Diabetes for finals

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What we will try to cover

- Diagnosing diabetes
  - Clinical features / Classification
- Complications
  - Acute / Chronic
- Treatment
  - Focus on insulin therapy
- Typical Questions

Questions

- How do you diagnose diabetes?
- What abnormalities of glucose tolerance exist?

Diagnosis of diabetes

	FPG	2 hr PG	RPG	HbA1c
Diabetes	≥7.0	≥11.1	≥11.1	48 (6.5%)
IGT	<7.0	7.8 – 11.0	-	42-47 (6.0-6.4%)
IFG	6.1-6.9	<7.8		

Questions

- What are the differences between type 1 and type 2 diabetes?
- What are secondary causes of diabetes?

Type 1 and Type 2 diabetes

Type 1 DM	*Type 2 DM*
Ketosis prone	Non-ketosis prone
Requirement for insulin	Insulin resistant ± deficient
Acute onset	Insidious onset
Non-obese	Often Obesity associated
Juvenile onset (<35)	Usually > 40 years
HLA DR3 & DR4	No HLA relation
FH +ve in 10%	FH +ve in 30%
50% conc. in MZ twins	100% conc. in MZ twins

Secondary diabetes

- Pancreatic disease:
  - Chronic pancreatitis
  - Cystic fibrosis
- Gestational diabetes
- Endocrine disease:
  - Cushings
  - Acromegaly
  - Phaeochromocytoma
  - Hyperpara
- Drug induced:
  - Steroids
  - Thiazides
  - Beta blockers
  - Atypical anti-psychotics
  - Immunosuppresants (tacro)
  - Statins
- Genetic syndromes:
  - Freidrichs Ataxia
  - Dystrophia Myotonica

Questions

- What is the differential diagnosis of polyuria and polydipsia?
- What are the dermatological manifestations of diabetes?

Clinical presentation of diabetes

- Acute Decompensation
- Symptoms:
  - Polyuria
  - Polydipsia
  - Thirst
  - Weight Loss
  - Tiredness
  - Skin problems
    - Abscesses
    - Thrush
    - Granuloma annulare
    - Necrobiosis lipoidica diabeticorum
    - Acanthosis nigricans
- Differential Diagnosis (DI, Hypercal, Renal F)
- Routine testing (Screening high risk)

Questions

- What are the precipitating causes of DKA?
- What are the clinical signs of DKA?
- What are the diagnostic criteria?
- What is the difference in management between DKA and HHS?

Case – a diabetic emergency

- 38 y/o Nigerian security guard
- Unwell for 4 weeks – tired, polyuria, taken to bed
- Found poorly rousable by friend
- On admission to A&E
  - GCS 8, Severe dehydration, P120 reg, BP 75/36 mmHg
  - Temp 35.4, Venous gas BG 68 mmol/L
  - ABG – pH 7.27, Lact 3.2, bicarbonate 17 (18-28) mmol/L, pO_2 12.3, pCO_2 3.4
  - Urine glycosuria (4+) and ketonuria (+)
  - Sodium 154mmol/L
  - Potassium 5.4 mmol/L
  - Urea 36 mmol/L
  - Creatinine 290 (60-96) umol/L
- What would you do?

Case – a diabetic emergency

- Given 12 u actrapid iv, 6 u / hour ivi insulin
- N/Saline infusion
- Sent to ITU – diabetes team contacted 8 hours later
  - Required ventilation (? Aspiration)
  - Poorly rousable off sedation
  - EEG – reduced cortical activity
  - MRI – cerebral oedema and pontine lesions
- What went wrong?

Case – a diabetic emergency

- This was not DKA
- Likely diagnosis was HHS (admission osmolality 408)
- Acidosis – renal failure
- Ketones – starvation

Hyperosmolar Hyperglycaemic Syndrome

- Usually elderly onset DM (usually Type 2 diabetes)
- Longer subacute history
- Hyperglycaemia often severe (>30 mmol/L)
- Osmolality >320 mosm/kg (275-295)
  - Use the formula to estimate serum osmo:
    - [2xSodium]+Urea+Glucose
  - Often hypernatraemic
- May or may not have ketonuria – remember mild ketosis occurs in people who have not eaten for a long time
- Usually no (keto) acidosis, but may have lactic acidosis
- Severe dehydration
- 66% previously undiagnosed DM

Hyperosmolar Hyperglycaemic Syndrome

- Diagnosis based on characteristic features of:
  - Hypovolaemia
  - Marked Hyperglycaemia (usually >30 mmol/l)
  - Usually little or no ketonaemia / ketonuria
  - Hyperosmolality (>320 mosm/kg)
- Patients may present with a mixed picture of DKA / HHS
- Remember lactic acidosis can occur in patients on metformin with significant renal failure
- Very important to try and differentiate from DKA
  - **Initial dose of insulin in HHS is very much less**

HHS - treatment

- Normalise osmolality gradually and safely by:
  - Replacing fluid and electrolyte losses
  - Normalising blood glucose
  - Treat underlying cause
  - Prevent arterial or venous thrombosis
  - Prevent foot complications
- Rapid shifts in glucose must be avoided due to risk of rapid water and sodium shifts, and risk of central pontine myelinolysis

HHS – principles of management

- Estimate serum osmo frequently to monitor progress (using formula)
- Use 0.9% saline (+/- potassium) to treat dehydration – aim to achieve +ve fluid balance of 3-6 litres in first 12 hours, and replace 100% of fluid losses by 24 hours (care if elderly or has heart failure)
- **NO INSULIN INITIALLY** – treating dehydration will bring down glucose
- Monitor blood glucose, serum osmolality and Na^+ every 1-2 hours
- Consider 0.45% saline ("half normal saline") if osmolality not falling despite adequate fluid hydration
- Commence ivi insulin (initially 1u / hour up to 0.05u/kg/hr) only if:
  - Significant ketonaemia
  - Glucose not falling despite adequate fluids
- Prophylactic LMW heparin due to high risk of thrombosis
- Treat underlying cause (eg sepsis)
- Monitor for foot ulceration / pressure sores

New DKA guidelines

- Venous blood gases show acidosis (pH <7.35, bicarb <15)
- JBDS guidelines suggest use of plasma ketones with bed side testing kits
- Continue long acting insulin on admission
- Fixed rate IV insulin infusion (FRIVII) – 0.1u / kg / hr

Assessing severity

- Blood ketones > 6 mmol/L
- Bicarb < 5 mmol/L
- pH < 7.1
- K+ < 3.5 mmol/L
- GCS <12
- O2 sats < 92%
- SBP < 90 mmHg
- Pulse >100 or < 60 bpm

Management tips

- Generous potassium replenishment and close monitoring – often more than we think 20, 40, 60mmol/L?
- Frequent *clinical monitoring* more evident benefit than frequent tests
- Prolonged iv insulin (and iv glucose) helps clear ketones more rapidly
- Persistent acidosis may require higher doses of insulin (+ 10% glucose)
- Avoid
  - Colloid
  - Bicarbonate (unless extremely severe acidosis)
  - Phosphate and magnesium replacement

Case 2 – another diabetic emergency

- 34 year old Type 1 diabetic female is admitted with recurrent hypoglycaemic episodes, some of which have required paramedic assistance. On this admission, she suffered a seizure at a bus stop.
- On post take ward round found confused, agitated and is noted to be sweaty and tachycardic
- CBG is 1.7 mmol/L
- She is not co-operative with the nurses
- How would you treat her?

