

REPUBLIC OF KENYA



MINISTRY OF PUBLIC HEALTH AND SANITATION

**NATIONAL CLINICAL GUIDELINES
FOR
MANAGEMENT OF DIABETES MELLITUS**

FIRST EDITION

**NATIONAL CLINICAL GUIDELINES
FOR
MANAGEMENT OF DIABETES MELLITUS**

July 2010

FIRST EDITION

National Clinical Guidelines for Management of Diabetes Mellitus

Funded by: Ministry of Public Health and Sanitation, World Diabetes Foundation and the International Diabetes Federation.

Process supported by: Kenya Diabetes Management and Information centre (DMI) and Diabetes Kenya Association (DK)

Copyright 2010, Ministry of Public Health and Sanitation

Enquiries regarding the Kenya National Clinical Guidelines for Management of Diabetes Mellitus should be addressed to:

National Diabetes Control Programme,
Division of Non-communicable Diseases,
Ministry of Public Health and Sanitation,
P.O. Box 30016 – 00100
Nairobi, Kenya

Telephone: +254 202717077/+254 202722599

Email: noncom@health.go.ke

Website: www.pubhealth.go.ke

Supported by :



WORLD **DIABETES** FOUNDATION



DMI Centre



International Diabetes Federation
African Region

TABLE OF CONTENTS

TABLE OF CONTENTS	(iii)
FOREWORD.....	(v)
INTRODUCTION	(vii)
TECHNICAL WORKING GROUP	(viii)
ACKNOWLEDGEMENTS.....	(ix)
ACRONYMS.....	(x)
EXECUTIVE SUMMARY	(xi)
CHAPTER 1: INTRODUCTION TO DIABETES.....	1
1.0 Introduction.....	1
1.1 Presentation of Diabetes Mellitus	1
1.2 Diagnosis and classification.....	2
CHAPTER 2: PREVENTION OF DIABETES	5
2.0 Introduction.....	5
2.1 Primary Prevention	5
2.2 Secondary prevention.....	6
CHAPTER 3: METABOLIC SYNDROME AND OBESITY	7
3.0 Introduction.....	7
3.1 The essential components of the Metabolic Syndrome are: .	7
3.2 Strong associations of the metabolic syndrome include:.....	7
3.3 Management of the metabolic syndrome	7
3.4 Obesity.....	8
CHAPTER 4: MANAGEMENT DIABETTES	10
4.0 Introduction.....	10
4.1 Management of Type 1 Diabetes.....	10
4.2. Management of Type 2 Diabetes.....	14
4.3 Non-pharmacological management.....	16
4.4 Pharmacological Management.....	19
CHAPTER 5: MANAGEMENT OF CO-MORBIDITIES INTYPE 2 DIABETES MELLITUS	25
5.1 Hypertension	25
5.2 Diabetes and other Cardiovascular Diseases.....	28
5.3 Lipids disorders in Diabetes	29
5.4 Management of Chronic Microvascular Complications.....	31

5.5 Retinopathy.....	32
5.6 Diabetic Neuropathies.....	33
5.7 Foot complications.....	34
5.8 Sexual dysfunction.....	36
CHAPTER 6:MANEGEMENT OF DIABETES IN SPECIAL SITUATIONS.....	37
6.1 Pregnancy.....	37
6.2 Fasting for religious purposes	39
6.3 Management of diabetes during fasting.....	42
6.4 Management of Type 2 Diabetes during Surgery	43
6.5 Diabetes and HIV	44
CHAPTER 7: ACUTE METABOLIC COMPLICATIONS OF DIABETES.....	45
7.1 Introduction.....	45
7.2 Diabetic Ketoacidosis (DKA)	45
7.3 Diabetic hyperosmolar hyperglycemic state.....	49
7.4 Hypoglycaemia.....	49
CHAPTER 8: LIVING WITH DIABETES	51
8.0 Living with Diabetes	51
8.1 Employment.....	51
8.2 Driving.....	51
8.3 Insurance.....	52
8.4 Sports, recreational and occupational exercise	52
ANNEX I.....	53
ANNEX II.....	54
ANNEX III	55
Bibliography	56

FOREWORD

The prevalence of chronic non-communicable diseases such as diabetes, cardiovascular diseases and cancers has been on the increase in Kenya in the recent past. This has been occasioned by changes in social and demographic situation in the country. The life expectancy in the country is improving, while the country is developing at a rapid pace. This has resulted in people living more years and at the time adopting lifestyles that have negative impacts on their health. This increase in diabetes and other non-communicable diseases has given rise to a double burden of communicable and non-communicable diseases in Kenya.

Diabetes and other non-communicable disease are now a threat to national development as they often result in long standing complications that are usually very costly to treat. Similarly these diseases are long standing and if not managed well can be fatal. They progressively drain the strength and resources of an individual rendering them unproductive and poor. This burden is in most cases passed on to families and the community with untold retardation of economic progress and eventually exacerbating poverty.

In response to this crisis, the Ministries of Health in collaboration with Non-Governmental Organizations, Regional and International Diabetes Support Bodies spearheaded the *National Guidelines for the Management of Diabetes Mellitus* in order to provide a standardized way of managing diabetes in the country.

A technical Working Group was established under the auspices of the Division of Non-communicable Diseases (DNCD) to develop these guidelines that are based on up to date and evidence based management of diabetes mellitus. These Guidelines are a synthesis of information drawn from an extensive review of local and international knowledge and experience. The Guidelines are suitable for use by all health workers and health institutions from both the public and privates sectors. They give clear directions on what needs to be done for people living with diabetes and provide a guide on the continuum of care required through out the life course of the individuals with diabetes.

The Guidelines are written for all Kenyans, though health workers may have to adapt information to meet local situation and specific needs for specific patients including translating information to meet various language needs.

The successful implementation and strict adoption of these guidelines will require the partnership of the care providers and people living with diabetes mellitus. A coordinated effort is required from health professions in many disciplines to ensure a multidisciplinary approach to diabetes management. This will eventually improve the care provided to people with diabetes which will eventually improve their quality of life.

Let us all Unite for Diabetes

A handwritten signature in blue ink, appearing to read 'Beth W. Mugo'.

Hon. Beth W. Mugo, EGH, MP
Minister for Public Health and Sanitation

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by high blood sugar (hyperglycaemia). This results from lack of insulin in the body or failure of body cells to respond to circulating insulin. Persistent hyperglycaemia results in progressive multiple organ damage giving rise to both acute and chronic complications.

