

Diabetes and Chronic Disease Update:

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November 2023



— B E L M A T T —
HEALTHCARE TRAINING

Objectives:

Impact of cardiovascular disease (CVD)

Revisit the pathophysiology of diabetes and metabolic syndrome

Identifying chronic disease and CVD risk factors

Assessment, monitoring and treatment of CVD

CVD and diabetes in the elderly

Chronic Disease:

- Chronic diseases are defined broadly as conditions that last 1 year or more ...
- Chronic diseases such as heart disease, cancer, and diabetes are the leading causes
- Other common chronic conditions are allergy, back pain and depression

Cardiovascular Disease Epidemiology:

CVD number 1
cause of death
globally

Second cause of
death in UK
1:4 deaths

Most common
contributing cause
is diabetes

1,500 premature
deaths each year

£140million NHS
spend each year

Over 5million in
UK living with
undiagnosed
hypertension

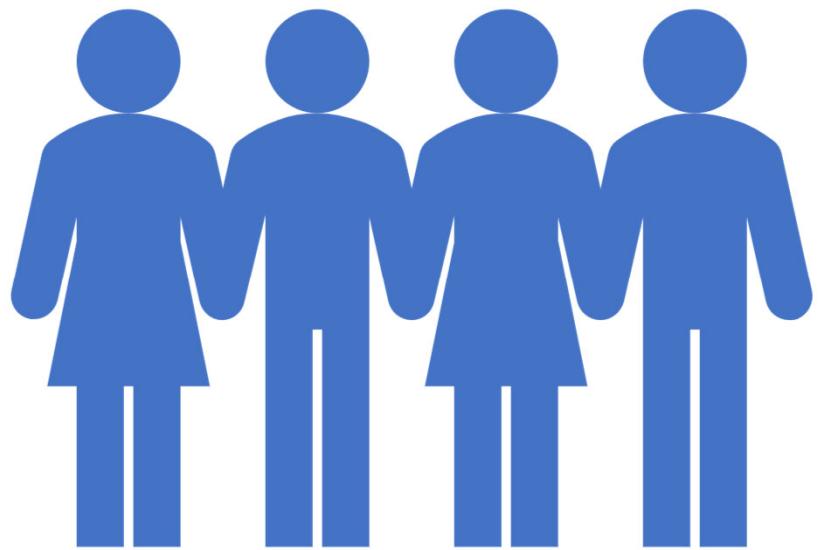
5million with
diabetes

850,000
undiagnosed
diabetes



Ageing Population

- 1:4 Residents have diabetes
- By 2050 8million people >85 in UK
- NHS Long Term Plan –Ageing Well Programme



Rockford Frailty Score

| Frailty Assessment using Rockwood Clinical Frailty Score | | |
|---------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | 1 | VERY FIT People who are robust, active, energetic and motivated. They tend to exercise regularly and are among the fittest for their age. |
|  | 2 | FIT People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active occasionally, e.g., seasonally. |
|  | 3 | MANAGING WELL People whose medical problems are well controlled, even if occasionally symptomatic, but often are not regularly active beyond routine walking. |
|  | 4 | LIVING WITH VERY MILD FRAILTY Previously "vulnerable;" this category marks early transition from complete independence. While not dependent on others for daily help, often symptoms limit activities. A common complaint is being "slowed up" and/or being tired during the day. |
|  | 5 | LIVING WITH MILD FRAILTY People who often have more evident slowing, and need help with high order instrumental activities of daily living (finances, transportation, heavy housework). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation, medications and begins to restrict light housework. |
|  | 6 | LIVING WITH MODERATE FRAILTY People who need help with all outside activities and with keeping house. Inside, they often have problems with stairs and need help with bathing and might need minimal assistance (cuing, standby) with dressing. |
|  | 7 | LIVING WITH SEVERE FRAILTY Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~6 months). |
|  | 8 | LIVING WITH VERY SEVERE FRAILTY Completely dependent for personal care and approaching end of life. Typically, they could not recover even from a minor illness. |
|  | 9 | TERMINALLY ILL Approaching the end of life. This category applies to people with a life expectancy <6 months, who are not otherwise living with severe frailty. (Many terminally ill people can still exercise until very close to death.) |

Clinical frailty scale. Adapted with permission from Moorhouse P, Rockwood K. Frailty and its quantitative clinical evaluation R Coll Physicians Edinb. 2012;42:333-340

Primary Prevention



NHS Long Term
Plan



CVD PREVENT-
National Audit



Public Health
England:
Cardiovascular
Prevention Packs



Quality Outcome
Frameworks



National
Diabetes Audit



Local Incentives-
Enhanced
Service
Payments

What Can We Do?



