DIABETES MELLITUS

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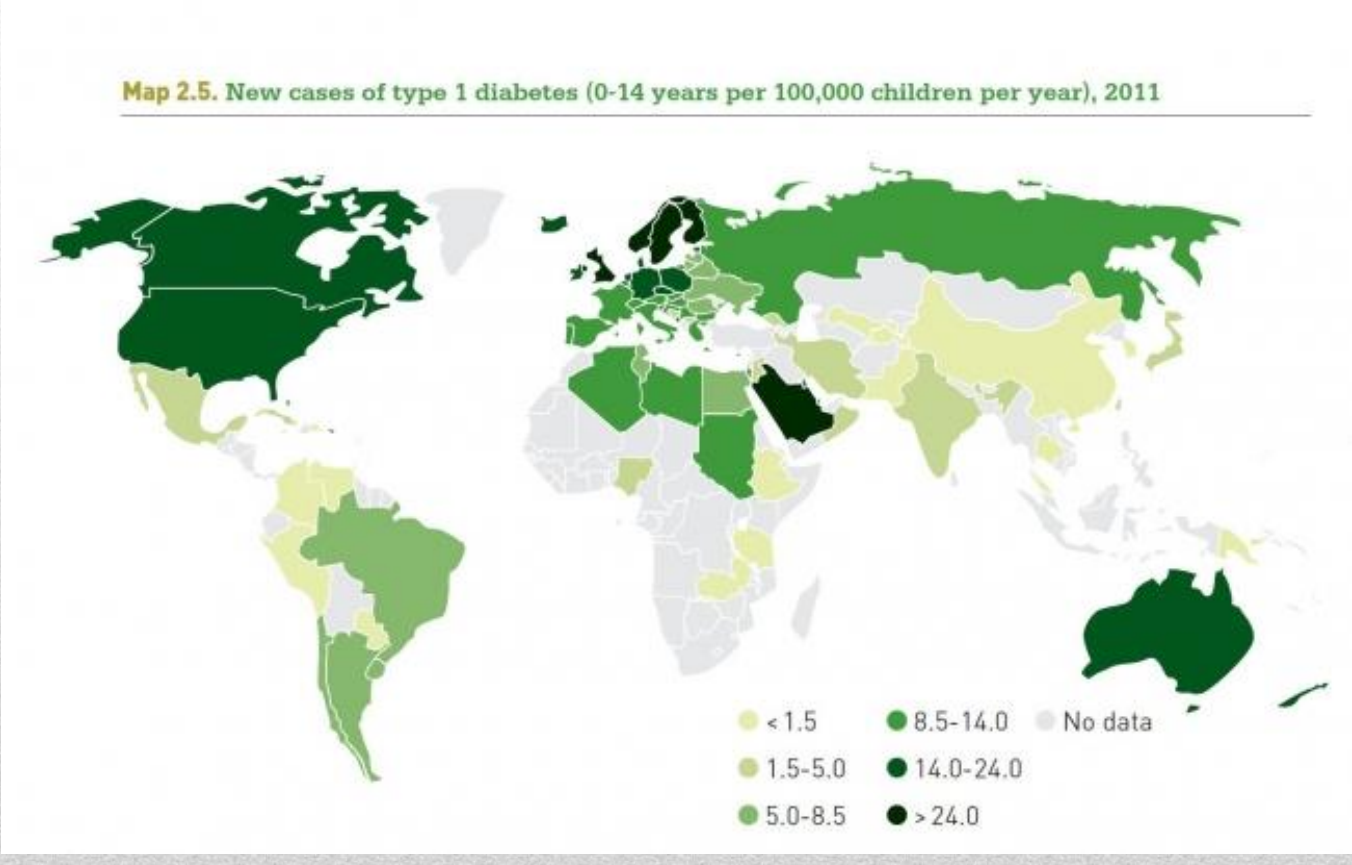
Outline

- Epidemiology
- Pathophysiology
- Clinical Context
- Complications
- Treatment Plan
- Prognosis

