

CLINICAL GUIDELINES
FOR THE MANAGEMENT OF
TYPE 2 DIABETES

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Introduction

These guidelines have been developed for the management of Type 2 diabetes at primary health care level as part of the Ministry of Health's endeavour to improve and standardize the diagnosis, management and follow up of patients suffering from non-communicable diseases. The guidelines have drawn on a number of reknown publications, a list of which appears at the end of the document. The development of these guidelines is the combined efforts of physicians, cardiologists, public health physicians, health educators, nutritionist, nurses and paramedical health care providers in association with the Mauritius Institute of Health. The authors have made special efforts to have evidence based details to support their recommendations and to adapt these to realities of health care facilities available at PHC level viz. availability of drugs, diagnostic facilities and staffing.

1. Definition and Diagnosis of Diabetes

1.1 Diabetes is a metabolic disorder of multiple aetiology characterised by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both with long-term complications affecting most organ systems. Diabetes is classified into two main categories: Type 1 (also sometimes referred to as insulin dependent) and Type 2 (non-insulin dependent). Other categories include gestational diabetes, malnutrition related diabetes and diabetes associated with other conditions or syndrome (hormonal disorders such as Cushings disease, and pancreatic disorders). The commonest form of diabetes is Type 2 diabetes and it accounts for over 99% of diabetes in Mauritius.

1.2 Making the diagnosis of diabetes

Patients who fall into one of the following categories should have a random capillary blood or casual plasma glucose measurement:

- Patients with clinical features associated with diabetes e.g. polyuria, polydipsia, weight loss despite good appetite, poor wound healing, repeated skin infections, deteriorating vision, poor obstetric history, impotence.
- Patients with a family history of diabetes in a first degree relative
- Overweight/obese patients (Body mass index > 25)
- Hypertensive patients (see the hypertension guideline for further details)
- Women with a poor obstetric history, such as a history of still birth, big babies.

1.3 Criteria for diagnosing diabetes

These are:

1. symptoms of diabetes plus a casual plasma glucose of 11.1 mmol/L (200 mg/dL) or greater
2. fasting plasma glucose level of 7.0 mmol/L (126 mg/dL) or greater
3. a 2-hour plasma glucose of 11.1 mmol/L or greater during an oral glucose tolerance test (OGTT)

Table 1: Values for diagnosis of diabetes mellitus and other categories of hyperglycaemia

Glucose concentration, mmol/l⁻¹ (mg dl⁻¹) Plasma Venous*	
Diabetes Mellitus:	
Fasting or 2-h post glucose load	≥ 7.0 (≥ 126) ≥ 11.1 (≥ 200)
Impaired Glucose Tolerance (IGT):	
Fasting (if measured and 2-h post glucose load	< 7.0 (< 126) and ≥ 7.8 (140) < 11.1
Impaired Fasting Glycaemia (IFG):	
Fasting	≥ 6.1 (≥ 110) and < 7.0 (< 126)
and (if measured) 2-h post glucose load	< 7.8 (< 140)

A diagnosis of diabetes implies lifelong treatment and should always be based on a confirmatory test i.e. the individual should have two plasma glucose measurements, taken on separate occasions, within the diagnostic range.

2. Clinical and Laboratory Assessment of Patients with Newly Diagnosed Diabetes

2.1 Aim

1. To detect aggravating or precipitating factors for DM
2. To identify all associated risk factors for macro and microvascular complications of DM
3. To detect target-organ damage.

2.2 All patients with newly diagnosed diabetes should have the following minimum assessment

- Measurement of height, weight, waist, BMI
- Measurement of blood pressure
- Examination of feet for pulses, loss of sensation to touch/vibration, signs of infection
- Measurement of visual acuity
- Urine tested for albumin, ketones and glucose
- Record made of current physical activity/recreational exercise levels, smoking history and alcohol consumption, addition of salt to prepared food

If the resources and laboratory facilities are available then the following may be desirable.

