Diabetes – Recognition and Management of Acute and Chronic Complications

RCN HCP Programme

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Learning Objectives:

- Provide a brief overview of Diabetes Mellitus (type 1 and type 2)
- To understand how to recognise Hypo and Hyper glycaemia (low and high blood glucose)
- To understand the treatment of Hypos and Hypers
- To identify the short and longer-term impact (complications) of poor blood glucose control
- To gain an understanding of the importance of your role in of the management of diabetic hyper and hypo glycaemia

Diabetes Mellitus:

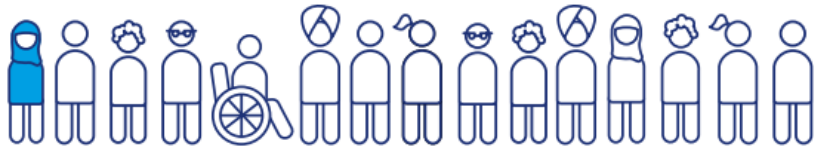
- ***A serious condition where blood glucose levels are too high. This can lead to short term acute illness and longer term chronic complications***

- Type 1
- Type 2
- Rarer forms

Diabetes Mellitus – The Facts…a growing issue

DIABETES UK
KNOW DIABETES. FIGHT DIABETES.

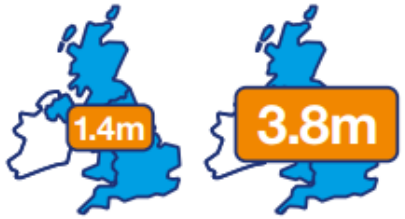
4.7 million
people in the UK
have diabetes.



One in 15 people have diabetes in the UK.

Around one million of those people have Type 2 diabetes but have not yet been diagnosed.

The number of people diagnosed with diabetes has **more than doubled in 20 years.**



In 1996 there were 1.4 million people diagnosed. In 2019 there are **3.8 million.**

With thanks and acknowledgment to Diabetes UK for Infographic use
DUK (2019) ‘Us, diabetes and a lot of facts and stats’. London. Diabetes UK

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Diabetes Mellitus – The Facts…a growing issue

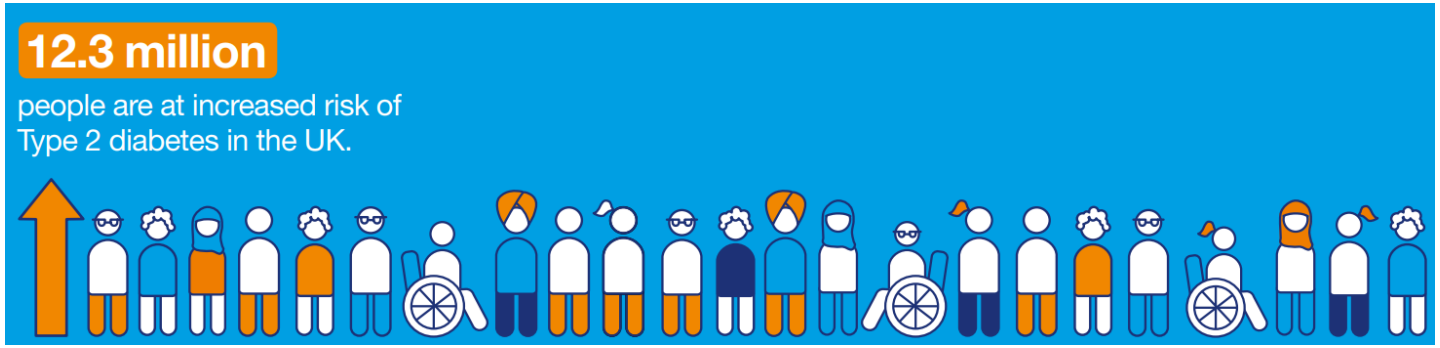
By 2025 we think
more than 5 million
people will have diabetes in the UK.

By 2030 we think
more than 5.5 million
people will have diabetes in the UK.

About 90% of people with diabetes have **Type 2.**

About 8% of people with diabetes have **Type 1.**

About **2%** of people have **rarer types** of diabetes.



