Training manual

WHO Package of Essential NCD Interventions (PEN)

Management of Type 2 Diabetes.

Centre for Community Medicine
All India Institute of Medical Sciences
New Delhi, India

WHO Collaborating Centre for Capacity Building and Research
in Community-based Noncommunicable Disease Prevention and Control

ACKNOWLEDGEMENT

This manual was prepared under the leadership and guidance of Gojka Roglic and Cherian Varghese, Department of Management of Noncommunicable Diseases, Disability, Violence and Injury Prevention WHO, Geneva. Staff from WHO regional offices provided valuable inputs and feedback.

The manual was developed through the WHO Collaborating Centre for Capacity Building and Research in Community-based Noncommunicable Disease Prevention and Control, All India Institute of Medical Sciences (AIIMS), New Delhi, India.

Dr Baridalyne Nongkynrih, Professor, Centre for Community Medicine, developed the draft and revised based on comments and feedback. Design and layout were provided by Mr Ramachandra B Pokale, Chief Artist, Centre for Community Medicine.
Professor Shashi Kant, Head of the Department, Centre for Community Medicine, All India Institute of Medical Sciences, New Delhi is acknowledged for his support in the development of this manual.

.

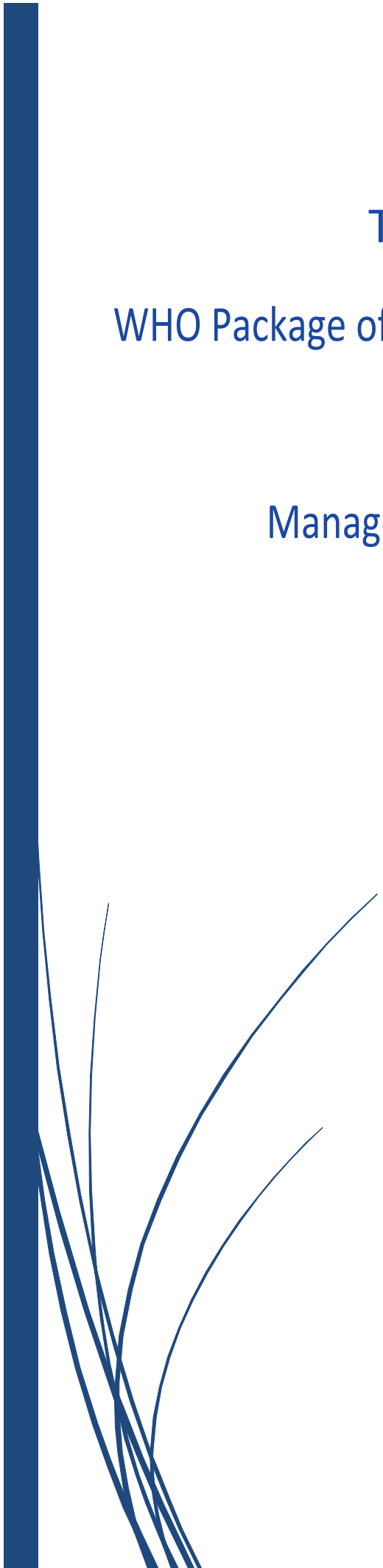
Centre for Community Medicine
All India Institute of Medical Sciences
New Delhi, India

WHO Collaborating Centre for Capacity Building and Research
in Community-based Noncommunicable Disease Prevention and Control

Training Manual

WHO Package of Essential NCD Interventions (PEN)

Management of Type 2 Diabetes



DIABETES

What is diabetes?

A group of metabolic disorders characterized by the presence of hyperglycaemia in the absence of treatment. The aetio-pathology includes defects in insulin secretion, insulin action, or both

The long-term specific complications of diabetes include retinopathy, nephropathy and neuropathy

Steps for management of diabetes in a primary care setting

ASSESS

Risk factors

Risk factors for type 2 diabetes (strong):

- overweight/obesity
- physical inactivity
- diabetes in first degree relatives
- history of gestational diabetes
- cardiovascular disease and its risk factors
- ethnicity (South Asian, Afro-Caribbean, Hispanic)

Risk factors for type 1 diabetes (weak):

- Certain genetic haplotypes
- Unknown environmental factors

Risk factors for gestational diabetes (strong)

- Similar to type 2 diabetes

Symptoms

- polyuria (excessive passing of urine)
- polydipsia (excessive thirst)
- unexplained weight loss
- polyphagia (excessive hunger)
- vision changes
- fatigue

Diagnostic values:

Test	mmol/l	mg/dl
Fasting blood glucose (FBG)[a,b]	=7	=126
Random plasma glucose (RPG)[b]	=11.1	=200
Plasma glucose two hours after a 75 g Oral glucose load-OGTT[b]	=11.1	=200
HaemoglobinA1c	=48	=6.5%

Treatment goal

HbA1c < 7% is generally considered to be adequate glycaemic control. If not available, fasting plasma glucose (FPG<7.0mmol/l or <125 mg/dl)

Pharmacological treatment

Metformin is recommended as the first-line medicine in the treatment of diabetes. Sulfonylurea is recommended as the second-line treatment, and human insulin as the third-line treatment.

Control of blood pressure and blood lipids

Hypertension treatment is indicated when SBP ≥130 and/or DBP ≥80. Statins are recommended for all people with type 2 diabetes older than 40 years, but only if this does not negatively impact access to glucose-lowering and blood pressure - lowering medication.

FOLLOWUP

Monitoring glycaemic control

- When diabetes is diagnosed, monitor glycaemic control every three months until diabetes is controlled, then every six months after that.

- HbA1c is the most accurate measurement of long-term glycaemic control and represents the average blood glucose over the previous two to three months. HbA1c < 7% is generally considered to be adequate glycaemic control. In people with frequent severe hypoglycaemia, severe complications and low life-expectancy, the goal for HbA1c could be relaxed, e.g. to<8%.

- Fasting plasma glucose (FPG<7.0mmol/l or <125 mg/dl) can also be used to monitor control when HbA1c testing is not available.

Acute complications of Diabetes

HYPOGLYCAEMIA

Hypoglycaemia (abnormally low blood glucose) is a frequent iatrogenic complication in diabetic patients, occurring particularly in patients receiving sulfonylurea or insulin. It can cause loss of consciousness and coma and is potentially life-threatening.

There is no universally agreed plasma glucose cut-off point for hypoglycaemia as symptoms and signs can occur at different thresholds. It is most frequently defined at plasma glucose of <3.9 mmol/l (70 mg/dl) when it should be managed even if there are no symptoms and signs.

Management of hypolycaemic emergencies

Conscious patient:

If the patient is able to eat and drink:

- Give oral carbohydrate that contains 15-20 g of rapidly absorbing forms of glucose (sugar-sweetened soft drink, 1-2 teaspoons of sugar, 5-6 hard candy, cup of milk).
- Plasma glucose levels typically increase by 2.8 mmol/l (50 mg/dl) within ~15 minutes; repeat the treatment if hypoglycaemia persists

Unconscious patient:

- Unconscious patients, those with plasma glucose <=2.8mmol/l (50mg/dl) and those unable to ingest drink should be given hypertonic glucose (dextrose) intravenously (20 – 50 ml of 50% glucose over 1-3 minutes. If this concentration is not available, substitute with any hypertonic glucose solution
- Food should be provided as soon as the patient is able to ingest food safely
- Discuss hypoglycaemia risk factors with the patient (skipping meals, physical activity more intense than usual, alcohol ingestion) and adjust medication if necessary

HYPERGLYCAEMIA

Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS) are life-threatening conditions with somewhat different features.