- ECG as baseline
- Fasting blood lipids-cholesterol and triglycerides, HDL, LDL
- Serum urea and creatinine for those with proteinuria
- Retinal examination by fundoscopy
- Urine for microalbuminuria if dipstick –ve
- Glycosylated haemoglobin (Hb_{A1c})

2.3 Clinical Examination

A full clinical examination with emphasis on baseline detailed assessment of main organs/systems affected by the condition is carried out.

Many diabetics are diagnosed while undergoing routine check ups or as part of preoperative assessment. Many are diagnosed when they see the doctor with signs and symptoms of end organ damage.

3. Management of Type 2 DM

3.1 Aims of management

1. To achieve euglycaemia
2. To eliminate or minimise all associated risk factors
3. To treat target organ damage if present

3.2 Non-pharmacological management and diabetes education

The following non-pharmacological measures for the management of diabetes should be continually reinforced, to all patients with diabetes. This should be done by all health care staff coming into contact with patients with diabetes, and ideally should form part of a more formal education programme which should be available for all people with newly diagnosed diabetes.

- **Diet** Avoid pure sugars in food and drinks. Encourage wholemeal cereals, vegetables and fresh fruits. Restrict the use of saturated fats . Vegetable oils used in food preparation should be of the monounsaturated/polyunsaturated type and used as part of a calorie-controlled diet. Consumption of fish, especially the oily varieties, should be encouraged. Restrict the addition of salt to prepared food. Limit canned food, processed food, dried food and pickles because of high salt content. The diet should aim to provide 55% of energy intake from carbohydrates, 10-15% from protein, and 25-30% from fat. The advice given should be individualised, based on traditional foods and around the eating habits of the household (See dietary guidelines).
- **Weight reduction and maintenance** All overweight patients should be encouraged to lose weight. All weight reduction diets should be accompanied by a plan to increase physical activity and/or exercise. Those whose BMI is <25 should be encouraged and supported to maintain their current weight.
- **Exercise** All patients should be encouraged to undertake regular moderate aerobic physical activity. Ideally patients should get about 30 minutes of exercise of moderate intensity (such as brisk walking, swimming, cycling) on most days of the week..
- **The effects of excessive alcohol** intake should be emphasised. Patients must be encouraged to drink in moderation. Those who do not drink should be advised not to start.
- **Harmful effects of smoking** should be emphasised and patients encouraged to stop smoking.

- **General hygiene and foot care.** Particular attention should be given to the importance of preventive foot care and to promptly seeking medical attention should foot problems arise.
- **Education** - the importance of attending clinic visits and compliance with treatment should be stressed.

3.3 Pharmacological management

In many patients with Type 2 diabetes non-pharmacological measures will be adequate to achieve the blood glucose targets (see table 2). However, where these are inadequate the introduction of pharmacological agents will be necessary. Three agents are recommended in our local context: glibenclamide, metformin and insulin.

- **The sulphonylureas are the drugs of first choice** in normal weight (BMI<25) patients. **Glibenclamide.** The starting dose is 2.5 mg with titration up to a maximum dose of 15mg in one or two daily doses according to blood glucose control. (alternatively, especially for elderly patients, Tolbutamide, starting at 500 mg bd, increasing to maximum of 1000 mg bd). The major side effect is hypoglycaemia, which is potentiated by alcohol consumption, renal impairment, concomitant therapy with aspirin, sulphonamides and warfarin, and in elderly patients. In all these patients great care must be exercised, starting at the lowest dose and titrating gradually upwards to achieve control.
- **Metformin** This drug is indicated as first line pharmacological therapy in overweight patients (BMI≥25) with normal renal function. Normal renal function either means a normal creatinine or urea level, if this measurement is available, or if not available then the absence of proteinuria on urine dipstick testing. The starting dose is 500mg up to a total of 3000 mg a day in one or two doses.
- **Insulin** is indicated early in the course of the disease in thin or ill patients who remain poorly controlled (based on the criteria given below) despite lifestyle modification, diet and maximum doses of oral agents (including glibenclamide and metformin in combination, where tolerated). The decision to use insulin and the initiation of insulin therapy will be made by the doctor supporting the clinic.