Diabetes Mellitus often goes undiagnosed because many of its symptoms though serious are often missed or are treated as common ailments. Recent studies indicate that the early detection of diabetes symptoms and treatment can decrease the chance of developing the complications of diabetes.

The overall goal of diabetes management is to help individuals with diabetes and their families gain the necessary knowledge life skills, resources, and support them to achieve optimal health. The *National Clinical Guidelines for the Management of Diabetes Mellitus* offers a step by step help to health workers to provide this optimal care. The recommendations on these guidelines are based on local and internationally sound best practices and provide up to date instructions and recommendations to all health workers when diagnosing and planning treatment for a person with diabetes mellitus.

To implement these guidelines in the best way, each health facility or care provider must embrace the multidisciplinary approach to diabetes care and management. There is need for management of diabetes to be patient centered and provided in a more comprehensive way which not only involves blood sugar control but also looking at the patient in a holistic manner. The strict adherence to these guidelines will also stimulate policy changes that will ensure availability of essential drugs and medical supplies for diabetes are secured and made affordable and accessible to all who need them. These Guidelines were developed based on local and international best practices. Periodic reviews of the Guidelines will be necessary to accommodate new information as it becomes available from time to time.



Dr. S. K. Sharif, MBS, MB.ChB, M.Med, DLSTMH, MSc.
Director of Public Health & Sanitation

TECHNICAL WORKING GROUP

Dr. William K. Maina	Ministry of Public Health and Sanitation
Dr. Eva Njenga	Diabetes Endocrinology Centre
Dr. Acharya Kirtida	University of Nairobi
Dr. Gaman Mohamed	Comprehensive Diabetes Centre
Dr. Paul Ngugi	Kenyatta National Hospital
Dr. Izaq Odongo	Ministry of Medical Services
Dr. C.F.O Otieno	Kenyatta National Hospital
Scholastica Mwendé	Ministry of Public Health and Sanitation
Zachary M. Ndegwa	Ministry of Public Health and Sanitation
Atieno Jalang'o	Diabetes Kenya Association
Eva Muchemi	Kenya Diabetes Management and Information Centre
Dr. Lois N. Wagana	Central Provincial General Hospital, Nyeri
Dr. Thomas Ngwiri	Eastern Provincial General Hospital, Embu
Dr. Paul Laigong	Gertrude Children's Hospital, Nairobi
Mrs. Rosemary Ngaruro	Ministry of Medical Services

ACKNOWLEDGEMENTS

The National Clinical Guidelines for the Management of Diabetes Mellitus was prepared with the active participation of several diabetes experts from several organizations in Kenya. The participation of the following individuals and organization is gratefully appreciated

The Guidelines were based on the Clinical guidelines for Management of Diabetes in Sub Sahara developed by the International Diabetes Federation (IDF) Africa whom we owe thanks for allowing us to use the materials.

The collation of review materials was supported by Dr. Mohammed Gaman and Dr. Eva Njenga who are renowned diabetologists. Funding for the process of development of these Guidelines was provided by the World Diabetes Foundation (WDF) through the National Diabetes Comprehensive Care Project. The process received a lot of technical support from the Kenya Diabetes Management and Information Centre (DMI), Diabetes Kenya Association, the University of Nairobi and Kenyatta National Hospital. Dr. Joyce N. Nato of the World Health Organization, Kenya Country Office provided technical advice to the drafting team. We thank all our regional diabetes coordinators (Dr. L.N. Wagana-Central, Dr. C.Muyodi – Coast, Dr. H. Sultani – Western, Dr. Otepo – Nyanza, Dr. Sule – Nairobi, Dr. Njoroge – N. Eastern, Dr. Muli – Eastern, Mr. Kimonjino – R/Valley for their active participation in the process of developing the draft.

The development of the guidelines was carried out under the auspices of the Division of Non-communicable Diseases. In this regard, the support extended by Dr. William K. Maina, Head of the Division and the staff of the division, particularly Mrs. Scholastica Mwendu and Zachary Ndegwa is gratefully acknowledged

ACRONYMS

ACEI	Angiotensin Converting Enzyme Inhibitors
ADA	American Diabetes Association
AHT	Anti-Hypertensive Therapy
ANC	Antenatal Care
ARB	Angiotensin Receptor Blockers
BMI	Basal Metabolic Rate
BP	Blood Pressure
CABG	Coronary Artery Bypass Graft
CRP	C-reactive protein
DCC	Diabetes Comprehensive Care
DKA	Diabetes Ketoacidosis
DMI	Diabetes Management and Information Centre
DNCD	Division of Non-communicable Diseases
ECG	Electrocardiograph
FBG	Fasting Blood Glucose
GDM	Gestation Diabetes Mellitus
HAART	Highly Active Anti-Retroviral Treatment
IDF	International Diabetes Federation
IFG	Impaired Fasting Glucose
IHD	Ischaemic heart disease
IU	International Units
OGLA	Oral Glucose Lowering Agents
OGTT	Oral Glucose Tolerance Test
RBG	Random Blood Glucose
SBGM	Self Blood Glucose Monitoring
WC	Waist Circumference
WDF	World Diabetes Foundation
WHO	World Health Organization
WHR	Waist Hip Ratio

EXECUTIVE SUMMARY

The complications of undetected and untreated diabetes are serious and cause huge human suffering and disability, and have huge socio – economic costs resulting from premature morbidity and mortality. Diabetes is one of the leading causes of blindness, renal failure and lower limb amputation. It also triggers cardiovascular disease which is the leading cause of deaths in diabetes patients.

The key risk factors for diabetes—obesity, physical inactivity, and unhealthy diets—require interventions to change unhealthy lifestyles. These changes are most likely to occur with implementation of a coordinated range of interventions to encourage individuals to maintain a healthy weight, participate in daily physical activity, and consume a healthy diet.

Education is central to implementing such changes. It is more effective when provided through multiple methods and sites, such as schools, workplaces, mass media, and health centers. Educational messages are also more effective if they are reinforced by action.

When prevention does not stop the occurrence of diseases, there is need for the health care services to provide quality care for people with diabetes. Improvement of care involves improvement of skills of health care providers, provision of requisite tools and regular supply of drugs and other medical supplies.

The purpose of these Guidelines is to:

- Provide simple and practical ways to assess persons with diabetes and make the right diagnosis and provide the best treatment and care.
- Assist health care providers to identify locally appropriate and sustainable ways of improving diabetes management.
- Mainstream diabetes management into the health care system.