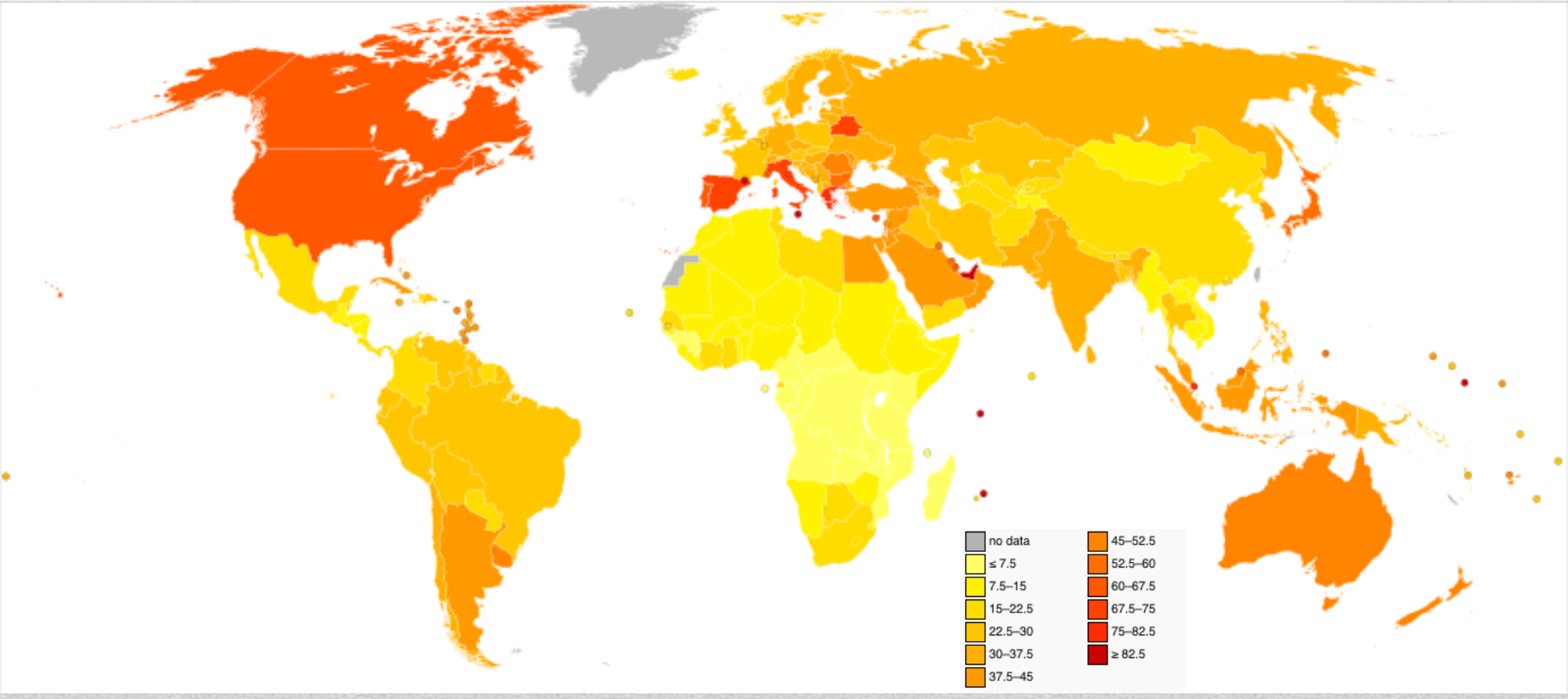
DM I vs. DM II

	TYPE I	TYPE II
Clinical Presentation	Juvenile Thin/Normal Body DKA	Adult/Elderly Overweight Ethnic Groups
Cause		
Prevalence	5%	95%
Onset/Progression	Abrupt	Gradual
Endogenous Insulin	Absent	Normal, Low/High
Concordance	50%	90%
Symptoms	Severe	Less severe
Treatment	Insulin	Weight loss Hypoglycaemics