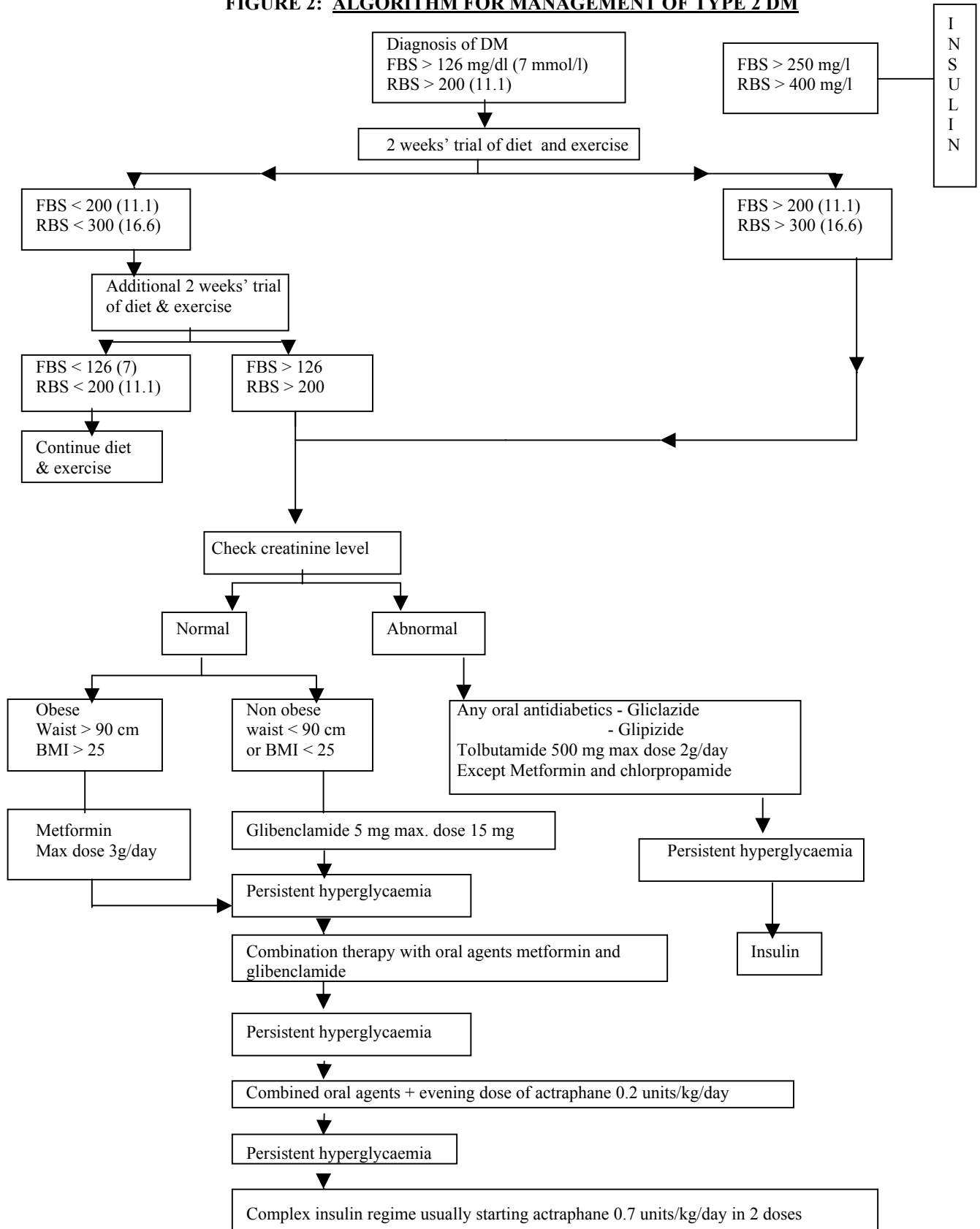
Figure 2 illustrates the stepped approach taken to the management of non-insulin dependent diabetes. A child or adult presenting with features suggestive of insulin dependent diabetes, such as being clinically unwell with a raised blood glucose and ketones in the urine should be referred to a physician for further assessment and management.

