Practice Guidelines for Type 2 Diabetes Mellitus

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Diabetes is one of the most prevalent chronic diseases among Malaysians. It is also well known that more than half of diabetic cases will eventually develop pathological changes in end organs. This will have a profound debilitating effect on the productivity and quality of life. Hence it is imperative that the Ministry of Health has to devote more care and attention towards diabetes so as to prevent its implications.

The proper diagnosis and control of diabetes is therefore essential. Appropriate skill in detecting diabetic complications and updated knowledge in the management of this is absolutely important.

The development of this guideline by The Ministry of Health with the help of Malaysian Diabetes Association is indeed very timely. It is our ardent hope that this guideline will assist doctors and paramedics in the profession to provide proper care and management of diabetic cases. I would take this opportunity to congratulate the task force who worked diligently to make this available. A note of special thanks to the contributors from universities, NGOs and the Ministry of Health.

TAN SRI DATO' (DR) ABU BAKAR SULEIMAN
DIRECTOR GENERAL OF HEALTH MALAYSIA
PREFACE

Professor Dato Dr Anuar Zaini Md Zain
President Malaysian Diabetes Association
Dean, Faculty of Medicine,
University of Malaya.

Diabetes Care is not the domain of any particular group of the health professionals. It provides a good example where an integrated and holistic approach to chronic disease management can increase efficiency and reduce health cost. It has been clearly demonstrated that the economic losses can be greatly reduced by investing in promotive and preventive programs particularly with regards to early detection of disease and prevention of complications.

It is estimated that there will be a 3-fold increase in the prevalence of diabetes among Asians by from the current estimates of 50 million people. Malaysians will probably see a prevalence exceeding 10% by the year 2020. At the same time the demographic change with a more elderly population the cost will escalate tremendously.

It is therefore, vital that Diabetes Care be co-ordinated properly and systematically at all levels of health care team. This consensus on practice guidelines on the management of Type 2 diabetes is an updated version of the first documentation in 1991. It represents the teamwork where doctors, dieticians and nurses were involved in the round table discussions for both versions. This updated edition provides a more comprehensive approach focusing on treatment strategies.

With the recent international agreement on the proper nomenclature for the various types of diabetes, it is suggested that this be included in this document. The term Type 2 diabetes, as it is now officially called, reflects the actual disease entity irrespective whether they require or depend on insulin or not. Diabetes mellitus is a complex disease and the heterogeneity in its clinical presentation, genetic predisposition and end-organ complications make it utterly important to approach its management in a concerted pattern enabling future meaningful evaluation. Any change of treatment strategies will then be justified and supported.
I would like to take this opportunity to thank everyone involved in developing this guidelines and particularly members of the task force team for their untiring effort to make this 'joint venture' successful.

Prof Dato Dr. Anuar Zaini
Chairman,

Practice Guidelines Taskforce
SCREENING FOR DIABETES MELLITUS

1.1 PREAMBLE

Types 2 Diabetes Mellitus (NIDDM) is a major public health problem in Malaysia. In 1995, the National Cardiovascular Risk Factor Prevalence Study showed that 7.7% of the adult population suffer from diabetes mellitus. It is estimated that about 95% of diabetes patient have type 2 diabetes mellitus. This disease is common in all ethnic groups especially among Indians.

The first step towards effective care is to ensure an early diagnosis. Recognizing that late diagnosis will lead to complications of diabetes, a good screening programme will prevent or delay the onset of complications and resulting morbidity.

1.2 OBJECTIVE

To assess specific high risk population groups for detection of diabetes and ensure timely and appropriate management.

1.3 STRATEGY

Selective - Opportunistic Screening.

1.4 TARGET GROUP

High risk individuals who present themselves to a health medical facility.

1.5 WHO SHOULD BE SCREENED

a) Any person found to have symptoms of diabetes mellitus (weight loss, tiredness, lethargy, polyuria, polydipsia, polyphagia, pruritus vulvae, balanitis) must be screened.

b) Any person who presents to a primary care facility for any reason, without symptoms of diabetes, but has any ONE of the following features should be screened:

* Age 35 years or older
* Obesity (BMI ≥ 30 and above)
* History of Gestational Diabetes Mellitus
* History of big baby (Birth Weight 4.0 kg.)
* Family history of diabetes mellitus
* Hypertension
* Hyperlipidaemia
  (Total cholesterol > 6.5 mmol/L and fasting triglyceride >2.3 mmol/L)

c) Pregnant women should be screened at least once at > 24/52 period of gestation.
1.6 SCHEDULE

Table 1: Schedule of the Screening Programme

<table>
<thead>
<tr>
<th>With one or more risk factors</th>
<th>Annually</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 35 to 40 years without any risk factor</td>
<td>Every 2 years</td>
</tr>
<tr>
<td>Age &gt;= 40 years</td>
<td>Annually</td>
</tr>
</tbody>
</table>

1.7 CENTRE FOR SCREENING

1. Outpatient clinics
2. Health clinics
3. Community Health Clinics (Klinik Desa)
4. General. Practitioners' Clinics
5. Hospitals

1.8 SCREENING TEST

Random Blood Glucose (capillary blood) using meters and strips by trained personnel (refer to Appendix 4)

1.9 PROCESS AND PROCEDURE FOR SCREENING

Refer to Figures 1 and 2.
Figure 1: Screening Process for Diabetes Mellitus at Primary Care Level

1. **Patient**
   - Risk Assessment
     - **No**
       - Screening for Random Blood Sugar
         - Suspected Diabetes
         - **Suspected Impaired Glucose Tolerance**
           - Laboratory Diagnosis
             - Diabetes
             - Impaired Glucose Tolerance
             - Normal
               - Follow-up as recommended
               - Management and Follow-up
               - Annual screening except for those aged 35 to 40 years old and without any risk factors
Figure 2: Procedure for Screening and Diagnosing Diabetes Mellitus and Impaired Glucose Tolerance.

Patients at risk:
- Age 35 and older, positive family history, obese, hyperlipidemia, hypertension, Gestational Diabetes.

Patients with symptoms of diabetes:
- Weight loss, thirst, polyuria, lethargy, polyphagia, pruritus vulvae, balanitis.

Random blood glucose (capillary whole blood)?

- < 7.0 mmol/l
- 7.0 - 11.0 mmol/l
- ≥ 11.0 mmol/l

For random blood glucose, capillary blood will be 1 mm higher.

Perform 75 gm oral glucose tolerance test, interpret according to WHO criteria.

- 2h PG < 7.8 mmol/l
- 2 hrs Plasma Glucose 7.8 - 11.0 mmol/l
- 2h PG ≥ 11.1 mmol/l

Diabetes

IMPAIRED GLUCOSE TOLERANCE

NORMAL

To follow as flow chart of screening process of Diabetes in Primary Care Level

Management and follow up
MANAGEMENT PLAN FOR TYPE 2 DIABETES (NIDDM) AND IGT

Three main approaches are recommended for the newly diagnosed type 2 diabetes (NIDDM) and IGT patient as illustrated in figure 3.

Figure 3: Management Plan for Type 2 Diabetes (NIDDM) and IGT

Health education, diet therapy and exercise must be reinforced
2.1 Education

Figure 4: Education Strategies

Information checklist:

1. The Disease
   a. It is a common chronic disorder
   b. There is chronic hyperglycaemia together with other metabolic abnormalities.
   c. The role of insulin resistance and/or deficiency
   d. Risk factors for diabetes
   e. Currently there is no known cure but the disease can be controlled enabling the person to lead a healthy and productive life.