FIND/ASK

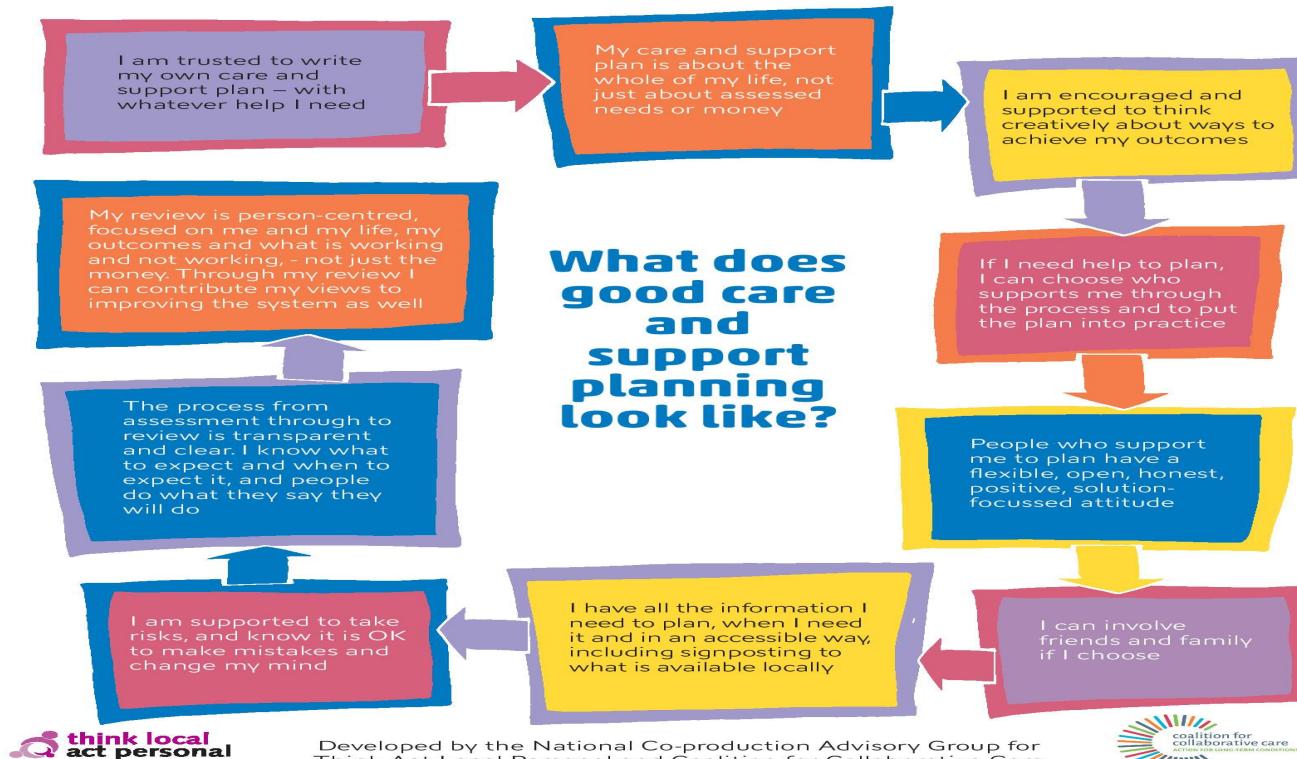


TREAT/ASSESS



MANAGE/ACTION

Patient Self-Management



**think local
act personal**

Developed by the National Co-production Advisory Group for Think Act Local Personal and Coalition for Collaborative Care

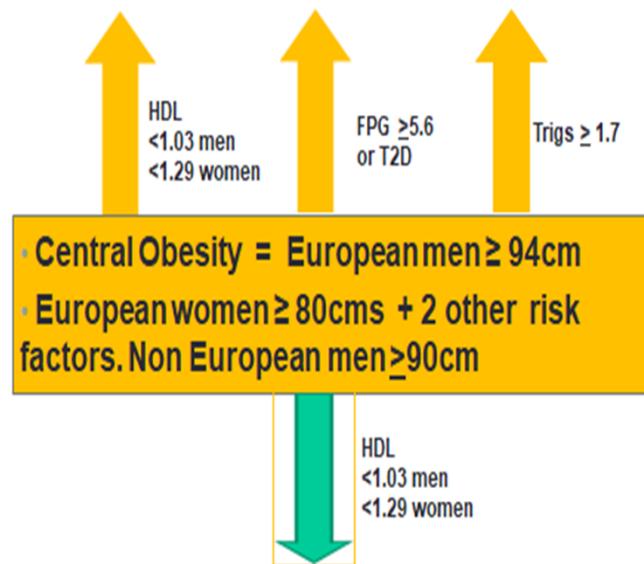
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Type 2 Diabetes: Metabolic Disease

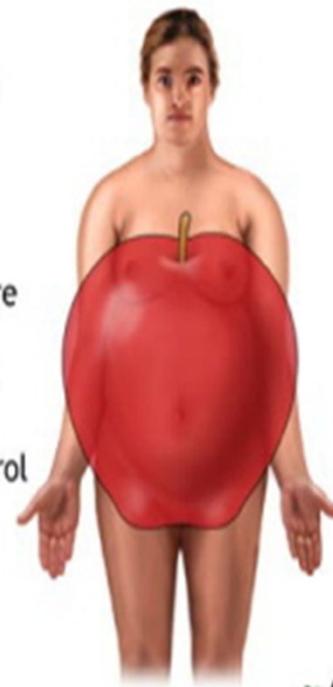
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Definition of Metabolic Disease



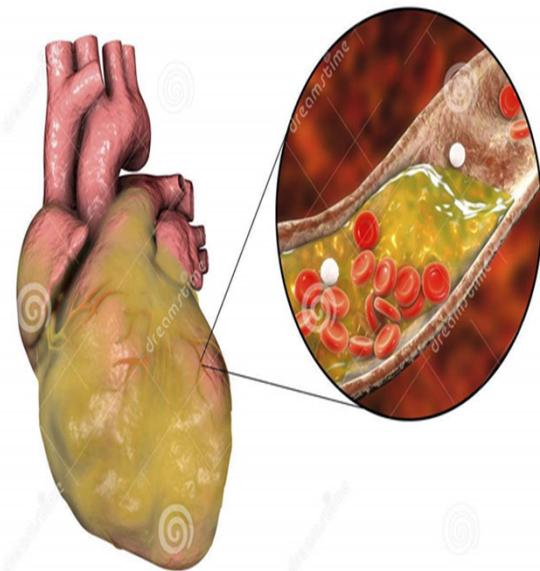
Metabolic syndrome (Syndrome X)

- Central obesity
- High blood pressure
- High triglycerides
- Low HDL-cholesterol
- Insulin resistance



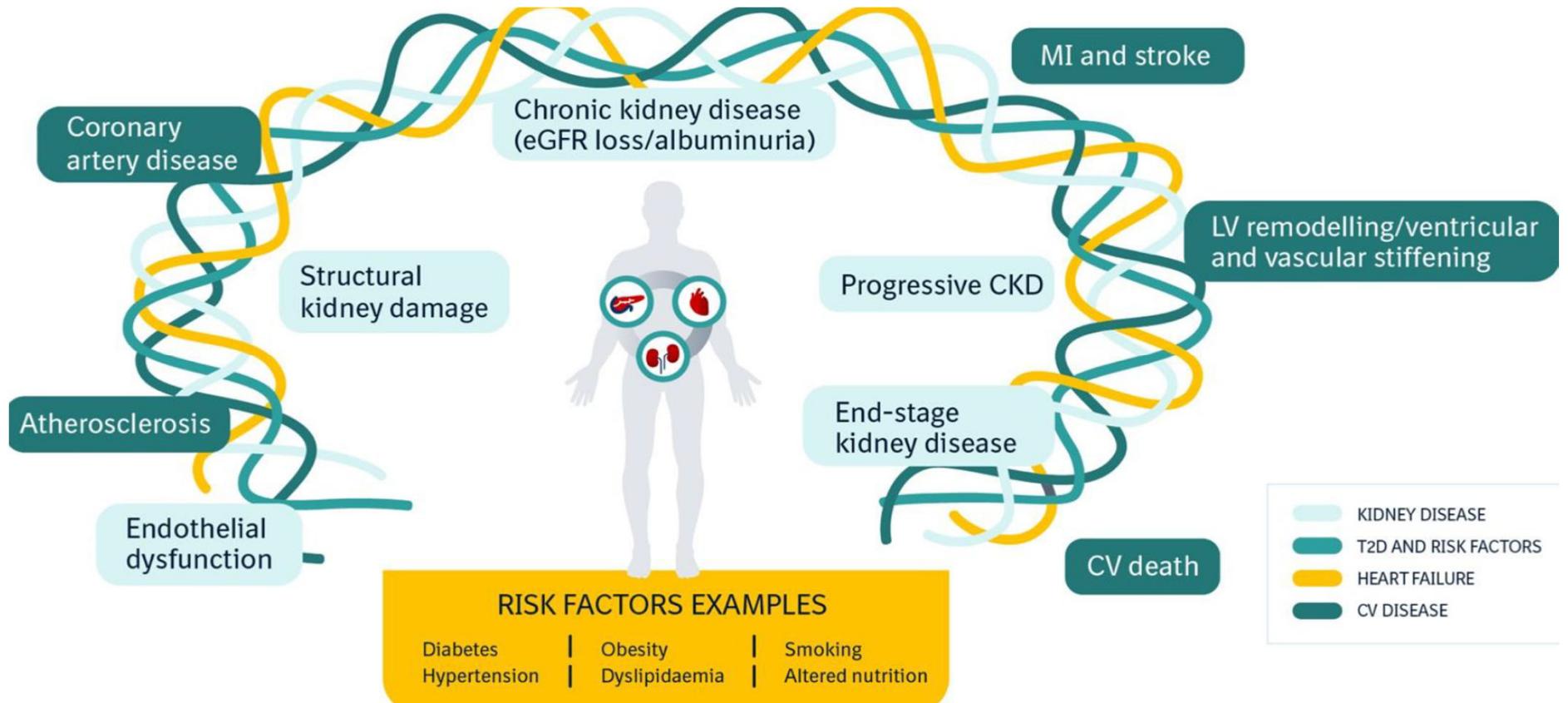
ADAM.