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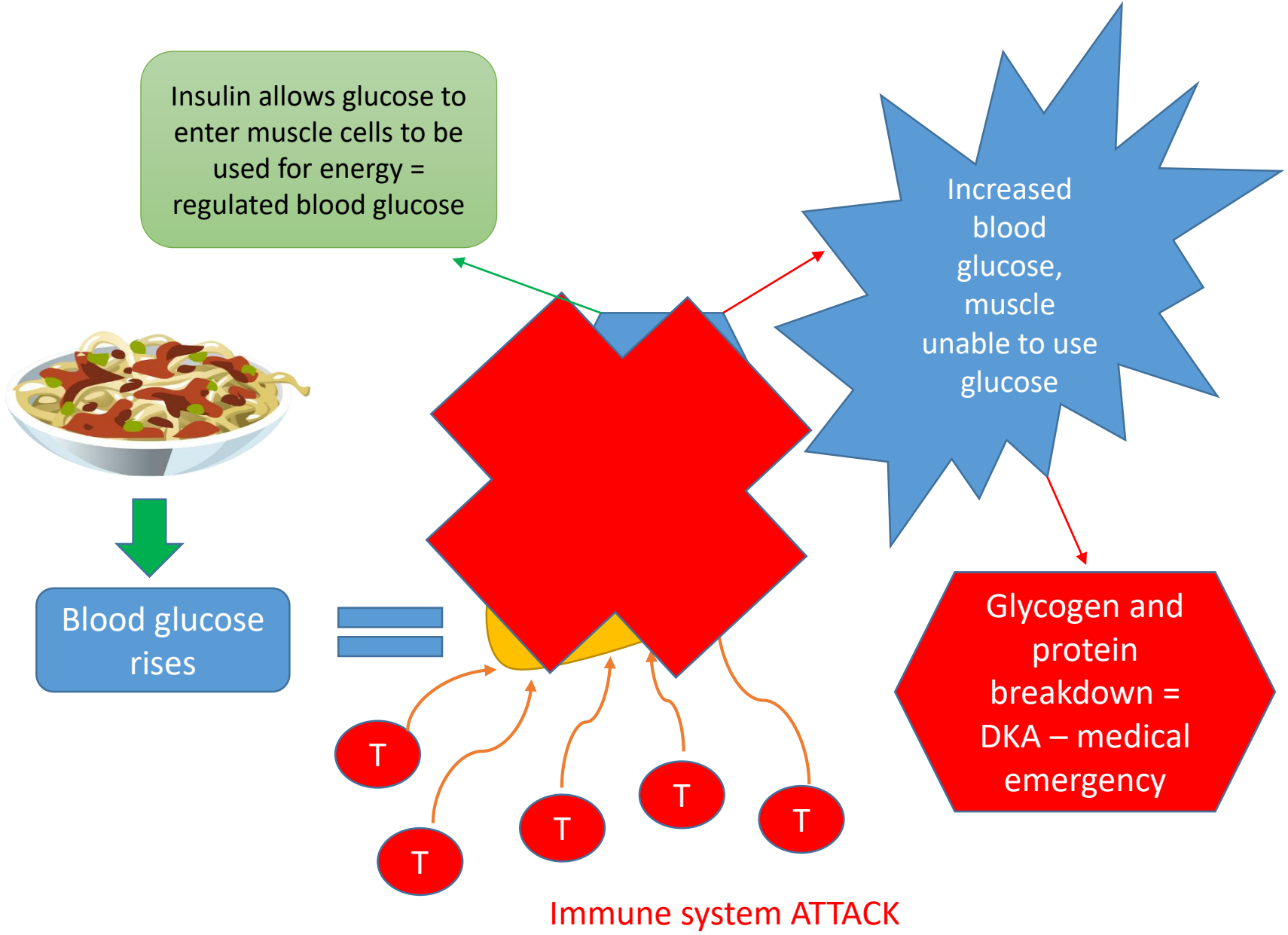
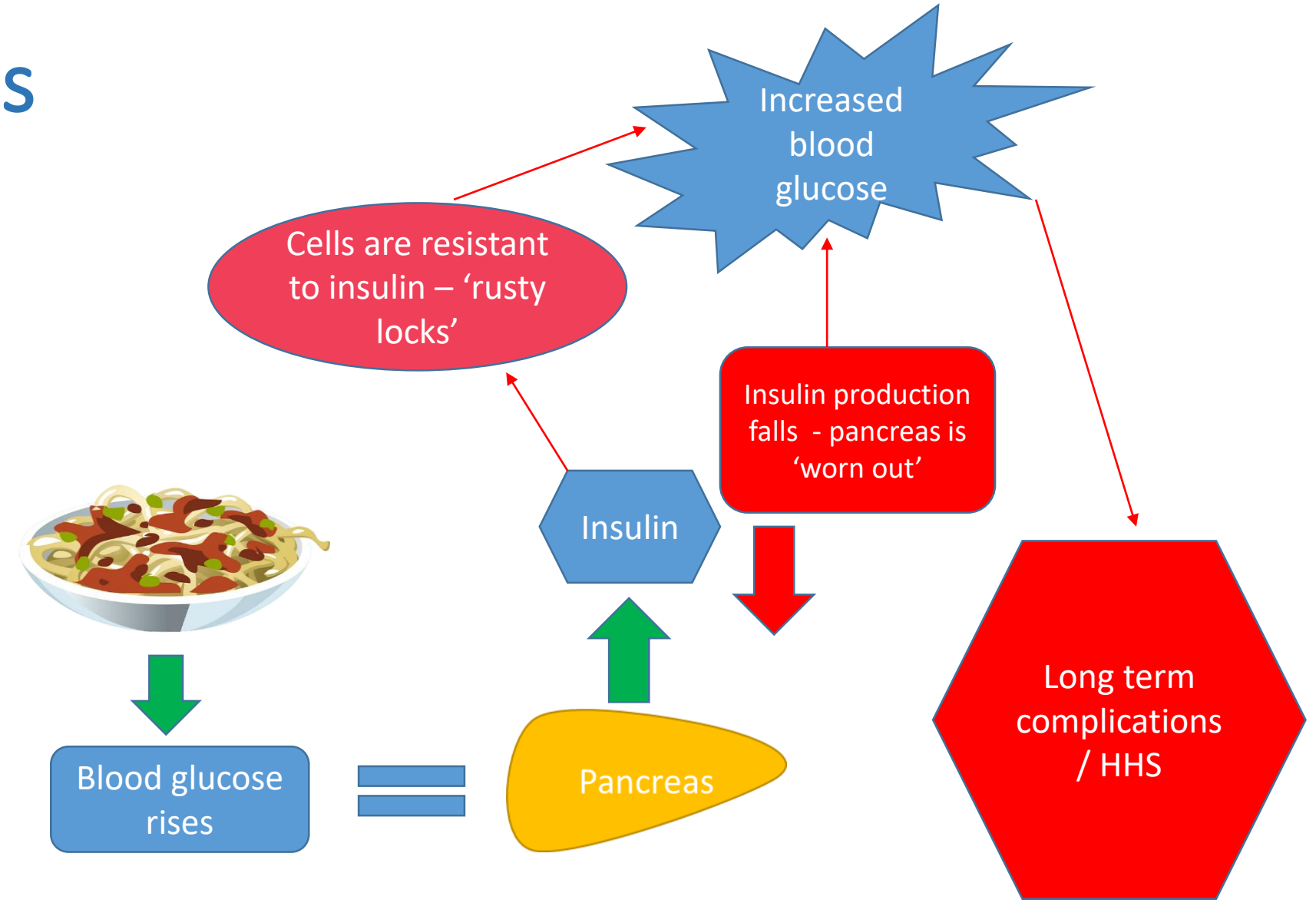
Type 1 Diabetes