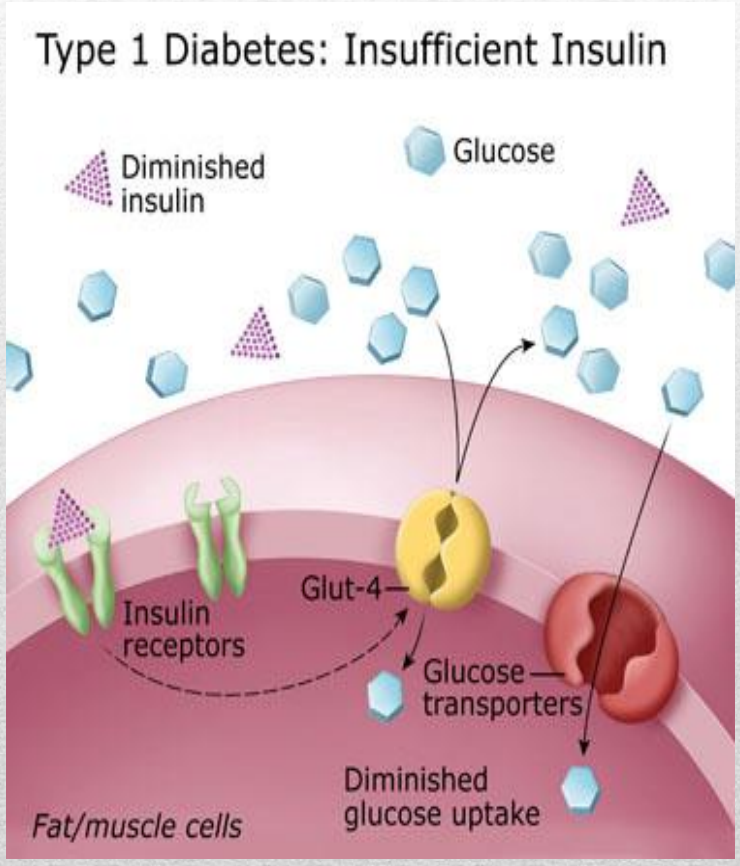
Epidemiology

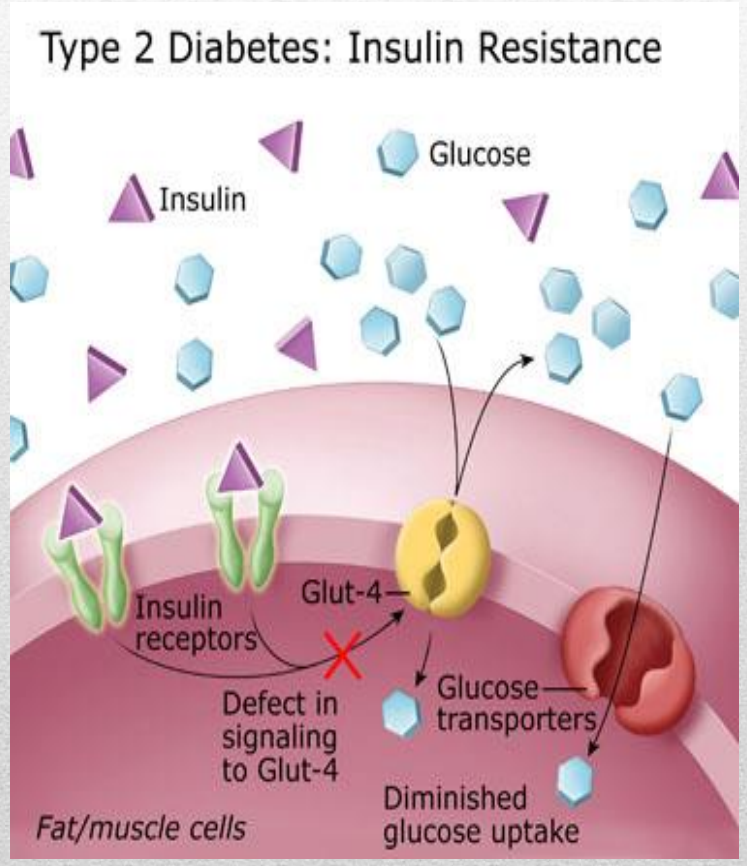


Epidemiology



Pathophysiology





Secondary Causes

- Acromegaly,
- Cushing syndrome,
- Thyrotoxicosis,
- Pheochromocytoma
- Chronic pancreatitis,
- Cancer
- Drug induced:
  - Atypical Antipsychotics
  - Beta-blockers
  - Calcium Channel Blockers
  - Corticosteroids
  - Thiazide Diuretics

Signs & Symptoms

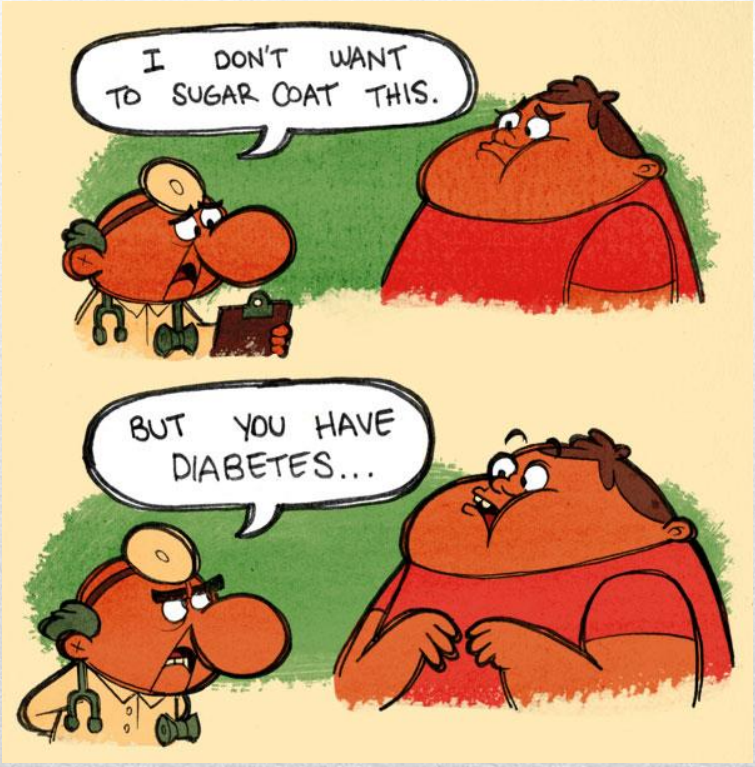
Investigations

- Random Plasma Glucose (>11.1 mmol/L or >200mg/dL)
- Fasting Plasma Glucose (>7.0 mmol/L or >126mg/dL)
- Oral Glucose Tolerance Test (>11.1mmol/L)
- Antibodies
- Insulin/C-peptide Levels
- Glycated Haemoglobin A1c (6.5%)
- Urinary Glucose/Albumin
- Serum Lipids
- Urea/Electrolytes

Diagnosis

- Symptoms of diabetes (polyuria, polydipsia and unexplained weight loss) with:
  - A random venous plasma glucose of > 11.1 mmoI/L
  - or fasting plasma glucose is greater than or equal to 7.0 mmoI/L
  - or 2 h post 75g oral glucose load of greater than or equal to 11.1 mmoI/L

- With **no symptoms**, diagnosis should **not** be based on a single glucose value, but requires confirmation with another value in the diabetic range, ideally collected fasting on more than one occasion.