Symptoms and signs of DKA and HHS

- frequent symptoms of DKA are nausea, vomiting and abdominal pain
- Severe cases of DKA can present with Kussmaul's breathing
- Changes in sensorium in DKA range from alertness to stupor or coma, depending on the severity
- Patients with HHS typically present in stupor or coma

Management of hyperglycaemia in primary health care

- DKA or HHS should be suspected in every ill patient with hyperglycaemia

- Refer to hospital all patients with plasma glucose levels >= 18 mmol/l (325 mg/dl) and all patients with suspected DKA or HHS

- Correction of dehydration is the critical first step for transport. Hyperglycaemia slows gastric emptying and oral rehydration might not be effective, even in patients who are not vomiting
- Hyperglycaemic emergencies should be managed in hospital by correction of dehydration
- electrolyte disbalance and administration of insulin

Chronic complications

Chronic complications of Diabetes are:

Diabetic eye disease (Diabetic retinopathy)

People with type 2 diabetes should be screened for retinopathy by a trained person upon diagnosis and biennially thereafter, or as per recommendations of the ophthalmologist:

- o Visual acuity
- o Direct or indirect ophthalmoscopy or retinal fundus photography, after dilating the pupils

· • Patients reporting vision loss at any visit and those who have not had a retinal exam in more than 2 years should be referred to an ophthalmologist.

Diabetic kidney disease (Diabetic nephropathy)

- Monitor the albumin/creatinine ratio in a spot urine sample and serum creatinine (for calculation of the glomerular filtration rate (eGFR) once a year.

- CKD is defined by GFR<OR the presence of moderate or severe albuminuria (albumin-creatinine ratio ≥30 mg/mmol).

- If measurement of the albumin/creatinine ratio is not available, test for proteinuria (preferably with strips that specifically measure lower concentrations of albumin).

- Refer for specialist assessment all patients with proteinuria, those with moderate albuminuria and those with GFR<60 ml/min/1.73 m^2

Diabetic neuropathy

Nerve damage or degeneration in diabetes is a group of disorders with diverse clinical manifestations like sensory and disorders of autonomic nervous system.

- Risk factors are duration of diabetes, poor glycaemic control, advancing age, hypertension, obesity
- Common symptoms are Sensory loss, unpleasant sensation of burning, pain, tingling or numbness

- Control of glycaemia and blood pressure can slow the progression of diabetic neuropathy.
- Specific treatment for the underlying nerve damage is not available

Diabetic foot

Patients can present with symptoms of peripheral neuropathy and or peripheral artery occlusion.

The absence of symptoms does not exclude diabetic foot problems.

Examination

All people with diabetes should have their feet examined at least once a year to assess risk.

1. Examination of the feet for the following risk factors after removing the patient's shoes, socks, dressings and bandages:

- Peripheral neuropathy
  - Pressure perception testing with 10g Semmes-Weinstein monofilament

At least one other test of sensation (128Hz tuning fork vibration / cotton wisp /pin prick) and Achilles tendon reflexes

- Peripheral arterial disease
  - Palpation of tibial posterior and dorsal pedal artery pulse,
  - Doppler ankle/brachial pressure index and toe-brachial pressure index if available
- Presence of current or previous (healed) ulcer
- Previous amputation
- Presence of callus
- Presence of deformity: claw toes, hammer toes, bony prominences; limited joint mobility
- Presence of Charcot arthropathy: redness, warmth, swelling or deformity, particularly if skin is intact
- Signs of infection or inflammation: at least two of redness, warmth, induration, tenderness, purulent secretion
- Signs of gangrene

Management of risk of diabetic foot problems

- Patients with diabetes should receive education on avoidance of foot complications
- Patients at low risk can be assessed annually, those at moderate risk every 3-6 months and those at high risk every 1-3 months
- Pre-ulcerative lesions need to be treated by a trained professional: removal of callus, protecting or draining blisters, treatment of ingrown and thickened nails, antifungal treatment for fungal infections
- Patients with gross foot deformities and/or absent peripheral pulses should be referred for further evaluation.

Stratify the level of risk of developing diabetic foot problems or needing an amputation

.

Risk level	Low risk	Moderate risk	High risk	Active foot problem
Features	No risk factor except *callus alone*	*Any of:* • deformity • neuropathy • non-critical limb ischaemia	*Any of:* • previous ulcer • previous amputation • neuropathy with non-critical limb ischaemia • neuropathy with callus and/or deformity • non-critical limb ischaemia with callus and/or deformity	*Any of:* • Ulcer • Spreading infection • Critical limb ischaemia • Gangrene • Suspicion of acute Charcot arthropathy • Unexplained red swollen foot
Action	Assess Annually	Assess every 3-6 months	Assess every 1-3 months	Urgent referral

Management of active diabetic foot problems

- Active foot problems require referral to a higher level of care. Best results in prevention of amputations have been achieved in settings with a multidisciplinary.
- Patients with a foot ulcer should be referred to a more specialized level for further evaluation if management by a trained professional and the necessary equipment and consumables are not available at the primary care level

- Urgent referral to acute services is recommended for patients with any of the following: infected ulcer, spreading infection, critical limb ischaemia, gangrene, suspicion of acute Charcot arthropathy, unexplained red swollen foot

Case study 1 - **Newly diagnosed diabetes**

A.B. is 42 years female has with no past medical history. She presents with 3 months of fatigue, excessive thirst and frequent urination at night. How will you manage initially?

History

A.B. is otherwise healthy with no other symptoms. She is a non-smoker who leads a sedentary lifestyle. What would you examine and test?

Physical examination

Biochemical tests

On examination, AB's BMI is 32 but there are nil other remarkable findings. BP 130/75.
FPG is 9.6mmol/L (172.8MG/DL), urine dipstick shows glucose 2+, the rest is negative
What further examinations and/or tests will you advise?

Foot exam shows low risk of foot complications. How do you manage the case?

Case study 2 - **Poorly controlled diabetic**

C.D. a 60-year-old male was diagnosed with T2DM 2 years ago. He is currently on metformin 2g daily and comes to the PHC for a check-up after 12 months. What do you do?

History

C.D. states that he has gained 4 kg over the past 6 months. He says that he has to wake up several times in the middle of the night to pass urine. He reports he is compliant with his metformin and has not experienced any side effects. He had a retinal exam and a urine protein test when he was diagnosed with diabetes.

Examination

Biochemical tests

On examination, you note BMI 27, BP 130/75 but otherwise unremarkable. FPG 9.2mmol/L, Urine dipstick: 0 protein, glucose 1+, ketones 0. What would you do next?

Case study 3 - **Hypoglycemia**

I.J. is a 70-year-old male who was diagnosed with T2DM 8 years ago. He is currently on metformin 2g daily and gliclazide 80mg daily. He has come because he is sweating, has a headache and light-headedness. His last check-up was 6 months ago. What do you want to know?

History

He reports he is otherwise well, is not in pain and has been compliant with his medication. He states that this is not the first episode. They occur about twice a week, most often a few hours after breakfast and are relieved by eating some crackers. He states he does have irregular meals as he sometimes forgets to eat.

What is your provisional diagnosis?

What do you want to do next?

Physical examination

Biochemical tests

On examination, I.J. is frail, with BP 120/75. He is sweating, appears anxious and slightly disoriented and feels weak at the time of examination. Random plasma glucose 3.2mmol/L (57.6 mg/dl)

What is your initial management?

What is your follow up management?

Case study 4 - **Diabetic foot (1)**

G.H. is a 73-year-old male who was diagnosed with T2DM 1 year ago. He is on metformin 2g daily. He presents for the first time since his diagnosis with a deep ulcer on his right heel which he first noticed 1 day ago. What would you do next?

History

He reports numbness in his feet but otherwise feels well. He has no history of ulcers.
What is your provisional diagnosis?

What would you do next?

Physical examination

Biochemical tests

On examination BMI=26.0, BP 180/95 mmHg. Dorsalis pedis and posterior tibial pulses are present and strong on both feet. Monofilament test is positive for diabetic neuropathy. No other abnormalities apparent. The edges of the ulcer on the right heel are clean and there does not appear to be any slough and minimal surrounding erythema.. There is no evidence of gangrene, systemic infection or ulcers elsewhere. He has not been examined for diabetic eye disease when he was diagnosed.
Investigations show FPG is 13.4mmol/L. Urine dipstick shows protein 0, ketones 2+.
What would be your management?

Case study 5 - **Newly diagnosed type 1.**

I.J.*is a 26-year-old female who presents after experiencing 6 kg of weight loss over the past 3 months. She also reports feeling fatigued and lethargic.*

What is your differential diagnosis?

What would you do next?