- An autoimmune disease in which the body's acts against and destroy the cells (beta cells) which produce insulin
- Not preventable (yet!)



Type 2 Diabetes

- A long-term metabolic disorder that is characterised by:
  - High blood glucose
  - Resistance to insulin
  - Relative lack of insulin
- Primarily occurs because of obesity and lack of exercise (other risk factors include genetics, ethnicity and medications)



NICE Recommended Target Ranges for Self-Monitoring of Blood Glucose (snapshot) (non-diabetic figures are provided for information only and are not part of NICE guidance)

Target Levels by Type	Upon Waking	Before meals (pre-prandial) mmol/l	At least 90 minutes after a meal (post prandial) mmol/l
Non-diabetic		4.0 – 5.9	Under 7.8
Type 2 diabetes		4.0 – 7.0	Under 8.5
Type 1 diabetes	5.0 – 7.0	4.0 – 7.0	5.0-9.0 (if choosing to test)

This is a guide – target ranges should be individualised!

HbA1c - Haemoglobin A1c

Glycated haemoglobin – A longitudinal view of glucose control

- Some of the glucose in the blood binds to haemoglobin (the protein that carries oxygen in the red blood cells)
- The amount of HbA1c formed is directly related to the average concentration of glucose in your bloodstream
- Red blood cells live for 2–3 months, and because of this, the amount of HbA1c in the blood reflects the average level of glucose in the blood during the last 2-3 months

Normal: Below 42 mmol/mol

NDH: 42 to 47 mmol/mol

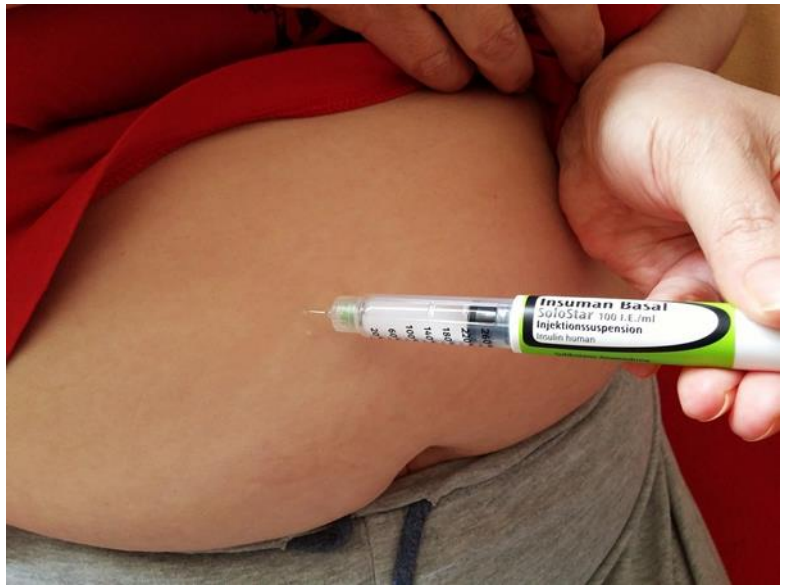
Diabetes: 48 mmol/mol

Hyperglycaemia

- What is hyperglycaemia?
- Random plasma glucose of more than 11 mmol/litre (NICE, 2015b)
- Hyperglycaemia describes any blood glucose concentration that is higher than recognised target ranges
- Acute hyperglycaemia occurs when the body cannot utilise glucose due to insufficient or complete lack of insulin production. This causes the body to generate glucose via glycogenolysis (glycogen breakdown), lipolysis (fat breakdown) and gluconeogenesis (glucose derived from substrates such as lactate, glycerol and glucogenic amino acids)
- Blood glucose rises further, the person is effectively 'starving in a sea of plenty'
- Fatty acid metabolites know as ketone bodies, accumulate from this process, resulting in Ketoacidosis. Ketones are observed in the blood and urine
- Acute hyperglycamia can lead to life threatening Diabetic Ketoacidosis -DKA (usually T1D) / Hyperosmolar, hyperglycaemic state - HHS (T2D)
- Prolonged hyperglycaemia can result in damage to many organs of the body leading to renal failure, blindness or gangrene resulting in amputation

Hyperglycaemia causes

- Undiagnosed type 1 / type 2 diabetes
- Inadequate doses of insulin / diabetes medications
- Infection
- Stress
- Surgery
- Medications (steroids, benzodiazepines)
- Lipohypertrophy
- Variations in nutritional intake
- Individuals receiving enteral / parenteral feeding
- Post hypo and over compensatory mechanisms (rebound hyperglycamia)
- Critical illness (unexplained increases in BG)
- NB: Check SMBG technique / equipment, especially if 1 erroneous reading!!!!