Inflammatory Response

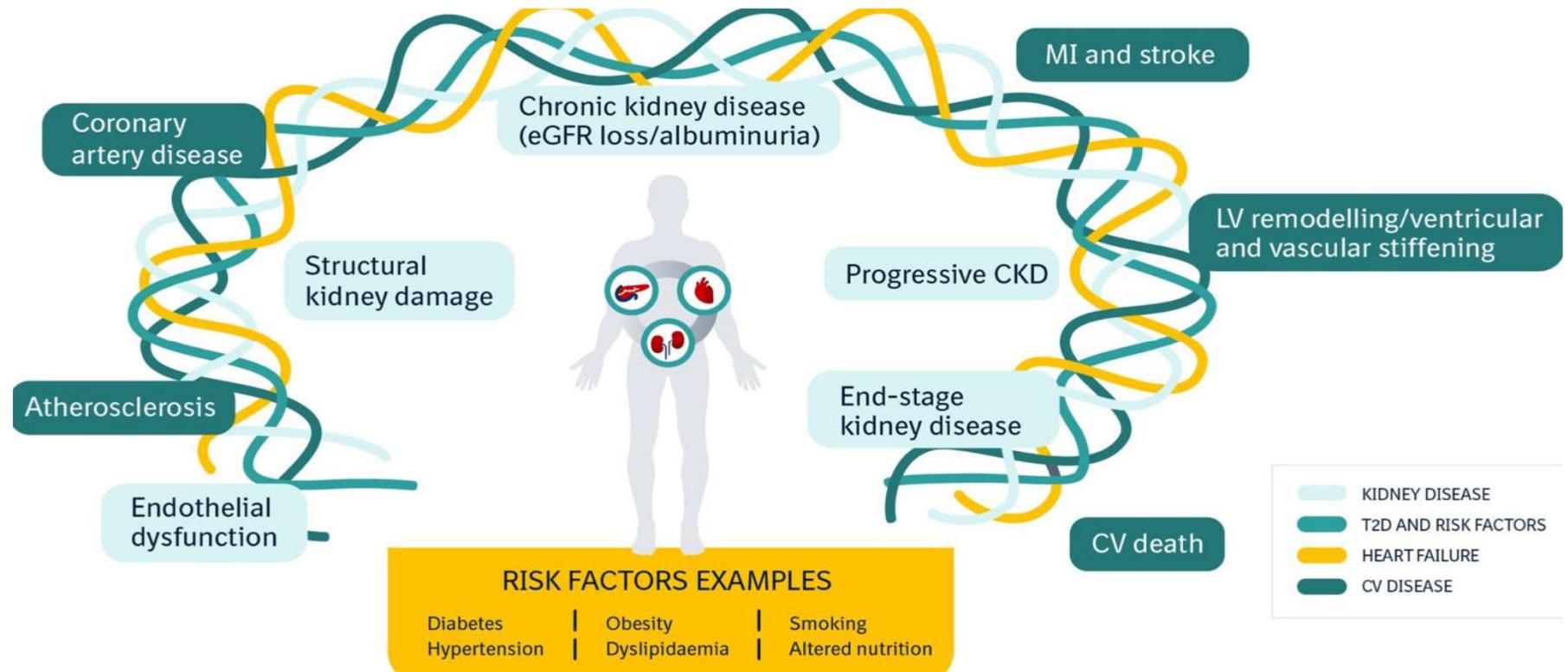


Hyperglycaemia

- Visceral Obesity
- Pro-Inflammatory cytokines
- Free fatty Acids
- Insulin Resistance

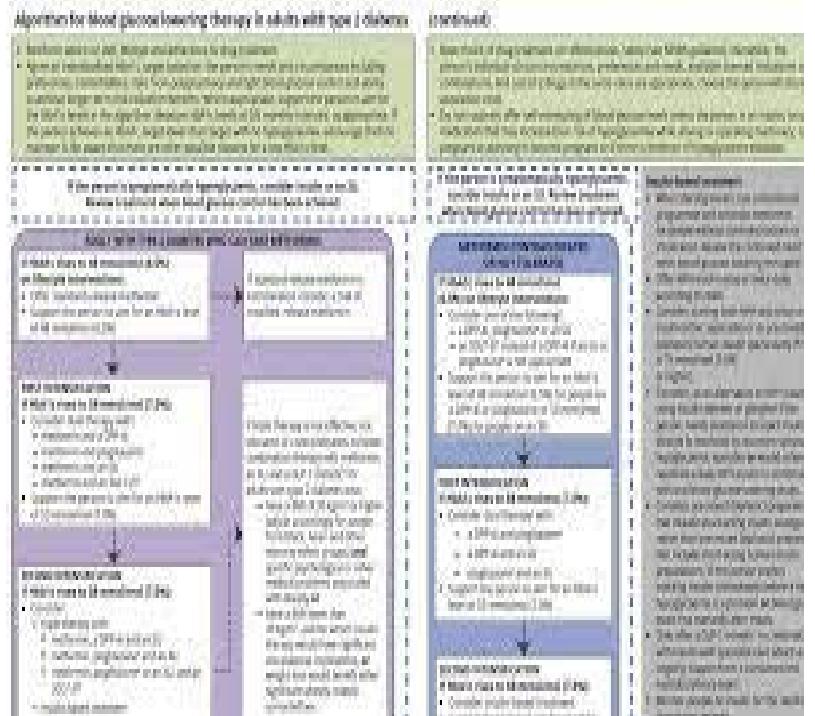
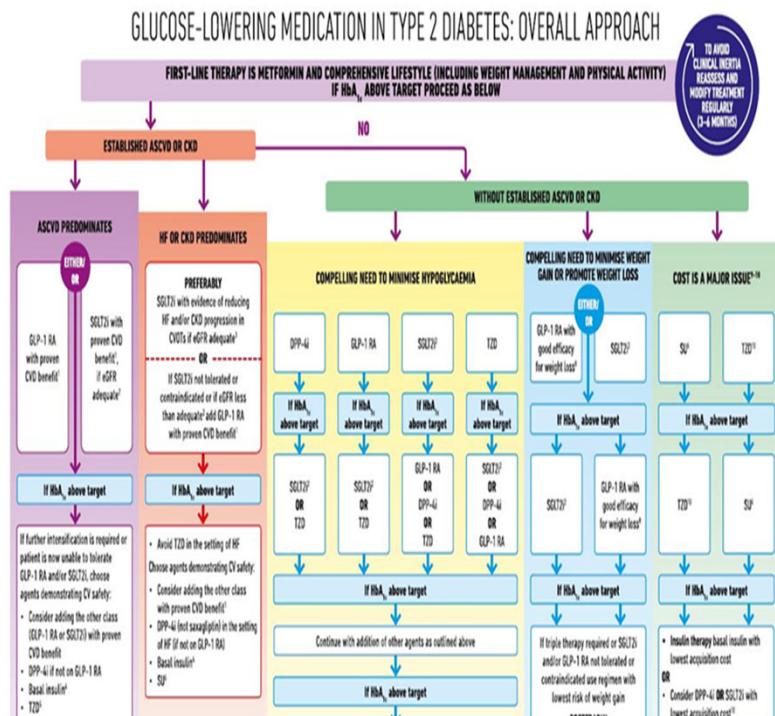