History

I.J. reports that the weight loss has been unintentional. She has noticed that she has been eating roughly the same amount as usual. She has a family history of coeliac disease. Liz says she has been more thirsty than usual and has had to urinate more as a result, including at night. On examination, Liz appears to be a fatigued slender young adult. Vital signs are within normal limit. No lymphadenopathy present. Thyroid examination unremarkable. Tongue appears dry and coated.

What biochemical tests would you want to do next in the primary care setting?

Results are as follows: Blood film,haemoglobin and haematocrit are within normal limits. FBG 20.0mmol/L. Urine glucose +++, Ketones +++, HIV negative

What is your provisional diagnosis?

How do you proceed?

Case Study 6 - Diabetic Foot (2)

K.L. is a 60 year old female who presents with a black 2nd toe on her left foot. She was diagnosed with T2DM 3 years ago and is currently on simvastatin 40mg daily, metformin 1g daily. She says she first noticed the black toe a couple of weeks ago, but has since come in because she has noticed that there is a deep ulcer at the tip of her 2nd toe. She currently smokes 20 cigarettes per day. She has not been reviewed since time of diagnosis.

What is your differential diagnosis?

What do you want to know?

History

What do you want to look for?

Physical examination

Biochemical tests

On examination, K.L.'s random PG is 20mmol/l. Her blood pressure is 160/95. Examination shows that in her left foot, there is an absent dorsalis pedis pulse and a weak posterior tibial pulse. The tip of her 2nd toe in the left foot is black with a 1cm x 1cm x 1cm ulcer with clean edges. There is no surrounding erythema or swelling.

Urinalysis shows protein 2+, ketones 0.

How would you proceed?

Case Study 7 - **Accidental diagnosis of diabetes in a young person**

M.N. is a thin, 25-year-old male who presents with a fever and a dry cough of 3 days duration. You diagnose pneumonia on lung auscultation and elevated leucocyte count and initiate antibiotic treatment. Random plasma glucose has also been measured and it is 12.4 mmol/l.

What do you do next?

History

Biochemical tests

M.N. denies having symptoms of diabetes and was well before the onset of fever and cough.

Urine glucose is +++, urine ketones ++

How do you proceed?

M.N. comes back feeling better, the fever has subsided and he has no symptoms of diabetes.

Fasting PG is 8.0 mmol/l, urine glucose is ++, ketones +

How do you proceed?

Diabetes case studies with solutions

Case study 1- Newly diagnosed diabetes

A.B. is 42 years female having with no past medical history and presents with 3 months of fatigue, excessive thirst and frequent urination at night. How will you manage initially?

History

- Any other symptoms/complaints?
- Diabetes in first-degree relatives?
- Risk factors: e.g. unhealthy diet, physical inactivity, smoking history of gestational diabetes

A.B. is otherwise healthy with no other symptoms. She is a non-smoker who leads a sedentary lifestyle. What would you examine and test?

Physical examination

- Blood pressure
- BMI

Biochemical tests

- Fasting plasma glucose
- Random plasma glucose is also an option because AB has symptoms, but it is a less sensitive test (will miss more cases than FPG)
- Urine dipstick: glucose, protein, ketones, bacteria

On examination, AB's BMI is 32 but there are nil other remarkable findings. BP 130/75.
FPG is 9.6mmol/L (172.8MG/DL), urine dipstick shows glucose 2+, the rest is negative
Any further examinations and/or tests?

Physical examination

- Examine feet to determine risk of foot complications or established presence of foot complications
- Retinal exam (refer to ophthalmologist if a trained person is not available in the health facility)

Biochemical tests

- AB has diabetes. The positive diagnostic test does not need to be confirmed because she has symptoms of diabetes

Foot exam shows low risk of foot complications. How do you manage the case?

Intervention

- Lifestyle education
- Diet: healthy diet, low calorie intake to promote weight loss
- Regular physical activity

Medication

- None

Follow-up

- Schedule for blood glucose control visit in 3 months

Case study 2: Poorly controlled diabetic

C.D. a 60-year-old male was diagnosed with T2DM 2 years ago. He is currently on metformin 2g daily and come to the PHC for a check-up after 12 months. What do you do?

History

- Any symptoms, e.g. weight loss, polyuria, polydipsia
- Any symptoms of complications (angina, symptoms of neuropathy, claudication, vision loss)
- Compliance with lifestyle recommendations (diet, smoking, exercise)

- Check date of last urine protein test (or urine albumin: creatinine ratio and serum creatinine, if available)
- Check date of last retinal exam

C.D. states that he has gained 4 kg over the past 6 months. He says that he has to wake up several times in the middle of the night to pass urine. He reports he is compliant with his metformin and has not experienced any side effects. He had a retinal exam and a urine protein test when he was diagnosed with diabetes.

Examination

- Blood pressure
- BMI
- Visual acuity
- Examine feet to determine risk of foot complications or established presence of foot complications

Biochemical tests

- FPG
- Serum cholesterol
- Urine dipstick for protein (or urine albumin: creatinine ratio and serum creatinine, if available)

On examination, you note BMI 27, BP 130/75 but otherwise unremarkable.
FPG9.2mmol/L, Urine dipstick: 0 protein, glucose 1+, ketones 0
What would you do next?

Lifestyle

- Reinforce need for compliance
- Education about hypoglycaemia, hyperglycaemia

Medication

- Continue metformin and add gliclazide 80 mg before breakfast (or other sulfonylurea if gliclazide not available, e.g. glibenclamide 5mg)

Physical examination

- Retinal exam (refer to ophthalmologist if a trained person is not available in the health facility)

<u>Case study 3- Hypoglycemia</u>

I.J. is a 70-year-old male who was diagnosed with T2DM 8 years ago. He is currently on metformin 2g daily and gliclazide 80mg daily. He has come because he is sweating, has a headache and lightheadedness. His last check-up was 6 months ago. What do you want to know?

History

- History of symptoms: when, has it happened before, frequency, precipitants or any aggravating/ alleviating factors
- Compliance with medication
- Is he currently feeling any pain (consider differential diagnoses for his symptoms)?

He reports he is otherwise well, is not in pain and has been compliant with his medication. He states that this is not the first episode. They occur about twice a week, most often a few hours after breakfast and are relieved by eating some crackers. He states he does have irregular meals as he sometimes forgets to eat.

What is your provisional diagnosis?

Hypoglycemia secondary to gliclazide

What do you want to do next?

Physical examination

- Blood pressure

Biochemical tests

- Plasma glucose

On examination, I.J. is frail, with BP 120/75. He is sweating, appears anxious and slightly disoriented and feels weak at the time of examination.
Random plasma glucose 3.2mmol/L (57.6 mg/dl)
What is your initial management?

- Give orally 10-20g of rapidly absorbing glucose (e.g. a sugar-sweetened drink, candy, fruit juice) or a carbohydrate meal if rapid glucose is not available (e.g., 4 crackers, a slice of bread)

What is your follow up management?

- Dietary advice about necessity of regular meals
- Decrease dose of gliclazide to 40mg daily
- Review blood glucose control in 3 months

Case study 4 – Diabetic foot (1) *G.H. is a 73-year-old male who was diagnosed with T2DM 1 year ago. He is on metformin 2g daily. He presents for the first time since his diagnosis with a deep ulcer on his right heel which he first noticed 1 day ago. What would you do next?*

History

- Symptoms of peripheral neuropathy (numbness, tingling)
- Symptoms of peripheral vascular occlusion (intermittent claudication)
- Symptoms of other complications: redness, swelling, tingling or weakness, black toes, feeling in feet, intermittent claudication
- Systemic symptoms of infection e.g. chills, rigors, fevers
- Compliance and side effects of medications
- Smoking, diet, exercise
- Ask about last examination for eye complications

He reports numbness in his feet but otherwise feels well. He has no history of ulcers.
What is your provisional diagnosis?
Diabetic foot ulcer secondary to peripheral neuropathy.

What would you do next?

