

# Endocrine and Metabolic Disorders for Surgeons

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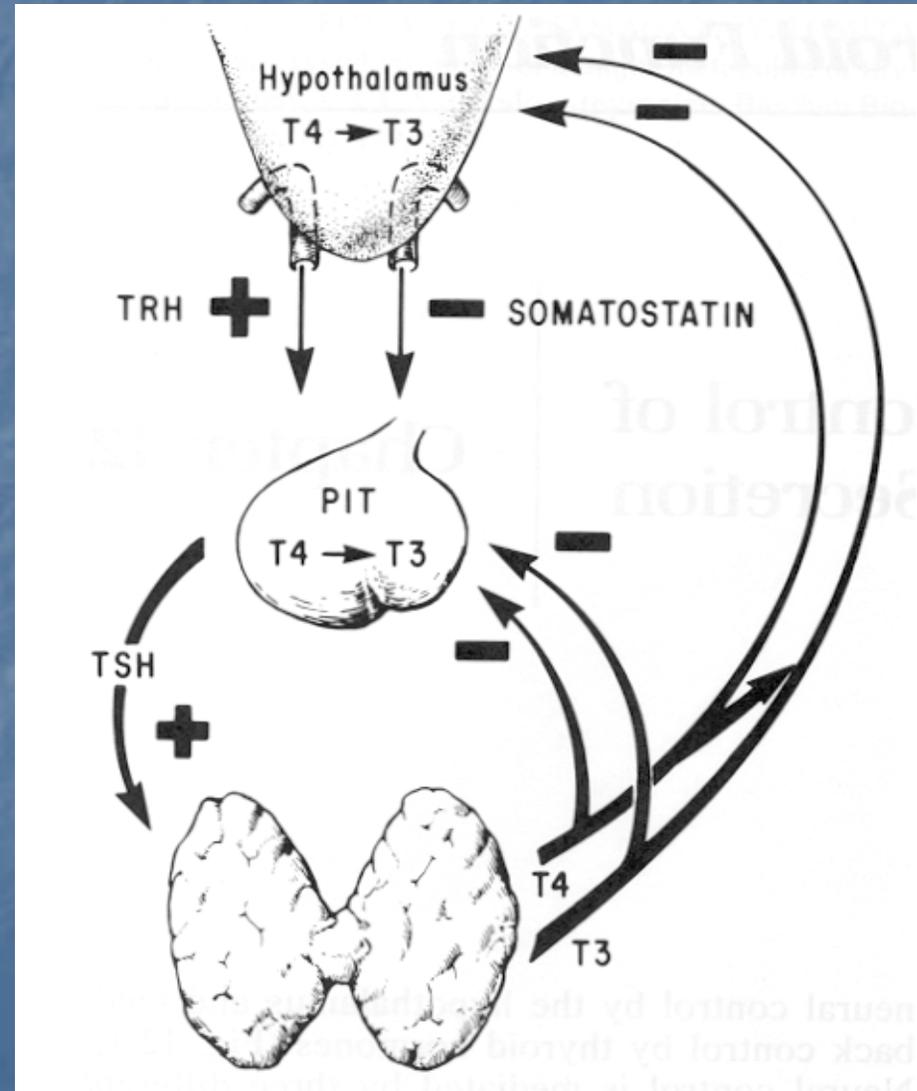
NNUH