Aims of Treatment



Assessment, Treatment and Monitoring of Hyperglycaemia

Global, National and Local Guidelines



Assessing Glycaemic Control

Capillary Blood Glucose Monitoring

HbA1c

Continuous Glucose Monitoring
(CGM)

Symptoms

HbA1c Targets

| Parameter | Independent RS 1-3 | Partially Dependent RS 4-6 | Dependent /Frail RS 7-9 |
|----------------------------------|--------------------------|-------------------------------|----------------------------|
| HbA1c CGM Time In Range (TIR) | 53–58.5 mmol/mol) 70% | 58.5–63.9 mmol/mol) 70-50% | 63.9–69.4 mmol/mol) 50% |
| BP | 130/80 mmHg | 140/90 mmHg | 150/90 mmHg |
| Dyslipidaemia | Continue | Continue | Consider stopping |

- Aging Clinical and Experimental Research
- <https://doi.org/10.1007/s40520-023-02519-3>

Biguanide: metformin/glucophage

Mechanism of action

Metformin decreases hepatic glucose production, decreases intestinal absorption of glucose and improves insulin sensitivity by increasing peripheral glucose uptake.

Advantages

First-Line Therapy

- Very low hypoglycaemia risk
- Weight neutral
- Some cardiovascular protection¹
- Use in Type 1 diabetes for those >40years
- Covid-19 protection

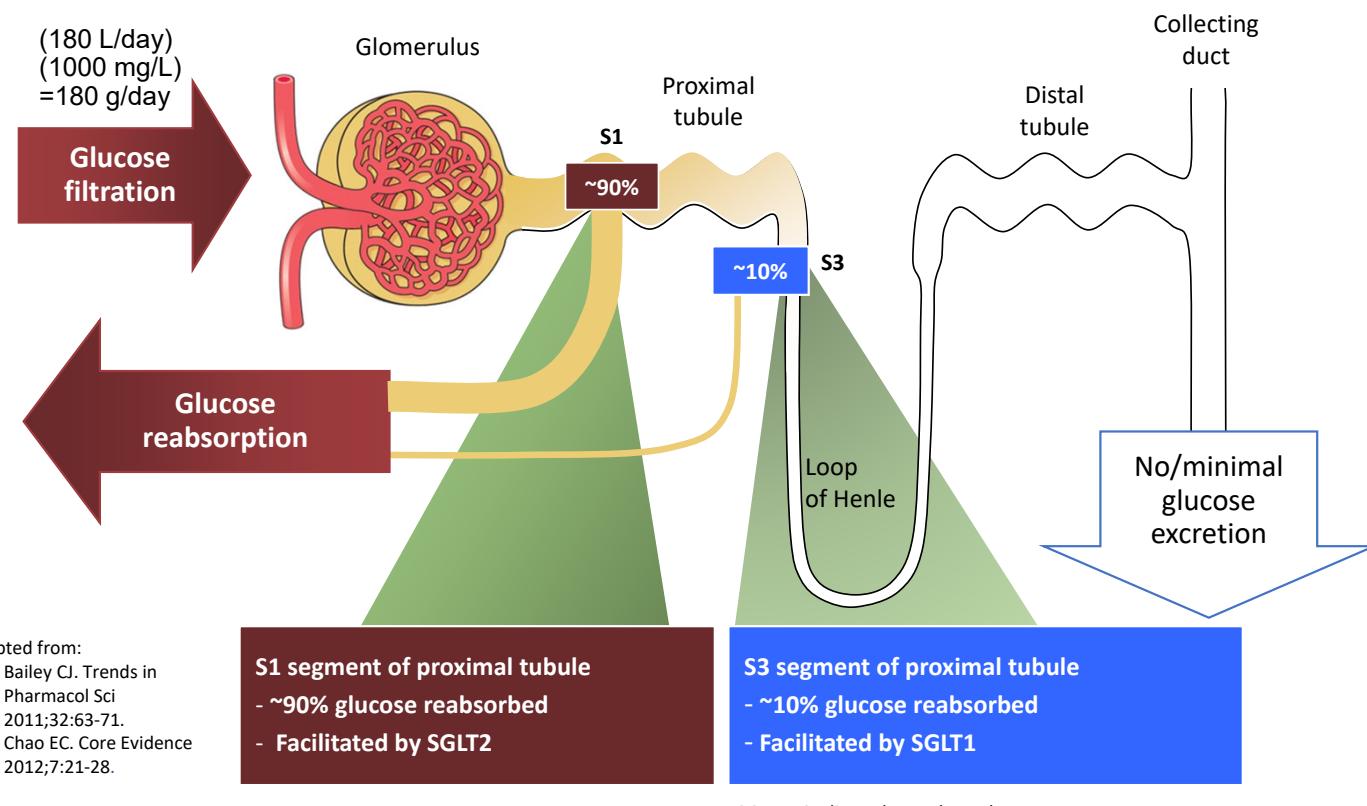
Disadvantages

- Gastrointestinal side-effects
- Effect on appetite/taste
- Caution in renal impairment
- Risk of lactic acidosis
- B12 deficiency with long-term use
- Acute kidney Injury drug

1.UKPDS Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). UK Prospective Diabetes Study (UKPDS) Group.

Lancet 1998; **352** (9131): 854–865.

Sodium glucose co-transporter 2 (SGLT2) inhibitors



Adapted from:
1. Bailey CJ. Trends in Pharmacol Sci 2011;32:63-71.
2. Chao EC. Core Evidence 2012;7:21-28.

