Endocrinology and VHL: The adrenal and the pancreas

Overview

- Definition of a hormone
- Adrenal gland
- Adrenal hormones
- Pancreas gland
- Pancreas hormones and enzymes

Endocrine Glands

- Organs in our body that make hormones

What is a hormone?
What is a hormone?

- Hormones are chemical messengers in the body
- Send messages about a particular function from one cell to another

Can you name some hormones?

Common examples
- Thyroid hormone
- Estrogen
- Progesterone
- Testosterone
- FSH

Several other hormones come from the adrenal and pancreas glands

Adrenal gland

Adrenal Histology

1. Capsule
2. zona glomerulosa
3. zona fasciculata
4. zona reticularis
5. Adrenal medulla

http://cf.ydcdn.net/1.0.1.66/images/main/A5adrenalgland.jpg

http://district.bluegrass.kctcs.edu/shirley/whitecarver/NIOS310ab
http://dspace.udel.edu:8080/dspace/bitstream/19716/1826/2/cenamc1.GIF

http://cit.pdx.edu/8.1.66/images/main/M1adrenalhisto.jpg
Adrenal Medulla

- Medulla is like a nerve ganglion and releases secretions (messages) directly into blood

[Image: Adrenal Medulla]

Adrenal medulla hormones

- TH (Rate limiting step)
- PNMT (Upregulated by cortisol)
- Also called adrenaline

[Image: Adrenal medulla hormones]

Adrenaline (metanephrines catecholamines)

- Pheochromocytoma – leads to high blood pressure, rapid heart rate, sweating, headache, anxiety, tremors, increased blood sugar
- Some people with pheo have no symptoms

[Image: Adrenaline (metanephrines catecholamines)]

Pheochromocytoma (and Paraganglioma)

- Pheochromocytomas (pheos)
  - Tumors in the adrenal medulla
  - Make adrenaline hormones
  - About 20% of patients with VHL will develop pheos

- Paragangliomas
  - Tumors in nerve bundles (ganglia) outside the adrenal gland
  - Similar to pheos
  - Rare in patients with VHL

[Image: Pheochromocytoma (and Paraganglioma)]
Testing for pheochromocytoma

- Blood test
  - Plasma free metanephrines
- 24hr urine test
  - Urine fractionated metanephrines

- If found to have pheo, need pre-op blocking with special blood pressure medication called alpha blocker before surgery
  - Blocks effects of high adrenaline
  - Ex: phenoxybenzamine, prazosin, doxazosin

VHL and Pheo

- VHL can be associated with bilateral pheochromocytomas
- “Can I survive with one adrenal gland?”
- What about no adrenal glands?

Aldosterone
Cortisol
Androgens (Testosterone)

Adrenal Insufficiency

- Caused by having no functional adrenal gland

  - Fludrocortisone (Florinef)
    - Aldosterone replacement
    - Salt/water balance hormone – maintains BP and potassium/sodium levels

  - Hydrocortisone/prednisone
    - Cortisol replacement
    - BP/metabolism/blood sugar/other hormone
    - Extra medication needed when sick or ill or before surgery – “sick day rules”
VHL and the pancreas

- VHL increases risk of several types of pancreatic masses and cysts
  - Mass is solid
  - Cyst is fluid filled
  - Most will be benign
- One type of mass seen is a pancreatic neuroendocrine tumor

Pancreatic Neuroendocrine Tumors (PNETs)

- 10-15% of all PNETs are associated with genetic syndromes
  - ~9-17% of patients with VHL develop PNETs
- Also seen in other syndromes
  - Multiple Endocrine Neoplasia Type 1 (MEN1)
  - Neurofibromatosis Type 1 (NF1)
  - Tuberous Sclerosis Complex (TSC)

Guidelines suggest removal of pancreatic masses over ~3cm in patients with VHL

The vast majority of PNETs in patients with VHL are benign and non-functional

Functional (F) vs Non-functional (NF)

- F-PNETS
  - Hormone elevated in blood + clinical syndrome
- NF-PNETS
  - No clinical syndrome even if hormone detectable
Pancreas

Exocrine pancreas
- makes enzymes to digest food

Endocrine pancreas
- Islet of Langerhans

Pancreas Hormones – Pancreas messengers

- Alpha cell (secretes glucagon)
- Beta cell (secretes insulin)
- Delta cell (secretes somatostatin)
- F cell (secretes pancreatic polypeptide)

Exocrine pancreas
- The pancreas produces enzymes that help digest our food

Histology of pancreas
Exocrine pancreas – makes enzymes to digest food

Lack of nutrients for our body
Can cause bloating and diarrhea

Pancreas Hormones – Pancreas messengers

Insulin
- Insulinoma – low blood sugar, confusion, vision changes, unusual behavior, rapid heart beat, sweating, shakiness, amnesia, eating every few hours, waking up at night to eat to avoid symptoms.

Glucagon
- Glucagonoma – blood sugar too high causing diabetes, weight loss, blood clots and a specific rash called necrolytic migratory erythema.
Somatostatin

- Somatostatinoma – results in dysregulation of many endocrine hormones. Lowers insulin leading to diabetes. Slows GI motility which can lead to gallstones, intolerance to fat in the diet and leads to fatty diarrhea.

Vasoactive Intestinal Polypeptide (VIP)

- VIPoma – causes huge amounts of very watery diarrhea leading to dehydration, low potassium and chloride

Majority of PNETs in VHL are non-functional

- So why am I talking about the hormones?
- A pancreas that is not functioning well or is absent due to surgery, may make too little hormone and enzymes
- We can replace these with medications

Abnormal functioning pancreas

- Insulin is the main hormone of concern when absent
  - Insulin deficiency causes diabetes mellitus
  - We can replace insulin to control diabetes
**Insulin**

- Liver
- Pancreas
- Muscle
- Blood sugar

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**Abnormal functioning pancreas**

- Absent exocrine pancreas is another concern
- Absent enzymes cause bloating and discomfort because food cannot be digested well
- We can control the symptoms with giving back the enzymes before each meal

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**Exocrine pancreas – makes enzymes to digest food**

- Exocrine
- Pancreas
- Enzymes
- Starch
- Protein
- Lipase

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**Summary**

- Definition of a hormone
- Adrenal gland
- Adrenal hormones
- Pancreas gland
- Pancreas hormones and enzymes
Questions?

Thank you!