The Guideline contents are organized into 8 chapters:

- Introduction to Diabetes – this chapter defines diabetes and provides the predisposing factors, various classifications of diabetes, clinical presentations and diagnosis.
- Prevention of diabetes is the second chapter which explores the modifiable risk factors for diabetes and the available preventative interventions.
- The metabolic syndrome and obesity in relation to diabetes are carefully analyzed in this chapter including measures that require to be taken to control them.
- The fourth chapter deals with treatment of type 2 diabetes, it emphasis on the different modalities of therapy from lifestyle modification to drug therapy. It emphasizes the need for stepwise consideration when instituting treatment and need for referral of complicated cases.
- Both acute and chronic complications of diabetes are serious as they cause considerable high burden of morbidity and mortality. The chapter overemphasis on the management of diabetes ketoacidosis which is a major medical emergency with high mortality rate if not managed well.
- The next chapter deals with the manifestation of diabetes co-morbidities and complication and provides guidance on their diagnosis and treatment.
- The guidelines explore special situations the clinician is confronted with when dealing with diabetes. These include pregnancy, sick days, fasting, sports and travelling for people with diabetes.
- Diabetes care is a lifelong responsibility. People living with diabetes must change many habits, such as what they eat, when they exercise and how frequently they see your medical providers. They may need to take daily medications or insulin to keep their blood sugar levels in check. Having diabetes means making adjustments at work and at home. But these changes don't mean one won't be able to succeed at work or enjoy a healthy and fulfilling life. People with diabetes have equal rights

with those without the condition and should be protected from all forms of discrimination.

In order to scale up and standardize the management of diabetes the implementation of this guideline is very critical. This calls for wide dissemination of the guideline and its acceptance and introduction into all health facilities in this country whether public, private for no-profit or private for profit. Its application will provide all the relevant information that will guide future revisions of the guidelines to suit the national needs for diabetes management.

CHAPTER 1

INTRODUCTION TO DIABETES

1.0 Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. It is associated with acute complications such as ketoacidosis and hypoglycaemia, as well as long-term complications affecting the eyes, kidneys, feet, nerves, brain, heart and blood vessels.

1.1 Presentation of Diabetes Mellitus

Type I diabetes

Patients present at a young age (usually their teens or twenties, but earlier presentation may also occur) with rapid onset of severe symptoms, in particular thirst, polyuria and weight loss. Blood glucose levels are high and ketones often present in the urine. If treatment is delayed, diabetic ketoacidosis (DKA) and death may follow.

The response to insulin therapy is dramatic and gratifying. Misclassification of patients as “Type 1” is probably relatively common and being treated with insulin is not the same as having Type 1 diabetes.

Type 2 diabetes

Most patients present with the classical symptoms of diabetes, including polyuria, polydipsia and polyphagia. Additionally, some patients present with sepsis, and/or diabetic coma (hyperosmolar non-ketotic states). A minority is asymptomatic and is therefore identified at screening. The patients usually do not seek early medical attention because of the insidious onset of the disease and therefore may present at diagnosis with features of diabetic complications, including visual difficulties from retinopathy, pain and/or tingling in the feet from neuropathy, foot ulcerations, impotence and stroke. Some elderly Type 2 patients present with hyperosmolar non-ketotic coma that has a high mortality.

Gestational diabetes

Gestational diabetes mellitus (GDM) is, as the name suggests, diabetes that arises in pregnancy. It also reverts to metabolic and clinical normality post-partum, though relative risks of later Type 2 diabetes is between 7- 13 times high in women with gestational diabetes compared to normo-glycaemic ones. Therefore,

GDM must be distinguished from pre-existing diabetes in women who become pregnant. The particular importance of GDM is that it is associated with a poor pregnancy outcome, especially if unrecognized and untreated. Particular adverse effects include, eclampsia, birth difficulties, intra-uterine growth retardation, foetal macrosomia,, neonatal hypoglycaemia and respiratory distress.

Other specific types:

- Diabetes as part of other Endocrine syndromes
- Drug Induced diabetes
- Pancreatic disease
- Monogenic diabetes; previously referred to as Maturity Onset Diabetes of the Young (MODY)

1.2 Diagnosis and classification

Diagnosis

In the majority of people presenting with the classical symptoms of diabetes, the diagnosis of diabetes is straightforward. However, it may pose a problem for those with a minor degree of hyperglycaemia, and in asymptomatic subjects. In these circumstances, two abnormal blood glucose results on separate occasions are needed to make the diagnosis. If such samples fail to confirm the diagnosis it will usually be advisable to maintain surveillance with periodic retesting until the diagnostic situation becomes clear. The clinician should take into consideration additional risk factors for diabetes before deciding on a diagnostic or therapeutic course of action.

The diagnosis of diabetes must be confirmed biochemically prior to initiation of any therapy,

- The presence of symptoms of hyperglycaemia, such as polyuria, polydipsia, pruritus vulvae, lethargy, loss of weight and a random capillary whole blood glucose equal or above 11.1 mmol/L

Or

- a fasting capillary whole blood glucose >6.1 mmol/L or more confirms the diagnosis of diabetes.

In asymptomatic subjects a single abnormal blood glucose result is inadequate to make a diagnosis of diabetes. The abnormal value must be confirmed at the earliest possible date using any of the following: fasting or random blood sample on two separate occasions or a 75 g oral glucose tolerance test.

For clinical purposes the diagnosis of diabetes should always be confirmed by repeating the test on another day, unless there is unequivocal hyperglycaemia with acute metabolic decompensation or obvious symptoms. People with impaired glucose tolerance or impaired fasting glycaemia should be retested after 1 year.

Children with suspected Type 1, with a single abnormal blood glucose reading should be admitted until the diagnosis is clarified.

Diagnosis and classification

Table 1. Values for the diagnosis of categories of hyperglycaemia, measured in mmol/l (WHO, 1999).

	Venous plasma (mmol/L)	Venous whole blood (mmol/L)	Capillary whole blood (mmol/L)
DIABETES			
Fasting	>7	>6.1	>6.1
Or 2h post 75g glucose load	>11.1	>10.0	>11.1
IMPAIRED GLUCOSE TOLERANCE			
Fasting	5.6 <7.0	5.6 <6.1	5.6 <6.1
And 2h post 75g glucose load	>7.8 and <11.1	>6.7 and <10.1	>7.8 and <11.1
IMPAIRED FASTING GLYCAEMIA			
Fasting	>5.6 and <7.0	>5.6 and <6.1	>5.6 and <6.1
GESTATIONAL DIABETES			
Fasting	>7		>6.1
2h post 75g glucose load	>7.8		5.6 to 6.1

Capillary whole blood =finger prick blood glucose

To convert mmol/l into mg/dl, multiply mmol/l by 18

Table 2. The classification of diabetes has been revised by the WHO and is based on aetiology.