Note:

Treatment of the elderly diabetic

Elderly diabetics are susceptible to hypoglycaemia at doses usually recommended for younger diabetics. Use low starting doses and increase gradually to optimal dose.

FIGURE 2: ALGORITHM FOR MANAGEMENT OF TYPE 2 DM



The stepped approach starts with education on diet, weight and exercise with the aim of achieving the targets indicated under ‘non-pharmacological management’. The patient is reviewed monthly for the first three months. On each visit the importance of diet, weight loss and exercise is stressed, the progress of the patient monitored and problems they are having identified. If after three months blood glucose control remains poor (based on the criteria given below) oral hypoglycaemic therapy is introduced, with monthly monitoring and increasing to the maximum dose if necessary. If blood glucose control remains poor a second oral agent can be introduced so long as there are no contraindications to its use. If the stage is reached that the person is on the maximum dose of both oral agents and control still remains poor then the person is assessed with a view to possibly starting insulin therapy.

Once acceptable blood glucose control is achieved review can be less frequent.

3.4 Follow-up

At each visit the following are measured/assessed.

- weight
- waist
- fasting blood glucose
- blood pressure
- symptoms of polyuria and polydypsia enquired about
- patients’ understanding of diet, weight loss/maintenance, exercise and foot care advice briefly enquired about
- general enquiry for any other problems

3.5 Targets for Diabetes Control

The main assessment of blood glucose control is on fasting blood glucose. Glycated haemoglobin gives indication of glucose control over the last 10-12 weeks and should be done at least 6 monthly. Patients should be advised to fast for at least 10 hours before attending the clinic with nothing to eat or drink except clear water. Clearly any hypoglycaemic medication should be omitted until after the blood test and food is available. Targets for diabetes control are shown in table 2.

Table 2: Target values for good diabetic control

Measure	Units	Optimal	Acceptable	Uncontrolled
Fasting Plasma Glucose	mmol/L	4.4 – 6.1	6.1 – 7.0	> 7.0
Capillary Blood Glucose	mmol/L	4.5 – 6.2	6.2 – 7.8	> 7.8
Non-fasting Plasma Glucose	mmol/L	4.4 – 8.0	8.0 – 10.0	≥ 10.0
Hb _{A1c} (depends on method used; Non diabetic < 5.0% by present method)	%	< 6.2		≥ 6.2
Serum Total Cholesterol	mmol/L	< 5.2		≥ 5.2
Serum Triglycerides	mmol/L	< 1.5		≥ 1.5
HDL-Cholesterol	mmol/L	> 1.1		≥ 1.1
LDL-Cholesterol (=[Total Cholesterol] – [Triglycerides/2.2 + HDL Cholesterol])	Mmol/L	< 2.5		≥ 2.5
BMI	Kg/m ²	< 23	23 – 25	> 25
Waist M	cm	< 94	94 – 99	> 99
F		< 80	80 – 85	> 85
BP	mmHg	≤ 130/80	130/80 – 160/95	> 160/95

4. References

1. Baker, R.K. Khunti, et al. (1993). Audit protocol: monitoring diabetes. Leicester, Eli Lilly National Clinical Audit Centre.
2. Mbanya, J.-C., F. Bonnici, et al., Eds. IDF Africa Region, Panafrican diabetes study group and WHO Region of Africa. (1996). Guidelines for the management of non insulin dependent diabetes mellitus (NIDDM) in Africa. A consensus document.
3. Vouliagmeni, Greece, Novo Nordisk.