2. Symptoms of the disease

50% of the cases are not aware that they are diabetic. The majority of them are symptomatic. Common symptoms: polyuria, polydipsia, tiredness, weight loss.
2.1 Acute Complications:

Table 2: Acute Diabetes Complications, Signs and Symptoms

<table>
<thead>
<tr>
<th>Acute</th>
<th>Warning Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperglycaemic coma</td>
<td>Severe thirst, Polyuria, tiredness, vomiting, drowsiness</td>
</tr>
<tr>
<td>Hypoglycaemic coma</td>
<td>Hunger, headache, tremor, sweating, aggressive behaviour</td>
</tr>
</tbody>
</table>

2.1 Chronic Complications

Damage to end-organs such as eyes, heart, blood vessels, kidneys, and nerves

3. Diet

3.1 Benefits of diet

- Control of weight, blood glucose and lipid levels

3.2 Type of diet

- Balanced diet with adequate amounts of proteins, fats, carbohydrate, vitamin and minerals.
- Importance of high fibre, high complex carbohydrate, low fat, low salt diet.

3.3 Distribution of Food Intake

Distribute food intake evenly throughout the day. Individualize diet intake accordingly to achieve and maintain reasonable bodyweight and optimal glycaemic and lipid control.

4. Exercise

4.1 Benefits of exercise

- Improves and control glycaemia, lipid level and blood pressure
- helps to control body weight
- improves cardiovascular fitness
- feeling of well being

4.2 Types of exercise

- Aerobic exercise e.g. brisk walking, stair/hill climbing jogging, cycling, swimming, tennis etc. At least 30 minutes, three times per week
Any other exercise recommended for healthy living

4.3 Precaution

- Seek your doctor’s advice before initiating any exercise program.
- Exercise must be individualized.
- If blood glucose is $\geq 20$ mmol/l, control diabetes first before starting exercise.

N.B Certain patients can control their diabetes with diet and exercise alone

5. Medication

Emphasize that diet and exercise are the mainstay of treatment. Medication should be given after an adequate trial of diet and exercise, unless symptomatic or if the blood glucose remains high.

4 groups of drugs

i. Biguanides e.g. **metformin**
   - delay absorption and increase peripheral utilization of glucose
ii. Sulphonylureas e.g. **glibenclamide, glipizide, glicazide**
   - Stimulate insulin secretion from pancreas and improve insulin action
iii. $\alpha$-glucosidase inhibitors e.g. **acarbose**
   - reduces glucose absorption from the gut
iv. Insulin
   - Used in those with uncontrolled diabetes and during acute complications and pregnancy

- Note:

(i) to (iii) oral medication. Expected decrease in blood glucose is around 20%.
(i) and (iii) not known to cause hyperglycemia

Emphasize appropriate dose, timing in relation to meals and compliance

6. Self care

Self care improves motivation and compliance. It allows the patient to assume responsibility and control of his/her own diabetes management. This include

- Blood glucose monitoring
- Body weight monitoring
- Foot care
- Personal hygiene
- Healthy lifestyle
2.2 Diet Therapy

Figure 5: Diet Therapy

- **ASSESSMENT**
- **DIETARY ADVICE**
  - Individualise diet and targets
  - Refer to Food Pyramid below and Appendix 6
- **ASSESSMENT**
- **Dietary Assessment**
  - Dietary and social history, anthropometric measures, metabolic parameters
- **Objectives**
  - To attain and maintain
    - Reasonable body weight
    - Acceptable blood glucose
    - Acceptable blood lipid

Figure 6: Food Pyramid for Diabetes

- Use sparingly
- Eat Less
- Have small amount of protein in each meal
- Choose low fat
- Eat Moderately
- Choose wide variety
- Eat More
- Use these as basis of meals
- Eat Most
2.3 Exercise

Figure 7: Exercise Strategies

**ASSESSMENT**
Medical, Physical Fitness

**Objectives:**
- To assist in blood glucose and lipid control
- To reduce and maintain satisfactory body weight
- To improve cardiovascular tolerance

**EXERCISE**

**Individualise exercise programme**
- Appropriate to the person’s physical, sociocultural and economic status
- Aerobic exercise e.g. jogging, cycling, swimming, tennis
- Regular at least 30 minutes 3 times/week
- Avoid injury
- Appropriate footwear
- Beware of hypoglycaemia

**Improve**

NB If blood glucose is > 20 mmol/L. control diabetes first before starting exercise

1. **How much to exercise?:**

Exercise should be done regularly and correctly. It should balance the amount of food we eat. For most people 30 minutes of exercise should be enough. Exercise should be carried out 3 to 4 times a week in order to be effective. Daily exercise is preferred. An exercise should be sufficient to cause sweating and raise the pulse rate to 120 to 150 beats per minute.

2. **Type of exercise:**

The kind of exercise to choose depends on individual physical condition, age and choice. It must be enjoyable and be capable of being incorporated into daily living. Common types of brisk walking, aerobic exercise, jogging, swimming, cycling, stairs climbing, skipping, tennis or badminton.
3. How To Exercise?

Before starting on an exercise programme, medical and physical fitness including glycaemic status should be assessed. For energy expenditure, types and level of physical activity, refer to Tables 3 and 4.

Any exercise regime should include the following:

- **First Phase**
  10 minute warming up in the form of general movements and stretching exercises.

- **Second Phase**
  20 to 30 minutes of exercise proper.

- **Third Phase**
  5 to 10 minutes of cooling down including stretching.

This routine should be strictly adhered to in order to avoid and minimise injury.

Table 3: ENERGY EXPENDITURE

<table>
<thead>
<tr>
<th>Kcal/hr</th>
<th>Intensity</th>
<th>Types of Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>minimal</td>
<td>at rest</td>
</tr>
<tr>
<td>300</td>
<td>moderate</td>
<td>walking, gardening, unassisted golf</td>
</tr>
<tr>
<td>400</td>
<td>intermediate</td>
<td>cycling, swimming, tennis</td>
</tr>
<tr>
<td>600</td>
<td>strenuous</td>
<td>squash, running, hill climbing</td>
</tr>
</tbody>
</table>

Table 4: Types and Levels of Physical Activity

<table>
<thead>
<tr>
<th>Level</th>
<th>Duration (min)</th>
<th>Types of Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>30</td>
<td>slow walking, shopping</td>
</tr>
<tr>
<td>Moderate</td>
<td>20</td>
<td>cycling at level surface, fast walking</td>
</tr>
<tr>
<td>Hard</td>
<td>10</td>
<td>climbing stairs or hills, jogging</td>
</tr>
<tr>
<td>Very Hard</td>
<td>5</td>
<td>soccer, swimming</td>
</tr>
</tbody>
</table>
MEDICATION

3.1 Indication

Oral hypoglycaemic agents (OHA) should only be used after adequate trial of therapy with prudent diabetic diet, exercises and healthy life style. Duration of trial therapy with diet and exercises alone to control diabetes is usually three months but it is variable and depends on patient compliance and response to the therapy.

Oral drugs may be required without waiting for response to diet and exercises in patients who are
- very symptomatic with thirst, polyuria, polydipsia and weight loss or
- asymptomatic and blood glucose levels are very high (above 20 mmol/L) on 2 occasions.

OHAs are not recommended for diabetes diagnosed in pregnancy as they are not proven to be safe.