Type 1 diabetes	Results from destruction most commonly autoimmune, of the pancreatic beta cells. Insulin is required for survival.
Type 2 diabetes	Characterized by insulin resistance and/or abnormal insulin secretion, either of which may predominate, but both of which are usually present. It is the most common type of diabetes.
Other specific types of Diabetes	These are less common and include genetic disorders, infections, and diseases of the exocrine pancreas, endocrinopathies or as a result of drugs.
Gestational diabetes	Appearing or recognized for the first time in pregnancy.

CHAPTER 2

PREVENTION OF DIABETES

2.0 Introduction

In view of the significant rise in the prevalence of diabetes in Kenya its well-recognized morbidity, premature mortality and increasing health costs, prevention is of paramount importance. Public and professional awareness of the risk factors for and the symptoms of diabetes are an important step towards its control and prevention.

Table 3. Risk factors for diabetes

Modifiable	Non-Modifiable
Obesity: general central	Age (>40 yrs.)
Physical inactivity and unhealthy diets	First degree relative with diabetes
Impaired glucose tolerance /Impaired fasting glycaemia	Previous gestational diabetes
Dyslipidaemia	Ethnicity
Alcohol abuse and Tobacco use	Hypertension

Diabetes prevention can be categorized into two groups:

- Primary prevention
- Secondary prevention

2.1 Primary Prevention

Primary prevention identifies and protects individuals at risk from developing diabetes. It therefore has an impact by reducing both the need for diabetes care and the need to treat diabetes-related complications.

While there is yet no conclusive evidence to suggest that type 1 diabetes can be prevented, primary prevention of type 2 diabetes is potentially possible.

Lifestyle changes aimed at weight control and increased physical activity are important objectives in the prevention of type 2 diabetes. The benefits of reducing body weight and increasing physical activity are not confined to type 2 diabetes;

they also play a role in reducing heart disease, high blood pressure, etc.

The components of lifestyle modification and their aims should include, but not be limited to, the following list:

- Weight loss of 5%-10%.
- Reduction in fat intake < 30% of calories.
- Reduction in saturated fat intake < 10% of calories.
- Increase in fibre intake > 15 g/1000 kcal (traditional African diets are high in fibre content).
- Increase in physical activity levels. This type of exercise (e.g. brisk walking) should last for at least 30 minutes and should be undertaken at least three times a week.
- Formal assessment of sedentary adults for underlying physical conditions that may limit the degree and duration of exercise that will require a structured prescription.
- Reduction in high levels of alcohol intake to less than one drink per day of any type (1 standard alcoholic drink per day (7 units per week) for women, 2 standard alcoholic drinks (14 units per week) for men, Ensure Alcohol free days. A standard unit of alcohol includes, 250ml of full strength beer (4.9% Alc./Vol.), 375ml of mild beer (3.5% Alc./Vol.), 30ml of spirits (40% Alc./Vol.) and 150 ml of average serve wine (12.5% Alc./Vol.)
- Stopping smoking

2.2 Secondary prevention

This involves the early detection and prevention of complications, therefore reducing the need for treatment. Action taken early in the course of diabetes is more beneficial in terms of quality of life and is more cost-effective, especially if this action can prevent hospitalization.

There is now conclusive evidence that good control of blood glucose levels can substantially reduce the risk of developing complications and slow their progression in all types of diabetes. The management of high blood pressure and raised blood lipids (fats) is equally important.

Health workers need not only provide treatment and care for people with diabetes but also play a major role in active prevention of diabetes through health promotion and public health education.

CHAPTER 3

METABOLIC SYNDROME AND OBESITY

3.0 Introduction

Type 2 diabetes and lesser degrees of hyperglycemia often co-exist with hypertension, obesity (particularly visceral adiposity) and dyslipidaemias. These components comprise the metabolic syndrome, a known cluster of risk factors for ischaemic heart disease, stroke and peripheral vascular disease. The pathogenesis of the syndrome is strongly linked to central obesity and tissue resistance to insulin action arising from genetic pre-disposition or acquired factors, such as obesity and physical inactivity

3.1 The essential components of the Metabolic Syndrome are:

1. Central obesity
2. Impaired fasting glycaemia (IFG) or Type 2 diabetes
3. Hypertension
4. Dyslipidaemia (raised triglycerides and/or low HDL-cholesterol)

The presence of three or more of the above essential components constitutes the metabolic syndrome. Formal assessment of insulin resistance is not required to make the diagnosis. The IDF definition classifies central obesity as measured by waist girth as an essential component,

3.2 Strong associations of the metabolic syndrome include:

1. Polycystic ovary disease
2. Acanthosis nigricans
3. Decreased fibrinolytic activity
4. Hyperuricaemia
5. Pro-inflammatory state (elevated highly sensitivity CRP)
6. Microalbuminuria

3.3 Management of the metabolic syndrome

Treatment of the metabolic syndrome consists of managing the various disease components and targeting the pathophysiological derangements of the syndrome: central obesity and insulin resistance. The first line of treatment for all components is lifestyle change- weight loss and increased physical activity. Insulin sensitivity can be improved by non-pharmacological and pharmacological means.

3.4 Obesity

Over 70% of the people with Type 2 diabetes are either overweight or obese. Being overweight/obese significantly increases the risk of morbidity and mortality from Type 2 diabetes and its co-morbidities. Successful reduction has a positive impact on these outcomes. Obesity is a major component of the metabolic syndrome.

Measurements for evaluation of obesity are:

- Calculation of overall obesity, the body mass index (BMI).
- Determination of central fat distribution by measurement of waist circumference.
- BMI represents overall fatness. It is derived from the patient's weight in kilograms (kg) and the height in meters (m) from the following formula:
-

$$\text{BMI} = \text{Weight (kg)} / \text{height (m)}^2$$

*** Waist circumference is more reliable in defining cardiovascular risks in Diabetes**

Clinicians frequently use the following classification of BMI

Table 4. Clinical Classification of BMI

Classification of BMI	(kg/m ²)
Underweight	<18.5
Normal weight	18.6-24.9
Overweight	25-29.9
Obesity (class 1)	30-34.9
Obesity (class 2)	35-39.9
Extreme obesity (class3)	>40

The pattern of distribution of the fat in the body (whether mostly peripherally or centrally distributed) is assessed by the use of the waist hip ratio (WHR):

$$\text{WHR} = \text{waist circumference (cm)} / \text{Hip circumference (cm)}$$

Waist circumference (WC) should be measured midway between the lower rib margin and the iliac crest, while the hip circumference is taken as the largest circumference of the hip. Waist circumference is now recognized as a better indicator of central or upper-body obesity than the WHR, the upper limits being 102 cm and 88 cm in men and women, respectively.