Multidisciplinary Team

HOSPITAL TEAM

- Endocrinologist
- Diabetes Specialist Nurse
- Dietician
- Podiatrist
- Optometrist
- Clinical Psychologist

COMMUNITY TEAM

- General Practitioner
- Practise Nurse
- Community Dietician
- Social Worker

SPECIALIST CLINICS

Monitoring

CLINICAL ASSESSMENT
- Weight/BMI
- Symptoms of hyperglycaemia
- Hypoglycaemic attacks if any
- Problems with medication
- Problems with eyesight, parasthesia, impotence
- Any symptoms of angina or claudication
- Patient monitoring records

RETINOPATHY

Ensure patient has follow up either with their optometrist or at hospital retinal screening clinic

RENAL DISEASE
- Check sitting BP
- Send urine for microalbumin screening

FOOT CARE

(Annual review by podiatrist)
- Assessment of peripheral pulses
- Assessment of sensations with 10g monofilament
- Foot care education
- Plan appropriate package of care relative to risk

GLYCAEMIC CONTROL
- Patient's own monitoring at home
- Check HbA1c

DIETARY AND LIFE STYLE REVIEW
- Review diet- dietician
- Smoking/alcohol
- Advise on appropriate exercise
- Advise on Diabetes (UK) membership benefits

BIOCHEMICAL TESTS
- HbA1c
- Lipid profile, creatinine, TFT
- Urine for albumin creatinine ratio (ACR)

INTERIM REVIEWS AS NECESSARY
- Dietary/lifestyle review
- Continuing education
- BP measurement
- Patient monitoring record
- Check HbA1c (minimum interval between two tests at least 3 months)
- Creatinine/TFTs if indicated

Complications

- Diabetic Ketoacidosis
- Hyperosmolar Hyperglycaemic Nonketotic Syndrome
- Coronary Artery Disease
- Hypertension
- Diabetic Nephropathy
- Diabetic Retinopathy
- Peripheral Vascular Disease

Diabetic Ketoacidosis

- Diabetes Type I
- Breakdown of fat and overproduction of ketones by the liver and loss of bicarbonate
- Occurs when Diabetes Type 1 is undiagnosed or known diabetic has increased energy needs (Physical/emotional stress)
- Signs & Symptoms
  - Kussmaul Breathing
  - Fruity Breath
- Treatment
  - Insulin
  - Monitor K^+ levels
  - Restore fluid balance
  - Treat Underlying Condition

HHNS

- Diabetes Type 2
- Enough insulin is secreted to prevent ketosis, but not enough to prevent hyperglycemia
  - Marked hyperglycemia (>50mmol) with no ketones
- High blood sugar causes an extreme diuresis with severe electrolyte and fluid loss
- Signs & Symptoms
  - Altered mental state, focal signs
  - Hyperviscosity
  - Polydipsia
- Treatment
  - Same as DKA (less insulin, more cautious fluid replacement and MUST use heparin)

Chronic Diabetic Complications

- **Microvascular**
  - Nephropathy
  - Retinopathy
  - Neuropathy
- **Macrovascular**
  - Heart disease
  - Stroke
  - Peripheral vascular disease
  - Hypertension

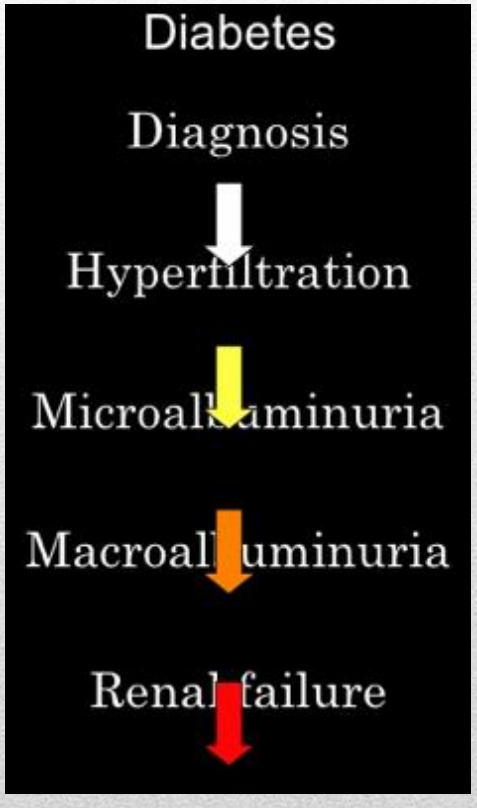
RISK FACTORS

- Hyperglycaemia
- Hypertension
- Dyslipidaemia
- Excess weight
- Smoking
- Disease duration
- Family history