OHAs are usually not the first line therapy in diabetes diagnosed during situations of stress, such as infections and myocardial infarction, since insulin therapy is usually given.

When indicated, start with a minimal dose of OHA, while re-emphasising diet and exercise. An appropriate duration of time (2 - 4 months) between increments, should be given to allow achievement of a steady state. Additional medications must not be encouraged to merely cover extra intake of food.

At each treatment review, the following aspects should be taken into account before deciding on further treatment:--:

a. Alleviation of symptoms.
b. Assessment of understanding of diabetic education given previously.
d. Blood glucose (taking into account the timing and amount of food taken and medication at the time of the blood test).
e. Fructosamine, HbA1 or HbA1c.
f. Compliance with
   - Diet
   - exercise
   - medication.

3.2. Oral Hypoglycaemic Agents (OHA)

Oral Hypoglycaemic agents (OHA) used in Type 2 diabetes (NIDDM) currently belong to 3 different types
3.2.1 Biguanides

- Biguanides do not stimulate insulin secretion, and probably lowers glucose by increasing tissue utilization of glucose. It can lower plasma glucose by up to 20% and is useful as first line drug treatment in the obese.
- Metformin and sulphonylurea, have synergistic effect to further reduce blood glucose. Metformin can increase insulin sensitivity and reduce insulin requirements.
- Metformin dosage

<table>
<thead>
<tr>
<th>Initial dose</th>
<th>500 mg daily increasing to 500 mg twice daily in one week to reduce gastrointestinal side effects. The side effects can be further reduced by taking it with food.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual therapeutic dose</td>
<td>500 mg three times daily.</td>
</tr>
<tr>
<td>Maximum dose</td>
<td>1.0 g three times daily.</td>
</tr>
</tbody>
</table>

- Metformin-SR, (slow release formulation)

<table>
<thead>
<tr>
<th>Usual dose</th>
<th>850 mg daily.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum dose</td>
<td>850 mg twice daily</td>
</tr>
</tbody>
</table>

Caution:

- Not recommended in elderly patients (>70 years)
- Must not be used in patients with impaired renal function (creatinine > 300 mol/L), liver cirrhosis, congestive cardiac failure, recent myocardial infarction, respiratory impairment, vascular disease and severe infections or any conditions known to cause lactic acid accumulation.
- Vitamin B12 deficiency may occur if metformin is given to patients who have had partial gastrectomy and terminal ileal disease.
- If serum creatinine increases, stop the drug.

3.2.2 Sulphonylureas

- Sulphonylureas lower plasma glucose by increasing insulin secretion by the islet cells of pancreas, by increasing insulin sensitivity at the tissues and by reducing hepatic glucose production. They can lower plasma glucose by up to 25%.
- Sulphonylureas should be taken 30 min before a meal.
- Second generation sulphonylureas restore first phase insulin secretion postprandially and reduce basal insulin and therefore less hypoglycaemia and less weight gain.
- Sulphonylureas can be combined with metformin, acarbose or insulin to improve control if indicated.
Side effects with sulphonylureas are rare and include hepatitis, SIADH, blood dyscrasia.

Table 5: Currently available Sulphonylureas and the respective recommended dosage:

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Minimum dose</th>
<th>Maximum dose</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolbutamide (Rastinon)</td>
<td>500 mg TDS</td>
<td>1 gm TDS</td>
<td>short</td>
</tr>
<tr>
<td>Chlorpropamide (Diabinese)</td>
<td>125 mg OM</td>
<td>500 mg OM</td>
<td>very long</td>
</tr>
<tr>
<td>Glibenclamide (Daonil, Euglucon)</td>
<td>2.5 mg OM</td>
<td>10 mg BD</td>
<td>Medium</td>
</tr>
<tr>
<td>Gliclazide (Diamicron)</td>
<td>40 mg OM</td>
<td>160 mg BD</td>
<td>short</td>
</tr>
<tr>
<td>Glipizide (Minidiab)</td>
<td>2.5 mg OM</td>
<td>10 mg BD</td>
<td>short</td>
</tr>
</tbody>
</table>

Chlorpropamide and tolbutamide are purely excreted by the kidneys and are contraindicated in renal impairment. Glibenclamide is metabolised by the liver but its metabolites are active and excreted by the kidneys. The dose must be reduced in renal impairment. Second generation sulphonylureas (Gliclazide and Glipizide) are purely metabolised by the liver and may still be used in renal impairment.

Caution:

- Sulphonylureas cause hypoglycaemia because they increase insulin secretion. The risk is higher in the presence of renal impairment or liver cirrhosis or the use of long acting preparations in the elderly.
- Sulphonylureas should be avoided in the obese because they cause increased appetite and weight gain.
- Sulphonylureas are contraindicated in patients known to be allergic to sulpha drugs.
- Sulphonylurea drugs are mostly protein bound. Administration of drugs that can displace them (e.g. antithyroid drugs, sulpha drugs, anticoagulants, NSAIDs and blockers) can thus increase the risk of hypoglycaemia.

3.2.3. -glucosidase inhibitors

- -glucosidase inhibitors (e.g. acarbose), act at the gut epithelium, to reduce glucose absorption by inhibiting the -glucosidase enzymes.
- -glucosidase inhibitors decrease postprandial glucose surge. They do not cause hypoglycaemia.
They are useful particularly in those with normal fasting glucose levels and raised postprandial glucose levels. They can have synergistic effects when used with metformin and sulphonylureas. They can also be used in combination with insulin.

**Dosage**

<table>
<thead>
<tr>
<th>Initial dose</th>
<th>50 mg/day and increase only in the absence of gastrointestinal symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual dose</td>
<td>50-100 mg during main meals</td>
</tr>
</tbody>
</table>

### 3.3 General Guidelines for Use of OHA in Diabetes

- For non obese patient who could not be controlled on diet and exercise, sulphonylureas such as glicazide, glipizide, glibenclamide should be started. Diet and exercise must be re-emphasised. Sulphonylureas can be combined with metformin and/or acarbose to improve control if indicated.
- For obese patient who could not be controlled on diet and exercise, metformin is a drug of choice. Acarbose is an acceptable alternative as first line therapy. For those who still could not be controlled on metformin and/or acarbose, sulphonylurea drug can be started, such as glibenclamide or glipizide or glicazide. Diet and exercise must be reemphasised.
- In elderly non obese subjects, a sulphonylurea can be started but long acting drugs are to be avoided. The patient should be monitored for renal impairment. Targets for control are less stringent because of increased risk of hypoglycaemia but metformin is to be avoided. Acarbose can be safely used. If diabetes is still not well controlled, insulin may be started.
- In elderly obese subjects, the drug of choice is a small dose of glicazide or glipizide and metformin must be avoided
- In patients with complications, the drug of choice is a second generation sulphonylurea at moderate dose. Acarbose can also be safely used.
Figure 8: Medication for obese type 2 diabetes (NIDDM)

- Obese Type 2 Diabetes
  - Diet & Exercise
    - Success
    - Metformin or Acarbose
      - Failure
      - Metformin and/or Acarbose + Sulphonylurea
        - Failure
        - Insulin
          - Success

Diet, exercise and compliance must be emphasised at all levels. Initiate screening for complications.
Figure 9: Medication for non-obese type 2 diabetes (NIDDM)

Non-obese Type 2 Diabetes

Success

Diet & Exercise

Failure

Success

Sulphonylureas

Failure

Success

Sulphonylurea + Metformin or Acarbose

Failure

Success

Insulin

Diet, exercise and compliance must be emphasised at all levels. Initiate screening for complications.
INSULIN

4.1 Indications:

Short term use

- acute illness,
- surgery,
- pregnancy,
- breast-feeding or
- severe metabolic decompensation (Diabetic ketoacidosis, hyperosmolar non-ketotic coma, lactic acidosis, severe hypertriglyceridemia

Long term use

- treatment failures despite maximal dose of oral drugs and non-pharmacological regimens.