# The Syllabus says

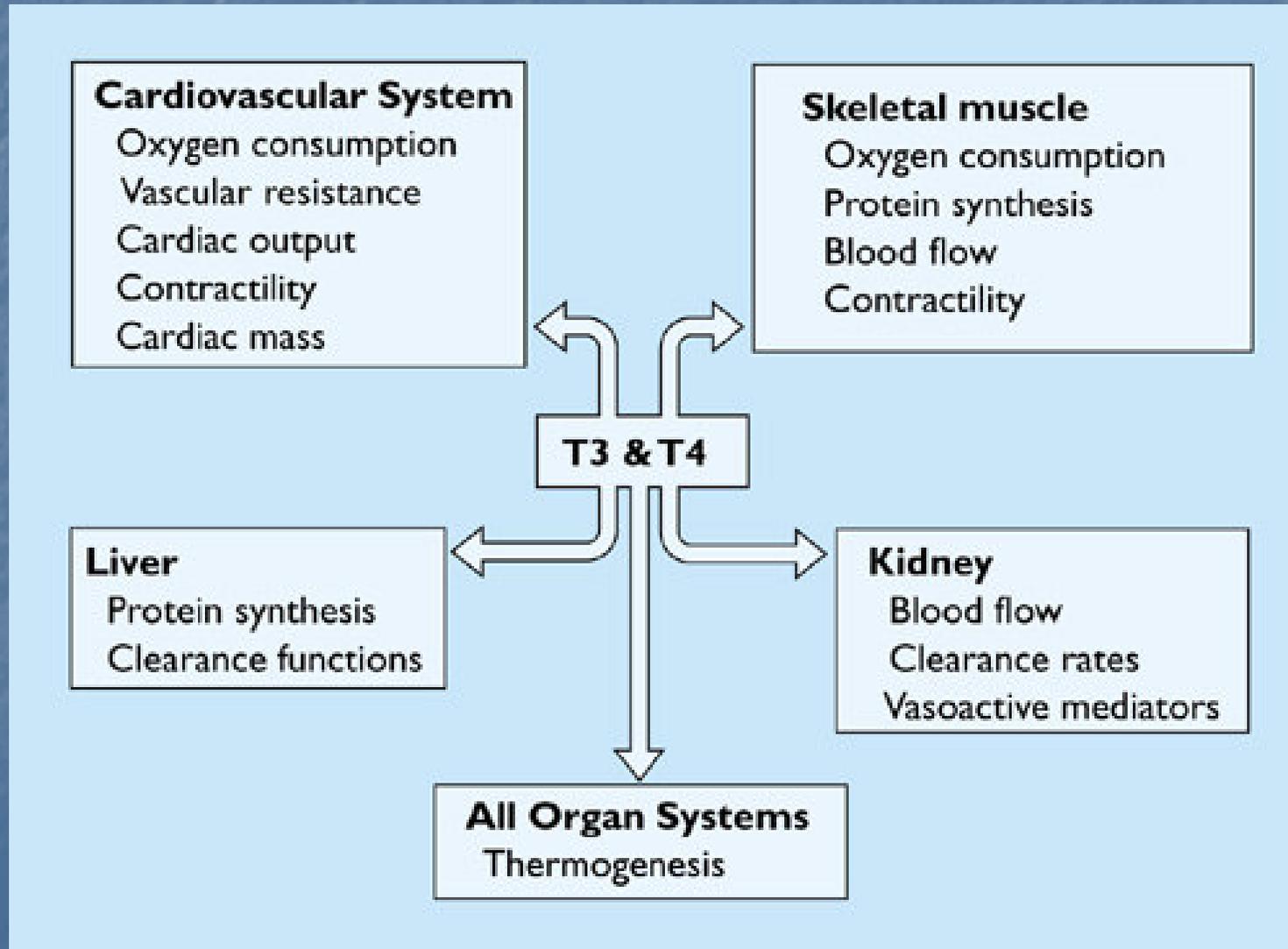
- To identify, investigate and manage surgical patients with common metabolic disorders
  - thyrotoxicosis and hypothyroidism
  - hypercalcaemia
  - corticosteroid therapy
  - diabetes mellitus
  - hyponatraemia