Sodium glucose co-transporter 2 (SGLT2) inhibitors:

Mechanism of action

Prevent the kidneys from reabsorbing glucose back into the blood by inhibiting the proteins that reabsorb the glucose.

Advantages

- Good efficacy
- Weight loss
- Low hypoglycaemia risk
- CV benefit-EMPA-REG outcome
- Licence for use in Heart failure
- Renal protection

Disadvantages

- Euglycaemic ketoacidosis
- UTI's/ Thrush
- Dehydration/hypotension risk
- Caution in high risk foot-
- Fournier's gangrene (rare)
- eGFR- individual initiation and discontinuation licensees

Cardio-Renal Protection

Although best avoided in frail elderly who may have significant weight loss and poor nutrition

1. <https://www.guidelinesinpractice.co.uk/diabetes/type-2-diabetes-what-are-the-benefits-and-risks-of-glucose-lowering-agents/453996.article>

Clinical Considerations



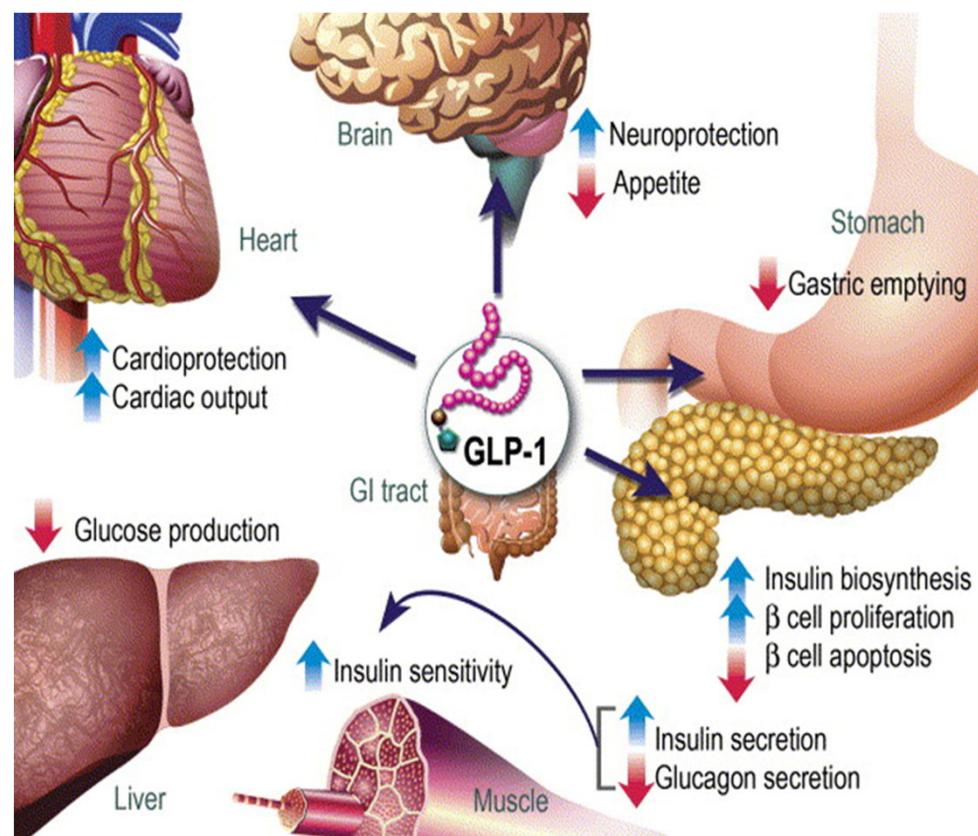
DKA risk. To discontinue if unwell, before surgery 3-4 days, fasting

May present with a normal blood-glucose level

Necrotising fasciitis of the perineum (Fournier's gangrene)

Adjust diuretics as necessary

GLP-1 Therapy



Glucagon-like peptide-1 receptor agonists (GLP-1) liraglutide semaglutide dulaglutide lixisenatide exenatide

Mechanism of action

Stimulates the release of the ‘incretin’ hormone and glucose-dependent insulin release from the pancreas. Inhibits glucagon secretion and slows gastric emptying.

Advantages

- Very good efficacy
- Weight loss
- Glucose-dependent -low hypoglycaemia risk
- CV benefit
- Can be used with insulin
- Can be used in eGFR >15ml/min
- Once weekly
- Available as oral therapy

Disadvantages

- Injection therapy
- GI side-effects
- Contra-indications- pancreatitis/thyroid
- Ozempic -caution with retinopathy
- Expensive
- On-going monitoring

Cardio-Renal Protection

Caution in elderly due to weight loss and poor nutrition

1. <https://www.guidelinesinpractice.co.uk/diabetes/type-2-diabetes-what-are-the-benefits-and-risks-of-glucose-lowering-agents/453996.article>

GLP-1/GIP tirepazide-Mounjaro

Mechanism of action

Long acting dual GIP and GLP-1 receptor agonist. Stimulates the release of the 'incretin' hormone and glucose-dependent insulin release from the pancreas. Inhibits glucagon secretion and slows gastric emptying.

Advantages

- Very good efficacy
- Weight loss
- Glucose-dependent -low hypoglycaemia risk
- Can be used with insulin
- No dose adjustment in renal impairment
- Once weekly

Disadvantages

- Injection therapy
- GI side-effects
- Contra-indications- pancreatitis/thyroid
- Caution with retinopathy
- Expensive

1. <https://www.guidelinesinpractice.co.uk/diabetes/type-2-diabetes-what-are-the-benefits-and-risks-of-glucose-lowering-agents/453996.article>

Sulphonylureas: gliclazide

Mechanism of action

Lowers blood glucose primarily by stimulating insulin secretion from the beta cells of the pancreatic islets¹.

Advantages

- Extensive clinical experience^{1,2}
- Good efficacy-quick glycaemic response and can be used as first-line if osmotic symptoms present

Disadvantages

- Increased risk of hypoglycaemia
- Greater increases in weight²
- Requires blood glucose monitoring
- Needs to be titrated according to blood glucose profile

1. Krentz AJ, Bailey C. Drugs 2005;65:385–411.

2. McIntosh B et al. Open Medicine 2011;5:E35–E48.

3. UKPDS. Lancet 1998; 352:837–853.

DPP-4 inhibitors:

sitagliptin vildagliptin linagliptin alogliptin

Mechanism of action

Prevents degradation of endogenously released incretin hormones to elevate plasma levels of the active incretins.

Advantages

- Increases insulin levels in response to hyperglycaemia
- Weight neutral
- Suppresses glucagon production from alpha cells and hepatic glucose
- Low hypoglycaemia risk
- Can be used in renal impairment with dose adjustment¹

Disadvantages

- Low efficacy- 5-5mmol/mol HbA1c
- Caution re pancreatitis
- No proven CV benefit²
- Must have beta cell function

1. Mosenzon O et al. Diabetes Care. 2017;40:69–76

2. <https://www.guidelinesinpractice.co.uk/diabetes/type-2-diabetes-what-are-the-benefits-and-risks-of-glucose-lowering-agents/453996.article6>

Thiazolidinedione: pioglitazone

Mechanism of action

Pioglitazone reduces insulin resistance in the liver and peripheral tissues, decreases gluconeogenesis in the liver, and reduces quantity of glucose and glycated haemoglobin in the bloodstream.