Figure 10: Insulin therapy in Type 2 Diabetes (NIDDM)
Figure 11: Oral Hypoglycaemic Agents (OHA) Failure

- **OHA Failure**
  - **Criteria:**
    - FPG $> 8.0$ mM
    - HbA1c $> 9.5\%$, HbA1c $> 7.5\%$
    - On maximal dose of OHA (Refer table 5)

- **Confirm OHA Failure**
  - **Criteria:**
    - Exclude Diet/Drug/Exercise non-compliance and inter-current illness e.g. TB
    - There is associated unexplained weight loss or patient non-obese

- **Suggest Insulin Therapy**
  - **Acceptance**
    - Start on insulin
      - BIDS Regimen
      - Full insulin therapy
  - **Refusal**
    - **Counselling**
      - **Refusal**
      - **Continue OHA**
Note:

FPG - Fasting Plasma Glucose

BIDS - Bedtime Insulin Daytime Sulphonylurea

4.2 INSULIN THERAPY IN TYPE 2 DIABETES (NIDDM) – PREGNANCY

These are recommendations for women with NIDDM who are planning pregnancies.
Pre-Pregnancy

- counseling is important:
- pregnancy should be planned
- glycaemic control before pregnancy, aim for normal HbA1c (< 7%)
- insulin therapy may be necessary before pregnancy

During Pregnancy:

- Achieve and maintain normal glucose levels
- close monitoring required (frequency of monitoring is individualised)
- FPG, pre-meal, post meal plasma glucose levels weekly,
- fructosamine (fortnightly)
- HbA1c (6 - 12 weekly)
- insulin therapy if dietary therapy fails,
- Glucose-Insulin-K regime can be used during delivery/LSCS

Post-partum

- In breast-feeding mothers, who require > 2.5 mg glibenclamide or its equivalent before conception should remain on insulin
- Metformin is contra-indicated
- It is recommended that women identified should be referred to the Physician for further management.

4.3 DURING STRESS AND EMERGENCY

- OHA may not be adequate in controlling glycaemia during stress and emergency (e.g. infection, myocardial infarction and surgery)
- In any form of stress, OHA therapy should be replaced by insulin. Patient may develop DKA during stress
- Patient can be put back on their OHA regime when stress is resolved.
- If patient developed DKA during the stress and the patient is young, consider long-term insulin therapy.
- All patients requiring GIK (glucose insulin potassium) therapy should be referred for hospital administration
Table 6: Management of Diabetes During Stress and Emergency

<table>
<thead>
<tr>
<th>Status of Control</th>
<th>Minor Surgery</th>
<th>Major Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptable control</td>
<td>Stop OHA</td>
<td>Stop OHA</td>
</tr>
<tr>
<td>FPG &lt; 8.0</td>
<td>Resume OHA post-op once taking orally</td>
<td>GIK regime during op s/c insulin post-op once taking orally</td>
</tr>
<tr>
<td>RPG &lt; 11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor control</td>
<td>Stop OHA</td>
<td></td>
</tr>
<tr>
<td>FPG &gt; 8.0</td>
<td>GIK regimen (pre and intra-op)</td>
<td></td>
</tr>
<tr>
<td>RPG &gt; 11.0</td>
<td>s/c insulin post-op, once taking orally</td>
<td></td>
</tr>
</tbody>
</table>

- If elective surgery, delay operation if diabetic control unacceptable. Control with insulin or OHA as indicated.
- GIK regime can be continued until normal oral intake after surgery. Keep on insulin during stress and post-surgery until the stress is resolved and post-operatively until satisfactory wound healing.

4.4 General Guidelines for Use of Insulin in Type 2 Diabetes

- Pancreatic failure in type 2 diabetes (NIDDM) is mainly a clinical judgement. Biochemical confirmation, (e.g. glucagon stimulation, insulin/c-peptide estimations) is not critical but should be obtained whenever possible.
- Treatment should be individualised to the daily needs of the patient, his/her lifestyles and other associated medical problems and medications especially those that affect insulin sensitivity.
- The combination of oral hypoglycaemic agents (OHA) and insulin can be used in OHA failure.
- In the BIDS regime, insulin is recommended to be given after 10 p.m. because of the risk of inducing hypoglycaemia in the early hours in the morning. In the event that insulin cannot be given after 10 p.m., then it can be given in the morning before breakfast.
- In the young, thin diabetic patient, full insulin therapy may be considered at the beginning.
- Choice of insulin formulations and/or should be individualised.
- The average daily insulin requirement is between 0.5 to 1.0 units/kg body weight. Requirements in excess of this should prompt a search for an underlying cause such as non compliance, incorrect dosing, occult infections and other aggravating factors.
- Always be aware of episodic hypoglycaemia causing apparent poor diabetes control (Somogyi effect) to avoid aggravating the condition.
- All insulin treated patients must be taught to recognise symptoms of hypoglycaemia and its management.
- All insulin treated patients must be encouraged to do self-monitoring of blood glucose.
• Consider converting some patients back to OHA e.g. those well-controlled requiring small doses of insulin (<30 units/day)
• In both obese and non-obese diabetic patients, onset of complications such as nephropathy or neuropathy is not an indication to commence insulin injections

MANAGEMENT OF CHRONIC DIABETIC COMPLICATIONS

5.1 INTRODUCTION

• Chronic diabetic complications (macrovascular and/or microvascular) contribute significantly to morbidity and mortality in diabetes mellitus.
• Insidious in onset; but may be present in up to 30% of type 2 diabetes (NIDDM) at diagnosis.
• Diabetes Control & Complications Trial (DCCT) has shown that in type 1 diabetes (IDDM) microvascular complications can be delayed or prevented in up to 76% with good diabetic control.
• Studies have shown that complications are reversible if detected and treated early

5.2 TYPES OF COMPLICATIONS

1. Microvascular

Microvascular complications associated with persistent hyperglycaemia:

• Retinopathy
• Neuropathy
• Nephropathy

2. Macrovascular

Macrovascular complications are common in patient with diabetes and IGT:

• Ischaemic heart disease
• Cerebrovascular disease
• Peripheral Vascular disease

3. Combination Micro- and Macrovascular

• Diabetic Foot
• Diabetic Dermopathy

5.3 EARLY DETECTION AND TREATMENT OF DIABETIC COMPLICATIONS

• Early diagnosis and treatment can revert or delay, complications but present treatment regimen cannot totally prevent these complications.
• Onset is insidious and patients do not usually complain until complications are far
advanced.
• Type 2 diabetes patients should be screened for complications at diagnosis and
type 1 diabetes patients at least 5 years after diagnosis and thereafter at yearly
intervals.
• Once a complication is diagnosed, immediate and appropriate management must
be given. Regular checks to assess progress of complication should be made
during follow-up visits.