# Thyroid Problems

- The hypothalamic-pituitary-thyroid axis is a classic feedback loop

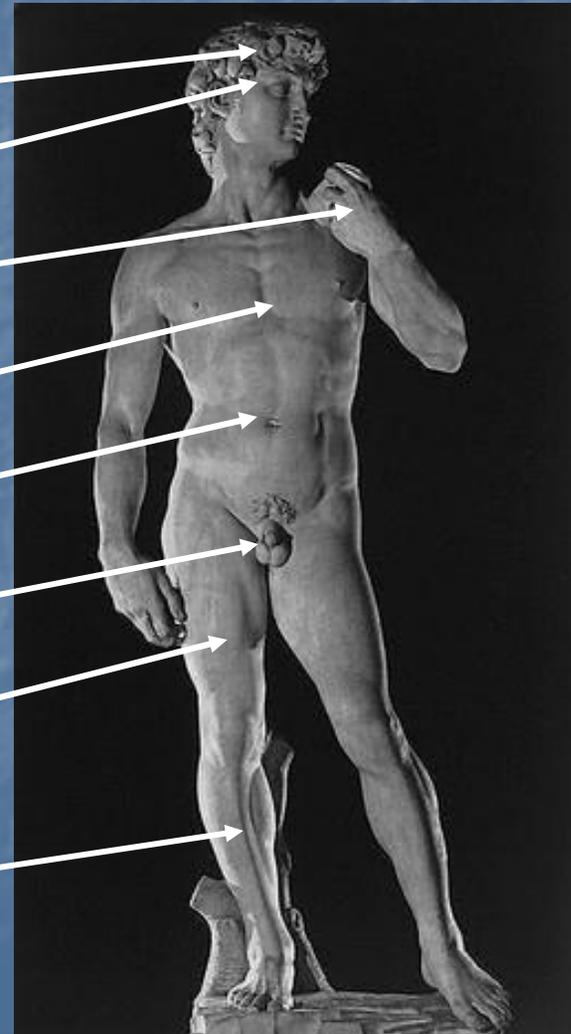


# What does Thyroid Hormone Do?



# Symptoms of Hyperthyroidism

- Neuro-psychiatric
- Thermoregulatory
- Dermatological
- Cardio-pulmonary
- Gastroenterological
- Endocrine / reproductive
- Muscular
- Skeletal



# Symptoms of Hyperthyroidism

- Hyperactivity, irritability, altered mood (99%)
- Heat intolerance, sweating, (90%)
- Palpitations (85%)
- Fatigue, weakness (85%)
- Weight loss with increased appetite (85%)
- Diarrhoea (33%)
- Eye complaints (55%)

# Signs of Hyperthyroidism

- Sinus tachycardia (100%) or AF (10%)
- Fine tremor (97%)
- Warm, moist skin (97%)
- Goitre (100% in Graves')
- Palmer erythema, onycholysis, pruritus (35%)
- Alopecia
- Muscle weakness and wasting, proximal myopathy
- Lid lag and retraction (71%)
- Gynaecomastia (10%)
- Chorea, periodic paralysis, psychosis (<1%)

# Causes of Hyperthyroidism

- Graves' disease – TSH stimulating Ab's
- Hyperfunctioning nodule – autonomous adenoma
- Toxic MNG – multiple nodules
- Iodine load with underlying Graves'
- Hyperemesis gravidarium
- Hydatidiform mole
- Choriocarcinoma
- Pituitary adenoma

# Symptoms of Hypothyroidism

- Tired, lethargy, fatigue, weight gain
- Depression / low mood
- Cold intolerance
- Dry skin, hair / hair loss
- Constipation
- Cardiac failure
- Hypercholesterolaemia / vascular disease
- Hoarse voice
- Menstrual changes (menorrhagia)

# Signs of Hypothyroidism

- Dry skin, thin hair
- Cool peripheries
- Puffy face hands feet
- Yellow skin
- Bradycardic
- Peripheral oedema
- Slow relaxing reflexes
- Carpal tunnel syndrome
- Serous cavity effusions
- Galactorrhoea
- Ataxia, dementia, psychosis, coma



# Causes of Hypothyroidism

## ■ Primary

- Iodine deficiency
- Autoimmune hypothyroidism (Hashimoto's)
- Iatrogenic:  $I^{131}$ , thyroidectomy, DXT
- Drugs: I containing contrast media, amiodarone, lithium
- Congenital: absent or ectopic glands, or dyshormonogenesis, TSH receptor mutation
- Destructive thyroiditis: postpartum, silent, subacute
- Infiltrative disorders: amyloid, sarcoid, haemochromatosis, etc.

# Causes of Hypothyroidism

## ■ Secondary

- Hypopituitarism: tumours, trauma, surgery or DXT, infiltration, infarction
- Isolated TSH deficiency or inactivity
- Hypothalamic disease: tumours, trauma, infiltration, idiopathic

# Surgical Considerations

- Complications abound in those operated on with hypo or hyperthyroidism
- If it is an elective procedure get an endocrinologists to fix their thyroid function if possible
- If it is an emergency then get senior help sooner rather than later
  - use T3 for those underactive
  - try and avoid operating on patients with uncontrolled hyperthyroidism at all costs

# Hypercalcaemia

- General mechanisms
  - increased bone resorption
  - increased intestinal absorption of calcium
  - decreased renal excretion of calcium
- Symptoms of elevated calcium
  - stones, bones, abdominal groans and psychiatric overtones or asymptomatic

# Hypercalcaemia - Causes

- Primary Hyperparathyroidism
  - benign tumor making PTH disregards feedback
- Malignancy
  - tumor making PTHrP (acts just like PTH)
- Extra-renal  $1\alpha$ hydroxylase activity
  - unregulated (not regulated by PTH)
  - lymphoid tissue and macrophages, granulomas
  - intestinal hyperabsorption of calcium

