

Diabetes Mellitus

Dr Kofi Amu-Darko

MB. ChB. DRCOG, DFFP, MRGCP, PgDip.
LLM

Introduction to diabetes mellitus

- **What is diabetes?**

Heterogenous clinical syndrome in which the central feature is a chronic elevation of the blood glucose concentration

- Due to a deficiency of insulin (absolute) or a resistance to insulin (relative).
- The chronic hyperglycaemia is associated with long term tissue damage, especially the blood vessels, nerves, heart, kidneys and eyes.

Normal physiology

- Normal blood glucose
- Insulin
 - 2 amino acids linked by disulphide bridges
 - Glucose is main stimulus
 - Amino acids, fatty acids and ketone bodies.
Activation of beta2-adrenergic receptors in pancreas also stimulate release of insulin whereas stimulation of the alpha-adrenergic receptors in pancreas inhibit insulin release
 - Effects are anabolic

Effects of insulin

- conservation of energy,
- promotes cell growth,
- suppresses gluconeogenesis and promotes glycogenolysis,
- promotes peripheral uptake of glucose – especially in skeletal muscle cells,
- encourages storage (as muscle glycogen)

Insulin

- Insulin receptors
 - action of insulin is mediated through these receptors.
- Insulin deficiency (absolute or relative)
 - catabolic effects (breakdown of complex molecules)
 - these contribute to signs and symptoms of diabetes

Classification of diabetes mellitus

- Old / Previous
- **Current Classification**
- 1. Type 1:
 - Immune mediated (could be in children with a more rapid onset (classic) or
 - adults with a slower onset – LADA, ‘late autoimmune diabetes of adults’)
- 2. Type 2: Insulin resistant
- 3. Other specific types (eg; drug induced; etc)
- 4. Gestational diabetes mellitus

epidemiology

- Type 1
- 5 – 10% of cases
- 5 – 10% of population in developed countries
- Type 2
- 80 – 95% of cases
- True prevalence is unknown / difficult to say
- Up 20% of people over 80 years
- Commoner in blacks than whites
- - Increasing incidence of diabetes parallels increase in incidence of obesity.
- - Epidemic in some countries.
- - Increasing incidence of obesity in children may be responsible for increased incidence of type 2 diabetes in children.

Diagnosis of diabetes mellitus

- Classical symptoms of hyperglycaemia - polyuria (excessive urination);
 - polydipsia (thirst);
 - nocturia (nocturnal urination);
 - lethargy; weight loss
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- Also may present with features of complications eg. ketoacidosis

Diagnosis of diabetes mellitus

- **Criteria for diagnosis:**

1. Classical symptoms plus a random plasma glucose concentration > 11.1mmol/l or



2. Fasting plasma glucose > 7.0mmol/l (fasting is no food for > 8 hours) or



3. 2 hour plasma glucose greater than 11.1mmol/l during oral glucose tolerance test (OGTT)

Clinical features - Type 1

- Onset is variable.
 - Classically, in younger age groups, the onset is acute and insulin is needed for survival –
- polyuria,
- polydipsia,
- lethargy and
- weight loss
- over a period of up to two weeks –
- many may present with ketoacidosis.
 - Ketoacidosis - salt and water depletion; loss of skin turgor; tachycardia; hypotension; deep and sighing breath (usually smells of acetone).
 - In older age groups onset is more insidious - residual beta cell function lessens risk of ketoacidosis at time of presentation.

Clinical features - type 2

- Usually in older age groups - especially obese (in 70%)
- however, incidence in child is assumed to be increasing due to increased prevalence of childhood obesity.
- - 50% have hypertension.
- - Classical signs of thirst, polyuria, nocturia and weight loss are not always present in Type 2
- often start with fatigue and malaise
 - Symptoms of hyperglycaemia are long standing and generally mild.
- Up to 20% may have one/some of the complications of diabetes present at time of diagnosis.

Impaired glucose tolerance

(IGT):

- represents an intermediate category between normal and diabetes – an area of uncertainty
- at higher risk of developing type 2 diabetes and macrovascular disease (sometimes called ‘dysglycaemic macroangiopathy’)
- usually clinically asymptomatic
- not at increased risk for microvascular complications
- a small percent with IGT revert to normal glucose tolerance on subsequent tests
- the diagnostic levels for fasting blood glucose are considered to be at a level that there is an increased risk for microvascular disease and not at the assumed lower levels when there may be an increased risk for macrovascular disease

Complications of diabetes

- **Acute complications:**
 - ketoacidosis,
 - hypoglycaemia,
 - hyperosmolar non-ketotic coma (HONC),
 - intercurrent illness

- **Chronic complications:**
 - retinopathy, (blindness
 - nephropathy,
 - neuropathy,
 - macrovascular disease,

Prevalence of complications:

- Liebl et al (2002)
 - foot ulcer (3.97%);
 - amputation (2.3%);
 - blindness (1.34%).