RETINOPATHY

1. PREAMBLE

Diabetic retinopathy includes dots and blots haemorrhage, soft and hard exudates and
new vessel formations. These can cause retinal detachment, fibrosis and sudden
blindness.

Usually classified as background retinopathy, pre-proliferative, proliferative and diabetic
maculopathy. Any evidence of retinopathy or reduced visual acuity merits referral to
ophthalmologist. Early laser treatment has been shown to be effective in arresting
progression and prevent blindness.

2. EDUCATION

• Stress the important of regular eye check-up as retinopathy may be silent.

3. SCREENING

• Ask for reduced visual acuity and blurring of vision.
• Visual acuity test (important for detecting maculopathy)
• Fundoscopy at diagnosis and at yearly intervals.
• Fundal photography is useful where available.

4. ASSESSMENT PROCEDURES

• Visual Acuity Test.
• Fundoscopy Examination (Refer to guidelines Appendix 9).
• Fluorescein Angiogram when indicated.
5. TREATMENT OPTIONS

- Blood glucose levels control.
- Blood pressure control.
- Laser photocoagulation therapy.
• Note: Rapid control of blood glucose may transiently worsen retinopathy and may also cause transient changes in visual acuity.

6. MONITORING OF RETINOPATHY

• Patients should be evaluated every 3 to 6 months when retinopathy detected or after laser therapy.

NEPHROPATHY

1. PREAMBLE

It is important to detect nephropathy early before overt proteinuria is present as early treatment may reverse or delay progression of nephropathy.

Presence of proteinuria on routine testing, in the absence of other causes such as infection, is indicative of nephropathy. Patients with established proteinuria invariably have retinopathy and must be examined. It is now established that there is positive correlation between proteinuria and cardiovascular morbidity and mortality. This is worsened by uncontrolled hypertension.

Assessment of renal functions such as blood urea, serum creatinine or creatinine clearance is not sensitive for the early diagnosis of diabetic nephropathy but indicated for monitoring of progression of this complication.

2. EDUCATION

Patient should be advised to have urine protein and blood pressure checked at regular intervals.

3. SCREENING

Blood pressure measurement at each visit.
Microalbuminuria test at yearly intervals.

4. ASSESSMENT PROCEDURES

• MICROALBUMINURIA
  Defined as an AER of 20-200ug/min. This level is not detected by usual dipstick test for protein. Ideally, this should be assessed on a 24 hr urine collection but analysis of an early morning spot urine is an acceptable compromise, using dipsticks specific for microalbuminuria. If positive, repeat test is required as excretion varies, especially in early stages.

• PROTEINURIA
  Ideally, it should be assessed on a 24-hr urine collection but an early morning spot
urine is an acceptable compromise. Use of dipstick to detect proteinuria is acceptable for screening.

Figure 14: Screening for Proteinuria

5. TREATMENT OPTIONS

- Strict control of blood glucose and blood pressure.
- Moderate protein restriction (0.8 g/kg body weight).
- ACE inhibitors
- Renal dialysis
- Transplantation

6. MONITORING

In established nephropathy, assess:

- microalbuminuria or proteinuria 6-12 monthly
- Serum creatinine, and BUSE at 6 monthly or more frequently when indicated.
NEUROPATHY

1. PREAMBLE

Peripheral sensory neuropathy of lower limbs most common and usually the first to occur. Others include mono-neuropathy, autonomic neuropathy and diabetic myotrophy. Presence of peripheral neuropathy predisposes to diabetic foot problems.

2. EDUCATION

Patients should be made aware of significance of numbness or paresthesia of feet/hands. They should seek immediate medical attention to any injury or ulcer in the feet. Patients with long standing or poorly controlled diabetes should be made aware of the possibility of autonomic dysfunction. In males, this include impotence.

3. SCREENING

- Ask about
  - numbness of feet/hands,
  - autonomic neuropathy symptoms such as postural giddiness, postprandial fullness, diarrhoea, abnormal sweating and impotence.
- Examine for peripheral neuropathy especially sensory.

4. ASSESSMENT PROCEDURES

Neurological assessment of lower limbs:

- Touch and pin prick sensation
- Vibration sense with 128 cycle tuning fork.
- Position sense
- Ankle jerk (reduced or lost)
- Others, warm skin, bounding pulse.

5. TREATMENT OPTIONS

- Strict diabetic control
- Symptomatic treatment for pain and paresthesia.
- Neurotrophic agents

6. MONITORING

As per screening.
DIABETIC FOOT

1. PREAMBLE

Foot problems are common in diabetes and are due to multiple factors including neuropathy, angiopathy and dermopathy with poor foot care and hygiene. They are usually related to poor diabetes control, improper foot wear and poor joint mobility. The high morbidity and mortality is related to foot ulceration, infection, gangrene and amputation. Clinical features may include skin discoloration, atrophy, ulceration and gangrene, as well as foot deformity (Charcot's joint).

2. EDUCATION

Foot care should be a standard module in diabetes education programme and must be intensive in high risk patients. They must be taught daily foot inspection, proper techniques of washing and drying their feet, especially between the toes, cutting their toenails, trimming calluses and corns. Patients, especially those with established neuropathy, must know how to take particular care of their feet and the need to seek urgent medical attention when injury, ulceration or infection occurs.

3. SCREENING

- Ask regarding symptoms of peripheral neuropathy, injury or ulceration to feet.
- Examine the feet including for neuropathy) six monthly or at least yearly.

4. ASSESSMENT PROCEDURES

Foot Examination (See Appendix 10)

5. TREATMENT OPTIONS

- Strict control of diabetes
- Treatment for neuropathy
- Specific and intensive foot care depending on severity from simple first aid for cuts and superficial infection to wound management in cases involving ulceration, infection or gangrene. Refer to appropriate specialist when indicated

6. Monitoring of Diabetic Foot

- Assess patient's foot care habits
- Foot examination at every follow-up (refer Appendix 10)
MACROVASCULAR COMPLICATIONS

1. PREAMBLE

In diabetes (including those with IGT macrovascular complications are are common because of accelerated atherosclerosis. They include coronary artery, cerebrovascular and peripheral vascular diseases. Risk of cardiovascular morbidity and mortality is higher in diabetic, especially in women and those with proteinuria (even at the stage of microalbuminuria).

Therefore it is important to identify or aggressively treat cardiovascular risk factors where possible. Risk factors include smoking, hypertension, dyslipidaemia (increased triglycerides and LDL-cholesterol with low HDL-cholesterol), obesity and positive family history.

2. EDUCATION

- Educate patient on the need to check and control modifiable risk factors regularly.
- Encourage self monitoring eg. blood pressure and blood glucose.
- Advice on diet for weight control and hyperlipidaemia.
- Stop smoking.
- Regular exercise.

3. SCREENING

Patients should be screened for risk factors,

- Ask for
  - symptoms of macrovascular complications.
  - risk factors
- Examine
  - BMI, WHR
  - Blood Pressure
- Fasting lipids including triglycerides, total cholesterol, HDL and LDL-cholesterol and HDL-LDL ratio.
- ECG (stress ECG when indicated)
- Echocardiograms (if available).
- Doppler study (if available).