# Hypercalcaemia - Causes 2

- Familial Benign Hypocalciuric Hypercalcaemia
  - inactivating mutation of CaR
  - autosomal Dominant - lifelong
  - typically mild hypercalcaemia and asymptomatic
  - hypocalciuria as CaR is in distal nephron also
- Vitamin D intoxication

# Corticosteroid Therapy

## ■ Cautions

- adrenal suppression and infection, children and adolescents (growth retardation possibly irreversible), elderly (close supervision required particularly on long-term treatment); frequent monitoring required if history of tuberculosis (or X-ray changes), hypertension, recent myocardial infarction (rupture reported), congestive heart failure, liver failure, renal impairment, diabetes mellitus including family history, osteoporosis (post-menopausal women at special risk), glaucoma (including family history), corneal perforation, severe affective disorders (particularly if history of steroid-induced psychosis), epilepsy, peptic ulcer, hypothyroidism, history of steroid myopathy; pregnancy and breast-feeding

# Corticosteroid Therapy

## ■ Complications

- *gastro-intestinal effects* include dyspepsia, peptic ulceration (with perforation), abdominal distension, acute pancreatitis, oesophageal ulceration and candidiasis; *musculoskeletal effects* include proximal myopathy, osteoporosis, vertebral and long bone fractures, avascular osteonecrosis, tendon rupture; *endocrine effects* include adrenal suppression, menstrual irregularities and amenorrhoea, Cushing's syndrome (with high doses, usually reversible on withdrawal), hirsutism, weight gain, negative nitrogen and calcium balance, increased appetite; increased susceptibility to and severity of infection; *neuropsychiatric effects* include euphoria, psychological dependence, depression, insomnia, increased intracranial pressure with papilloedema in children (usually after withdrawal), psychosis and aggravation of schizophrenia, aggravation of epilepsy; *ophthalmic effects* include glaucoma, papilloedema, posterior subcapsular cataracts, corneal or scleral thinning and exacerbation of ophthalmic viral or fungal disease; *other side-effects* include impaired healing, skin atrophy, bruising, striae, telangiectasia, acne, myocardial rupture following recent myocardial infarction, fluid and electrolyte disturbance, leucocytosis, hypersensitivity reactions (including anaphylaxis), thromboembolism, nausea, malaise, hiccups

# Primary Adrenal Insufficiency

- Functional Status
  - primary “damage” to adrenal cortices
  - low cortisol
  - low aldosterone
  - high ACTH