Advantages

- Reduction in HbA1c
- Low risk of hypoglycaemia
- Increases insulin sensitivity
- Some benefit on increasing HDL and decreasing TG1
- Can be used in renal impairment and
· ESRD3

Disadvantages

- Weight gain
- Oedema
- Increased risk of heart failure
- Increased risk of fractures
- Increased risk of bladder cancer

1. Krentz AJ, Bailey C. Drugs 2005;65:385–411.

2. McIntosh B et al. Open Medicine 2011;5:E35–E48

3. Scottish Intercollegiate Guidelines Network. *Pharmacological management of glycaemic control in people with type 2 diabetes*. SIGN 154. Edinburgh: SIGN, 2017.

Insulin Therapy

- Use as rescue therapy during illness
- Failure to control hyperglycaemia on oral therapy alone
- Use insulin with low hypoglycaemia risk
- Always consider de-prescribing if situation changes

Insulin Update: What's New?

- Higher strength insulins
- Ultra long-acting basal
- Biosimilars
- Extra fast rapid-acting
- Ultra Long acting
- Once-weekly

Continuous Blood Glucose Monitoring

2022 NICE Proposals:

All people with Type 1 diabetes

All children/young adults

Type 2

MDI insulin regime with either:-

Recurrent / severe / impaired hypo's

Advised to test >8 times per day

Once-daily insulin

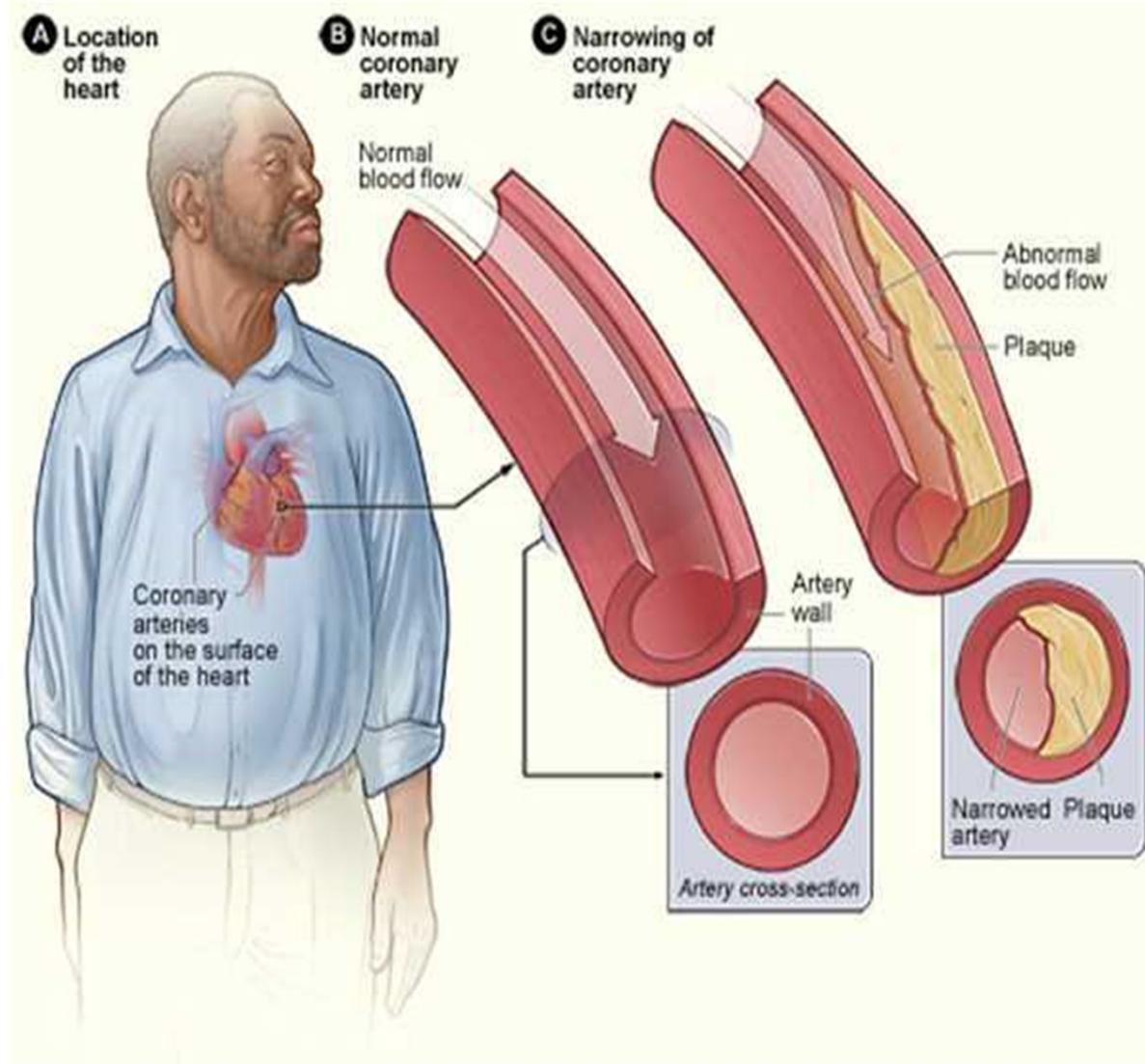
People requiring third party support for BG monitoring

Cardiovascular Disease (CVD)

- Coronary Artery Disease (MI/heart failure)
- Cerebrovascular Disease (Strokes TIA's)
- Peripheral Artery Disease (intermittent claudication of lower limbs)
- Aortic Atherosclerosis (thoracic and abdominal aneurysms)
- Others: endocarditis, rheumatic heart disease, conduction abnormalities

Atherosclerosis

- Dyslipidemia-plaque buildup in the wall of the arteries
- Inflammatory pathways
- Endothelial damage
- Calcification