General principles of the management of obesity:

- Assess dietary intake, level of physical activity, BMI, and waist circumference (on presentation and monitor regularly). The socio-economic situation will affect ability to comply with dietary advice.
- Assess efficacy of weight loss measures.
- Integrate weight control measures into the overall management of diabetes mellitus and co-morbidities if BMI > 25 and/or waist circumference > 102 cm and > 88 cm in men and women, respectively.
- Weight loss is difficult to achieve and maintain – acknowledge any achievements made.
- Educate people with diabetes, as well as their families.
- Set realistic goals,
- Use a multi-disciplinary approach to weight control
- Dietary changes and increased level of physical activity are the most economical means to lose weight,
- Maintain records of goals, instructions and weight progress charts.

CHAPTER 4

MANAGEMENT DIABETTES

4.0 Introduction

The overall goal of diabetes management is to improve the quality of life and productivity of people with diabetes by:

- Early diagnosis.
- Prevention of short-term and long-term morbidities.
- Prevention of premature mortality.
- Promotion of self-care practices and empowerment of people with diabetes.
- Reduction of the personal, family and societal burden of diabetes.
-

The successful establishment of the diabetes health-care team and infrastructure to support it is critical for the achievement of these goals. This includes provision of education for health-care professionals and for people living with diabetes.

4.1 Management of Type 1 Diabetes

Management of a child or adolescent with type 1 diabetes is a partnership with the child, adolescent and family and the multidisciplinary team of health professionals. All children and adolescents with type 1 diabetes should have access to the multi-disciplinary team at least once per year where complications screening are undertaken annually for pre-pubertal children after five years of diagnosis and in pubertal adolescents after two years of diagnosis.

Initial assessment

The successful management of the diabetic patient depends on working in partnership with the patient and all members of the team responsible for the various elements of their care. Before a management plan can be agreed, an initial assessment of the health and lifestyle of the patient must be undertaken with particular reference to:

History

- Diabetic history, both recent and historical
- Symptoms of potential complications e.g. deterioration in eyesight
- Other medical conditions

- Drug history, current medications
- Family history
- Occupation and social history e.g. level of exercise, type of diet, smoking history, use of alcohol and recreational drugs
- Prior knowledge of, attitudes to and concerns about the condition.

Examination

- General examination
- Height/ weight/ BMI
- Examination of feet (e.g. ulcers, loss of sensation)
- Examination of eyes (e.g. cataracts, diabetic retinopathy)
- Blood pressure measurement
- Examination of peripheral pulses

Investigations

- Consideration should be given to performing the following investigations depending on age and previous history of the condition:
- Urine albumin excretion (microalbuminuria is albumin loss of 30-300mg/day)
- Urine protein (diabetic nephropathy- albumin loss of > 300mg/day)
- HbA1c
- U&Es, estimated Glomerular Filtration Rate (eGFR)
- TFTs in young diabetic until transferred to adult service
- Serum cholesterol - aim for total cholesterol level below 4.0mmol/l, LDL levels < 2.0mmol/l, HDL levels 1.0mmol/l or above in men and 1.2mmol/l or above in women and triglyceride levels 1.7mmol/l or less
- Test for coeliac disease in young diabetic - then at 3 yearly intervals until transfer to adult service

Diabetes education

Education, when delivered in a patient centered, age appropriate manner, provides a knowledge base, which becomes a vehicle for optimal self-management. Children and adolescents with type 1 diabetes need to understand what diabetes is and its treatment including insulin therapy, injection technique, blood glucose monitoring and acute complications such as hypoglycaemia

Ongoing diabetes education is also essential, as education is a continuous process that requires reinforcement for it to be effective. Ongoing education includes meal planning, management for life activities and growth and self management. Give advice and support on smoking cessation where appropriate

Psychosocial support

Diabetes in a child or adolescent may be associated with acute distress and in some cases prolonged distress for both the individual and the family. Pre-existing psychological, social, personal, family or environmental problems are likely to be exacerbated.

Physical activity

Regular physical activity is an essential component of a healthy lifestyle for all children and adolescents, including those with diabetes. The benefits are similar to those in type 2 diabetes.

Advise that regular physical activity can reduce arterial risk in the medium to long term and where appropriate discuss adjustments to insulin regime or calorie intake during exercise.

Nutrition

Nutrition education for children and adolescents is an ongoing process that needs to be provided at a time that is suitable to meet the individual needs of the families. In order to achieve optimal outcomes for the child/adolescent and family, initial and ongoing nutrition education should ideally be delivered by a dietitian-nutritionist who has appropriate training and experience in paediatric diabetes management.

Discuss diet and give dietary advice taking into account other factors e.g. obesity, hypertension, renal impairment - offer referral to dietician.

Insulin therapy and blood glucose monitoring

Patients with type 1 diabetes should be started on insulin rather than oral glucose lowering agents.

- Discuss patient preferences for twice daily or multiple injection regimes.
- Arrive at regime in partnership with the patient, as patients arriving at informed shared decisions with their practitioner are more likely to be successfully controlled with the chosen regime.
- Twice daily regimes using isophane (NPH) insulin or long acting

insulin analogues (insulin glargine) may be more suitable for those who require assistance, or have a dislike of injecting.

- Multiple injection regimes using unmodified or “soluble” insulin or rapid-acting insulin analogues are suitable for well motivated individuals with a good understanding of disease control, or those with active or erratic lifestyles.
- Patients should be given instruction in injection technique using a device best suited to the patient’s requirements.
- Where appropriate, advise use of self monitoring of blood glucose (aim for pre-prandial blood glucose 4.0-7.0 mmol/l, post prandial <9.00mmol/l).
- Give advice on how to change the regime in case of illness.
- Give advice on how to recognize a hypoglycaemic episode and what action to take.
- Advise patients to carry a source of glucose in case of hypoglycaemic episodes.
- Advise to carry insulin in hand luggage if travelling.
- Patients should be made aware of contact numbers for advice and it may be helpful to provide written information and/or details of how to access further information if required.

Review assessment

All diabetics should be reviewed at least annually and more frequently if there are any factors which may cause concern to the patient or their doctor.

The aim of regular review should be to assess and decrease the risk of known complications of diabetes such as peripheral vascular disease, nephropathy and retinopathy.