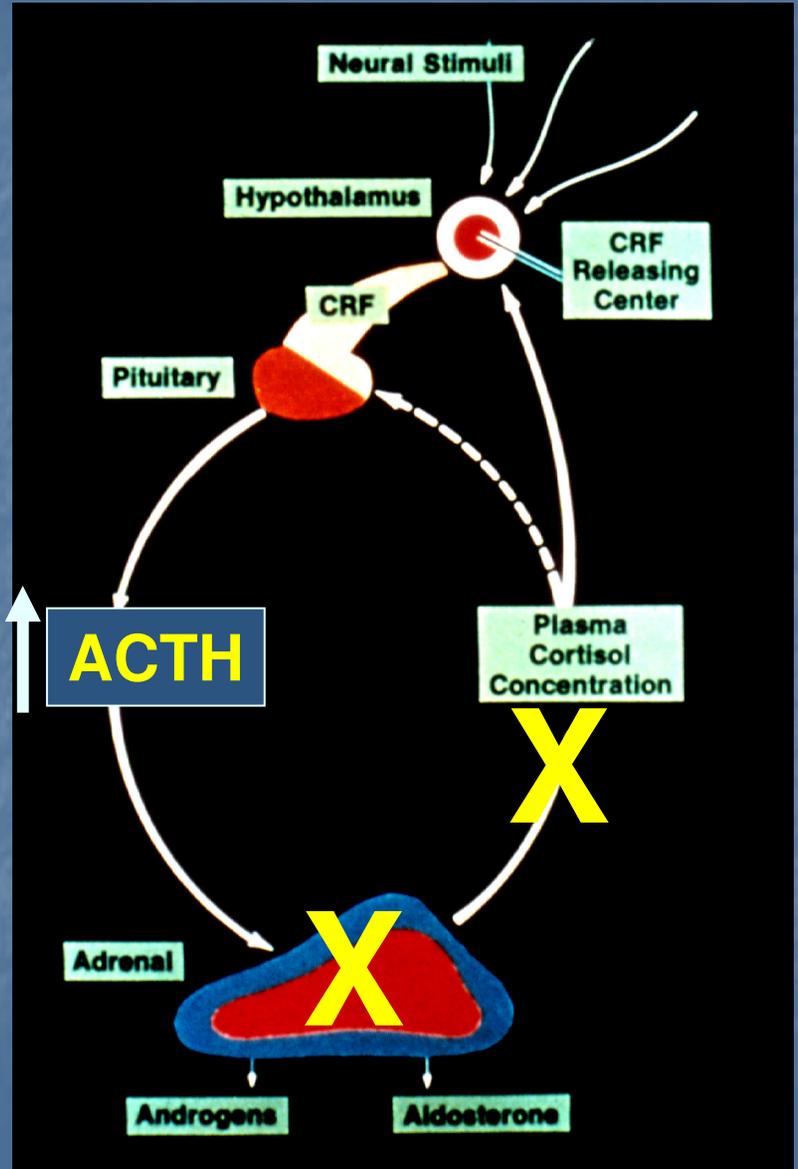
# Primary Adrenal Insufficiency

## Aetiologies:

- Autoimmune
  - Antibody(s) directed toward cellular components
  - Most common to 21-hydroxylase
  - Can be with combination immune injury to other target organs
    - skin (vitiligo), Thyroid, Gonad, Gastric parietal cells (Vit B<sub>12</sub>)
- Infectious
  - Tuberculosis most common in past (5% of people with TB have adrenal involvement)
  - Fungal most common now (histoplasmosis, etc.)
  - Opportunistic infections (immune compromised patients, AIDS)
- Metastatic malignancies
  - Lung, breast, melanoma, etc.
  - Lymphoma
- Ischaemic injury
  - Haemorrhage
  - Coagulation disorders
  - Disseminated infections with intravascular coagulation

# Primary Adrenal Insufficiency

- Diagnosis
  - low random cortisol
  - low blood glucose and low blood pressure
  - hyponatraemia and hyperkalaemia (mild)
  - elevated ACTH
  - blunted / absent short synacthen test





Hyperpigmentation  
& Vitiligo



Hyperpigmented  
scars

# Management

- Call the endocrine team
- DO NOT OPERATE ON A SUSPECTED ACUTE ADDISONIAN PATIENT
  - glucocorticoid replacement with hydrocortisone
  - mineralocorticoid replacement with fludrocortisone

# Diabetes

- How long do we have to talk?

# Two Main Types

- Type 1
  - Autoimmune destruction of the  $\beta$  cells of the Islets of Langerhans in the pancreas. This leads to an absolute insulin deficiency. Insulin treatment is therefore mandatory
  - Previously known as IDDM or juvenile onset diabetes

# Two Main Types

- Type 2
  - Impaired insulin action (insulin resistance) and eventually, impaired insulin secretion as well
  - Usually treated with oral medication initially, then may move onto insulin
  - Formerly known as NIDDM or maturity onset diabetes