Risk Factors for CVD

Non-Modifiable Risk Factors

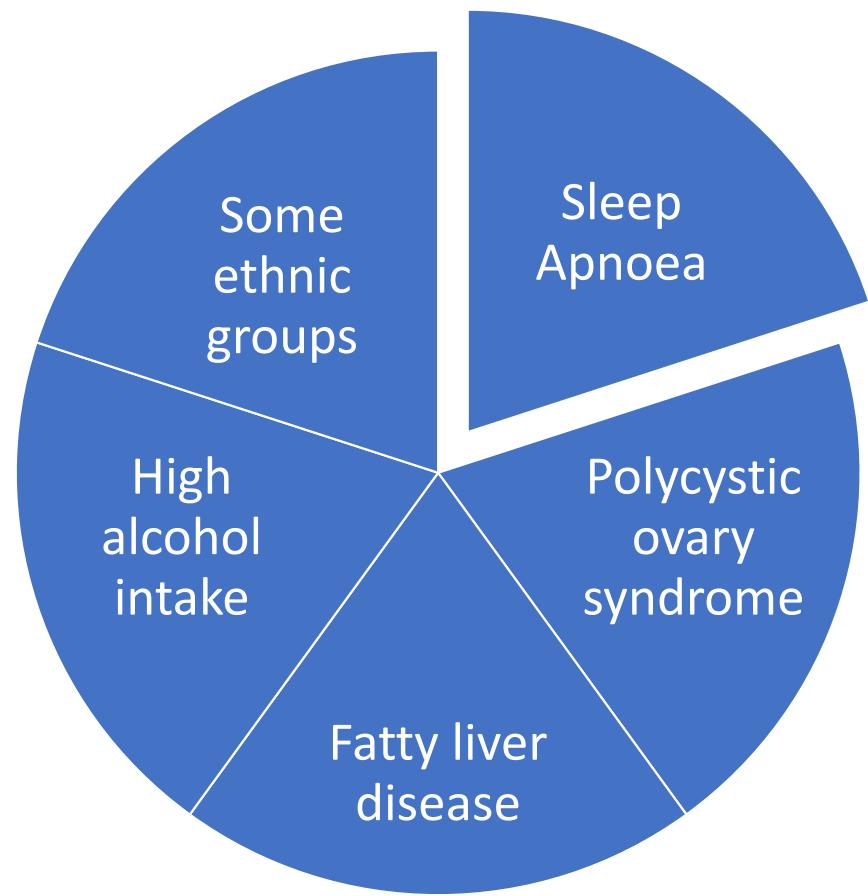
- Age
- Race
- Family history
- Chronic conditions (CKD, diabetes, lung disease, hypertension, dyslipidaemia)

Risk Factors for CVD

Modifiable Risk Factors

- Overweight or obesity
- Lack of exercise
- Smoking
- Salt intake
- Diet- fruit and vegetables
- Alcohol abuse
- Stress
- Psychosocial

Other Risk Factors



What Can We Do?:

Find

- Opportunistic surveillance- BP/pulse checks
- Routine screening-on admission
- Clinical history-signs and symptoms
- QRisk Score3- [QRISK3](#)
- Family history
- Identifying risk factors
- Investigations
- Care Plans

Risks of Hypertension

Aneurysms
Metabolic syndrome
Stroke
Cognitive difficulties/ dementia
Heart attack
Heart failure
Vascular eye problems
Chronic kidney disease

BP Targets

| Parameter | Independent RS 1-3 | Partially Dependent RS 4-6 | Dependent /Frail RS 7-9 |
|---------------|-----------------------|-------------------------------|----------------------------|
| HbA1c | 53–58.5 mmol/mol) | 58.5–63.9 mmol/mol) | 63.9–69.4 mmol/mol) |
| BP | 130/80 mmHg | 140/90 mmHg | 150/90 mmHg |
| Dyslipidaemia | Continue | Continue | Consider stopping |

- Aging Clinical and Experimental Research
- <https://doi.org/10.1007/s40520-023-02519-3>

Drug Therapy

| | African or Caribbean |
|-------------------------------------------|------------------------------------|
| ACE -ramipril | CCB eg amlodipine |
| ARB - losartan | |
| Thiazide-like diuretic | Thiazide-like diuretic -indapamide |
| Beta blocker-bisoprolol | |
| Aldosterone antagonist- spironolactone | SGLT2 |
| SGLT2 | |

Pulse Rate

The heart rate, or pulse rate, is the number of times your heart beats in one minute.

A normal heart rate is between 50 and 90 beats per minute, but it can vary..

Regularity

A pulse can either be regular or irregular.

If the pulse is regular then each beat happens consistently and in rhythm.

An irregular heart beat feels different. It may feel like a skipped beat, or you may feel that the rate swaps from fast to slow.

Atrial Fibrillation(AF)



- Up to 90% of AF events may be asymptomatic
- Accounts for 1:6 strokes
- Complications of AF include heart failure and thromboembolism
- If 100 people with AF are treated an average of 4 strokes are prevented

Heart Failure

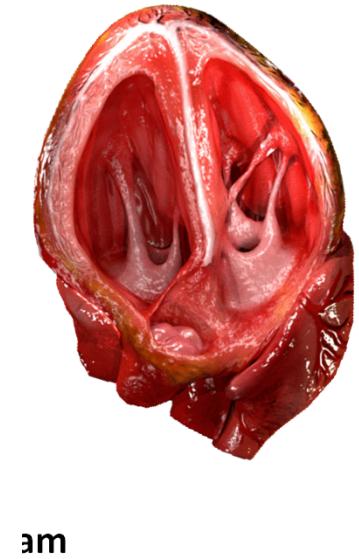
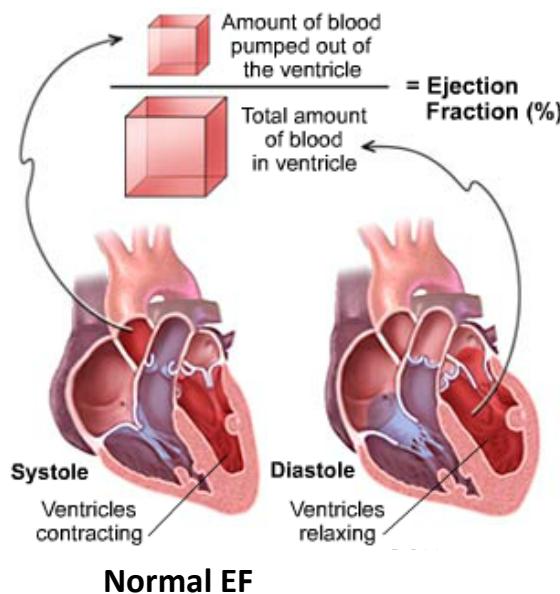
- More than 550,000 people in England have heart failure
- There were 94,185 hospitalisations in England for heart failure in 2019/20
- 50% of people are diagnosed on admission to hospital
- 2x Risk with Type 2 diabetes
- Around a quarter of people with heart failure die within the first year and over half within 5 years.

What is Heart Failure?