DIABETIC RETINOPATHY

Progression from mild non-proliferative diabetic retinopathy (increased vascular permeability)



Moderate non-proliferative diabetic retinopathy



Severe non-proliferative diabetic retinopathy (vascular closure)
(NPDR)



Progressive diabetic Retinopathy (PDR)
(growth of new blood vessels on retina and posterior
surface of the vitreous)

Vision loss:

- first central vision loss due to macular oedema or capillary non-perfusion
- second severe and irreversible vision loss (due to fractional retinal detachment)
- Pre-retinal or vitreous haemorrhage (Bleeding of new blood vessels)

Improved blood glucose control by intensive therapy results in 25% reduction in micro vascular complications

For every percentage point decrease in the HbAc (e.g 9-8%) there is reduction in microvascular complications

Intensive therapy results in reduced progression of diabetic retinopathy

Associated factors to treat:

- Proteinuria
- High blood pressure
- High serum lipid levels

DIABETIC EYE DISEASE

Note: Beware of pregnancy – risk of development and/or progression of diabetic retinopathy

Guidelines

Screening purposes:

Initial dilated eye examination

Repeat annually (specially after 30 years of age)

If retinopathy is progressing – more frequent examinations

2. REFER TO OPHTHALMOLOGIST IF:

- Decrease of visual acuity with background retinopathy/cataract
- Presence of macular oedema and severe non-proliferative diabetic retinopathy
- Presence of ischaemic areas in the retina (soft exudates) which are precursors of the proliferative phase of diabetic retinopathy
- The presence of proliferative retinopathy with an abnormal growth of a fine leash of blood vessels seen.
- The presence of retinal detachment
- The presence of vitreous hemorrhage

TYPE 2 DIABETES MELLITUS AND EXERCISE

Exercise may improve insulin sensitivity and assist in diminishing elevated blood glucose level into the normal range.

The diabetic health care team will be required to analyse the risks and benefits of exercise.

Exercise includes walking, brisk walking, jogging, cycling, swimming, dancing.

Evaluation before exercise

- Detailed medical evaluation with appropriate diagnostic studies.
- Carefully screen for the presence of macro- and microcardiovascular complications that may be worsened by the exercise program.
- Exam to focus on the symptoms and signs of disease affecting the heart and blood vessels, eyes, kidneys and nervous system.

Cardiovascular system

High risk:-

- Age > 35 years.
- Type 2 diabetes of > 10 years duration.
- Presence of any additional factor for coronary artery disease e.g. dyslipidaemia, obesity.
- Presence of microvascular disease (proliferative retinopathy or nephropathy, including microalbuminuria).
- Peripheral vascular disease.
- Autonomic neuropathy.

Do low intensity forms of exercise, such as walking.

Those with coronary artery disease-to undergo a supervised evaluation of the ischaemic response to exercise, ischaemic threshold, and the propensity to arrhythmias during exercise.

Peripheral Arterial Disease

Evaluate for signs and symptoms

- Intermittent claudication.
- Cold feet.
- Absent pulses.
- Atrophy of subcutaneous tissues.
- Hair loss.

Retinopathy

- Active strenuous activity may precipitate vitreous haemorrhage, or traction retinal detachment.
- To avoid anaerobic exercise and exercise involving straining, jarring, or Valsalva-like maneuvers.

Nephropathy

- High intensity or strenuous exercises to be discouraged.
- Can do low to moderate intensity forms of activity.

Neuropathy Peripheral

- Loss of protective sensation in the feet.
- Limit weight-bearing exercise.
- Repetitive exercise on insensitive feet can ultimately lead to ulceration and fractures.
- Evaluate by checking deep tendon reflexes, vibratory sense, position sensed touch sensation (with 10g monofilament).

Neuropathy Autonomic

- Indicated by resting tachycardia > 100 /minute, orthostasis (fall of systolic blood pressure > 20 mm Hg upon standing), skin, pupils, gastrointestinal and genitourinary systems-sign and symptoms.
- May result in sudden death and silent myocardial ischemia.