Case 2

A. Oral glucose 20-30g

B. Glucagon IM

C. 75 mls 20% glucose IV

D. Oral Glucogel®

E. 50 mls 50% glucose IV

Causes of hypoglycaemia

- "Four's the floor"
  - Symptoms usually start at around 3.6 mmol/L
- Imbalance of food and insulin or SU intake
- Other factors
  - Exercise
  - Alcohol
  - Vomiting
  - Breastfeeding

Treatment of Hypoglycaemia

Mild (conscious, lucid, able to self treat)

- Sugary drink, e.g. lucozade, ordinary coke, orange juice
- 5-7 glucose tablets, or 3-4 heaped teaspoons of sugar in water

Moderate (conscious, but can't self administer and needs help)

- Glucogel – 1-2 tubes buccally
- IM glucagon

Severe (unconscious)

- Do not put anything in the mouth
- In hospital, administer iv glucose
  - Ideally 75mls of 20% glucose or 150mls 10% glucose over 15 mins
  - 50mls 50% glucose can be given, but take care with veins – extravasation can cause severe chemical burns

Treatment of Hypoglycaemia

Post hypo once glucose above 4.0 mmol/L, must have some longer acting carbs:

- Two biscuits
- One slice of bread/toast
- 200-300ml glass of milk (not soya)
- Normal meal if due (must contain carbohydrate)

Case 2 continued

- 34 y/o female with T1D is admitted with recurrent hypoglycaemic episodes, some of which have required paramedic assistance. On this admission, she suffered a seizure at a bus stop.
  - HbA1c 45 mmol/mol (6.3%)
  - Rotating injection sites appropriately
  - Is undertaking carbohydrate counting – insulin/carb ratio 1:10
  - Has lowered insulin doses by 10%
- What is the next step in managing her hypoglycaemia unawareness?

Case 2 continued

A. Undertake further investigations

B. Lower insulin doses by further 10%

C. Commence on insulin pump therapy

D. Teach family how to administer glucagon

E. Re-education from diabetes nurse specialist

Case 2 continued

- Investigations:
  - Na 131, K 5.6, Ur 4.5, Creat 96
  - Calcium 2.76
  - TFT normal

Case 2 continued

- Random plasma cortisol 82 mmol/L
- Short Synacthen Test – 60 min cortisol 234 mmol/L
- Diagnosis – ADDISON'S DISEASE

- New onset hypos need investigation:
  - Thyroid disease
  - Hypoadrenalism
  - Liver disease
  - Deteriorating renal function
  - Adult Coeliac Disease

Questions

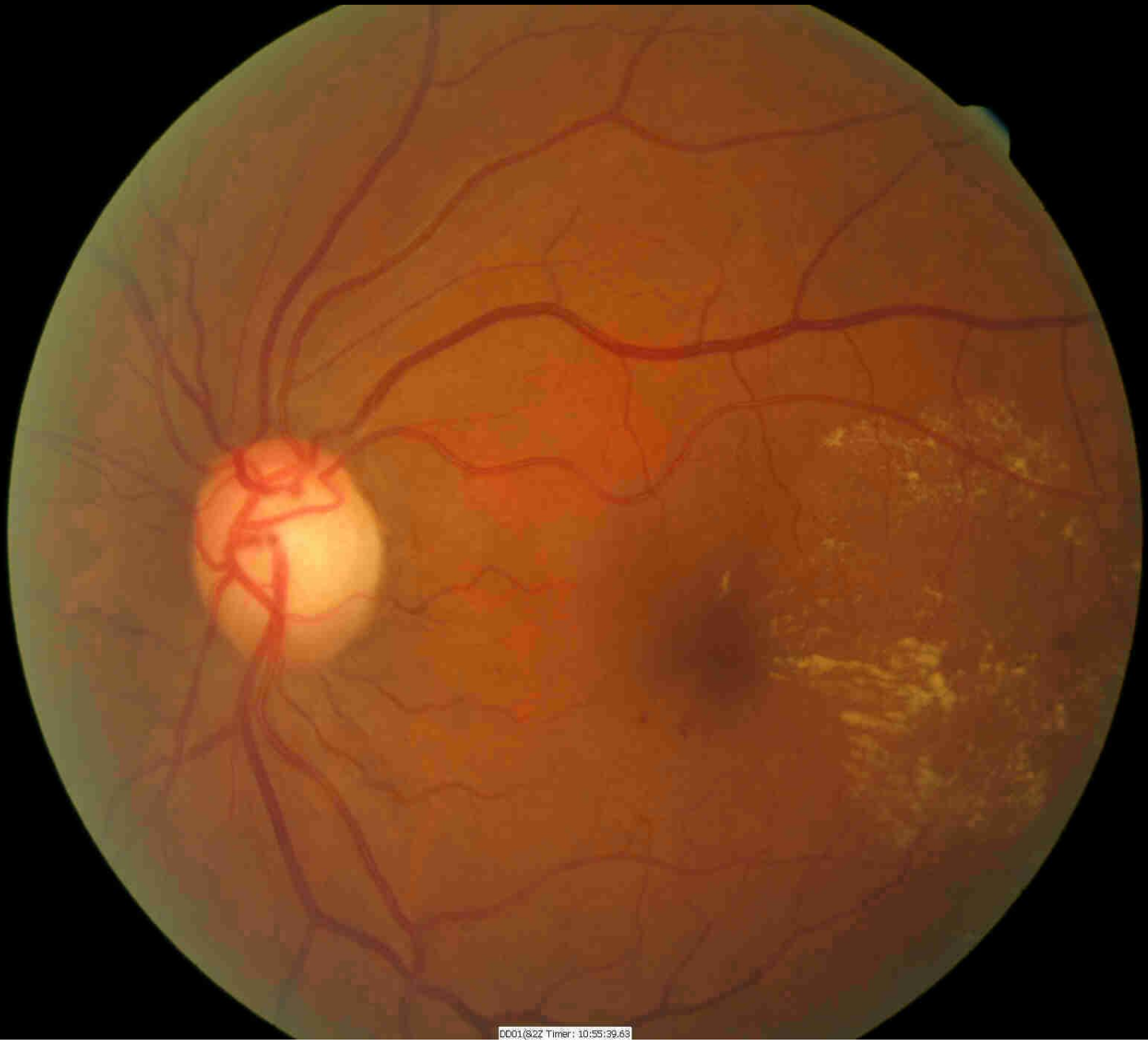
- What are the chronic complications of diabetes?
- How can they be prevented?