Diabetic Nephropathy

- Definition: glomerular changes in kidneys of diabetics leading to impaired renal function
- Diabetics without treatment go on to develop hypertension, edema, progressive renal insufficiency
- In type 1 diabetics, 10 – 15 years
- May occur soon after diagnosis with type 2 diabetes since many are undiagnosed for years
- Most common cause of end-stage renal failure
- Kimmelstiel-Wilson syndrome: glomerulosclerosis associated with diabetes

Diabetic Nephropathy



Stage	Description	GFR
1	Kidney damage with normal or increase in GFR	>90
2	Kidney damage with normal or mild reduction in GFR	60-89
3a	Moderate reduction of GFR	45-59
3b		30-44
4	Severe reduction in GFR	15-29
5	Renal failure	<15 (or dialysis)

Treatment Plan

A	• **Diet and Exercise**
B	• **Oral hypoglycaemic therapy**
C	• **Insulin Therapy**

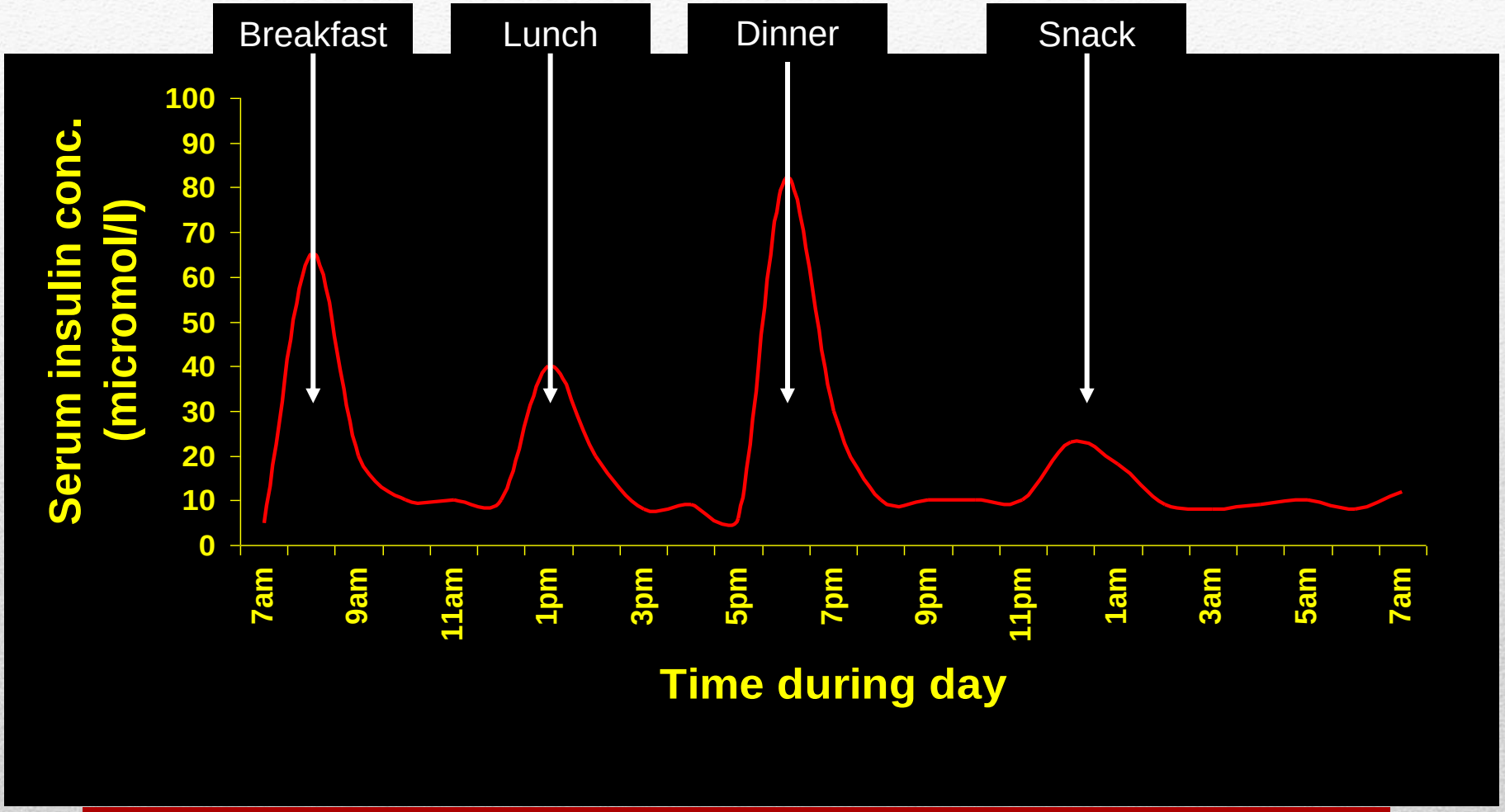
Lifestyle Changes

- Physical Activity
  - Promotes weight loss and insulin sensitivity
  - Moderate-intensity recommended (2.5 hours walking/week)
- Diet
  - Well-balanced and scheduled meals
  - Carbohydrates 60-70%, Protein 15-20%, Fats < 10%
  - Limited alcohol/sodium intake
  - Stay hydrated

Medication

Drug Class	Drug Name	Brand Name	Mechanism of Action
Biguanides	Metformin	Glucophage®	Inhibit glucose production by the liver
Sulfonylureas (second-generation)	Glimepiride Glipizide Glyburide	Amaryl® Glucotrol® Diabeta®, Glynase PresTab®, Micronase®	Increase insulin secretion by pancreatic beta cells
Meglitinides	Repaglinide Nateglinide	Prandin® Starlix®	Increase insulin secretion by pancreatic beta cells
Thiazolidinediones (TZDs)	Pioglitazone Rosiglitazone	Actos® Avandia®	Increase glucose uptake by skeletal muscle
Alpha-glucosidase inhibitors	Acarbose Miglitol	Precose® Glyset®	Inhibit carbohydrate absorption in the small intestine