Physical examination

- Presence of any other ulcers
- Presence of foot deformities and calluses
- Monofilament and tuning fork test
- Reflexes
- Peripheral pulses, black toes
- Signs of local infection (swelling, redness, warmth, induration, smell, discharge,)
- Signs of systemic infection (fever, shivers)
- Blood pressure
- BMI

Biochemical tests

- FPG (HbA1C if available)
- Urine dipstick
- GFR/creatinine (if available)
- Serum cholesterol (if available)

On examination BMI=26.0, BP 180/95 mmHg. Dorsalis pedis and posterior tibial pulses are present and strong on both feet. Monofilament test is positive for diabetic neuropathy. No other abnormalities apparent. The edges of the ulcer on the right heel are clean and there does not appear to be any slough and minimal surrounding erythema.. There is no evidence of gangrene, systemic infection or ulcers elsewhere. He has not been examined for diabetic eye disease when he was diagnosed.
Investigations show FPG is 13.4mmol/L. Urine dipstick shows protein 0, ketones 2+.
What would be your management?

- Refer to high level of care unless there is possibility of treatment with dressings and offloading
- Education about appropriate footwear and foot hygiene and daily examination for ulceration, minor skin breaks or injury
- Advice about signs of infected ulcers
- Introduce thiazide diuretic or ACE-inhibitor
- Add gliclazide 80 mg daily (or glibenclamide 5mg, if gliclazide not available)
- Education about hypoglycaemia
- Retinal exam (refer to ophthalmologist if a trained person is not available in the health facility)

Case study 5. Newly diagnosed type 1. I.J.is a 26-year-old female who presents after experiencing 6 kg of weight loss over the past 3 months. She also reports feeling fatigued and lethargic.

What are your differential diagnosis?

- Malignancy
- Type 1 diabetes
- Hyperthyroidism
- Malabsorptive disease (e.g. coeliac disease)
- Anaemia
- HIV

What would you do next?
History

- When did this start?
- Has the weight loss been intentional?
- Is this related to any diet or has anything changed over the past 6 months?
- Any family history of autoimmune disease (e.g. thyroid, coeliac, type 1 diabetes)?

Symptoms review (endocrine- thyroid disease, T1DM symptoms (e.g. polydipsia, polyuria), gastrointestinal- coeliac disease, hematological- any source of focus for any cancers, e.g. hemoptysis, early morning headaches, early satiety, appetite changes; renal- urinary changes)

I.J. reports that the weight loss has been unintentional. She has noticed that she has been eating roughly the same amount as usual. She has a family history of coeliac disease. Liz says she has been more thirsty than usual and has had to urinate more as a result, including at night. On examination, Liz appears to be a fatigued slender young adult. Vital signs are within normal limit. No lymphadenopathy present. Thyroid examination unremarkable. Tongue appears dry and coated.

What biochemical tests would you want to do next in the primary care setting?

- Fasting or random PG
- Urine nitrites, protein, leukocytes, blood (infection)
- Urine glucose and ketones
- Blood film, haemoglobin and hematocrite , if available
- HIV

Results are as follows: Blood film, haemoglobin and haematocrit are within normal limits. FBG 20.0mmol/L. Urine glucose +++, Ketones +++, HIV negative

What is your provisional diagnosis?

First presentation of type 1 diabetes, probable ketoacidosis

How do you proceed?

- I.V. drip of 0.9% NaCl (1 litre in first 2 hours, continue at 1 litre every 4 hours)
- Urgent referral to hospital
- If available: short-acting (regular) insulin can be administered s.c. or i.m. (0.15 – 2 I.U. per kg body weight)

<u>Case Study 6 - Diabetic Foot (2)</u>

K.L. is a 60-year-old female who presents with a black 2nd toe on her left foot. She was diagnosed with T2DM 3 years ago and is currently on simvastatin 40mg daily, metformin 1g daily. She says she first noticed the black toe a couple of weeks ago but has since come in because she has noticed that there is a deep ulcer at the tip of her 2nd toe. She currently smokes 20 cigarettes per day. She has not been reviewed since time of diagnosis.

What is your differential diagnosis?

Peripheral vascular disease and peripheral neuropathy secondary to poorly controlled diabetes

What do you want to know?

History

- Symptoms of peripheral neuropathy (numbness, tingling)
- Symptoms of peripheral vascular occlusion (intermittent claudication)
- Symptoms of other complications: redness, swelling, tingling or weakness
- Systemic symptoms of infection e.g. chills, rigors, fever

- Compliance and side effects of medications
- Smoking, diet, exercise

What do you want to look for?
Physical examination
- Blood pressure
- Peripheral pulses
- Neurological lower limb exam (particularly looking for Charcot's, monofilament, tuning fork, reflexes)

Biochemical tests
- Fasting PG (HbA1C if available)
- Urine protein dipstick (or urine albumin/creatinine ratio and serum creatinine if available)
- Urine glucose and ketones

On examination, K.L.'s random PG is 20mmol/l. Her blood pressure is 160/95. Examination shows that in her left foot, there is an absent dorsalis pedis pulse and a weak posterior tibial pulse. The tip of her 2nd toe in the left foot is black with a 1cm x 1cm x 1cm ulcer with clean edges. There is no surrounding erythema or swelling.
Urinalysis shows protein 2+, ketones 0.
How would you proceed?

- Refer urgently to hospital for surgical admission for suspected gangrene (probable need for toe amputation and angioplasty if available)
- In referral papers indicate suspected renal impairment and need for eye exam and blood pressure and plasma glucose control

Case Study 7 – Accidental diagnosis of diabetes in a young person
M.N. is a thin, 25-year-old male who presents with a fever and a dry cough of 3 days duration.
You diagnose pneumonia on lung auscultation and elevated leucocyte count and initiate antibiotic treatment.
Random plasma glucose has also been measured and it is 12.4 mmol/l.
What do you do next?

History
- Ask about symptoms of diabetes (weight loss, thirst, frequent urination)

Biochemical tests
- Urine glucose and ketones

M.N. denies having symptoms of diabetes and was well before the onset of fever and cough.
Urine glucose is +++, urine ketones ++
How do you proceed?

The plasma and urine glucose values are diagnostic of diabetes. However, plasma glucose is sometimes elevated in infectious diseases. Urine ketones could be positive because of incipient diabetic ketoacidosis, or because the patient has eaten little since his illness started

- Give the patient counselling on a healthy diet and advise plentiful oral rehydration with water
- Ask the patient to come in 3-4 days, fasting.

M.N. comes back feeling better, the fever has subsided, and he has no symptoms of diabetes. Fasting PG is 8.0 mmol/l, urine glucose is ++, ketones +
How do you proceed?

- Continue pneumonia treatment as planned
- You can either:
  - Refer the patient to a higher level of care on suspicion of evolving type 1 diabetes
  - Measure fasting plasma glucose again in a week, alerting the patient to come immediately if diabetes symptoms occur; refer to a higher level if diabetic FPG values persist.

DIABETES ASSESSMENT QUESTIONS FOR PEN

Q 1. Urgent referral is indicated if FPG or RPG >18mmol/l and urine ketones are

a) >=2+
b) >=3+
c) >=4+
d) >=5+

Q 2. According to the WHO Diabetes protocol, which of the following is TRUE

a) Adults who are 40+ years old with BMI >30 should be tested with FPG or RPG
b) Those who have symptoms of diabetes should be tested with FPG or RPG
c) Those with FPG ≥7 mmol/l and <18 mmol/l should be started on metformin 1000mg daily
d) Goal for glycaemic control is FPG≤6.5 mmol/l

Q.3. In gestational diabetes, which of the following is NOT TRUE

a) Mild hyperglycaemia first detected in pregnancy
b) Blood glucose levels are the same as those diagnostic of diabetes in non -pregnant women..
c) Women with gestational diabetes are at increased risk of hypertensive disorders
d) History of gestational diabetes is a strong risk factor for diabetes type 2

Q 4. All the following are used as diagnostic criteria for diabetes EXCEPT

a) Fasting venous or capillary plasma glucose ≥7.0 mmol/l (126 mg/dl)
b) 2-hour post-load venous plasma glucose ≥11.1 mmol/l (200 mg/dl)
c) Random plasma glucose≥11.1 mmol/l (200 mg/dl)
d) HbA1c 7%

Q 5. Metformin is contraindicated in people with all EXCEPT

a) chronic kidney disease
b) liver disease
c) alcohol abuse
d) elderly persons

Q 6. Targets for glycaemic control are all EXCEPT

a) HbA1c of 7.0% (53 mmol/mol)
b) HbA1c target can be relaxed (e.g. to <8% or <64 mmol/mol) in people with frequent severe hypoglycaemia
c) FPG value of 7.0 mmol/l (126mg/dl)
d) Postprandial PG value of 11.1 mmol/l (200 mg/dl)

Q 7. Which is Not True in the management of hyperglycaemic emergencies?

a) Correction of dehydration is the critical first step for transport.
b) In patients who are not vomiting, oral rehydration can be given till the patient reaches the hospital
c) All patients with plasma glucose levels >= 18 mmol/l (325 mg/dl) and urine ketones >=2+ should be referred
d) Infuse isotonic saline (0.9% NaCl) at a rate of 1000 ml in the first 2 hours, continue with 1000ml every 4 hours until reaching hospital.