A review appointment may involve many health care workers such as dietician, optometrist, podiatrist or other appropriately trained members of staff.

- Glycaemic control and any perceived problems:
- Reinforce need for lifestyle measures
- BMI
- HbA1c - excellent control defined as <6.5% currently
- Examination of eyes for signs of retinopathy and cataracts
- Examination of feet for ulceration/sensation/peripheral pulses
- Examination of injection sites

4.2. Management of Type 2 Diabetes

The successful establishment of the diabetes health-care team and infrastructure to support it is critical for the achievement of these management goals. This includes provision of education for health-care professionals and for people living with diabetes.

Management of Type 2 diabetes entails the following components:

- Treatment of hyperglycaemia
 - Treatment of hypertension and dyslipidaemias
 - Prevention and treatment of microvascular complications
 - Prevention and treatment of macrovascular complications
1. Treatment of hyperglycaemia
 - a. Non -pharmacological
 - i. Education
 - ii. Diet
 - iii. Physical activity
 - b. Pharmacological
 - i. Oral glucose lowering agents(oral hypoglycaemic agents)
 - ii. Insulin
 - iii. Combination Therapies - Oral glucose lowering agents and insulin
 2. Treatment of hypertension and dyslipidaemias
 - a. Non- pharmacological
 - i. Education
 - ii. Diet
 - iii. Physical activity
 - b. Pharmacological
 3. Prevention and treatment of microvascular complications
 4. Prevention and treatment of macrovascular complications

Optimal targets for glycaemic, lipid and blood pressure control in people with diabetes

Table. 5: Optimal targets

Biochemical index		Optimal
Capillary blood glucose values (finger -prick)	Mmol/l	Mg/dl
Fasting	4-6.7 mmol/l	72-108 Mg/dl
2hours-post - prandial	4 - 8 mmol/l	72-144 Mg/dl
Glycated haemoglobin (HbA1C)		<7 %
Weight and height (BMI) (kg/m ²)		18.5 - <25
Blood pressure (mmHg)		
systolic		<130 mmHg
diastolic		< 80 mmHg
If persistent, dipstick for microalbuminuria / proteinuria		
	systolic	<125 mmHg
	diastolic	<75 mmHg
Lipids		
Total cholesterol	<4.8 mmol/l	<93.6 Mg/dl
LDL cholesterol	<2.6 mmol/l	<46.8 Mg/dl
HDL cholesterol	>1.2 mmol/l	>19.8 Mg/dl
Triglycerides	<1.7 mmol/l	<30.6 Mg/dl

Methods for Monitoring Glycaemic Control

Clinical and laboratory methods are employed to monitor or assess whether the individualized glycaemic targets are being attained.

- HbA1c tests are desirable standard tests but are presently unavailable in most of the primary and secondary health facilities in Kenya. Where available twice a year test is recommended.
- A combination of fasting and postprandial plasma glucose ideally measured in a laboratory is the best alternative.
- Glycosuria is a poor means of assessing glycaemic control but in

certain clinics this may be the only available tool. In this situation, the second voided specimen of the day should be tested.

- Where possible self-blood glucose monitoring (SBGM) should be encouraged.
- Results of self-urine testing or blood glucose tests should be recorded in a logbook.
- The clinic protocol should set out, in some detail, the parameters to be monitored at the initial visit, regular follow-up visits, and at the annual review.

4.3 Non-pharmacological management

4.3.1 Diabetes Education

Diabetes education is the provision of knowledge and skill to people with diabetes that will empower them to render self-care in the management of their diabetes and associated disorders. This is one of the cornerstones of management together with diet, physical activity and pharmacotherapy, and is critical in improving the outcome.

People with diabetes and their families need to know:

- that diabetes is serious chronic disease, has no cure, but can be controlled
- that complications are not inevitable (they can be prevented)
- that the cornerstones of therapy include: education, what foods to eat, how much and how often to eat, how to exercise and its precautions, how and when to take medications
- their metabolic and blood pressure targets
- how to look after their feet, and thus prevent ulcers and amputations
- how to avoid other long-term complications
- that regular medical check ups are essential
- when to seek medical help, e.g. how to identify hypoglycaemic and hyperglycaemic emergencies and symptoms, as well as signs of chronic complications
- that good glucose control is required before and during pregnancy,
- How to make informed choices about their use of traditional medicine And alternative medicine

4.3.2 Dietary Management of Type 2 Diabetes Mellitus

Dietary modification is one of the cornerstones of diabetes management, and is based on the principle of healthy eating in context of social, cultural and psychological influences of food choices. Dietary modification and increasing level of physical activity should be the first steps in the management of newly diagnosed people with Type 2 diabetes, and have to be maintained.

Principles of dietary management of Type 2 diabetes mellitus

- All members of the diabetes-care team must have knowledge about nutrition to be able to educate people with diabetes about dietary measures.
- Dietary counseling is best given by a dietitian or nutritionist with an interest in diabetes mellitus.
- To achieve ideal weight loss, an appropriate diet should be prescribed together with an exercise regimen.
- Caloric restrictions should be moderate yet provide a balanced nutrition.
- At least three meals a day should be eaten, and binge eating should be avoided.
- The diet should be individualized, based on traditional eating patterns, be palatable and affordable.
- Animal fat, salt, and so-called diabetic foods should be avoided.
- Pure (simple) sugars in foods and drinks should be avoided.
- Eating plans should be higher in complex carbohydrates (starches) and fibre content, vegetables and limited numbers of fruits should be encouraged.
- Simple explained and written dietary instructions should be provided.
- Food quantities should be measured in volumes using available household items, such as cups, or be countable, such as number of fruits or slices of yam or bread.
- Alcohol should be avoided.
- Sweeteners are not essential and should be avoided as much as possible.

4.3.3 Physical activity and exercise

Physical activity or exercise is one of the essentials in the prevention and management of Type 2 diabetes mellitus. Regular physical activity improves metabolic control, increases insulin sensitivity, improves cardiovascular health,

and helps weight loss and its maintenance, as well as giving a sense of well-being.

There are two main types of physical activity:

- e. Aerobic or endurance exercise (e.g. walking or running) and
- f. Anaerobic or resistance exercise (e.g. lifting weights).

Both types of activity maybe prescribed to persons with Type 2 diabetes mellitus, but the aerobic form is usually preferred.

In most parts of Kenya, prescribing formal exercise in gyms or requiring special equipment is a recipe for non-adherence. Therefore, patients should be encouraged to integrate increased physical activity into their daily routine. The programme should impose minimum, if any, extra financial outlay in new equipment and materials.