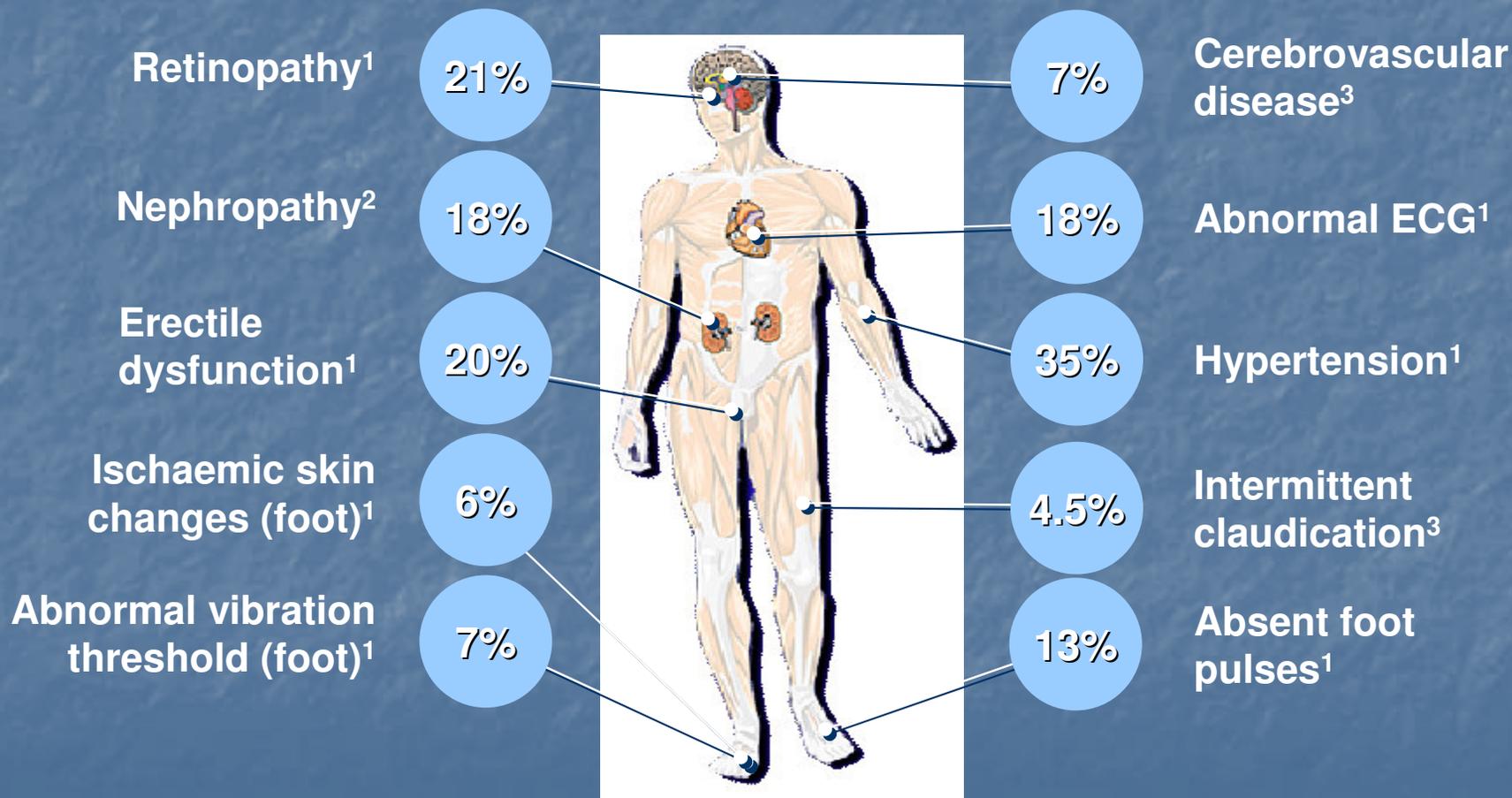
# Why is it Important?

- Poorly controlled diabetes leads to accelerated cardiovascular morbidity and mortality
- A combination of microvascular and macrovascular disease