Q 8. Which statement is NOT TRUE for hypoglycaemia

a) Hypoglycaemia is a frequent complication in people receiving medication for control of blood glucose
b) Severe hypoglycaemia can be life-threatening
c) People with hypoglycaemia should have a meal high in protein if they are able to swallow
d) People with hypoglycaemia who are unable to swallow should be given 20-50ml of hypertonic glucose intravenously

Answers to diabetes assessment questions for PEN

Q 1. Ans: a). >=2+ according to diabetes WHO protocol

Q 2. Ans: b).

a) Adults who are 40+ years old with BMI >25 should be tested with FPG

c) 500mg after 3 months of LSM

d) Goal for glycaemic control is FPG≤7 mmol/l

Q.3 Ans: b) Blood glucose levels are lower than those diagnostic of diabetes.

Q 4. Ans: d) HbA1c 6.5%

Q 5. Ans: d) Elderly persons with normal renal functions can be given metformin

Q 6. Ans: d) Postprandial PG value of 9.0 mmol/l (160 mg/dl)

Q 7. Ans: b) Hyperglycaemia slows gastric emptying and oral rehydration might not be effective, even in patients who are not vomiting

Q 8. Ans: c) People with hypoglycaemia who are able to swallow should have food or drink high in rapidly absorbing glucose (e.g. sugary drink, sweets) or at least food containing carbohydrate (rice, bread, potato).

Presentation -

TYPE 2 DIABETES

Outline of presentation

- Types of diabetes
- Diagnosis of diabetes
- Management of diabetes
- Acute complications of diabetes
  - Hypoglycaemia
  - Hypergycaemic emergencies
- Specific long-term complications of diabetes
  - Diabetic retinopathy
  - Diabetic nephropathy
  - Diabetic neuropathy
  - Diabetic foot
- Activities & case studies

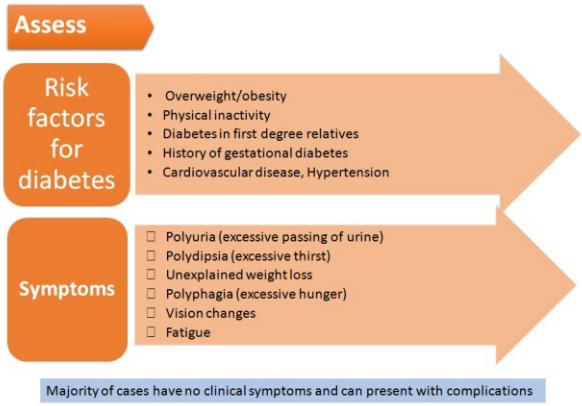
What is diabetes ?

- Diabetes is a group of metabolic disorders characterized by the presence of hyperglycaemia in the absence of treatment.
- Diabetes occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces
- The long-term specific complications of diabetes include retinopathy, nephropathy and neuropathy

Types of diabetes

- Type 1 diabetes
  - characterized by deficient insulin production
  - requires daily administration of insulin for survival
- Type 2 diabetes
  - The most common type of diabetes (>90%)
  - Combination of resistance to insulin action and an inadequate insulin secretory response due to ß-cell dysfunction.
  - Insulin is not required for survival, but often needed it for controlling blood glucose levels.
- Gestational diabetes
  - Gestational diabetes is hyperglycaemia with blood glucose values above normal but below those diagnostics of diabetes, occurring during pregnancy.

Steps of management of diabetes in a primary care setting



Diagnostic criteria for diabetes

Measurement	Diagnostic cut-off	Comments
Fasting* venous or capillary** plasma glucose	=7.0 mmol/l (126 mg/dl)	Least costly but difficulties with ensuring a fasting state
2-hour post-load venous plasma glucose	=11.1 mmol/l (200 mg/dl)	Standard method, but cumbersome and costly
2-hour post-load capillary** plasma glucose	=12.2 mmol/l (220 mg/dl)	Cumbersome and costly, difficulties with ensuring a fasting state
Random plasma glucose	=11.1 mmol/l (200 mg/dl)	*Least sensitive* test, to be used in the presence of symptoms
HbA1c***	6.5% (48 mmol/l)	Does not require the fasting state but more costly

overnight fast of 8-14 hours; **if laboratory measurement is not available, point of care devices can be used (they report glucose values in capillary plasma); * plasma glucose is preferred in people with symptoms who are suspected of having type 1 diabetes*

TREATMENT GOAL IN DIABETES

HbA1c of 7.0%

OR

Fasting PG value of 7.0 mmol/l (126mg/dl)

AND (if feasible)

Postprandial PG value of 9.0 mmol/l (160 mg/dl)

Treatment principles

Non-pharmacological

- **A healthy diet**, maintaining **normal body weight** and regular **physical activity** are the **mainstay** of diabetes management

Pharmacological

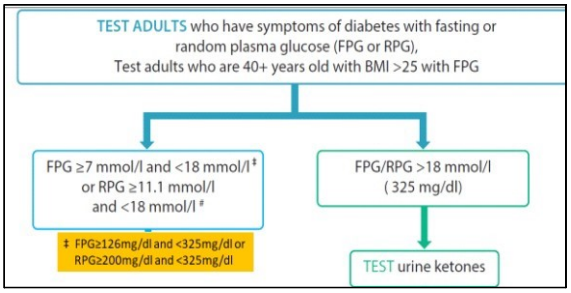
- **Metformin** is the recommended **initial treatment** for people who do not achieve the desired glycaemic control with diet and physical activity.
- **Sulfonylurea** can be used as initial (first-line) treatment **when metformin is contraindicated or not tolerated**
- **Add sulfonylurea** when metformin fails
- **Add human insulin** if treatment with metformin and sulfonylurea fails (see protocol for details)

Indications for referral

- If control is not achieved even after 3 months despite adherence to medication, healthy diet and physical activity

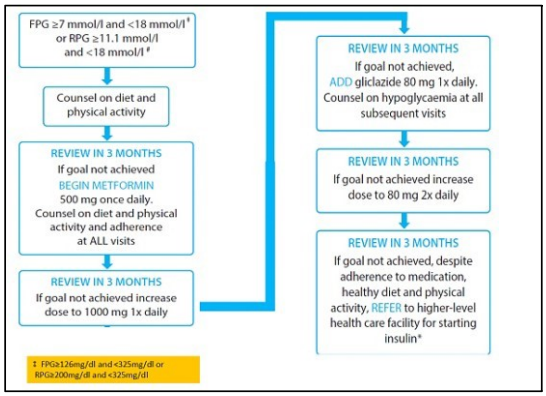
Whom to test?

(According to WHO Diabetes protocol 2018)

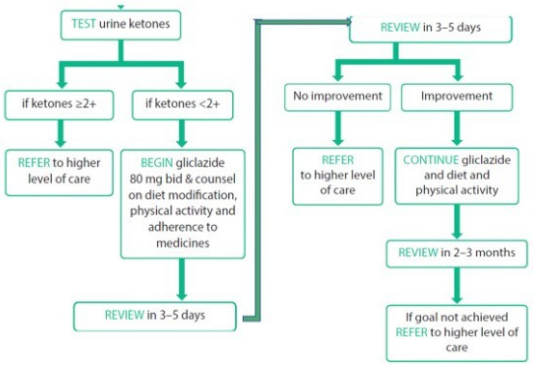


In **asymptomatic** people, it is recommended to **repeat** testing to confirm the diagnosis, preferably with the same test, as soon as practicable on a subsequent day

Management of Raised blood sugar



Management in presence of Ketones



Follow-up

Check for complications

- Measure **blood pressure** at every visit
- REFER for dilated-pupil **retinal exam** upon diagnosis, and every two years thereafter
- Examine **feet for ulcers** at every visit. REFER to higher level of care if ulcer present
- Assess risk of **lower limb** amputation annually. REFER to higher level of care if ulcer present or pulse absent
- Test for **proteinuria** annually. REFER to higher level of care if positive.