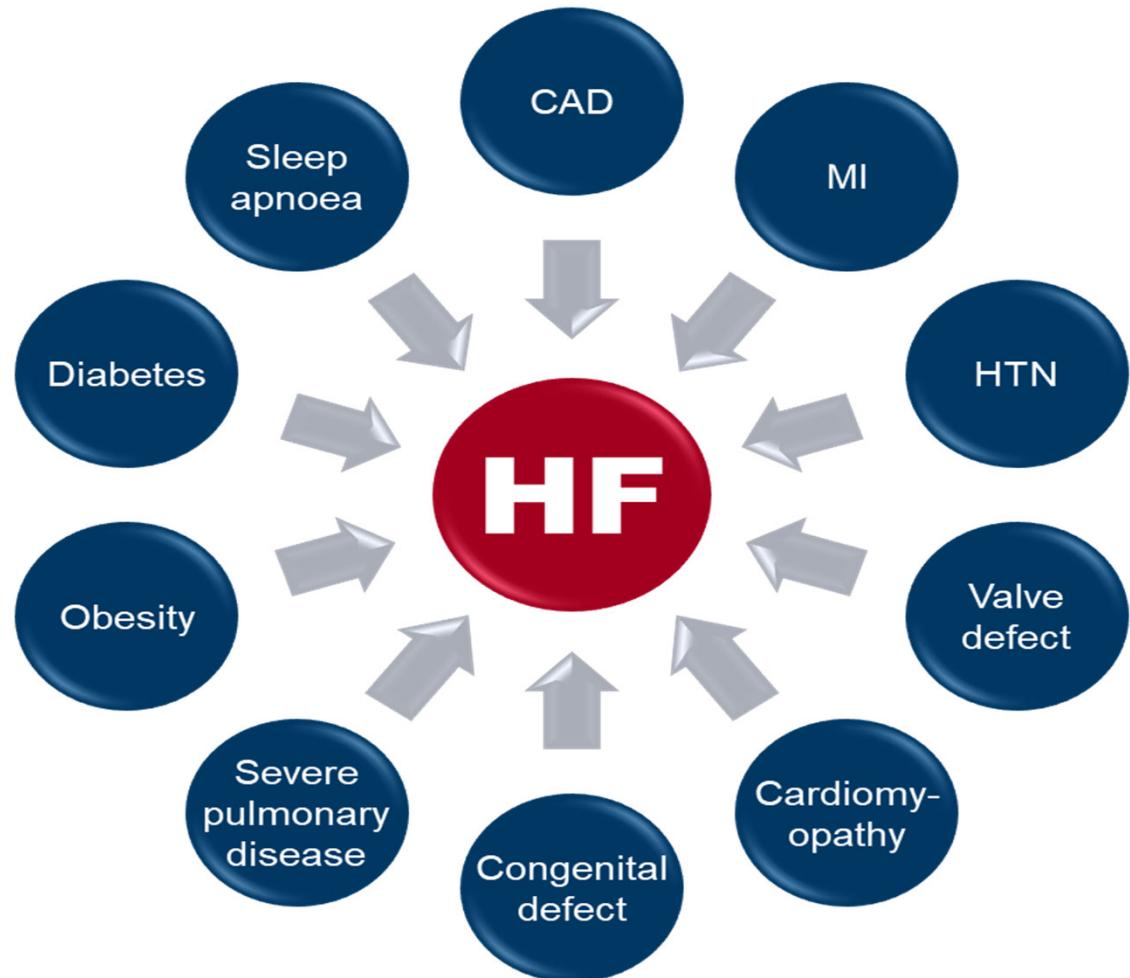
- Structural or functional abnormalities which impairs the pumping action of the left ventricle

Ejection fraction (EF) is a key criteria in heart failure management

- EF is the percentage of blood that is pumped out of the heart during each beat
- A normal EF is $\geq 50\%$
- Heart failure with an EF $\leq 40\%$ is known as **heart failure with reduced ejection fraction (HFrEF)**
- Heart failure in the setting of a normal EF is known as **heart failure with preserved ejection fraction (HFpEF)**



Causes of Heart Failure?



CAD, coronary artery disease; HF, heart failure; HTN, hypertension; MI, myocardial infarction.

American Heart Association. Causes of heart failure. <https://www.heart.org/en/health-topics/heart-failure/causes-and-risks-for-heart-failure/causes-of-heart-failure>. Update May 31, 2017. Accessed August 8, 2018.

Symptoms of Heart Failure

Oedema

Dyspnoea

Fatigue

Coughing or
wheezing

Sudden weight
gain

Orthopnea

Frequent
urination at
night

Light
headedness or
dizziness

Confusion

INVESTIGATIONS

Detailed clinical assessment

- NTproBNP
- FBC
- ELECTROLYTES
- ECG
- ECHOCARDIOGRAM
- CHEST XRAY
- Cardiac MRI

Dyslipidaemia

Abnormal amounts of lipids in the blood

- **LDL cholesterol** causes plaques to form in the blood vessels
- **HDL cholesterol** can help to remove LDL from the blood.
- **Triglycerides** stored in fat cells.

Lipid Management

- Full lipid profile= total cholesterol, non-HDL cholesterol
HDL- high density lipoprotein and triglyceride
- Establish risk using QRisk3 score- treat if >10%
- Atorvastatin 20mg for primary prevention
80mg for secondary prevention
- Aim for > 40% reduction in non-HDL cholesterol

Statin Treatment in the Elderly

- Treatment should be started before 75-80 years if life expectancy over 5 years
- Seek specialist advice > 84 years
- No need to discontinue due to age alone
- Review with increased frailty, side-effects and multi concomitant drugs
- Always discontinue with palliative treatment

[Role of Statin Therapy in Primary Prevention of Cardiovascular Disease in Elderly Patients - PubMed \(nih.gov\)](#)

Lipid Targets

| Parameter | Independent RS 1-3 | Partially Dependent RS 4-6 | Dependent /Frail RS 7-9 |
|---------------|-----------------------|-------------------------------|----------------------------|
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| BP | 130/80 mmHg | 140/90 mmHg | 150/90 mmHg |
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- Aging Clinical and Experimental Research
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Diabetes and Renal Disease

Indicator of cardiovascular risk

Importance of screening and identification

Role of SGLT2 therapies in treatment and protection-
‘oral protection drugs’-

De-prescribing

Remember prescribing guidelines/licences

Keep patient safe- AKI / Hypoglycaemia/Dehydration

UKKA guideline: SGLT2i in adults with kidney disease
(ukkidney.org)

Treatment Pathway for Elderly/Frail

Always
individualise
targets

Tight control not
usually beneficial

Choose glucose-
lowering therapies
with low
hypoglycaemia risk

Frequent
medication
reviews

Annual Review for
assessment of
control and
complications

Targets for the Frail Elderly

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Gladys

- 88 years
- Advanced dementia
- Diabetes for 20 years
- HbA1c 43mmols/mol

- Metformin 2 gram daily
- Gliclazide 80mgs BD
- Ramipril 5mgs
- Atorvastatin 20mgs



Frank

- Diabetes 15 years
- Amputee
- Unable to cope at home
- HbA1c 76mmols/mol

- Metformin 2 grams daily
- Basal Insulin once daily
- Atorvastatin 20mgs
- Ramipril 10mgs

What targets
would be
acceptable for
Gladys and Frank?

HbA1c

BP

Targets for Gladys

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Targets for Frank

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Key Learning Points

- CVD is largely preventable
- Early identification and management saves lives
- Opportunistic screening
- Ask Assess Action
- Care Plan