Hyperglycaemia – signs and symptoms

Gastrointestinal	Nausea Vomiting Abdominal pain Hunger
Adrenergic	‘Fight or flight response’
Respiratory	Tachypnoea
Renal	Glycosuria (excess glucose in urine) Polyuria (and dehydration) Polydipsia
Electrolyte imbalance	Excess ketones (from fat metabolism) Hypokalaemia Hyponatraemia
Liver and adipose tissue	Acetone breath
Cardiovascular	Cardiac irregularities
Central Nervous System	CNS depression – drowsiness Coma

Hyperglycaemia - treatment

- No adjustment based on a single reading – look for trends
- Check ketones:
  - <0.6 (neg) – **normal levels**
  - 0.6-1.5 (Trace +) **indicates more ketones being produced than normal, slightly increased risk – retest in several hours**
  - >1.6 - 3 (mod ++to +++) **indicates risk of DKA – seek assistance**
  - >3 (large ++++) **likely DKA – requires urgent care**
- If trend is high increase insulin by 10%, review in 48 hrs
- Use rapid acting insulin if symptomatic or ketotic. BG >20 mmol/l = 10 units Actrapid and review (acute settings only) – follow local guidelines

Does your area of practice have a blood ketone meter?

A note on DKA (Diabetic KetoAcidosis)

- DKA is a serious and life-threatening complication of diabetes caused by absolute or relative insulin deficiency leading to severe hyperglycamia with ketosis (fat metabolism).
- Requires high intensity nursing usually within HDU / ICU – fluid resus and address electrolyte imbalance, insulin delivery to clear ketones
- Usually seen in T1DM – most common acute complication but incidence is not well characterised*
- Rare cases occur (1:1000) in acutely unwell T2DM taking SGLT2
- Always consider possibility of DKA (whether T1 or T2) with non-specific symptoms and a positive test for urine or plasma ketones

*BMJ Open. 2017 Aug 1;7(7):e016587. doi: 10.1136/bmjopen-2017-016587.**Incidence and prevalence of diabetic ketoacidosis (DKA) among adults with type 1 diabetes mellitus (T1D): a systematic literature review.** Fazeli Farsani S[1], Brodovicz K[2], Soleymanlou N[3], Marquard J[4], Wissinger E[5], Maiese BA[5].

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A note on HHS (previously HONK)

- Hyperosmolar Hyperglycaemic State (HHS) occurs in people with Type 2 diabetes who experience very high blood glucose levels (often over 40mmol/l).
- It can develop over a course of weeks through a combination of illness (e.g.infection) and dehydration. Haemodynamic state is the best indicator to severity.
- Stopping diabetes medication during illness (e.g. Because of swallowing difficulties or nausea) can contribute, but blood glucose often rises despite the usual diabetes medication due to the effect of other hormones the body produces during illness.
- Less common than DKA although carries a higher mortality rate.
- HHS is a medical emergency and carries a mortality of 10-15% (approx. 10 x higher than DKA)
- Rare: Contributes to less than 1% of all diabetes-related admissions
- The goals of treatment of HHS are to treat the underlying cause commence fluid and electrolyte replacement (normalise osmolality), THEN gradually normalise blood glucose

Causes

- Poorly treated T2D
- Delayed diagnosis of T2D (50%)
- Infections/sepsis
- Cardiovascular events
- Unplanned high dose steroids

Symptoms

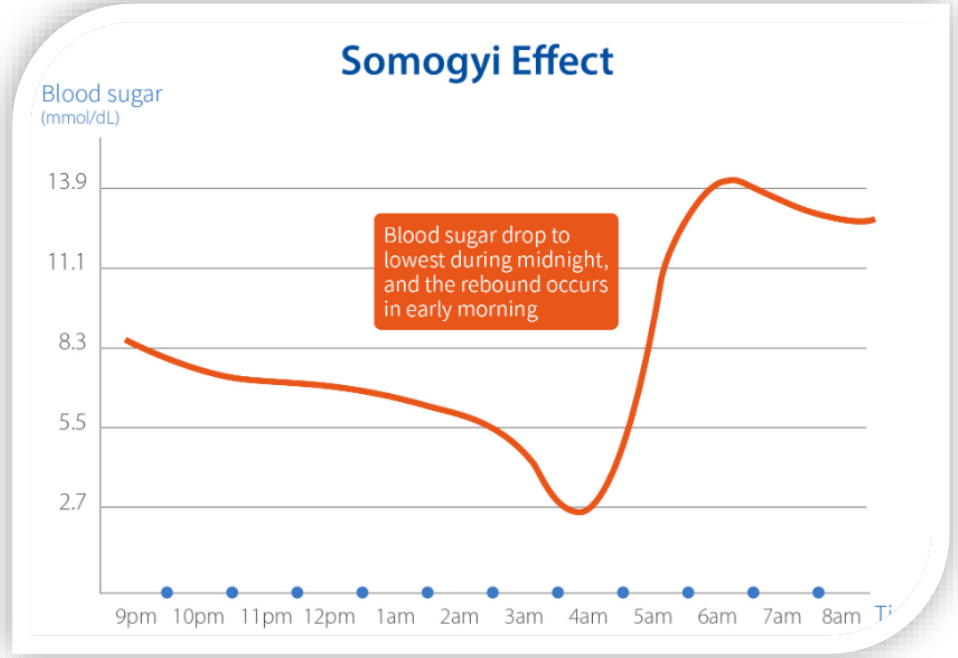
- Urination – due to high BG
- Thirst
- Nausea
- Dry skin
- Disorientation
- In later stages, drowsiness and a gradual loss of consciousness