4. ASSESSMENT PROCEDURES

- Assessment of obesity (BMI, WHR - see Appendix 11)
- Blood Pressure and all peripheral pulses including carotids.
- ECG (stress ECG when indicated)
• Doppler study (if available)

5. TREATMENT OPTIONS

• Strict control of blood glucose (avoid hypoglycaemia)
• Diet.
• Exercise.
• Control of modifiable risk factors.
  ✓ Stop smoking.
  ✓ Blood pressure:
    ▪ Use of ACE inhibitors preferable especially in those with concomitant microalbuminuria.
• Dyslipidaemia.
  ✓ To treat if persistent after adequate attempt is made to control diabetes (to check).
• Aspirin and other anti-platelet agents

6. MONITORING OF MACRO VASCULAR COMPLICATIONS

At regular follow-up (3-6 monthly)

• Monitor for symptoms related to macrovascular disease.
• Assess risk factor parameters (refer Appendices 12 and 13). The ECG, CXR and Doppler studies should should be done at least annually
• Review smoking habit, exercise and diet compliance.
### APPENDIX 1

**Definition of Terminology**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Obese:             | BMI >30  
|                    | BMI based on formula  
|                    | BMI = Weight (kg) / Height (m)^2  
| Hypertension:      | BP >140/85 mmHg on 3 different occasion with/without treatment.  
| Hyperlipidaemia:   | Total cholesterol >6.5 mmol/l and/or fasting triglyceride > 2.3 mmol/l  
| Symptoms of Diabetes: | Polyuria  
|                    | Polydipsia  
|                    | Polyphagia  
|                    | Lethargy / Tiredness  
|                    | Pruritus vulvae  
|                    | Balanitis  
|                    | Weight loss  
| Family History:    | Natural parents and/or siblings  
| Gestational Diabetes: | Diabetes first diagnosed during that particular pregnancy  
| History of big baby: | Birth weight > 4.0 kg or more  

APPENDIX 2

Procedure for Fasting Plasma Glucose (FPG)

Testing for Fasting Plasma Glucose should be preceded by an overnight fast of 10 - 16 hours, during which patient may drink plain water.

The blood should be collected in a tube containing sodium fluoride (6 mg per ml of whole blood) and centrifuged to separate plasma.

Freeze plasma for glucose for estimation unless it can be done immediately.

For interpretation refer Appendix 5.
APPENDIX 3

Procedure for Oral Glucose Tolerance Test (OGTT)

The OGTT should be done in the morning after at least 3 days of normal diet (more than 150 g of carbohydrate daily) and usual physical activity.

The test should be preceded by an overnight fast of 10 - 16 hours during which plain water may be allowed.

Smoking is not permitted during the test. The presence of factors that influence interpretation of the results of the test must be recorded (e.g. medication, inactivity, infection)

After collection of the fasting blood sample, the subject is required to drink 75 g of anhydrous glucose in 250 - 300 ml of water over 5 minutes.

Blood samples must be collected 2 hours after the glucose test load.

Unless the glucose concentration can be determined immediately, the blood samples should be collected in sodium fluoride a tubes (6 mg per ml of whole blood) and centrifuged to separate the plasma. The plasma should be frozen until the glucose concentration can be estimated.

Use glucose oxidase or hexokinase method for glucose assay.

For interpretation of results, refer to Appendix 5.

Note:

For children, the test load should be 1.75 g of glucose per kg of body weight up to a total of 75 g of glucose.

APPENDIX 4

Procedure for use of glucose meter

Get ready equipment

Calibrate as per instruction

Inform patient of procedure

Clean tip of finger with alcohol swab (allow finger to dry)

Switch on meter, insert strip

Prick finger using disposable lancet

Wipe off first drop of blood

Press gently to ensure adequate drop of blood is formed

Follow instruction manual for individual meter for further step

Read and record reading

NB: Use of glucose meters is not acceptable for diagnosis but can be used for screening.
APPENDIX 5

Diagnostic values for the oral glucose tolerance test (OGTT) - WHO Criteria

<table>
<thead>
<tr>
<th>Glucose Concentration, mmol/l</th>
<th>Whole Blood</th>
<th>Plasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venous</td>
<td>Capillary</td>
<td>Venous</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>· Fasting value</td>
<td>&gt; 6.7</td>
<td>&gt; 6.7</td>
</tr>
<tr>
<td>· Two hrs after glucose load</td>
<td>≥ 10.0</td>
<td>≥ 11.1</td>
</tr>
<tr>
<td>Impaired glucose tolerance</td>
<td>≥ 6.7</td>
<td>≥ 6.7</td>
</tr>
<tr>
<td>· Fasting value</td>
<td>6.7 - 10.0</td>
<td>7.8 - 11.1</td>
</tr>
<tr>
<td>· Two hrs after glucose load</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For epidemiological or population purposes, the 2 hour value determined by specific enzyme-assay after an oral glucose load (75 g in 250 - 300 ml of water for adults and 1.75g/kg of body weight, up to maximum of 75g, for children) may be used alone or with fasting value. The fasting value alone is considered less reliable since true fasting cannot be assured and spurious diagnosis of diabetes may more readily occur.

APPENDIX 7

IMPLEMENTATION OF DIABETES CARE PROGRAM

1. Equipments Required

- Glucose meter
- Dipstick strips
- Glucose test strips
- Ophthalmoscope
- Weighing machine
- Snellen’s Chart
- Height scale
- Sphygmomanometer
- lancets for finger pricking
- Cotton, Gauze, Alcohol

2. Training of Personnel (Care Providers)

Category of personnel to be trained

- Doctors
- Medical Assistant
- Staff Nurse / Public Health Nurse
- Community Nurse (JD)

Scope of training

- Introduction
- Epidemiology
- Conduct and interpretation of test
- Risk assessment
- History taking
- BMI
- Symptoms of diabetes
- NIDDM Practise Guidelines

3. Monitoring and Evaluation by Diabetes Care Providers

i. Prevalence study every 5 years (sentinel survey)
ii. Monitoring of selected samples from selected health clinics
iii. Quality Assurance

- Internal Quality Assurance include regular calibration of glucose meter
- External Quality Assurance use 1 in 20 samples to be tested (venous blood) in accredited reference Laboratory for validation
- Utilise Laboratory (External Quality Assurance Scheme)
### Checklist for Screening of Diabetes Mellitus at Primary Care Level

<table>
<thead>
<tr>
<th>Name</th>
<th>Date of Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/C. No:</td>
<td>Ethnic Group:</td>
</tr>
<tr>
<td>Weight:</td>
<td>Date:</td>
</tr>
<tr>
<td>Height</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Height</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

#### BMI: >30

#### Symptoms of diabetes
- Polyuria
- Polydipsia
  - Polyphagia
  - Lethargy / Tiredness
  - Weight loss
  - Pruritus vulvae / Balanitis

#### Definite Hypertension

#### Hyperlipidaemia

#### History of Gestational Diabetes

#### History of big baby (Birth Weight >/ 4.0 kg)

#### Family history of diabetes

<table>
<thead>
<tr>
<th>Screening: RBS</th>
<th>mmol/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 7.0 mmol/l</td>
<td>(Normal)</td>
</tr>
<tr>
<td>7.0 - 11.0 mmol/l</td>
<td>(Suspected)</td>
</tr>
<tr>
<td>&gt; 11.0 mmol/l</td>
<td>(Diabetes)</td>
</tr>
</tbody>
</table>

**Recommendation**

### Appendix 9

**Visual Acuity and Fundoscopy Examination**
A preliminary eye examination should include:

Distance visual acuity testing, using a Snellen’s or E chart for the illiterate, tested at 6 m. If the patient failed to achieve normal vision with the best corrected distance glasses; pinhole acuity should be measured.