Chronic complications of diabetes

- Microvascular
  - Retinopathy
  - Nephropathy
  - Neuropathy
- Macrovascular
  - CHD
  - CVD
  - PVD

Diabetic retinopathy

- What sort of retinopathy is this?
- How could it be prevented?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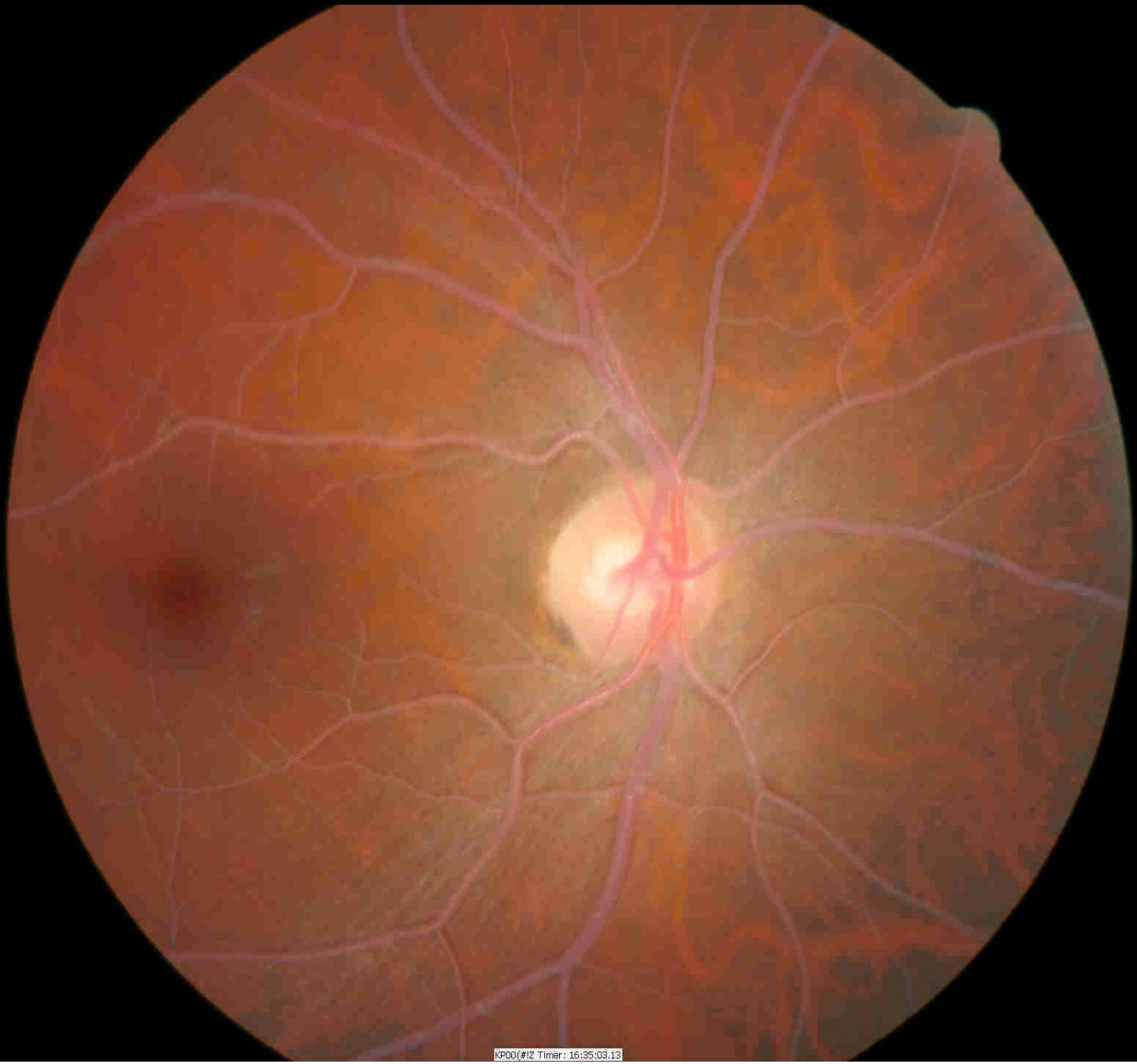
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Questions

- What are the symptoms and signs of diabetic peripheral neuropathy?
  - What is the screening test?
- What are the symptoms and signs of diabetic autonomic neuropathy?

Diabetic neuropathy

- Peripheral sensory neuropathy
  - Glove and stocking distribution
  - High risk of ulceration and amputation
  - Paraesthesia, numbness
  - Decreased reflexes / vibration / PP / Muscle wasting
- Autonomic neuropathy
  - Impotence / Atonic bladder
  - Gastroparesis / Diarrhoea
  - Gustatory sweating
  - Postural hypotension

Diabetic neuropathy

Commonest cause of non-traumatic amputation

Questions

- How should diabetic nephropathy be screened for?
- What is the treatment?

Diabetic nephropathy

- Triad:
  - Hypertension,
  - Proteinuria (microalbuminuria) – raised ACR
  - Declining renal function

- Treatment
  - ACEI or ARB at stage of *microalbuminuria*
  - Aim for BP <130/80 mmHg

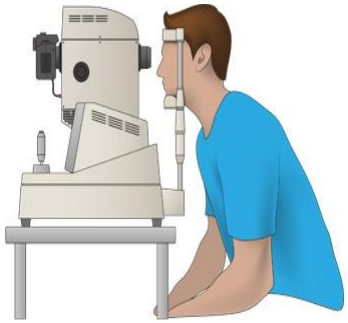
Questions

- How do we prevent CVD complications of diabetes?

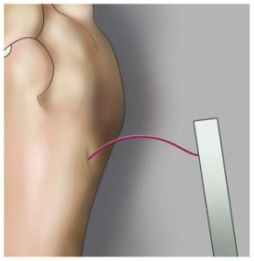
Preventing complications

- Smoking Cessation
  - 1 cig in a diabetic = 5 in a non-diabetic
- BP
  - Aim for 140/80 mmHg (130/80 mmHg if CVD or Renal d)
  - First line – ACEI, Calcium channel blockers (often >2)
- Cholesterol
  - All diabetic >40yrs, or diabetic <40years + 1 RF = statin
  - Aim for total cholesterol <4.0 mmol/L, LDL <2.0 mmol/L
- Screening
  - Eyes – digital retinal photo yearly
  - Feet – yearly check
  - Kidneys – yearly ACR and eGFR
- Glycaemic control
  - NICE suggest general target of 48 mmol/mol (6.5%), but individualised to patient

