension
- Sweating and pallor
- Anxiety
- Chest pain & weakness 50%

Symptomatology

- Attacks often occur spontaneously but may be precipitated by vigorous exercise, Alcohol, tobacco and drugs : Anesthesia, phenothiazines & tricyclic antidepressants.

Clinical associations

* Multiple endocrine neoplasia type 2

  Phaeo , medullary thyroid ca, hyperparathyroidism

* Neorofibromatosis . 10% of patients with neurofibromatosis may develop phaeochromocytoma

Investigations

- A– 24 hours urinary vanyl mandilic acid (VMA) 60% sensitive.
- Urinary catecholamines . 90% sensitive
- Localization: C T scan

  M R I

  M I B G , isotope scan

Managemant:

=Adrenalectomy

- Preoperative management
- Operative management
- Post operative management