General principles and recommendations for physical activity in Type 2 diabetes mellitus

- A detailed physical evaluation of cardiovascular, renal, eye and foot status (including neurological) should be performed before starting an exercise programme.
- The presence of chronic complications may preclude certain forms of exercises
- Prescribed physical activity programmes should be appropriate for the patient's age, socio-economic status, state of physical fitness, lifestyle, and level of glycaemic control.
- While exercise generally improves metabolic control, it can also precipitate acute complications like hypoglycaemia and hyperglycaemia.
- The physical activity should be regular (-3 days/week), last at least 20-30 min. per session, and be of at least moderate activity.
- Activities like walking, climbing steps (instead of taking lifts) should be encouraged.
- For sedentary persons with diabetes, a gradual introduction using a low-intensity activity like walking is mandatory.
- Avoid strenuous exercise if ambient glycaemia is > 250 mg/dl (14 mmol/L), the patient has ketonuria or blood glucose is less than 80 mg/dl (4.5 mmol/L),

- To avoid exercise-induced hypoglycaemic, dosages of insulin secretagogues or insulin may need to be reduced and/or peri-exercise carbohydrate intake increased.
- Glycaemia should be monitored (using strips and meters) before and after planned strenuous physical activity as delayed hypoglycemia may occur.
- Proper footwear must always be worn.

4.4 Pharmacological Management

4.4.1 Oral Glucose Lowering Agents (OGLAs)

These were previously referred to as oral hypoglycaemic agents

Indications:

- Failure of lifestyle modifications
- Oral pharmacotherapy is indicated when an individuals glycaemic targets are not met by the combination of dietary modifications and physical activity/exercise.
- In some cases, oral pharmacotherapy or insulin is indicated at the first presentation of diabetes, i.e. a fasting blood glucose level > 11 mmol/L or random blood glucose level > 15 mmol/L.

The “Table of Glucose-lowering Agents” in the **Appendix I** summarizes the characteristics of the OGLAs, which are frequently used in controlling glycaemia in diabetes care. The list is not exhaustive but includes agents that are most commonly used in Kenya.

Choice of Oral Glucose Lowering Agents (OGLA)

The use of low cost proven effective generic drugs instead of proprietary brands, which are usually expensive, should be encouraged.

- The choice of OGLAs should depend on the patient’s characteristics, lifestyle, degree of glycaemic control, access to drugs, economic status and mutual agreement between the doctor and the person with diabetes,
- The sulphonylureas and metformin are the agents most widely available. Stocking these agents would meet the diabetes-care needs of most diabetes facilities.
- Monotherapy with any of the drugs should be the initial choice. Use of the stepped-care approach is recommended, as monotherapy is seldom sufficient, because of the progressive nature of the disease (see

Algorithm Appendix I). Combination therapy should be considered as initial choice if HBA1C is greater than 8 %

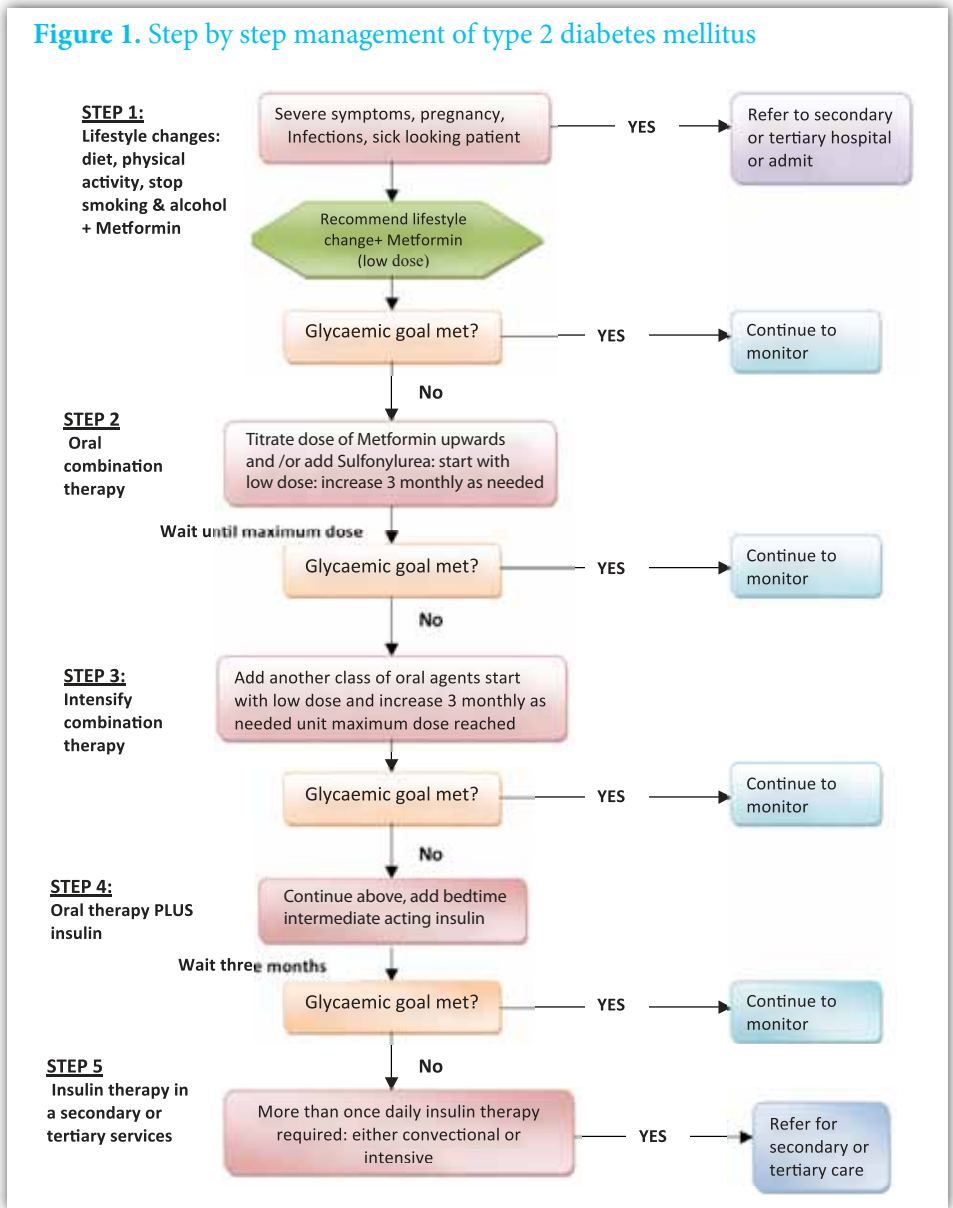
Precautions:

- If overweight (BMI > 25 kg/m²) Metformin should be the first choice. If Metformin is contraindicated thiazolidinediones may be used.
- Long-acting sulphonylureas should be avoided in elderly patients. In such patients, use short-acting sulphonylureas such as glimepiride, gliclazide.
- Metformin should be used with care in the elderly (over the age of 75 years) and is contraindicated in people with elevated serum creatinine, liver disease and severe respiratory, cardiac and peripheral vascular disease
- Combination therapy using OGLAs with different mechanisms of action is indicated if monotherapy with one of the agents has failed.