Screening



To prevent



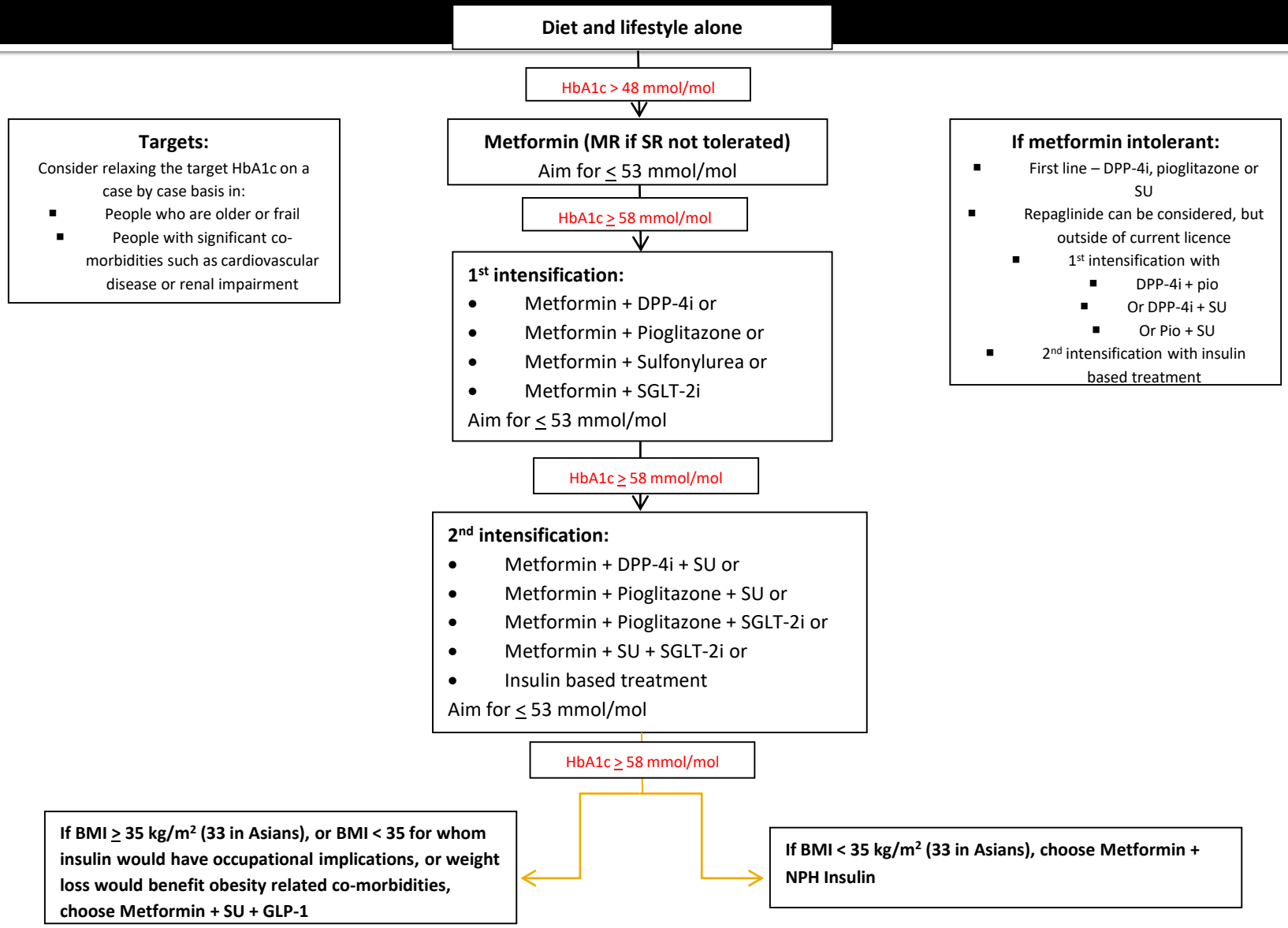
To prevent

To prevent

Treatment for hyperglycaemia

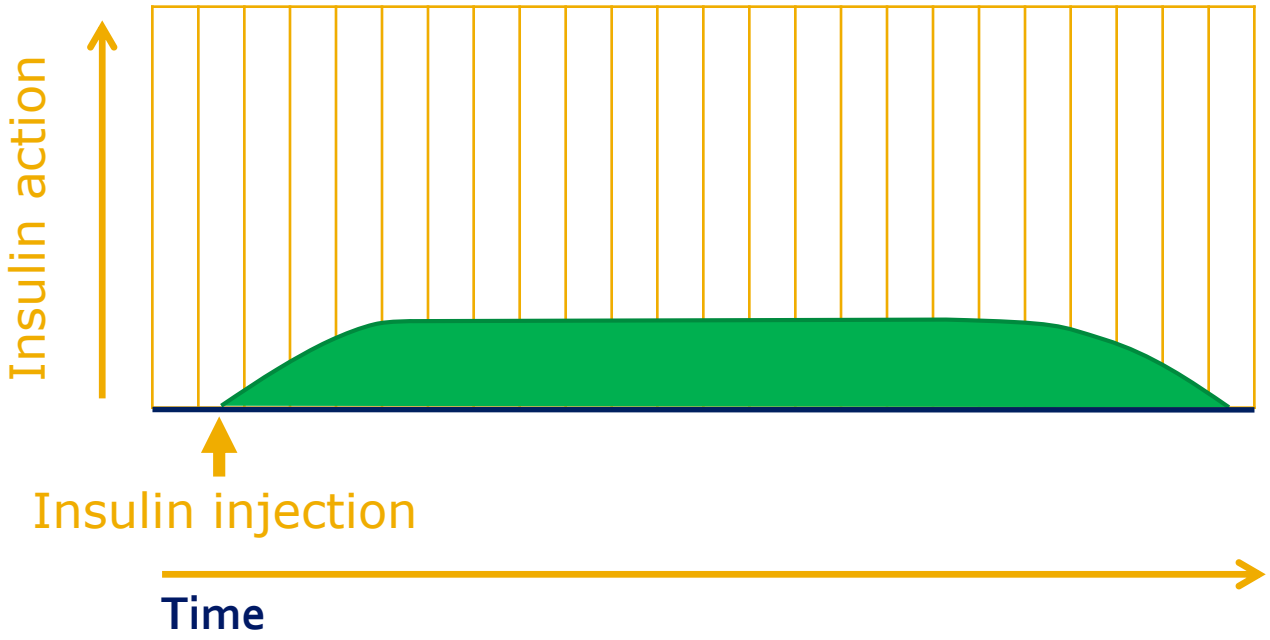
- Diet
  - Low in fat, refined CHO
  - High in fruit, vegetables, starchy CHO
- OHGAs
  - Metformin / Sulfonylureas / Meglitinides
  - Glitazones
  - Gliptin
  - Gliflozins
- GLP-1
  - Exenatide / Liraglutide
- Insulin
  - Od long acting (eg Insulatard) plus tabs
  - BD mixed (eg Humulin M3)
  - Basal bolus – qds