Preparing for exercise

- Young individual in good metabolic control can safely participate in most activities.
- Middle age and older individual to be encouraged to be physically active.
- Need for proper warm-up and cool-down period.
- Warm-up: 5-10 minutes of aerobic activity (walking, cycling etc.) at a low-intensity level.
- After warm-up, muscles to be gently stretched for another 5-10 minutes.
- Cool-down period to last 5-10 minutes and gradually to bring heart rate to pre-exercise level.
- Use silica gel or air midsoles, as well as polyester or cotton polyester socks to prevent blisters and keep the feet dry.
- Proper footwear is essential.
- Self monitoring for blisters and other potential damage to feet before and after exercise.
- Need for proper hydration before, during and after exercise.

Benefits of exercise

- Substantial.
- Consistent beneficial effect of regular exercise training on carbohydrate metabolism and insulin sensitivity.
- Improvement in insulin sensitivity and prevent cardiovascular disease.
- Effective in reducing levels of triglyceride rich VLDL.
- Improvement in levels of HDL.
- Reduction of blood pressure level, specially in hyperinsulinemic subjects.
- Exercise enhances weight loss.
- Loss of intra-abdominal fat.
- Exercise helpful in the prevention or delay in the onset of type 2 diabetes.
- Protects from osteoporosis in post menopausal women.
- In the elderly, progressive decrease in fitness and muscle mass and strength with ageing is in part preventable by maintaining regular exercise.
- Promoting exercise as a vital component of the prevention, as well as management of type 2 diabetes must be viewed as a high priority.

DIABETIC NEPHROPATHY

1. Onset and course of diabetic nephropathy can be ameliorated to a very significant degree by several interventions but these interventions have their greatest impact if instituted at a point very early in the course of the development of this complication.
2. Earliest manifestation of nephropathy is albuminuria.
For type II diabetes screen for proteinuria at time of diagnosis.
For type I diabetes screening should start with puberty or after 5 years disease duration.
3. If negative for albuminuria (by albustix) check for microalbuminuria (<300 mg/day of albuminuria). This stage is called incipient nephropathy. Screening can be done by special dipstix or 24 hr urine collection. Because of marked day to day variability in albumin excretion, at least 2 of 3 collection times in a 3 to 6 month period should show elevated levels before diagnosing a patient to have microalbuminuria.

4. If negative for microalbuminuria check yearly for microalbuminuria.

5. Effect of glycaemic control

Level of glycaemic control is very important as it reduces the risk of developing nephropathy and retarding its progression if already present.

6. Effect of hypertension control

Both systolic and diastolic hypertension accelerate the progression of diabetic nephropathy. Aggressive antihypertensive management greatly decreases the rate of fall of glomerular filtration rate.

- (a) In diabetic patients (18 years and above) aim to decrease blood pressure to and maintain it at < 130 mm Hg systolic and < 85 mm Hg diastolic.
- (b) For patients with isolated systolic hypertension with SBP > 180 mm Hg, reduce SBP by 20 mm Hg; also for those whose SBP is between 160-170 mm Hg. If these initial goals are met and well tolerated, further lowering may be indicated.
- (c) ACE inhibitors have selective benefit in retarding the progression of diabetic nephropathy. ACEI are recommended as primary treatment for **all** hypertensive diabetics with microalbuminuria or overt nephropathy (albuminuria > 300 mg/day).

- (d) ACEI recommended for all type I diabetics with microalbuminuria even if normotensive.
- (e) For type II diabetics should those with microalbuminuria show progressive increase in albumin excretion or should they develop hypertension, ACEI is indicated.
- (f) Start with enalapril 2.5 mg/day and increase up to 20 mg/day. Other antihypertensives such as β blockers or calcium channel antagonists can be added if necessary.

When using ACEI watch for hyperkalaemia and check creatinine soon after the start of treatment.

Should creatinine start to rise or hyperkalaemia develop stop ACEI.

7. **Microalbuminuria** is also a marker for greatly increased cardiovascular morbidity and mortality for diabetic patients. Therefore the finding of microalbuminuria is an indication for screening for possible vascular disease and aggressive intervention to reduce all cardiovascular risk factors (eg. lowering of LDL cholesterol, antihypertensive therapy, cessation of smoking, exercise etc.).