# How Do You Make The Diagnosis?

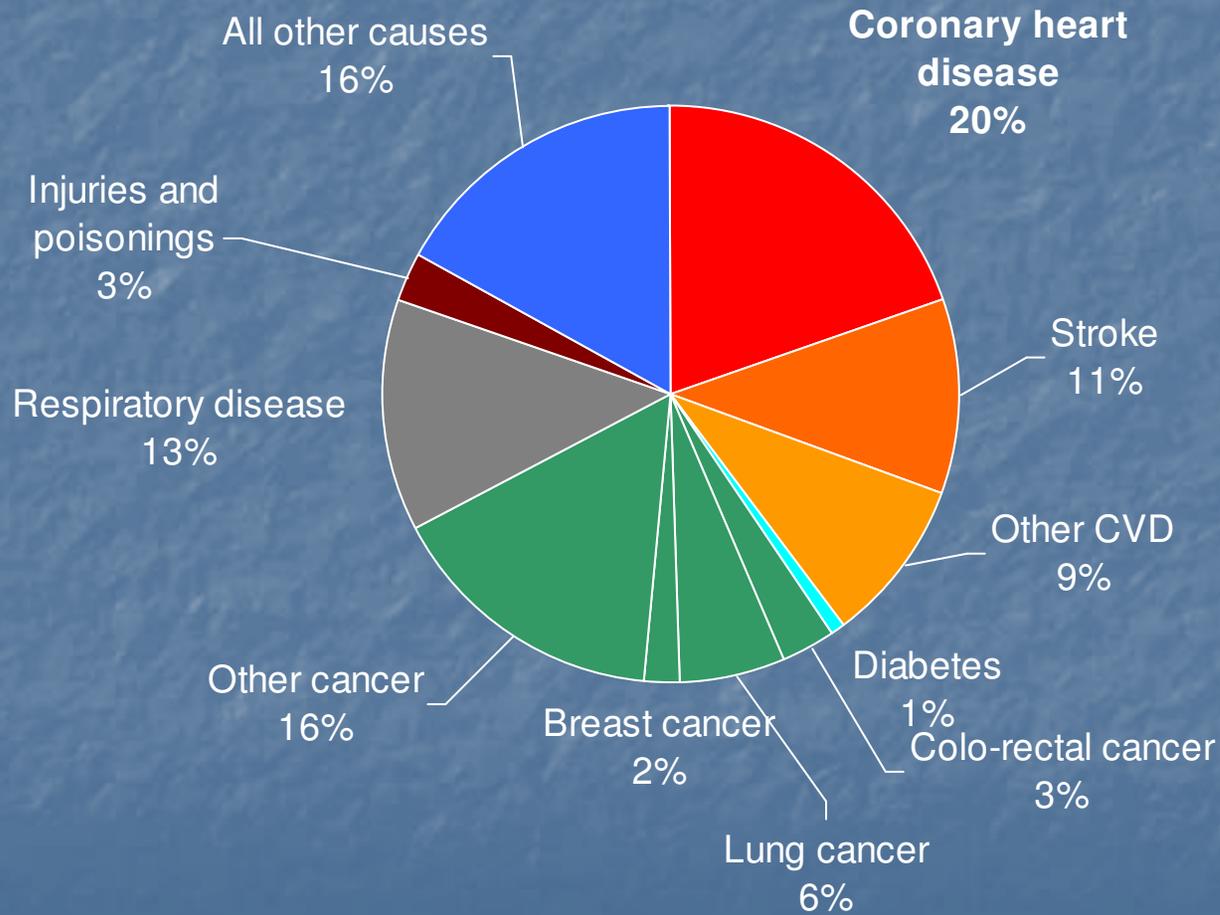
Plasma glucose concentration 2 h following a 75 g oral glucose test (mmol/l)	Fasting plasma glucose concentration (mmol/l)		
	< 6.1	≥ 6.1–6.9	≥ 7.0
< 7.8	Normal	Impaired fasting glycaemia	Diabetes
≥ 7.8–11.0	Impaired glucose tolerance	Impaired glucose tolerance	Diabetes
≥ 11.1	Diabetes	Diabetes	Diabetes

# Vascular Complications Of Type 2 Diabetes At The Time Of Diagnosis



1. UKPDS Group. *Diabetes Res* 1990; **13**: 1–11. 2. The Hypertension in Diabetes Study Group. *J Hypertension* 1993; **11**: 30–17. 3. Wingard DL *et al.* *Diabetes Care* 1993; **16**: 1022–5.

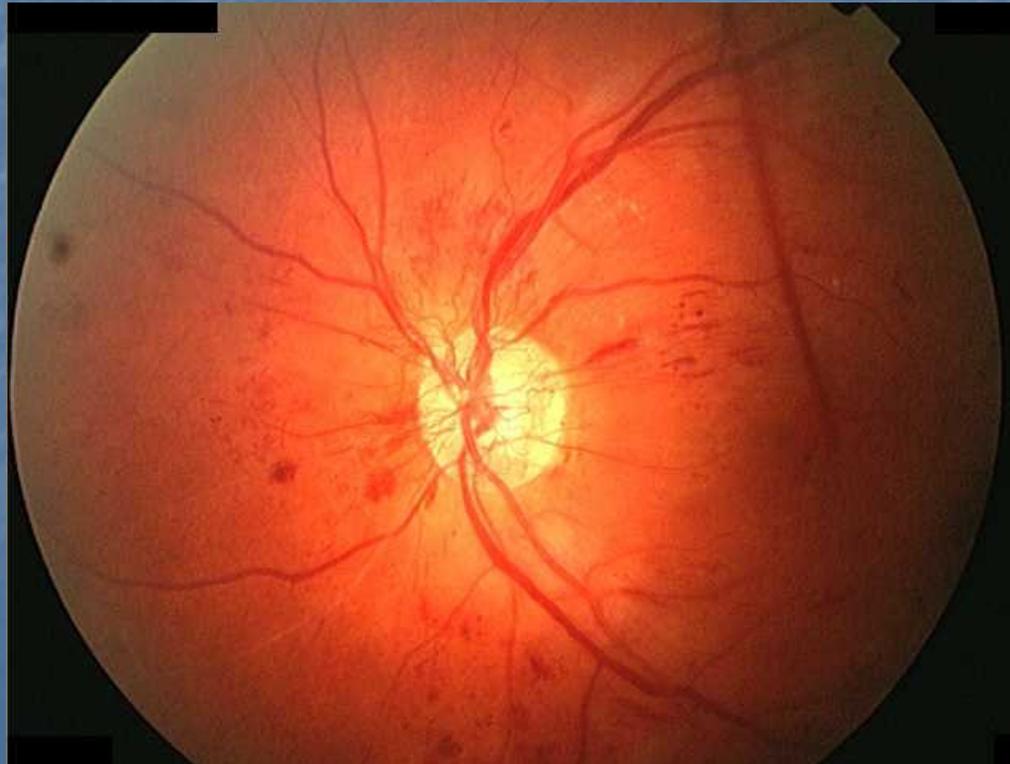
# Causes of Death in the UK (2001)