Precautions with antidiabetic drugs

Metformin is contraindicated in

- people with chronic kidney disease (estimated glomerular filtration rate (eGFR) <45 ml/minute/1.73m2)
- liver disease
- cardiac/respiratory insufficiency
- alcohol abuse
- history of lactic acidosis

Glibenclamide is not recommended in

- people aged 60 years or older
- In patients for whom hypoglycaemia is a concern (people who are at risk of falls, people who have impaired awareness of hypoglycaemia, people who live alone)
- people who drive or operate machinery as part of their job

Macrovascular complications

Patients with diabetes are at a higher risk of

- Coronary heart disease
- Cerebrovascular disease
- Peripheral vascular diseases

Management of CVD risk factors in diabetes (hypertension)

Blood pressure control

- Blood pressure lowering in people with diabetes reduces the risk of microvascular and macrovascular complications
- **Thiazide diuretics** and **angiotensin-converting enzyme** (ACE) inhibitors are **recommended**
- Target should be to achieve a target blood pressure < 130/80 mmHg.
- If this is not achievable, refer to a higher level of care.

Management of CVD risk factors in diabetes (lipid control)

Lipid control

- Some lipid profile improvement can be achieved with a healthy diet and physical activity.
- *Statins* can reduce the risk of CVD events in people with diabetes.

Antiplatelet treatment

- Use of antiplatelet treatment only for secondary prevention of CVD events.
- 75-100 mg of acetylsalicylic acid daily is recommended to all people with diabetes who have survived a CVD event and have no history of major bleeding

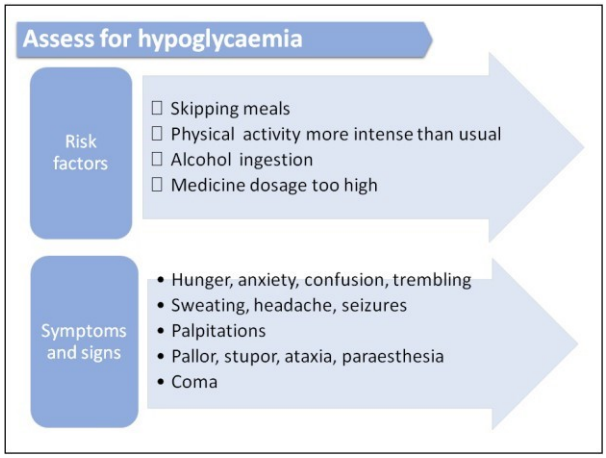
Acute complications of diabetes

Hypoglycaemia

Hyperglycaemia

Hypoglycaemia

- Hypoglycaemia (abnormally low blood glucose) is a frequent complication in patients receiving sulfonylurea or insulin.
- There is no universally agreed plasma glucose cut-off point for hypoglycaemia as symptoms and signs can occur at different thresholds.
- It is most frequently defined at **plasma glucose of <3.9 mmol/l (70 mg/dl)** when it **should be managed even if there are no symptoms and signs**.
- **Severe hypoglycaemia** (plasma glucose <50 mg/dl or 2.8 mmol/l) or appearance of signs
- It can cause loss of consciousness and coma and is potentially life-threatening



Management of hypoglycaemia – conscious patient

If the patient is able to eat and drink:

- Give oral carbohydrate that contains 15-20 g of rapidly absorbing forms of glucose (sugar-sweetened soft drink, 1-2 teaspoons of sugar, 5-6 hard candy, cup of milk)
- Repeat the treatment if hypoglycaemia persists after 15 minutes
- If rapidly absorbing glucose is not available, any foods containing carbohydrate can be given (e.g. bread, rice, potato)
- Follow by a small meal

Management of hypoglycaemia- unconscious patient

If patient is Unconscious,

- If plasma glucose <=2.8mmol/l (50mg/dl) and those unable to eat or ingest drink – give hypertonic glucose (dextrose) intravenously (20 – 50 ml of 50% glucose over 1-3 minutes.
- If this concentration is not available, substitute with any hypertonic glucose solution
- Food should be provided as soon as the patient is able to ingest food safely
- Adjust medication if necessary
- Educate the patient about conditions leading to hypoglycaemia

Hyperglycaemic emergencies

- **Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS) are life-threatening conditions**
- **Severe hyperglycaemia-**
  - **P**lasma glucose >18 mmol/l (325 mg/dl) and
  - Urine ketone 2+ or signs and
  - Symptoms of severe hyperglycaemia

Symptoms and signs of hyperglycaemia (DKA and HHS)

- Nausea, vomiting and abdominal pain
- Severe cases of DKA can present with Kussmaul's breathing*
- Changes in sensorium range from alertness to stupor or coma, depending on the severity
- Patients with **HHS typically present in stupor or coma**

**Kussmaul breathing: Air hunger, or rapid, deep, and labored breathing characteristic of patients with acidosis*

Management of hyperglycaemic emergencies

- DKA or HHS should be suspected in every ill patient with hyperglycaemia
- Refer to hospital all patients with plasma glucose levels >= 18 mmol/l (325 mg/dl) and all patients with suspected DKA or HHS
- **Infuse isotonic saline (0.9% NaCl) at a rate of 1000 ml in the first 2 hours, continue with 1000ml every 4 hours until reaching hospital.**
- Hyperglycaemia slows gastric emptying and oral rehydration might not be effective, even in patients who are not vomiting

Correction of dehydration is the critical first step for transport.

Specific Long- term Complications of Diabetes

- Diabetic retinopathy
- Diabetic nephropathy
- Diabetic neuropathy
- Diabetic foot

Diabetic retinopathy

Definition

Diabetic retinopathy is a highly specific vascular complication of diabetes and among the leading causes of blindness

Risk factors for diabetic eye changes

- duration of diabetes
- glycaemic control
- hypertension
- diabetic kidney disease
- dyslipidaemia.

Signs and symptoms of diabetic eye changes

- Vision-threatening retinopathy and macular changes may be *asymptomatic*
- Vision loss occurs at advanced stages.

Diagnosis

- Presence of specific retinal lesions and macular edema on fundus examination after pupil dilation

Recommendations for early detection of diabetic retinopathy

- Good control of glycaemia as well as blood pressure and dyslipidaemia can slow the progression of diabetic retinopathy and macular edema
- People with type 2 diabetes should be screened for retinopathy by a trained person ***upon diagnosis and every 2 years thereafter***
  - Visual acuity
  - Direct or indirect ophthalmoscopy or retinal fundus photography, after dilating the pupils
- Patients reporting vision loss at any visit and those who have not had a retinal exam in more than 2 years should be referred to an ophthalmologist.
- Referral to an ophthalmologist is recommended if screening by a trained person is not available in primary care

Diabetic nephropathy

Definition

Diabetic nephropathy is aa clinical syndrome defined by albuminuria* characterized by a relentless decline in glomerular filtration rate (GFR), raised arterial blood pressure and high risk of CVD & death

Risk factors for kidney changes

- genetic susceptibility
- poor glycaemic control
- elevated blood pressure

Signs and symptoms of diabetic nephropathy

- The first symptom of diabetic nephropathy is usually **peripheral edema,** but this occurs at a very late stage
- The first clinical sign of diabetic nephropathy is moderately increased **urine albumin** excretion (microalbuminuria: 30–300 mg/24 h, or an albumin/creatinine ratio 30–300 mg/g).