NICE 2015 glucose therapy pathway



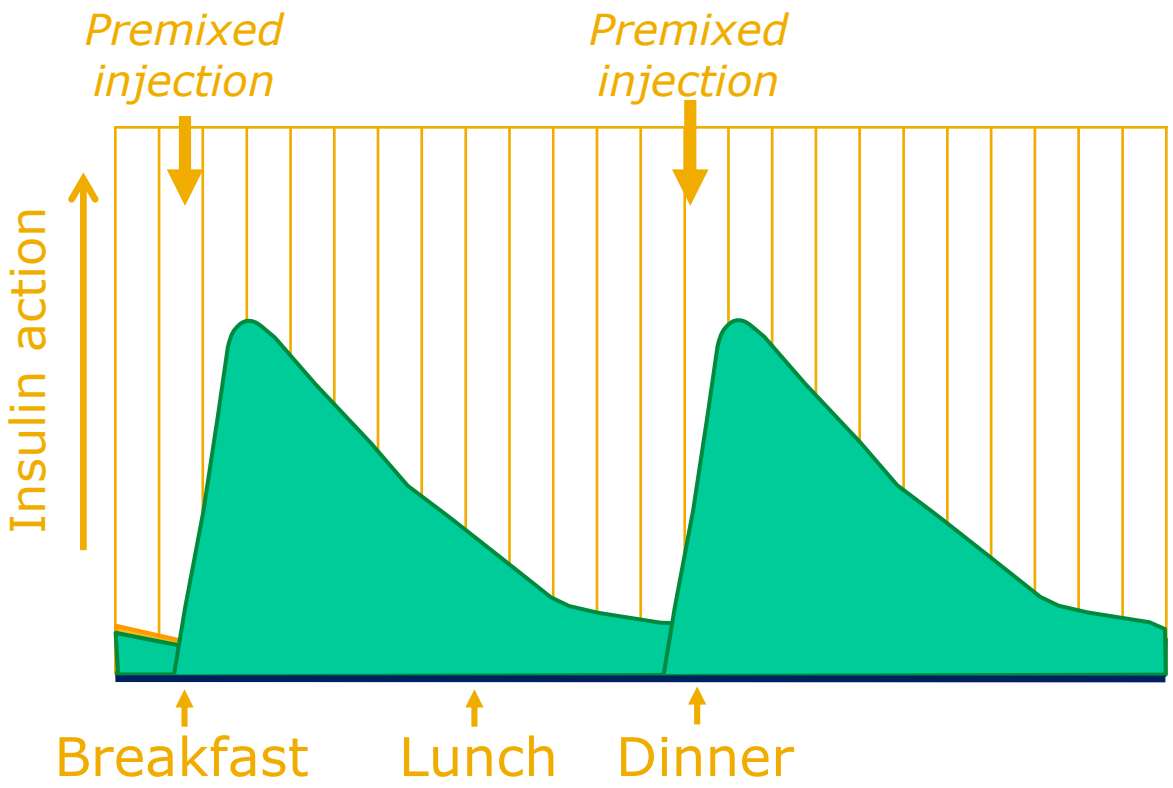
Once-daily basal insulin

- Once daily with tablets
- Usually given before bed



Schematic representation

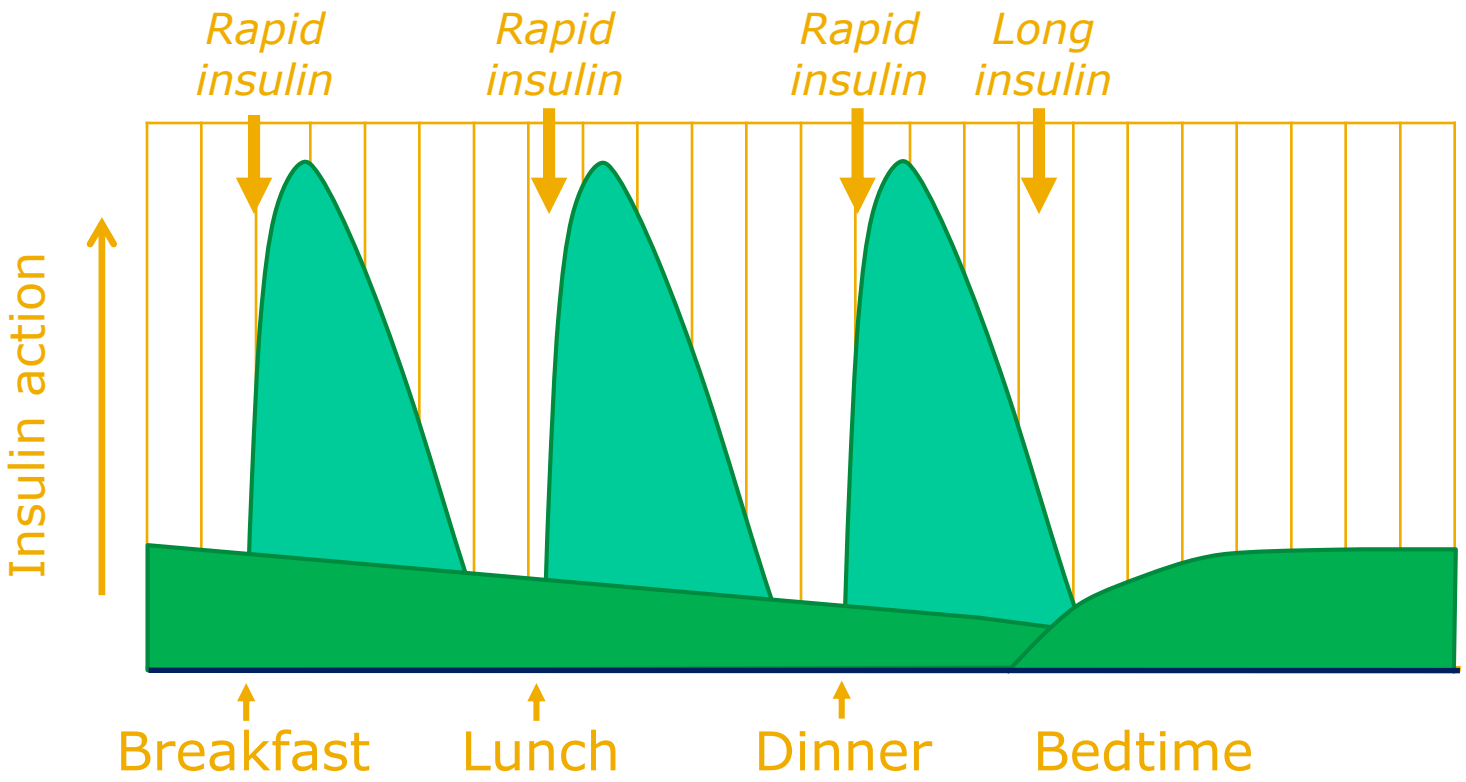
Premixed insulin – twice daily regime



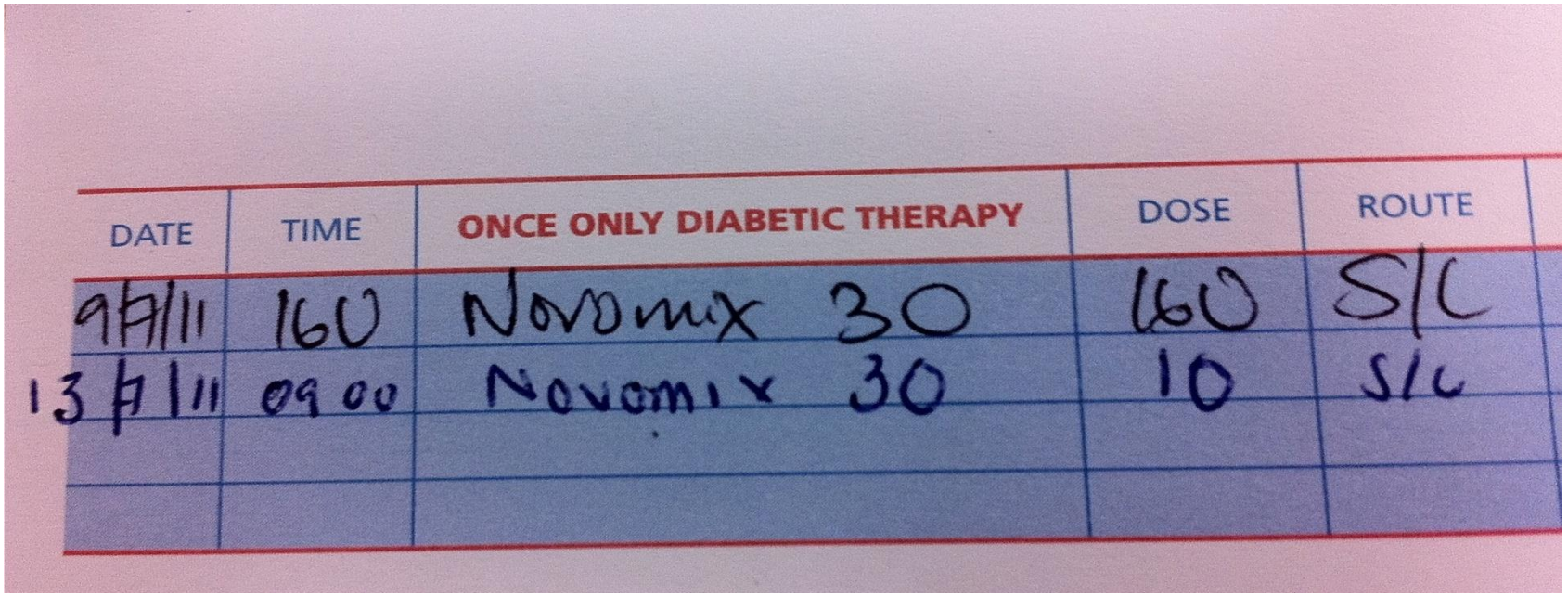
Contains:

- Basal component
- Short-acting component

Basal–bolus therapy



Writing up insulin – what is wrong with this prescription?



DATE	TIME	ONCE ONLY DIABETIC THERAPY	DOSE	ROUTE
9/1/11	16U	Novomix 30	16U	S/C
13/1/11	0900	Novomix 30	10	S/C

Writing up insulin