Prevalence of complications:

Macrovascular	microvascular complications
Stroke 6.6%	neuropathy (28%);
myocardial infarction (9%). (Heart Attack)	renal damage (20%);
heart failure (12%);	retinopathy (20%);
angina (17%);	Other eye complication needing treatment (6%)
peripheral vascular disease (18%);	
Erection dysfunction	
	Williams et al (2002) reported that at least 72% of those with type 2 had at least one complication

Other complications

Pregnancy problems– eg. bigger babies

Neonatal complications

Skin – necrobiosis lipoidica

Infections – UTI, thrush

Gastrointestinal

Dyslipidaemia

Psychosocial

Musculoskeletal –
joint problems

Gout

osteoporosis

Complications: Hypoglycaemia

- Most "hypo's" are minor and easily treated
- Prolonged and repeated attacks can result in permanent damage.
- Symptoms occur when blood glucose level drops to about 3.00mmol/l.
- Commonly precipitated by diet changes (eg missed meals, delayed meals, not eating enough), exercise, inappropriate insulin doses.
- More common in those on insulin than sulphonylurea drugs.
- Fictitious or deliberately induced hypoglycaemic attacks may occur for psychological reasons.

Risk factors for hypoglycemia

- older person;
- change in hypoglycaemic treatment;
- type of sulphonylurea;
- male;
- tight glycaemic control;
- polypharmacy; renal disease;
- high alcohol consumption

Clinical features of hypoglycaemia

tremor/trembling,	blurred vision,
palpitations/pounding heart,	irritability,
anxiety,	aggressive behaviour,
tiredness,	slurred speech,
pallor,	confusion,
headache,	drowsiness,
hunger,	convulsions
dizziness,	coma
irritability,	sweating,

Clinical features of hypoglycaemia:

- Most patients recognise the symptoms (except during sleep)
- longstanding cases develop a hypoglycaemic unawareness (especially in presence of autonomic neuropathy) and have difficulty recognising the symptoms.

Consequences of serious and/or repeated hypoglycaemic attacks

Coma	Cardiac arrhythmias
Convulsions	Eye damage
Impaired cognitive function	hypothermia
Intellectual decline	accidents (eg motor vehicle)

Management of hypoglycemia

- Give food containing glucose
 - soft drink;
 - honey;
 - sweets
- nothing by mouth if unconscious - use glucagon or IV dextrose;
- ALWAYS determine cause

Diabetic ketoacidosis (DKA)

- Life threatening –
 - result of severe insulin deficiency –
 - leading to a release of free fatty acids into the circulation and
 - hepatic fatty acid oxidation → forms ketone bodies.
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- Biochemical features –
 - hyperglycaemia,
 - hyperketonaemia and
 - metabolic acidosis

Aetiology:

- New presentation;
- intercurrent infection
- loose appetite - stop taking insulin
- illness (eg stroke);
- withdrawal of insulin;
- major dietary indiscretion;
- significant emotional stress.

Clinical features of DKA

polyuria;	Abdominal pain & tenderness
Thirst	Dehydration
Weight loss	Kussmual respiration (air hunger)
Weakness	Blurred vision
Leg cramps	Ketotic breath
Hypotension	Hypothermia
Tachycardia	Confusion
Nausea	coma
vomiting	

Diabetic Eye problems

- Blindness
- Retinopathy
- Cataracts
- Glaucoma
- Transient blurred vision

- **Risk factors for eye problems**
- Smoking
- Pregnancy
- Hypertension
- Renal disease
- Poor control of diabetes

Nephropathy

- Important cause of morbidity and mortality in those with diabetes.
- Commonest cause of end stage renal failure/disease (ESRF/ESRD) in developed countries.
- Nephropathy is symptom free until it is moderately advanced.
- First sign is a microalbuminuria and elevated blood pressure –
 - progresses to a macroproteinuria with a decline in renal function.

Management:

- Routine urinalysis at diagnosis of Type 2 for possible albuminuria
- annual screening is advisable.
- Intensive insulin therapy (DCCT showed reduction in risk of developing of 50%);
- reduction of protein intake;
- ACE inhibitors;
- reduce cardiovascular risk factors (especially hypertension);
- calcium channel blockers.
- Later need dialysis and maybe transplant

Diabetic Neuropathy

- Polyneuropathy
- Sensory
- Motor
- autonomic

annual review

- Discussion
- Physical & Psychological exam
- Investigation
- Management

Annual review - **Discussion**

- physical and psychological health
 - review of results of self monitoring
 - enquiry into episodes of hypos and hypers
 - knowledge of diabetes and self management
 - smoking and alcohol use
 - discussion of other diabetes related problems

Annual review - **Physical examination**

- - BMI
 - BP
 - Visual acuity
 - Detailed fundus examination
 - Inspection of feet and footwear
 - Injection sites

Annual review - **Investigations**

- - Urinalysis (for proteins)
 - HbA1c
 - Serum creatinine and electrolyte levels
 - Serum lipids

Annual review - Management

- Glycaemic control review
 - Assessment of co-morbidity
 - Review of all medications
 - Attention to modifiable cardiovascular risk factors
 - Management of long term complications
 - Management plan for next 12 months
 - Arrange review date