Hypoglycaemia – ‘hypo’

- What is hypoglycaemia?
- Random plasma glucose of less than 4 mmol/litre
- Hypoglycaemia results in inadequate energy available for the brain to function leading to abnormal behaviour - sometimes mistaken for drunkenness
- If prolonged the individual may lose consciousness / have seizures / hemiparesis
- If not treated may be at risk of permanent brain injury or even death

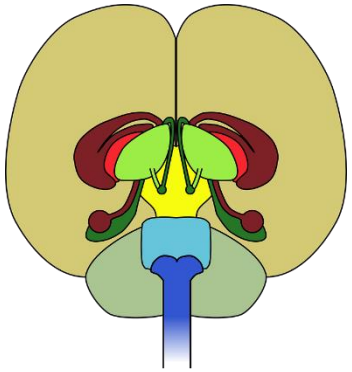
Hypoglycaemia

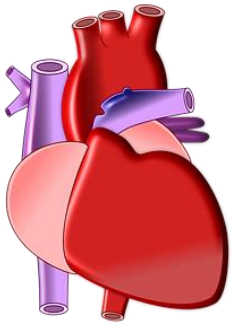
- Who is at risk of a hypo?
  - Anyone on Insulin
  - Anyone on a Sulphonylurea +/- combination with GLP1
  - Those with impaired awareness
  - Adolescents / irregular lifestyle
  - Elderly
  - Malabsorptive disorders (reduced absorption of nutrients)
  - Cognitive dysfunction
  - Tight control
  - Alcoholism
  - Lipohypertrophy

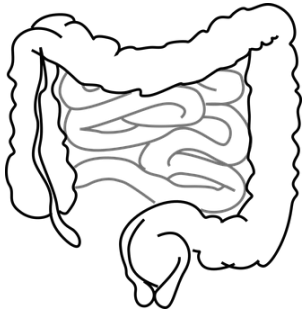


- What might cause a hypo?
  - Inadvertent insulin or sulphonylurea overdose (sulphonylureas work by increasing endogenous insulin production in the person with type 2 diabetes) or in response to a recent change in dose
  - Missed or inadequate meal
  - Unexpected exercise
  - Error in timing of dosage
  - Drug / prescribing error – nursing administration, meal timings, NBM

Hypo symptoms







Central nervous system
- Headache
- Confusion
- Concentration difficulties
- Changes is personality

Cardiovascular
- Palpitations

Gastrointestinal
- Hunger
- Nausea
- Belching

Adrenergic
- Sweating
- Anxiety

Consider dementia, TIA, falls, weakness in the elderly. Hypo can precipitate VT, VF

Remember: Some people may not be aware they are hypo – 'hypo unawareness'

Remember: Some people may experience hypo symptoms >4 mmol/l if they usually run high

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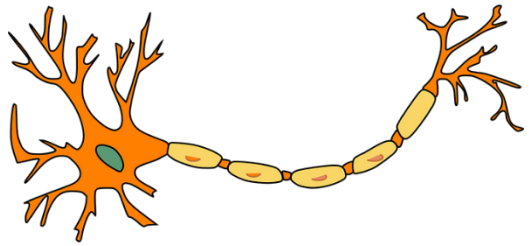
Hypo treatment

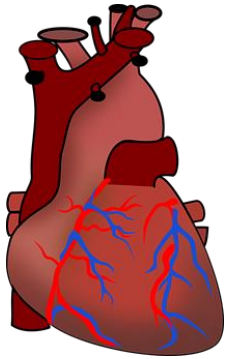
- 10-20g glucose given by mouth either in liquid form (such as *GlucoGel*®) or as granulated sugar / sugar lumps / 4-5 Jelly Babies
  - Alternatively:
    - 10g of glucose is obtained from 2 teaspoons of sugar / 3 sugar lumps and also from non-diet drinks i.e.: 100ml *Coca-Cola*®. Note that the carbohydrate content of some glucose drinks is currently subject to change – check the label
- Repeat BG after 10-15 minutes. Repeat above if BG is <4.
- After initial treatment a snack (20g CHO – 1 slice bread, 2 biscuits) providing sustained carbohydrate release will minimise further falls in BG.
- In severe cases, glucagon / IV glucose may be used

Long Term Complications

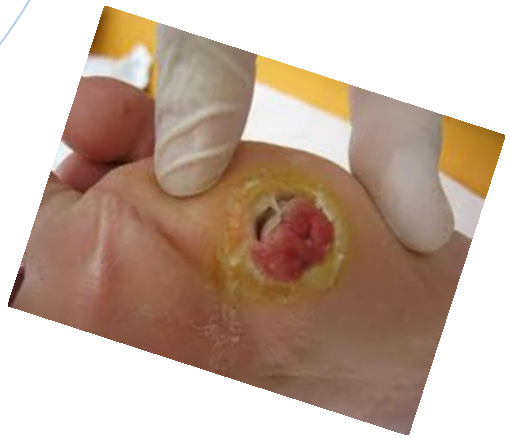
Depression



Neuropathy – Nerve damage



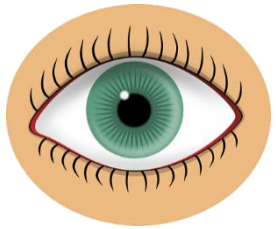
Cardiovascular Disease



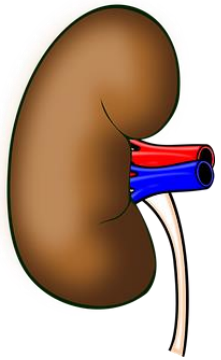
Foot problems

Sexual dysfunction

Retinopathy (eye problems)



Nephropathy (kidney problems)



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Every week diabetes leads to more than

169 amputations

680 strokes

530 heart attacks and almost **2,000** cases of heart failure.