- Only write number
  - Eg Novomix 30 – 10 and 8
- Never write "U", "IU" or "UNITS"
- Ensure insulin given at correct times
  - Usually pre meal
- Ensure correct type of insulin written up
  - Care with novomix and novorapid
- Ensure blood glucose monitoring undertaken appopriately
  - Usually 2-4 times per day – fasting, pre meal and pre bed

Adjusting insulin

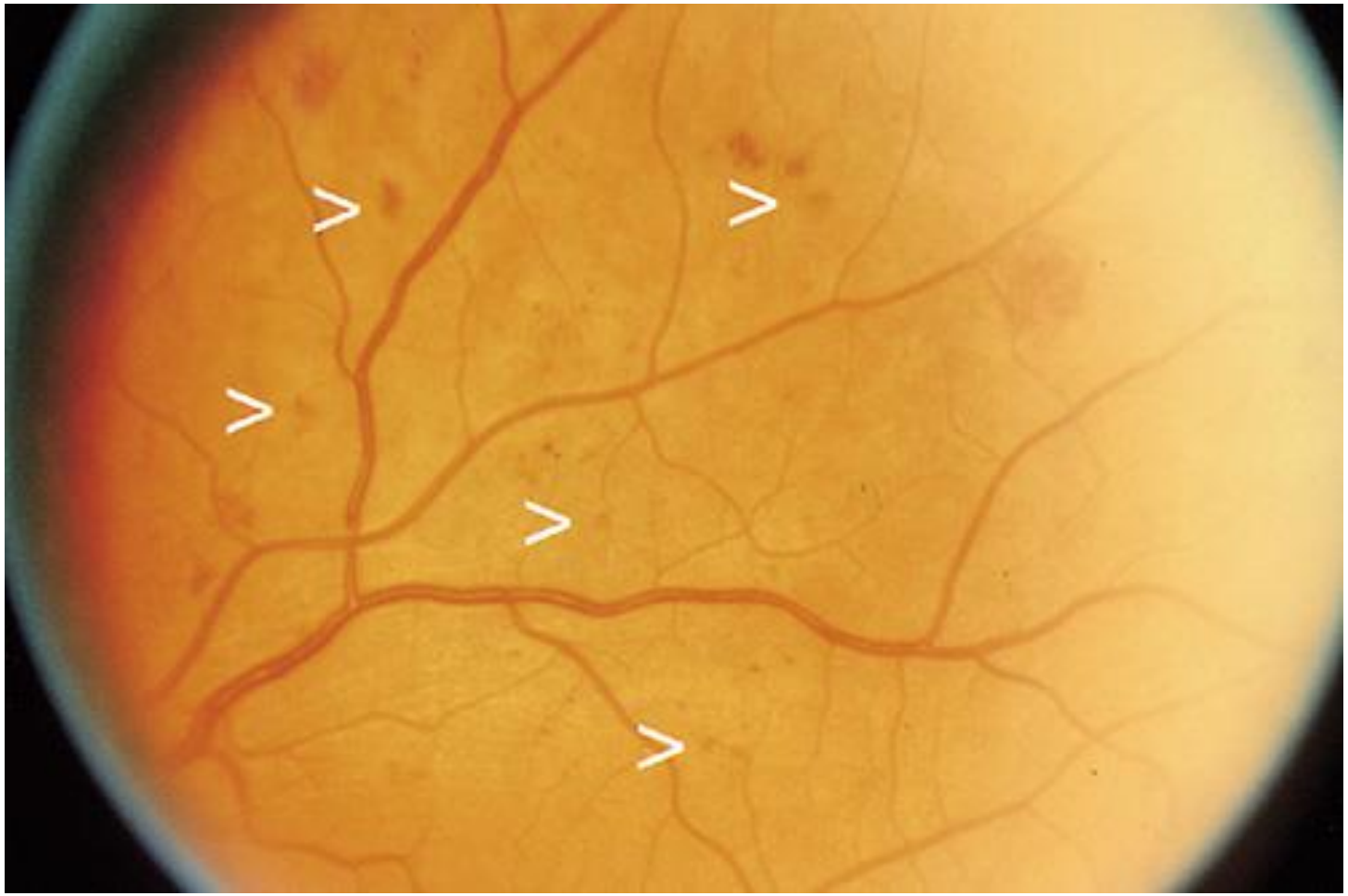
- Patient on basal bolus insulin – novorapid 8/6/10, levemir 20
  - Morning glucose persistently 10-14
  - What would you do?
  - Morning glucose persistently 2-4
  - What would you do?