*(*albuminuria in at least 2 of 3 consecutive samples > 300 mg/24 h, or albumin/creatinine ratio of> 300 mg/g*)

Recommendations for early detection of diabetic nephropathy

- Control of glycaemia and blood pressure can slow the progression of diabetic nephropathy.
- Aim for good glycaemic control but adjust for hypoglycaemia risk
- ***Once a year monitor*** the albumin/creatinine ratio in a spot urine sample and serum creatinine for screening of CKD
- If measurement of the albumin/creatinine ratio is not available, test for proteinuria (preferably with strips that specifically measure lower concentrations of albumin).
- Maintain blood pressure levels at <130/80 mmHg with a thiazide diuretic and an ACE-inhibitor
- Modify other major CVD risk factors (dyslipidaemia, smoking)

Diabetic neuropathy

Definition

- Nerve damage or degeneration in diabetes is a group of disorders with diverse clinical manifestations like sensory and disorders of autonomic nervous system.

Risk factors

- Duration of diabetes, Poor glycaemic control
- Age, Hypertension , Obesity

Signs and symptoms of diabetic neuropathy

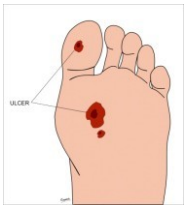
Peripheral neuropathy	Autonomic neuropathy
• Sensory loss • Unpleasant sensation of burning, pain • Tingling or numbness	• Hypoglycaemia • Orthostatic hypotension • Resting tachycardia • Diarrhoea, constipation and fecal incontinence • Erectile dysfunction • Urinary incontinence and bladder dysfunction

Recommendations for management of diabetic neuropathy

- Specific treatment for the underlying nerve damage is not available
- If possible, exclude causes of peripheral neuropathy other than diabetes (alcohol, chemotherapy, vitamin B12 deficiency, hypothyroidism, renal disease, malignancies, HIV infection)
- Refer patients with painful peripheral neuropathy to specialized care for pharmacological management of pain
- Refer patients with suspected autonomic neuropathy to specialized care
- **Improve glycaemic and blood pressure control**

Foot problems in diabetes

- **Diabetic foot** is one of the most common, costly and severe complications of diabetes
- A diabetic foot ulcer is a localized injury to the skin and/or underlying tissue below the ankle.
- Most diabetic foot ulcers are most often caused by *trauma* from inappropriate footwear and/or *walking barefoot with insensitive feet*.
- Combined with reduced blood flow, neuropathy in the feet increases the chance of foot ulcers, infection and eventual need for limb amputation.



Symptoms of diabetic foot

- Patients can present with symptoms and signs of peripheral neuropathy and/or peripheral artery occlusion and other risk factors for amputation
- Symptoms are:
  - Intermittent claudication - pain in calves when walking, usually disappears in rest (occlusion in peripheral arteries)
  - symptoms of neuropathy

The absence of symptoms does not exclude diabetic foot problems.

Assessment and management of risk of active foot problems

Examination of the feet

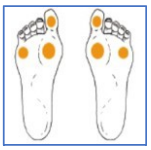
- Remove the patient's shoes, socks, dressings and bandages
- *Check for Peripheral neuropathy -*
  - ***Pressure perception*** *testing with 10g Semmes-Weinstein monofilament and*
  - *At least one other test of* ***sensation*** *(128Hz tuning fork vibration / cotton wisp /pin prick – see images)and*
  - *Achilles* ***tendon reflexes***

Monofilament test

Sensory examination should be carried out in a quiet and relaxed setting.

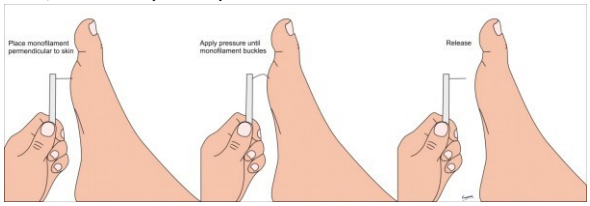
- First apply the monofilament on the patient's hands (or elbow or forehead) so that she or he knows what to expect.
- The patient must not be able to see whether or where the examiner applies the filament.
- The three sites to be tested on both feet are indicated in Figure
- The total duration– skin contact and removal of the filament should be approx. 2 secs.
- Apply the filament along the perimeter of **not on an ulcer site callus or necrotic tissue.**
- Do not allow the filament to slide across the skin or make repetitive contact at the test site.

Figure a: Sites for monofilament test



Monofilament test (contd)

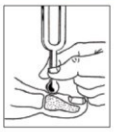
- Apply the monofilament perpendicular to the skin surface. Apply sufficient force to cause the filament to bend or buckle.
- Press the filament to the skin and ask the patient whether they feel the pressure applied (Yes/No)
- Next, ask where they feel the pressure (right foot / left foot)
- Repeat this application twice at the same site but alternate this with one "mock" application in which no filament is applied
- So, in total **three questions per site** should be asked



Tuning fork test

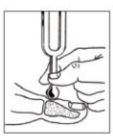
- Sensory examination should be carried out in a quiet and relaxed setting.
- First, apply the tuning fork on the patient's wrist (or elbow or clavicle) so that he or she knows what to expect
- The patient must not be able to see whether or where the examiner applies the tuning fork.
- The tuning fork is applied on a bony part on the dorsal side of the distal phalynx of the first toe
- The tuning fork should be applied perpendicularly with constant pressure (fig d)
- Repeat this application twice but alternate this with at least one "mock" application in which the tuning fork is not vibrating.

Figure d : Site for tuning fork test



Interpretation of Tuning fork test

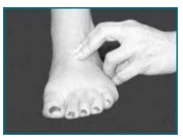
- The test is **positive** if the patient correctly answers at least two out of three applications
- The test is **negative** with two out of three incorrect answers, i.e patient is "**at risk for ulceration**"
- If the patient is unable to sense the vibrations on the big toe the test is repeated more proximally (malleolus)



Palpation of arteries

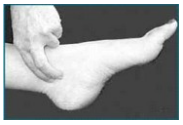
Palpation of dorsal pedis:

- Feel in the middle of the dorsum of the foot just lateral to the tendon of extensor halluces longus (extensor tendon of the great toe)



Posterior tibial artery:

- Midway between medial malleolus and tendon calcaneus



Signs for classifying a patient's risk for developing diabetic foot problems

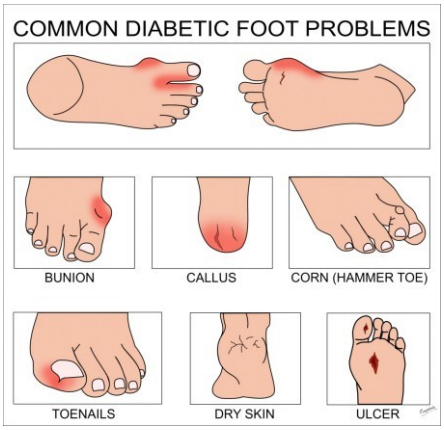
1. Palpation of tibial posterior and dorsal pedal artery pulse
2. Presence of current or previous (healed) ulcer
3. Previous amputation
4. Presence of callus
5. Presence of deformity: claw toes, hammer toes, bony prominences; limited joint mobility
1.6. Presence of Charcot arthropathy : redness, warmth, swelling or deformity, particularly if skin is intact
7. Signs of infection or inflammation: at least two of redness, warmth, induration, tenderness, purulent secretion
8. Signs of gangrene

Stratification of risk for developing diabetic foot problems

Risk level	Low risk	Moderate risk	High risk	Active foot problem
Features	No risk factor except *callus alone*	*Any of:* • deformity • neuropathy • non-critical limb ischaemia	*Any of:* • previous ulcer • previous amputation • neuropathy with non-critical limb ischaemia • neuropathy with callus and/or deformity • non-critical limb ischaemia with callus and/or deformity	*Any of:* • Ulcer • Spreading infection • Critical limb ischaemia • Gangrene • Suspicion of acute Charcot arthropathy • Unexplained red swollen foot
Action	Assess Annually	Assess every 3-6 months	Assess every 1-3 months	Urgent referral

Recommended actions for foot deformities

- Removal of callus (or refer if not feasible)
- Protecting or draining blisters
- Treatment of ingrown and thickened nails (or refer if not feasible)
- Antifungal treatment for fungal infections
- Patients with **gross foot deformities** and/or absent peripheral pulses should be referred for further evaluation.