More than **500** people with diabetes die prematurely every week.

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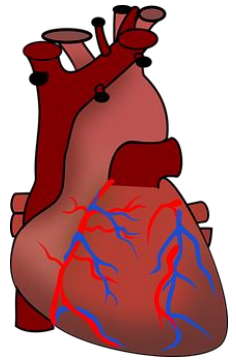
Cardiovascular Disease

- Macrovascular (large vessel) disease, including MI and stroke is the prime cause of excess mortality in diabetes and leads to reduced life expectancy
- Microvascular (small vessel) disease leads to complications such as nephropathy, retinopathy, foot problems and erectile dysfunction



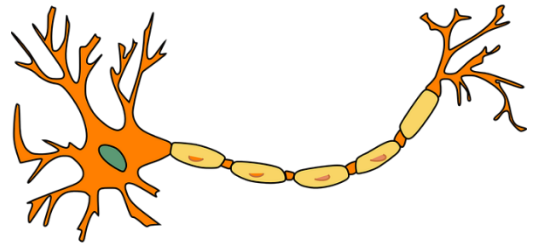
Patient considerations

- Aim for good control of blood glucose
- BP (<140 / 80)
- Cholesterol (total <4.0 mmol/l, LDL<2.0 mmol/l)

(All of the above checked at annual review)

- Drug therapies may include anti-hypertensives and statins
- Lifestyle changes – increased exercise, reduce weight, salt and alcohol consumption
- Encourage smoking cessation

Neuropathy – Nerve Damage



- One of the most common complications of diabetes
- Defined as nerve dysfunction – can be
  - **Sensory** – inability to feel pain, pressure or temperature – foot complications
  - **Autonomic** – can involve every system of the body (tachycardia, silent MI, loss of hypo awareness, postural hypotension, gastroparesis)
  - **Motor** – muscle weakness, wasting, cramps, twitching, clawed toes, Charcot foot, contractures
- Can lead to ulceration, amputation and death
- Arises due to macro and microvascular changes resulting in reduced oxygen supply to the nerve but still unclear as to exact mechanisms that lead to neuropathy
- Peripheral sensory neuropathy is often painful and disabling

Patient considerations:

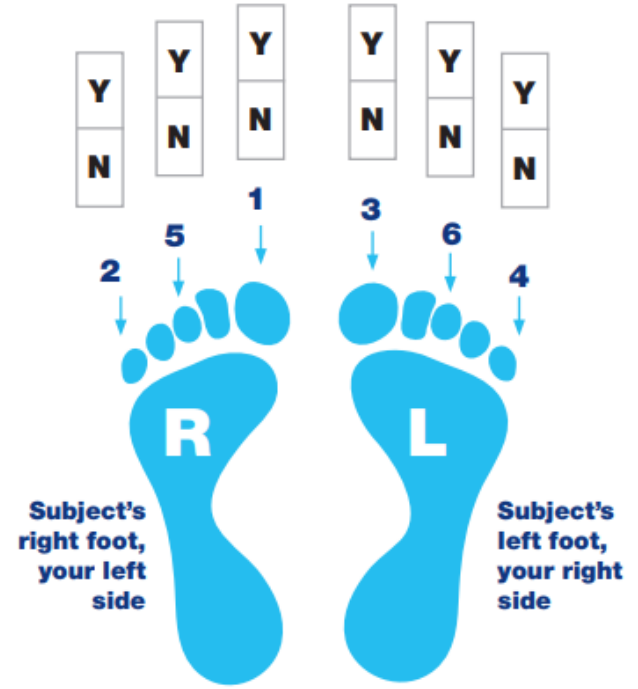
- Ensure patients have suitable footwear
- Ensure falls risk assessments are completed for in-patient admissions
- Annual review and assessment for new / on-going signs / symptoms of neuropathy
- Do not assume because a patient has lost sensation that they cannot feel pain!

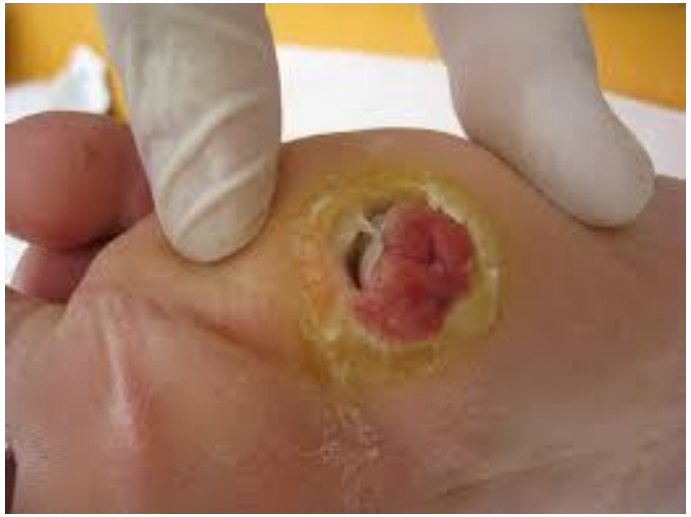
Foot problems

- Foot complications are common and include arterial insufficiency and peripheral neuropathy
- There are more than 20 leg, foot or toe amputations each day due to diabetes; 4/5 are preventable
- Foot ulcers may be associated with deep infection – risk of osteomyelitis and sepsis