Diabetes Questions

Which of the following is diabetes is a common cause of (more than one)?

A. End stage renal failure
B. Optic Atrophy
C. Pulmonary Hypertension
D. Liver Cirrhosis
E. Erythema Nodosum

What sort of retinopathy is this?



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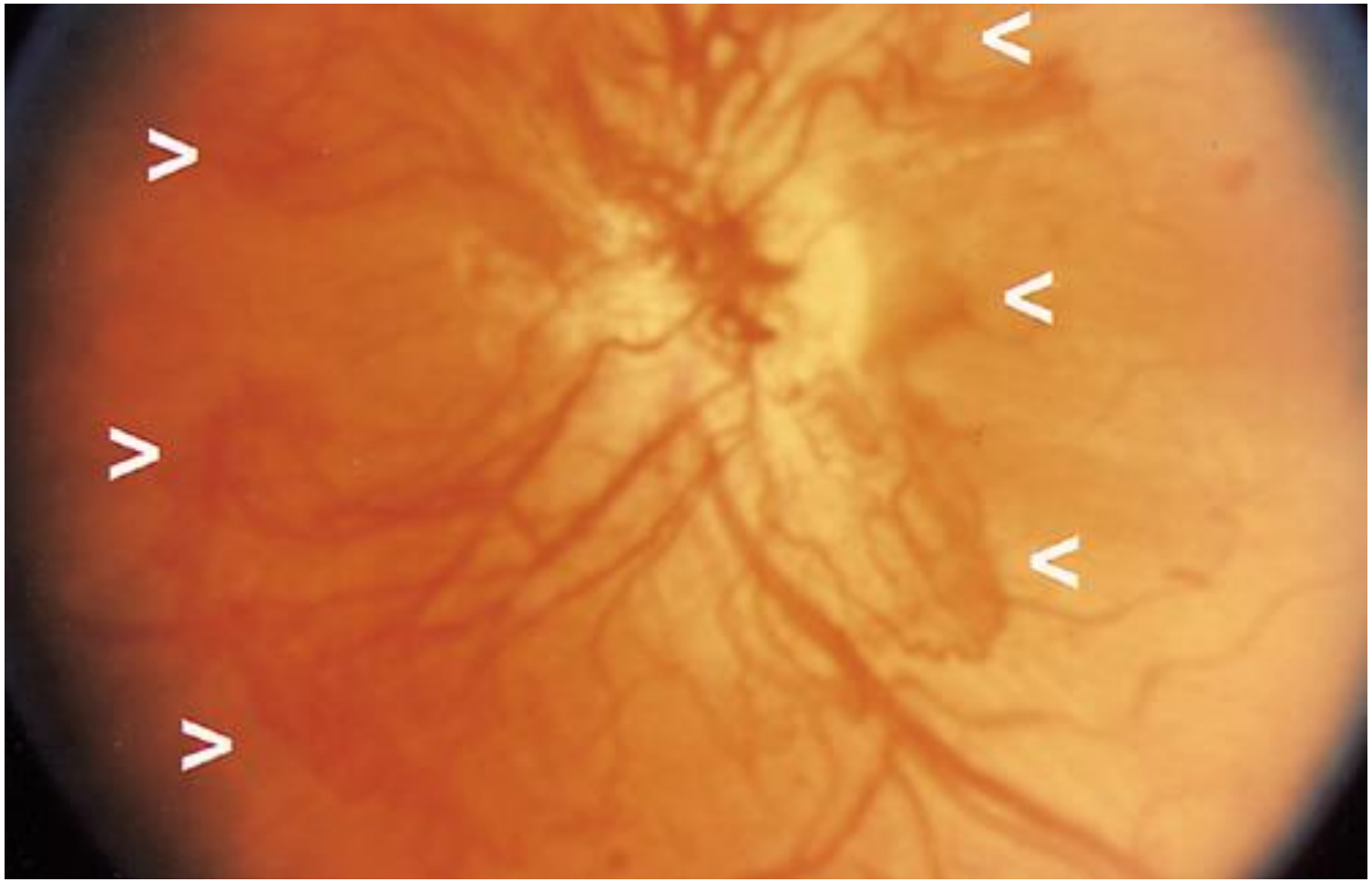
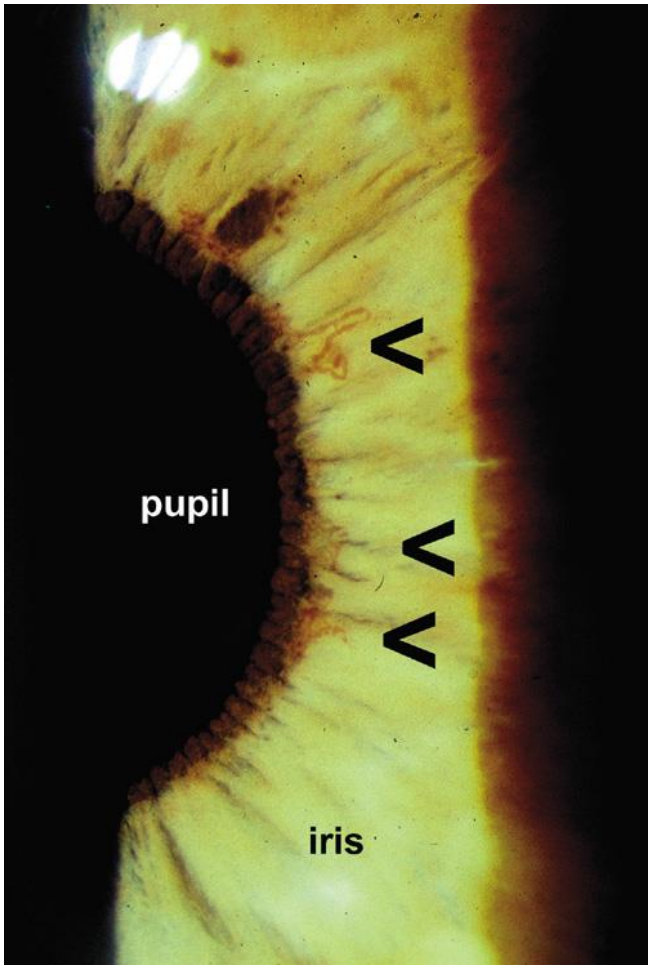


What is demonstrated here?