Near vision or reading acuity with the patient’s corrected reading glasses, using a near vision chart.

Assessment of the anterior chamber depth, using torchlight, based on the following finding.

The illuminating light is aimed horizontally across the surface of the anterior chamber from one limbus to another. If the anterior chamber depth is normal, and the entire iris is illuminated. If the anterior chamber depth is slightly shallow there will be a slight shadow on the nasal side. If the anterior chamber is very shallow, there will be a large crescentic shadow on the nasal side of the iris.

Acute glaucoma may be precipitated by pupillary dilatation if the anterior chamber is very shallow. It is important to tell the patient to return if they feel any pain or discomfort some hours after the pupillary dilatation.

Dilate the pupil using Tropicamide (Mydriacyl) 1% eye drops.

Examine of the fundus through the dilated pupil using a direct ophthalmoscope. The technique of ocular examination is as follows:

Adjust to + 10 on the lens slide of the direct ophthalmoscope.
Hold the ophthalmoscope some 8-10 inches from the eye.
Illuminate the red reflex of the fundus.
Gradually move the ophthalmoscope forward until the structures in the anterior part of the eye come into focus. Any defect that is lying in the cornea, the lens (i.e. cataract) or the vitreous will cause a darkening of the red reflex.
Gradually reduced the number on the ophthalmoscope lenses and at the same time approach the eye until the retina come into focus.

# When examining the retina, it is sensible to develop a technique that enables all parts of the fundus to be checked, in the following order:

Start with the optic disc, looking for any possible cupping, defect, and the appearance of the retinal vessels.
Examine the quadrants carefully. Pay particular attention to the appearance of the retina adjacent to the veins, as it is here that new vessels are most likely to be found.
Finally examine the areas temporal to the macula and then the macula itself. These 2 areas should be examined last as they excite the greatest pupillary constriction.
APPENDIX 10

EXAMINATION OF THE FOOT
**Parameter** | **Clinical Examination** | **Objective Testing**
---|---|---
Skin | Visual inspection: lesions, nails, interdigital maceration, calluses scars, ulcers, etc. | C & ST, fungal
Sensory | pinprick sensation light touch vibration heat and cold sensation proprioception | 
Motor | Intrinsic muscle wasting, weakness, foot drop, absent tendon reflexes. | Electro-physiological test
Autonomic | Decrease sweating and cause dryness, fissuring distended dorsal veins, bouncing pedal pulses - warm dusky pink colour. | 
Vascular | leg and foot pulses rubor/pallor venous/capillary filling time skin temperature | Non-invasive Doppler Studies
Deformity | toes and foot deformities prominent metatarsal heads Charcot joints | Radiographs

**SCREENING AND EARLY DETECTION OF FOOT PROBLEM**

Name: ___________________________ Age: ____________________

Duration of Diabetes: ________ Yrs

*1 point for Yes and 0 for No

<table>
<thead>
<tr>
<th>A. PATIENT QUESTIONNAIRE</th>
<th></th>
<th>POINTS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Are your legs or feet numb?</td>
<td>Yes [ ] No [ ]</td>
<td></td>
</tr>
<tr>
<td>2 Do you ever have any burning pain in your legs or feet?</td>
<td>Yes [ ] No [ ]</td>
<td></td>
</tr>
<tr>
<td>3 Do you ever have any pricking feelings in your legs or feet?</td>
<td>Yes [ ] No [ ]</td>
<td></td>
</tr>
<tr>
<td>4 Do you get muscle cramp in your legs or feet?</td>
<td>Yes [ ] No [ ]</td>
<td></td>
</tr>
<tr>
<td>5 Do your legs hurt when you walk?</td>
<td>Yes [ ] No [ ]</td>
<td></td>
</tr>
<tr>
<td>6 Are you able to sense your feet when you</td>
<td>Yes [ ] No [ ]</td>
<td></td>
</tr>
</tbody>
</table>
walk?

<table>
<thead>
<tr>
<th>7 Are your symptoms worse at night?</th>
<th>Yes [ ]</th>
<th>No [ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>/ 7</td>
<td></td>
</tr>
</tbody>
</table>

### CLINICAL EVALUATION

<table>
<thead>
<tr>
<th><strong>PHYSICAL EXAMINATION</strong></th>
<th><strong>(R) Right leg &amp; foot</strong></th>
<th><strong>(L) Left leg &amp; Foot</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To detect signs of high risk foot</strong></td>
<td>points</td>
<td>points</td>
</tr>
<tr>
<td>1 Dry skin</td>
<td>Yes( ) No( )</td>
<td>Yes( ) No( )</td>
</tr>
<tr>
<td>2 Callus/ corns</td>
<td>Yes( ) No( )</td>
<td>Yes( ) No( )</td>
</tr>
<tr>
<td>3 Fissure</td>
<td>Yes( ) No( )</td>
<td>Yes( ) No( )</td>
</tr>
<tr>
<td>4 Skin changes (shinning skin/hair lost)</td>
<td>Yes( ) No( )</td>
<td>Yes( ) No( )</td>
</tr>
<tr>
<td>5 Nail deformities/colon</td>
<td>Yes( ) No( )</td>
<td>Yes( ) No( )</td>
</tr>
<tr>
<td>6 Abnormal shape/deformed e.g. claw toe/hammer toe/carus feet</td>
<td>Yes( ) No( )</td>
<td>Yes( ) No( )</td>
</tr>
<tr>
<td>7 Past ulcer/present ulcer</td>
<td>Yes( ) No( )</td>
<td>Yes( ) No( )</td>
</tr>
<tr>
<td>8 Previous amputation</td>
<td>Yes( ) No( )</td>
<td>Yes( ) No( )</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>/8 pts</td>
<td>/8 pts</td>
</tr>
</tbody>
</table>

Note : Total score for physical examination is 16 points.

### C:NEUROLOGICAL EXAMINATION

<table>
<thead>
<tr>
<th><strong>Light touch</strong></th>
<th><strong>Pin Prick</strong></th>
<th><strong>Knee Reflex</strong></th>
<th><strong>Ankle Reflex</strong></th>
<th><strong>Total Score /12</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Normal=0 diminished=1 absent=2 normal=0

### D:VASCULAR EXAMINATION

<table>
<thead>
<tr>
<th><strong>Femoral</strong></th>
<th><strong>Popliteal</strong></th>
<th><strong>Dorsalis</strong></th>
<th><strong>Tibialis</strong></th>
<th><strong>Total Score /12</strong></th>
</tr>
</thead>
</table>
Risk and Management Category

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Management Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk category 0</td>
<td>Patient education.</td>
</tr>
<tr>
<td><em>No loss of protective sensation</em></td>
<td>Annual check-up.</td>
</tr>
<tr>
<td>Risk category 1</td>
<td>Foot care education a must.</td>
</tr>
<tr>
<td><em>Loss of protective sensation</em></td>
<td>Examine feet at every visit.</td>
</tr>
<tr>
<td></td>
<td>Risk factor education e.g. <em>stop smoking.</em></td>
</tr>
<tr>
<td>Risk category 2</td>
<td>Foot care education a must.</td>
</tr>
<tr>
<td><em>Loss of protective sensation with high pressure (callus/deformity) or poor circulation</em></td>
<td>Examine feet at every visit.</td>
</tr>
<tr>
<td></td>
<td>Prescription foot ware</td>
</tr>
<tr>
<td></td>
<td>Risk factor education e.g. <em>stop smoking</em></td>
</tr>
<tr>
<td>Risk category 3</td>
<td>Foot care education a must.</td>
</tr>
<tr>
<td><em>Loss of protective sensation history of plantar ulcer.</em></td>
<td>Risk factor education</td>
</tr>
<tr>
<td></td>
<td>Examine feet at every visit.</td>
</tr>
<tr>
<td></td>
<td>Prescription foot ware</td>
</tr>
<tr>
<td></td>
<td>Refer specialist if necessary</td>
</tr>
</tbody>
</table>