8. **Protein Restriction**

At this point in time general consensus is to prescribe a protein intake of approximately the adult recommended dietary allowance of 0.8g/kg/day. When the patient develops overt nephropathy, however it has been suggested that once creatinine starts to rise, further restriction to 0.6g/kg/day may prove beneficial in selected patients.

9. **Deteriorating renal function**

When glomerular filtration rate begins to decline substantially (eg. when creatinine rises $> 200\text{-}250 \mu\text{ moles/L}$) refer to physician for further follow up.

Summary

Annual screening for microalbuminuria will allow identification of patients with nephropathy at a point very early in its course. Improving glycaemic control, aggressive antihypertensive treatment, and the use of ACE inhibitors will slow the rate of progression of nephropathy.

PATIENT INSTRUCTIONS FOR THE CARE OF THE FOOT IN
DIABETICS

1. Do not smoke
2. Inspect feet regularly for cuts, blisters and scratches. Once a week a thorough examination with mirrors is necessary to see the soles of the feet and in between toes.
3. Wash feet daily – dry carefully between toes.
4. If feet feel cold at night during winter, wear socks.
5. Do not walk on hot surfaces barefoot.
6. Do not walk barefoot.
7. Do not use any chemical agents to remove corns and callouses. See a doctor or a podiatrist (chiroprapist) for these.
8. Inspect visually and by hand the inside of shoes before wearing them especially foreign objects, nailpoints, torn linings and rough areas.
9. Do not soak feet.
10. For dry feet, use babyoil or emollient cream but not in between toes.
11. Wear properly fitting stockings – Do not wear mended stockings, avoid stockings with seams, change stockings daily.
12. Shoes should be comfortable at time of purchase – do not depend on them to stretch out. Always wear socks with shoes.
13. Cut nails straight across.
14. Do not cut corns and callouses. Take advice from doctor or chiroprapist.
15. Do not cross your legs while sitting. This may cause pressure on nerves and blood vessels.
16. If fungal infections occur in between toes, leading to maceration of skin then a simple antimycotic topical application like Econazole or Tolnaftate will cure the infection fairly quickly.

GUIDELINES FOR THE MANAGEMENT OF DIABETIC NEUROPATHY

1. To control the symptoms of all the diabetic neuropathies, it is essential that strict glycaemic control be established, and that means, sometimes changing patients on OHA to insulin in those badly controlled on OHA or giving 4 daily doses of insulin – 3 doses of soluble insulin before each meal and 1 dose of long acting insulin at night.
2. In painful neuropathies, the use of analgesics ranging from aspirin to narcotics may be necessary. Other drugs most commonly used are:
 - Phenytoin
 - Carbamazepine
 - Amitriptyline
3. Cranial nerve palsies (most commonly the 3rd nerve) are presumed to be the result of vascular occlusion and usually resolve spontaneously. Use of aspirin as platelet anti aggregating agent and analgesics for the pain together with good glycaemic control forms the basis of the treatment.
4. Mononeuropathy e.g. radiculopathy, femoral neuropathies and meralgia paraesthetica can be treated by strict glycaemic control and local nerve blocks, if necessary.
5. Autonomic neuropathy of the cardiovascular system most commonly manifests itself as postural hypotension with severe dizziness when the patient changes posture. This can be dealt with by elastic stockings and in severe cases with fludrocortisone.
6. Bladder dysfunction and urinary retention are treated by encouraging the patient to void every 3 to 4 hours during the day.
7. Impotence is difficult to treat. Androgenic hormones are of no use. Use of implanted prosthesis or ‘erectaid’ or papaverine injected in the corpus cavernous have proved useful in certain cases.
8. Excessive sweating can be controlled by anti-cholinergic drugs. Gastric atony can be relieved by metochlopramide or domperidone. Diabetic diarrhoea can be controlled by broad spectrum antibiotics and occasionally codeine or loperamide.