Patient considerations:

- Refer to Diabetes UK ‘Putting Feet First’ Campaign including ‘touch the toes’ test (2 x N = impaired sensation)
- Regular foot checks and patient education are key to maintaining foot health – advise your patient to look at their feet daily
- If experiencing sensory loss – advise not to go barefoot and ensure shoes and socks are well-fitting. Patients should also take care when cutting nails
- Encourage patients to stop smoking
- Ensure you understand local pathways / referral for foot care





Identification of foot status and what action to take

DIABETES UK
KNOW DIABETES. FIGHT DIABETES.

Level of risk		Action
Active	• Ulceration or • spreading infection or • critical limb ischaemia (severe peripheral arterial disease) or • gangrene or • suspicion of acute Charcot foot or an unexplained hot, red, swollen foot with or without pain.	• Rapid referral (within one working day) to the Foot Protection Service (FPS) or the multidisciplinary foot team, for triage within one further working day. • Assess feet and lower limbs, then agree a tailored treatment plan. • Provide written and verbal education with emergency contact numbers. • Refer for special intervention if/when required. • Liaise with other healthcare professionals eg GP as necessary.
High	• Previous ulceration or • previous amputation or • on renal replacement therapy (dialysis or transplant) or • neuropathy (loss of sensation) and lower limb peripheral arterial disease together or • neuropathy (loss of sensation) in combination with callus and/ or deformity* or • lower limb peripheral arterial disease in combination with callus and/or deformity*.	• Refer to a specialist podiatrist or member of the Foot Protection Service (FPS) and request an assessment within 2–4 weeks. • Thereafter they should be assessed every 1–2 weeks if there is immediate concern or every 1–2 months if there is no immediate concern. This is in addition to their annual assessment. Both assessments should be carried out by a specialist podiatrist or a member of the FPS. • Assess feet and lower limbs, then agree a tailored treatment plan. • Provide written and verbal education with emergency contact numbers. • Refer for special intervention if/when required. • Liaise with other healthcare professionals eg GP as necessary.
Moderate	• Deformity* or • neuropathy (loss of sensation) or • lower limb peripheral arterial disease.	• Refer to a specialist podiatrist or member of the Foot Protection Service (FPS) and request an assessment within 6–8 weeks. • Thereafter they should be assessed every 3–6 months in addition to their annual assessment, by a specialist podiatrist or a member of the FPS. • Assess feet and lower limbs, then agree a tailored treatment plan. • Provide written and verbal education with emergency contact numbers. • Refer for special intervention if/when required. • Liaise with other healthcare professionals eg GP as necessary.
Low	• No risk factors, as listed above, present. • Callus alone is considered low risk.	• Annual screening by a suitably trained Healthcare Professional. • Agree self management plan. • Provide written and verbal education with emergency contact numbers.

Record risk status and inform patient of their risk status and what it means.

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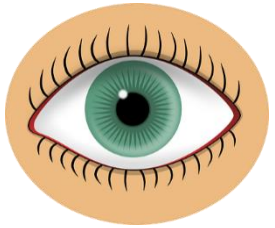
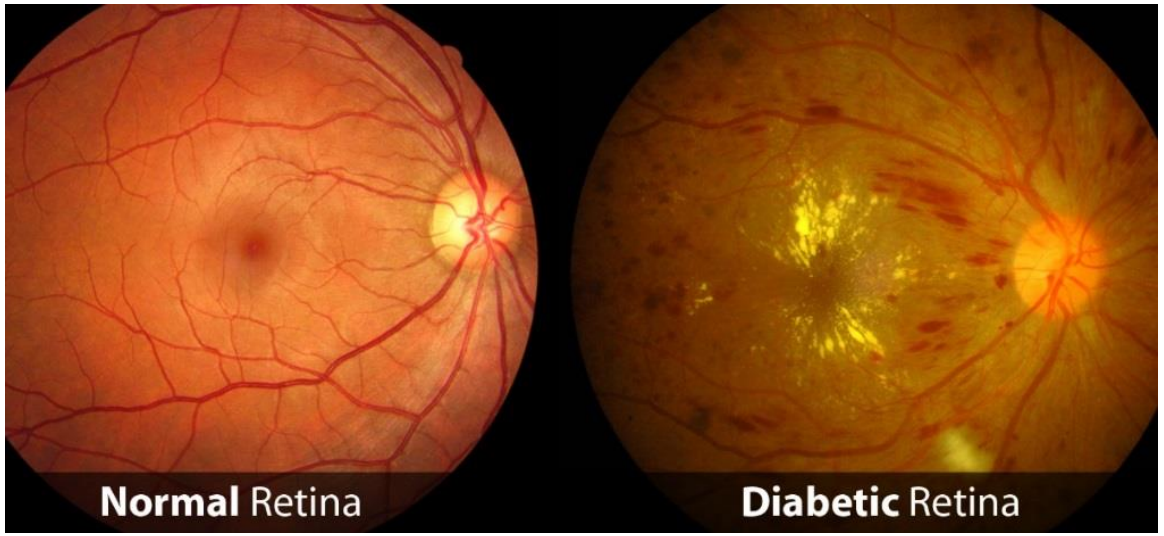
Retinopathy – eye problems