What eye complication is demonstrated?



What skin complication is demonstrated?

What are these findings due to?

Which are neuroglycopenic symptoms of hypoglycaemia?

1. Confusion
2. Sweating
3. Palpitations
4. Tremor
5. Seizures

A 26 year old lady with Type 1 diabetes phones A&E stating that she is vomiting, and can't eat. She asks whether or not to take her insulin. What is your response?

1. Don't take insulin until you can eat something
2. Monitor you blood glucose regularly, drink sugary drinks and take frequent doses of insulin
3. Reduce your insulin by 50%
4. Come to hospital immediately
5. Just take your long acting insulin, don't worry about the short acting

A 26 year old lady with Type 1 diabetes phones A&E stating that she is vomiting, and can't eat. She asks whether she should come to hospital. What is your response?

A. Come to hospital immediately
B. Come to hospital if you glucose rises above 14 mmol/L
C. Come to hospital if you have ketones in your urine
D. Come to hospital if you cannot eat or drink anything
E. Don't bother us – A&E is too busy

A 26 year old lady with Type 1 diabetes is admitted with vomiting. She is dehydrated, BP 90/40mmHg, pulse 110 reg. Capillary glucose is 27 mmol/L. Urine shows ++ ketones. Which of the following is the next important test to undertake?

A. Plasma glucose
B. Pregnancy test
C. Venous blood gas
D. Arterial blood gas
E. ECG

A 26 year old lady with Type 1 diabetes is admitted with vomiting. She has had a bad cough with green sputum for 3 days. She is dehydrated, BP 90/40mmHg, pulse 110 reg, Temp 37.8°C. Capillary glucose is 27 mmol/L. Urine shows ++ ketones. Bicarbonate is 15 mmol/L (18-25). Which of the following is the most important treatment to commence immediately?

A. Subcutaneous insulin
B. Intravenous Glucose
C. Intravenous 0.45% saline
D. Intravenous insulin
E. Intravenous antibiotics

A 26 year old lady with Type 1 diabetes is admitted with vomiting. She has had a bad cough with green sputum for 3 days. She is dehydrated, BP 90/40mmHg, pulse 110 reg, Temp 37.8°C. Capillary glucose is 27 mmol/L. Urine shows ++ ketones. Bicarbonate is 15 mmol/L (18-25). The nurses ask you what fluid needs to be given. Which of the following would you write up?

A. 0.9% saline - stat
B. 0.9% saline with 20mmol/L K – 4 hours
C. 0.45% saline with 20mmol/L K - stat
D. 5% Dextrose with 20mmol/L K - stat
E. 1 unit plasmalite - stat

A 67 year old Afro-Caribbean lady is admitted acutely with confusion and incontinence. Two weeks ago, she was fit and well, apart from a past history of hypertension. She is dehydrated, BP 115/60 mmHg, pulse 110 reg, Temp 37.8°C. Capillary glucose is 47 mmol/L. Urine shows + ketones. Bicarbonate is 20 mmol/L (18-25). What is the likely diagnosis?

A. Diabetic Ketoacidosis
B. Lactic Acidosis
C. Hyperosmolar Hyperglycaemic Syndrome
D. Septic shock
E. Acute renal failure

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A. Intravenous heparin
B. Intravenous fluids
C. Intravenous insulin
D. Subcutaneous insulin
E. Intravenous antibiotics

A 67 year old lady with diabetes is admitted for a routine operation. One the day of the operation, she is found slumped in her bed unresponsive. BP is 125/75 mmHg, pulse 100. What is the likely cause?

1. Anxiety
2. Hypoglycaemia
3. Hyperosmolar state
4. Septic shock
5. Hypoadrenalism

A 67 year old lady with diabetes is admitted for a routine operation. One the day of the operation, she is found slumped in her bed unresponsive. BP is 125/75 mmHg, pulse 100. Capillary glucose is 1.9 mmol/L. How would you treat her?

A. Oral glucose 20-30g
B. IM Glucagon
C. IV glucose 20%
D. Oral Glucogel
E. IV glucose 50%

A 54 year old South Asian woman presents with polyuria and tiredness. Fasting plasma glucose is 7.2 mmol/L and HbA1c is 49 mmol/mol (6.7%). Does she have diabetes?

A. Yes
B. No
C. Maybe

A 54 year old South Asian woman presents with polyuria and tiredness. Fasting plasma glucose is 7.2 mmol/L and HbA1c is 49 mmol/mol (6.7%)

How would you treat her?

A. Diet & Lifestyle
B. Metformin
C. Gliclazide
D. Sitagliptin
E. Insulin

A 45 year old South Asian man has poorly controlled diabetes, and is taking maximum doses of gliclazide and metformin. BMI is 27.4 kg/m^2 (<23 kg/m^2). Which is the most appropriate next drug?

A. Pioglitazone
B. Insulin
C. Sitagliptin
D. Exenatide
E. Acarbose

You are asked to write up insulin for a patient with diabetes whose chart needs re-writing. Which is the correctly written prescription?

A.	Novomix 30	7.00am 26u	6.00pm 14u
B.	Novomix 30	9.00am 26	10.00pm 14
C.	Novomix 30	7.00am 26	6.00pm 14
D.	Novomix 30	7.00am 26 units	6.00pm 14 units
E.	Novomix 30	12.00pm 26	12.00am 14

A 64 year old man takes twice daily biphasic insulin (Humulin M3) for his diabetes, 26 units pre-breakfast and 14 units pre evening meal. His glucose levels are 12-17 mmol/L before his evening meal, but 4-7 mmol/L pre breakfast. How would you advise him to adjust his insulin:

A. 24 / 14
B. 28 / 14
C. 26 / 16
D. 24 / 16
E. 28 / 16

A 64 year old man complains of pins and needles and burning pains in his feet, especially bad a night. Examination of his feet is likely to elicit the following Signs?

A. Hyper-reflexia
B. Reduced fine touch
C. Impalpable pulses
D. Hallux valgus
E. Pitted nails

A 64 year old man complains of pins and needles and burning pains in his feet, especially bad a night. Which of the following drugs classes may be beneficial in treating his symptoms?

A. Non-steroidal anti-inflammatory drugs
B. Benzodiazepines
C. Anti-depressants
D. Anti-arrhythmics
E. Anti-hypertensives

Which of the following are secondary causes of diabetes?

A. Hypoparathyroidism
B. Addison's disease
C. Hypopituitarism
D. Hypothyroidism
E. Acromegaly