Risk Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Foot not at risk</td>
</tr>
<tr>
<td>1 – 3</td>
<td>Foot at risk</td>
</tr>
<tr>
<td>Neurological examination &gt; 3</td>
<td>Loss of protective sensation</td>
</tr>
<tr>
<td>Vascular examination &gt; 3</td>
<td>Poor circulation</td>
</tr>
</tbody>
</table>

**APPENDIX 11**

1. **BODY MASS INDEX (BMI)**

\[ 	ext{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)} x \text{Height (m)}} \]
Alternatively, obtain BMI by referring to BMI Chart.

The healthy range for BMI is 18.5 – 25

<table>
<thead>
<tr>
<th>BMI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 18.5</td>
<td>Under weight</td>
</tr>
<tr>
<td>18.5 - less than 25</td>
<td>healthy weight</td>
</tr>
<tr>
<td>25 - less than 30</td>
<td>over weight</td>
</tr>
<tr>
<td>≥30</td>
<td>Obese</td>
</tr>
</tbody>
</table>

BMI applicable for adults aged 18 - 64 years.

Remove shoes.

Wear light clothing.

2. WAIST HIP RATIO (WHR)

Measure waist at its narrowest or measure waist at the navel (umbilical level)
Measure hips at its widest.

Healthy Waist Hip Ratio: -

Female < 0.85
Male < 0.95

APPENDIX 12

Clinical Monitoring Protocol

Name: ___________________________  Sex: ___________________________
Date of Birth : ____________________________ Age : ______________________

NRIC No. (new): ________________________ Ethnic Group : _______________

Height: ____________________m

History

At each visit, must elicit symptoms of complications and symptoms of risk factors

Education

At every visit emphasise on:
A.
Good diabetic control
Diet
Drug compliance
Foot care
Weight control
Self monitoring

B. Prevention and Control of Complication

<table>
<thead>
<tr>
<th>AT INITIAL AND AT EACH VISIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination\Date</td>
</tr>
<tr>
<td>Weight (kg)</td>
</tr>
<tr>
<td>BMI</td>
</tr>
<tr>
<td>WHR</td>
</tr>
<tr>
<td>BP - supine</td>
</tr>
<tr>
<td>-standing</td>
</tr>
<tr>
<td>Feet - Neuropathy</td>
</tr>
<tr>
<td>-Pulses</td>
</tr>
<tr>
<td>-Ulcer</td>
</tr>
<tr>
<td>Fasting / 2 hr post meal BS</td>
</tr>
<tr>
<td>HbA1c (%)</td>
</tr>
<tr>
<td>Sr. Fructosamine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AT INITIAL AND ANNUAL VISIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual acuity</td>
</tr>
<tr>
<td>Fundoscopy</td>
</tr>
<tr>
<td>Heart</td>
</tr>
<tr>
<td>Test</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>ECG</td>
</tr>
<tr>
<td>Urine for Protein</td>
</tr>
<tr>
<td>Microalbuminuria</td>
</tr>
<tr>
<td>BUSE</td>
</tr>
<tr>
<td>Sr. Creatinine</td>
</tr>
<tr>
<td>Total Cholesterol</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
</tr>
<tr>
<td>Triglyceride</td>
</tr>
<tr>
<td>TChol / HDL Ratio</td>
</tr>
<tr>
<td><strong>WHEN INDICATED</strong></td>
</tr>
<tr>
<td>Echocardiogram</td>
</tr>
<tr>
<td>Stress test</td>
</tr>
<tr>
<td>Doppler studies</td>
</tr>
<tr>
<td>CXR</td>
</tr>
</tbody>
</table>

**Notes:**
*When complications have been diagnosed appropriate examination and investigations are done at more frequent intervals.*

**APPENDIX 13**

Biochemical Monitoring

Methods and frequency of self monitoring depend on the goals and mode of treatment

Self Monitoring
1. Home Blood Glucose Monitoring

Blood glucose testing is the method of choice in monitoring glycaemic control. It is desirable for patients on oral hypoglycaemic agents and is strongly advised for patients on insulin. It is mandatory for diabetic women during pregnancy. It is the only way to confirm hypoglycaemia.

**Timing**

<table>
<thead>
<tr>
<th>Mode of Treatment</th>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Diet Only</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>OHA</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Insulin</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Frequency**
The frequency of testing depends on the stability of glycaemic control.

<table>
<thead>
<tr>
<th>Poorly controlled / unstable</th>
<th>At least once daily&lt;br&gt;Adjust treatment accordingly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well controlled / stable</td>
<td>Once or twice weekly</td>
</tr>
</tbody>
</table>

2. Urine glucose self-monitoring

It is useful in detecting major hyperglycaemic swings. It is NOT useful if renal threshold is HIGH or LOW. The test should be performed on a double voided specimen.

**Timing**

- Fasting and Post meals
- Frequency: 1-2 times weekly

**Caution**

Urine glucose monitoring is UNABLE to confirm/warn against hypoglycaemia.

**Targets for Control**

1. Target Blood Glucose Levels

<table>
<thead>
<tr>
<th>Glucose Levels (mmol/L)</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal*</td>
<td>Acceptable</td>
</tr>
<tr>
<td>Time Period</td>
<td>Prebreakfast</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------</td>
</tr>
<tr>
<td></td>
<td>3.5-5.3</td>
</tr>
<tr>
<td></td>
<td>3.5-5.8</td>
</tr>
<tr>
<td></td>
<td>4.4-6.7</td>
</tr>
<tr>
<td></td>
<td>&gt;3.9</td>
</tr>
</tbody>
</table>

*Ideal levels are similar to those seen in non-diabetic individuals and are recommended for the pregnant type 2 DM (NIDDM)*

2. Other targets for control

<table>
<thead>
<tr>
<th>Test</th>
<th>Ideal</th>
<th>Acceptable</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HbA1c</strong></td>
<td><strong>Within 1.5% points of upper limit of normal</strong></td>
<td><strong>Within 2% points of upper limit of normal</strong></td>
<td><strong>&gt; 2% points of upper limit of normal</strong></td>
</tr>
<tr>
<td><strong>Fructosamine</strong></td>
<td>Please refer to literature enclosed with the assay kit</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lipids</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>mmol/L</td>
<td>&lt; 5.2</td>
<td>5.2-6.5</td>
</tr>
<tr>
<td>HDL-cholesterol</td>
<td>mmol/L</td>
<td>&gt;1.1</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>Fasting triglycerides</td>
<td>mmol/L</td>
<td>&lt;1.7</td>
<td>&lt;2.3</td>
</tr>
<tr>
<td>Body mass index</td>
<td>kg/m²</td>
<td>&lt; 25</td>
<td>≥ 27</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>mmHg</td>
<td>≥ 130/85</td>
<td>≥ 160/95</td>
</tr>
</tbody>
</table>