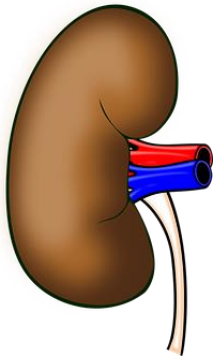
- The leading cause of blindness in those under 65 (i.e.: working population)
- Risk correlates with duration of diabetes
- One of the most ‘feared’ complications
- Caused by microvascular damage, hypoxia and growth of new vessels
- Early detection enables effective interventions such as tightening control of cardiovascular risk factors or laser treatment
- Other eye problems include glaucoma, cataract, optic neuropathy and ocular palsies



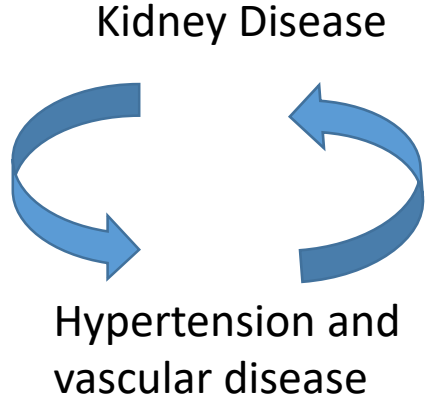
Patient considerations:

- Screening should form part of annual review and requires coordination between primary care, diabetologists and opthalmologists

Nephropathy



- Kidney disease caused by microvascular damage to the structures within the kidney which filter the blood
- May already be present at diagnosis of T2D and is a common complication of T1D
- In early stages will experience no symptoms therefore screening is vital
- People are living longer with diabetes, therefore more are reaching end stage failure



Patient considerations:

- Progression of renal disease is slowed through good control of BP, blood glucose and lipids
- Patients should have renal function measured as part of their annual review
- Patients with early signs of nephropathy should be given medications to reduce their blood pressure

Sexual Dysfunction

- Sex is exercise so may result in hypo's – associated with 'hypo fear'
- Damage to microvascular circulation can result in reduced blood supply, loss of sensation impacting on physical and emotional arousal
- High blood glucose can increase risk of UTI and thrush in males and females
- Females:
  - Increased vaginal dryness
- Males:
  - Males with diabetes are 3 x more likely to suffer from erectile dysfunction and at a younger age
  - Caused by neuropathy, vascular disease, alcohol intake and medications
  - Underlying psychological basis – anxiety that this loss of function is due to diabetes can exacerbate symptoms

Patient considerations:

- Advise to check blood glucose before sex and have hypo treatment nearby
- The underlying causes of sexual dysfunction should be explained
- Assessment of sexual function should form part of annual review
- Onward referral / medications as appropriate

Depression

- People with diabetes are 2 x likely to suffer from depression and are more likely to be depressed for longer and more frequently
- 40% struggle with their well being, often because of the demands of diabetes
- The NHS spends an extra 50% treating the physical health of someone with T2D and poor mental health than T2D alone
- Patient considerations:
  - People with diabetes should be regularly assessed regarding their emotional well-being
  - You should be aware of where to seek guidance in your area for additional support for people who may have, or be at risk of depression

Causes:

- Diagnosis
- Being different
- Responsibility
- Guilt (‘Language matters’)
- Anxiety
- Fear (hypo’s. complications, injections)
- Lifestyle changes
- Diabetes ‘burn out’ (depression caused by living with diabetes)
- Pre-existing mental illness (e.g.: depression and diabetes)
- Adherence to treatment / difficulties with self – management
- Sub-optimal glycaemic control
- Complications
- Reduced life expectancy
- Poorer QoL

Screening for Complications – Annual check: 15 Healthcare Essentials

- Blood glucose test (HbA1c test)
- Blood pressure check
- Cholesterol check
- Eye screening
- Foot and leg check
- Kidney tests
- Advice on diet
- Emotional and psychological support
- Diabetes education course (e.g.: DESMOND)
- Care from diabetes specialists
- Free flu jab
- Good care when in hospital
- Support with sexual problems
- Help to stop smoking
- Specialist care if planning to have a baby
- Diabetes UK 15 Healthcare Essentials

Your role….

- Accurate blood glucose measurement technique – following local policy / manufacturers guidance. Also refer to:

RCN First Steps Guidance

- Accurate patient assessment (as appropriate to training and level of competence e.g.: DPP or 15 Healthcare Essentials for Diabetes)
- Awareness – know what is required within your role, when to seek guidance and ensure your competence

Further Resources

- https://www.rcn.org.uk/get-involved/forums/diabetes-forum
- https://www.diabetesinhealthcare.co.uk/lnt/Login.aspx?ts=636933433162983178
  (Diabetes in Healthcare is accredited by the **Royal College of Nursing** and endorsed by the Royal Pharmaceutical Society, and is flexible to fit round a busy work schedule. It consists of an introduction and seven distinct modules and takes around 2.5 hours to complete – suitable for nurses, healthcare assistants, dietitians, doctors and pharmacists)
- https://www.diabetes.org.uk/diabetes-the-basics
- https://www.diabetes.org.uk/guide-to-diabetes/complications
- https://www.diabetesonthenet.com/