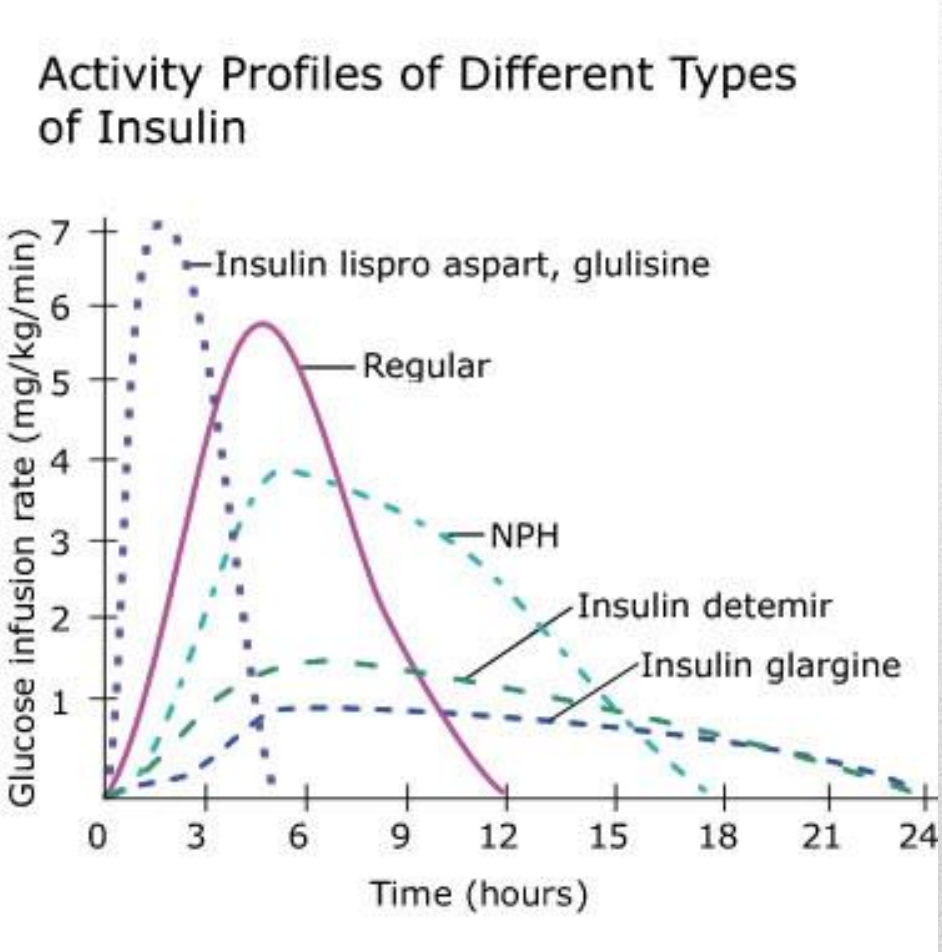
Insulin


Breakfast
Lunch
Dinner
Snack
Serum insulin conc. (micromol/l)
100
90
80
70
60
50
40
30
20
10
0
7am
9am
11am
1pm
3pm
5pm
7pm
9pm
11pm
1am
3am
5am
7am
Time during day

Insulin

Types of insulin			
Insulin type/action (appearance)	**Brand names** (generic name in brackets)	**Basal/bolus**	**Dosing schedule**
Rapid-acting analogue (clear) Onset: 10–15 minutes Peak: 60–90 minutes Duration: 4–5 hours	Humalog® (insulin lispro) NovoRapid® (insulin aspart)	Bolus	Usually taken right before eating or to lower high blood glucose
Short-acting (clear) Onset: 0.5–1 hour Peak: 2–4 hours Duration: 5–8 hours	Humulin®-R Novolin®ge Toronto	Bolus	Taken about 30 minutes before eating, or to lower high blood glucose
Intermediate-acting (cloudy) Onset: 1–3 hours Peak: 5–8 hours Duration: up to 18 hours	Humulin®-N Novolin®ge NPH	Basal	Often taken at bedtime, or twice a day (morning and bedtime)
Extended long-acting analogue (Clear and colourless) Onset: 90 minutes Peak: none Duration: 24 hours	Lantus® (insulin glargine) Levemir® (insulin detemir)	Basal	Usually taken once or twice a day
Premixed (cloudy) A single vial contains a fixed ratio of insulins (the numbers refer to the ratio of rapid- or fast-acting to intermediate-acting insulin in the vial)	Humalog® Mix 25™ Humulin® (20/80, 30/70) Novolin®ge (10/90, 20/80, 30/70, 40/60, 50/50)	Combination of basal and bolus insulins	Depends on the combination

Insulin


Activity Profiles of Different Types of Insulin
Glucose infusion rate (mg/kg/min)
7
6
5
4
3
2
1
Insulin lispro aspart, glulisine
Regular
NPH
Insulin detemir
Insulin glargine
0
3
6
9
12
15
18
21
24
Time (hours)

Prognosis

- Lifelong disease
- No cure
- Usual cause of death – CVD/Stroke
- Prognosis dependent on:
  - Time of diagnosis
  - Progress of diabetic complications
  - Compliance with treatment
- Life Expectancy
  - Type I – 20 years less
  - Type II – 10 years less