Counselling on foot care

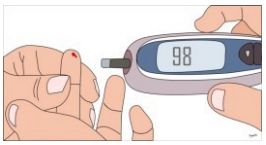
- ✓ Examine the feet daily, including between the toes
- ✓ Avoid walking barefoot, in thin-soled footwear or in socks only, both at home and outside
- ✓ Wash feet daily with water temperature below 37°C and dry them well, especially between the toes
- ✓ Lubricate skin with emollients, but not between the toes
- ✓ Cut toenails straight across.
- ✓ Wear socks without seams, not wear tight or knee-high sock and change socks daily
- ✓ Not wear shoes that are too tight, have rough edges or uneven seams; the inside should be 1-2 cm longer than the foot
- ✓ Inspect shoes inside before putting them on
- ✓ Not remove corns and calluses, including with chemical agents or plasters

Points to remember ..

- Adults who are symptomatic can be tested with FPG or RPG (if they present in a non-fasting state)
- Fasting (venous or capillary) plasma glucose =7.0 mmol/lOR =126 mg/dl is diagnostic of diabetes
- Adults who are asymptomatic, should be tested with FPG
- If plasma glucose >= 18 mmol/l (325 mg/dl) urine ketones should be measured
- Metformin is the recommended initial pharmacological treatment.
- Target for glycaemic control is
  - HbA1c of 7.0% or,
  - FPG value of 7.0 mmol/l (126mg/dl) and (if feasible) a postprandial PG value of 9.0mmol/l (160 mg/dl)

Activities & case studies

How to use blood glucose meter



- Requirements for testing
  - Blood glucose meter
  - Lancet
  - Test strips
- Step 1 : Prick the middle or ring finger
- Step 2 : Apply blood to strip
- Step 3 : Read the result : Meter will display the blood glucose level.
- Precautions
  - Participant has to be in a fasting state for at least eight hours (participant can have water in fasting period but not tea or coffee)
  - Do not squeeze the finger take blood
  - Check the expiry date of test strips

Activity:
Demonstrate the use of a Glucose meter

1. Discuss the correct steps of using a Glucose meter
2. Ask two participants to volunteer to demonstrate the use of a glucometer
3. Discuss the process of calibration of the instrument

Activity:
Demonstration of foot examination

- Discuss how to conduct the foot examination and calculate the risk assessment
- Divide participants into pairs and ask them to carry out foot examination on each other and do the risk assessment
- Summarize the activity by explaining the dos and don'ts for prevention of diabetes foot

Case study 1: A Newly Diagnosed Diabetic

- *A.B. 42 years female has with no past medical history and presents with 3 months of fatigue, excessive thirst and frequent urination at night . How will you manage initially?*
- *A.B. is otherwise healthy with no other symptoms. She is a non-smoker who leads a sedentary lifestyle. What would you examine and test?*
- *On examination, AB's BMI is 32 but there are nil other remarkable findings. BP 130/75. FPG is 9.6mmol/L (172.8MG/DL), urine dipstick shows glucose 2+, the rest is negative. What further examinations and/or tests will you advise?*
-

Case study 2: Poorly controlled diabetic

1. *C.D. a 60 year- old male was diagnosed with T2DM 2 years ago. He is currently on metformin 2g daily and come to the PHC for a check-up after 12 months. What do you do?*
2. *C.D. states that he has gained 4 kg over the past 6 months. He says that he has to wake up several times in the middle of the night to pass urine. He reports he is compliant with his metformin and has not experienced any side effects. He had a retinal exam and a urine protein test when he was diagnosed with diabetes.*
3. *On examination, you note BMI 27, BP 130/75 but otherwise unremarkable. FPG 9.2mmol/L, Urine dipstick: 0 protein, glucose 1+, ketones 0 . What would you do next?*

Case study 3: Hypoglycemia

1. *I.J. is a 70 year- old male who was diagnosed with T2DM 8 years ago. He is currently on metformin 2g daily and gliclazide 80mg daily. He has come because he is sweating, has a headache and light-headedness. His last check-up was 6 months ago. What do you want to know?*
2. *He reports he is otherwise well, is not in pain and has been compliant with his medication. He states that this is not the first episode. They occur about twice a week, most often a few hours after breakfast and are relieved by eating some crackers. He states he does have irregular meals as he sometimes forgets to eat.*
3. *What is your provisional diagnosis? What do you want to do next?*
4. *On examination, I.J. is frail, with BP 120/75. He is sweating, appears anxious and slightly disoriented and feels weak at the time of examination. Random plasma glucose 3.2mmol/L (57.6 mg/dl)*
5. *What is your initial management? What is your follow up management?*

Case study 4 : Diabetic foot (1)

1. *G.H. is a 73 year- old male who was diagnosed with T2DM 1 year ago. He is on metformin 2g daily. He presents for the first time since his diagnosis with a deep ulcer on his right heel which he first noticed 1 day ago. What would you do next?*
2. *He reports numbness in his feet but otherwise feels well. He has no history of ulcers.*
3. *What is your provisional diagnosis? What would you do next?*
4. *On examination BMI=26.0, BP 180/95 mmHg. Dorsalis pedis and posterior tibial pulses are present and strong on both feet. Monofilament test is positive for diabetic neuropathy. No other abnormalities apparent. The edges of the ulcer on the right heel are clean and there does not appear to be any slough and minimal surrounding erythema.. There is no evidence of gangrene, systemic infection or ulcers elsewhere. He has not been examined for diabetic eye disease when he was diagnosed. Investigations show FPG is 13.4mmol/L. Urine dipstick shows protein 0, ketones 2+.*
5. *What would be your management?*

Case study 5-Newly diagnosed type 1

- I.J. *is a 26 year -old female who presents after experiencing 6 kg of weight loss over the past 3 months. She also reports feeling fatigued and lethargic.*
- *What are your differential diagnosis? What would you do next?*
- *I.J. reports that the weight loss has been unintentional. She has noticed that she has been eating roughly the same amount as usual. She has a family history of coeliac disease. IJ says she has been more thirsty than usual and has had to urinate more as a result, including at night. On examination, Liz appears to be a fatigued slender young adult. Vital signs are within normal limit. No lymphadenopathy present. Thyroid examination unremarkable. Tongue appears dry and coated.*
- *What biochemical tests would you want to do next in the primary care setting?*
- *Results are as follows: Blood film, haemoglobin and haematocrit are within normal limits. FBG 20.0mmol/L. Urine glucose +++, Ketones +++, HIV negative*
- *What is your provisional diagnosis? How do you proceed?*

Case study 6- Diabetic Foot (2)

- *K.L. is a 60 year- old female who presents with a black 2nd toe on her left foot. She was diagnosed with T2DM 3 years ago and is currently on simvastatin 40mg daily, metformin 1g daily. She says she first noticed the black toe a couple of weeks ago, but has since come in because she has noticed that there is a deep ulcer at the tip of her 2nd toe. She currently smokes 20 cigarettes per day. She has not been reviewed since time of diagnosis.*
- *What is your differential diagnosis? What do you want to know? What do you want to look for?*
- *On examination, K.L.'s random PG is 20mmol/l. Her blood pressure is 160/95. Examination shows that in her left foot, there is an absent dorsalis pedis pulse and a weak posterior tibial pulse. The tip of her 2nd toe in the left foot is black with a 1cm x 1cm x 1cm ulcer with clean edges. There is no surrounding erythema or swelling. Urinalysis shows protein 2+, ketones 0.*
- *How would you proceed?*

Case study 7 –
Accidental diagnosis of diabetes in a young person

- *M.N. is a thin, 25-year-old male who presents with a fever and a dry cough of 3 days duration. You diagnose pneumonia on lung auscultation and elevated leucocyte count and initiate antibiotic treatment.*
- *Random plasma glucose has also been measured and it is 12.4 mmol/l. What do you do next?*
- *M.N. denies having symptoms of diabetes and was well before the onset of fever and cough. Urine glucose is +++, urine ketones ++*
- *How do you proceed*?
- *M.N. comes back feeling better, the fever has subsided, and he has no symptoms of diabetes.*
- *Fasting PG is 8.0 mmol/l, urine glucose is ++, ketones +*
- *How do you proceed?*

Training manual

WHO Package of Essential NCD Interventions (PEN)

Management of Type 2 Diabetes.