1. BHF Coronary Heart Disease Statistics 2003. Available on [www.heartstats.org](http://www.heartstats.org)

# Microvascular Disease

- Diabetic retinopathy – the commonest cause of blindness in the developed world



# Microvascular Disease

- Combinations of neuropathy and ischaemia



# What Would Be Ideal?

- That they did not have diabetes
- If they had diabetes, for the HbA<sub>1</sub>C to be <7% and blood glucose levels between 6 and 8 all the time
- If they had diabetes for it to be diet controlled
- If they were not diet controlled then for someone else to operate on them

# What About Insulin and Surgery?

- Complex but can be worked out

# Once Daily

- Usually a long acting analogue
- If taken in the morning, half the dose and have blood glucose tested on admission
- If  $>12$  mmol/l give 6 units of Human Actrapid and repeat blood glucose level 1 hour later, giving another 6 units Human Actrapid if it was still higher than 12 mmol/l
- Resume normal insulin the next day, and be warned that their blood glucose would be high for a day or so

# Once Daily

- If taken in the evening, then no dose change required

# Twice Daily Insulin

- Usually a mixture
- Half morning dose and have blood glucose tested on admission
- If  $>12$  mmol/l give 6 units of Human Actrapid and repeat blood glucose level 1 hour later, giving another 6 units Human Actrapid if it was still higher than 12 mmol/l
- Resume normal insulin that afternoon, and be warned that their blood glucose would be high for a day or so

# 3, 4 or 5 Injections Per Day

- If on a morning list
- Half morning dose and have blood glucose tested on admission
- If  $>12$  mmol/l give 6 units of Human Actrapid and repeat blood glucose level 1 hour later, giving another 6 units Human Actrapid if it was still higher than 12 mmol/l
- Restart normal insulin later that afternoon if eating and drinking normally

# 3, 4 or 5 Injections Per Day

- If on an afternoon list
- Have their usual morning insulin doses in then omit their lunchtime dose
- Have blood glucose tested on admission
- If  $>12$  mmol/l give 6 units of Human Actrapid and repeat blood glucose level 1 hour later, giving another 6 units Human Actrapid if it was still higher than 12 mmol/l
- Restart normal insulin later that afternoon if eating and drinking normally

# For Non Day Case or Emergencies

- Not difficult
- Intravenous insulin from the time of admission to the time they are eating and drinking normally

# When in Doubt – Ask for Help

- There is a Diabetes Inpatient Specialist Nurse available 9 to 5 Monday to Friday on bleep 0407
- There is an inpatient consultant diabetes ward round almost every weekday
- There are 2 consultant or SpR led triage rounds every single day



# Hyponatraemia

- The ideal scenario is that everyone on intravenous fluids should have their U&E's checked every day – and the results should be looked at

# Hyponatraemia

- Symptoms – mainly due to CNS dysfunction
  - headache, nausea, vomiting, muscle cramps, lethargy, restlessness, disorientation, and depressed reflexes
  - severe and rapidly evolving hyponatraemia include seizures, coma, permanent brain damage, respiratory arrest, brain-stem herniation, and death

# Treatment

- Depends on cause
- Call for help sooner rather than later

**Any Questions?**