Never use two drugs from the same class.

- The rapid acting secretagogues (glitinides) and the alpha glucosidase inhibitors allow for flexibility in the glycaemic management but are relatively expensive,
- When oral combination therapy fails, insulin should be added to the treatment regimen or the OGLAs replaced.

Figure 1. Step by step management of type 2 diabetes mellitus



Three-drug combination therapy can be used when two-drug regimens fail to achieve target values. However, such regimens are very expensive and difficult to manage. Such patients should be referred to a specialist. Use of combination therapy often results in an increased number of tablets to be taken and creates

new adherence problems. Fixed combination therapies inhibit flexibility in dosing prescription.

4.4.2 Insulin Therapy

Indications for use of insulin in type 2 diabetes

- Initial presentation with severe hyperglycaemia and are symptomatic
- Presentation in hyperglycemic emergency
- Peri-operative period especially major or emergency surgery
- Other medical conditions requiring tight glycaemic control e. g acute MIs, strokes, sepsis
- Organ failure (e.g. renal, liver, heart)
- Pregnancy
- Latent autoimmune diabetes of adults (LADA)
- Contraindications to OGLAs
- Failure to meet glycaemic targets with OGLAs

The regimen and dose of insulin therapy vary from patient to patient.

vii. Supplemental Therapy:

Intermediate acting (NPH) insulin administered at 22.00 hrs given as a Total Daily Dose calculated by: $\text{Kg} \times 0.2 \text{ IU}$ of insulin (70 kg patient $\times 0.2 \text{ IU} = 14 \text{ IU}$ insulin). The OGLAs are continued (half maximum dose of sulphonylureas and metformin dose of 2 g/day, or the sulphonylureas stopped and metformin continued). Monitor blood glucose levels when possible.

viii. Substitution Therapy:

OGLAs are discontinued (unless the patient is obese where METFORMIN will be continued), and a PRE-MIXED insulin is introduced twice daily at a dosage of 0.2 IU/kg body weight. This is split into $2/3$ in the morning and $1/3$ in the evening, at 30 minutes before the morning and the evening meals. If the requirement of insulin exceeds 30 units/day, referral should be considered.

Table 6 : Types of Insulin and their properties

Insulin preparation	Onset of action (hrs.)	Peak action	Duration of action (hrs.)	Injections per day
Rapid-acting analogues	10-20 min	1-2	3-5	Immediately before meals or with meals
Short acting (Soluble)	30-60 min	2-4	6-8	30 min before meals
Intermediate (NPH)	1-2h.	5-7	13-18	Once or twice
Biphasic mixture 30/70	30.min	2-8	14-16 hrs	twice
Long acting analogue	1-2 hours	peakless	24 h	Once

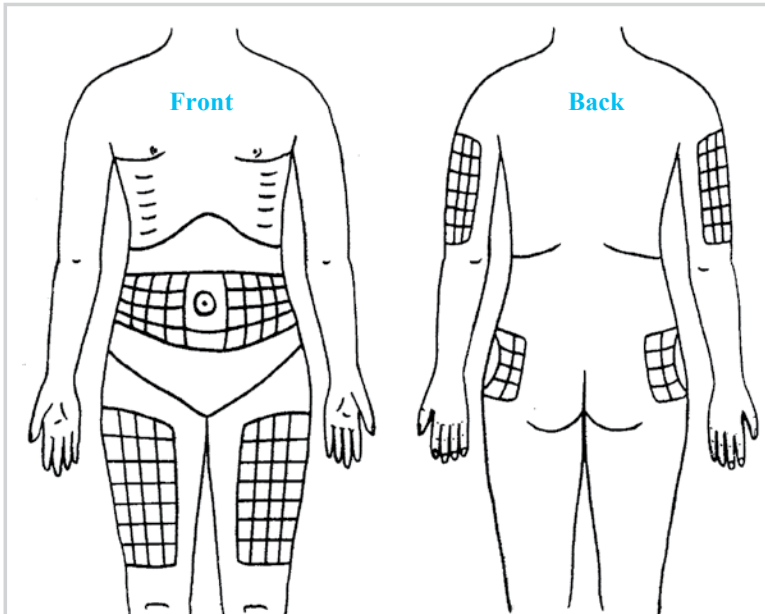
Table 7. Examples of some of the types of insulins available locally in the market

Insulin preparation	Examples available in the market	
Rapid-acting analogues	Humalog or lispro, Novolog or aspart, Apidra or glulisine	Rapid-acting insulin covers insulin needs for meals eaten at the same time as the injection. This type of insulin is used with longer-acting insulin.
Short Acting (soluble)	Regular (R) humulin or novolin, Velosulin (for use in the insulin pump)	Short-acting insulin covers insulin needs for meals eaten within 30-60 minutes
Intermediate	Humulin N (NPH (N)) Novolin N Lente	Intermediate-acting insulin covers insulin needs for about half the day or overnight. This type of insulin is often combined with rapid- or short-acting insulin.

<p>Biphasic mixture 30/70</p> <p>Premixed insulin)*</p>	<p>Humulin 70/30, Novolog 70/30, Novolin 70/30</p>	<p>These products are generally taken twice a day before mealtime.</p>
<p>Long acting analogue</p>	<p>Lantus/Glargine Levemir/Detemir Ultralente</p>	<p>Long-acting insulin covers insulin needs for about 1 full day. This type of insulin is often combined, when needed, with rapid- or short-acting insulin.</p>

*Premixed insulins are a combination of specific proportions of intermediate-acting and short-acting insulin in one bottle or insulin pen (the numbers following the brand name indicate the percentage of each type of insulin).

Figure 2: Injection Sites for Insulin



CHAPTER 5

MANAGEMENT OF CO-MORBIDITIES IN TYPE 2 DIABETES MELLITUS

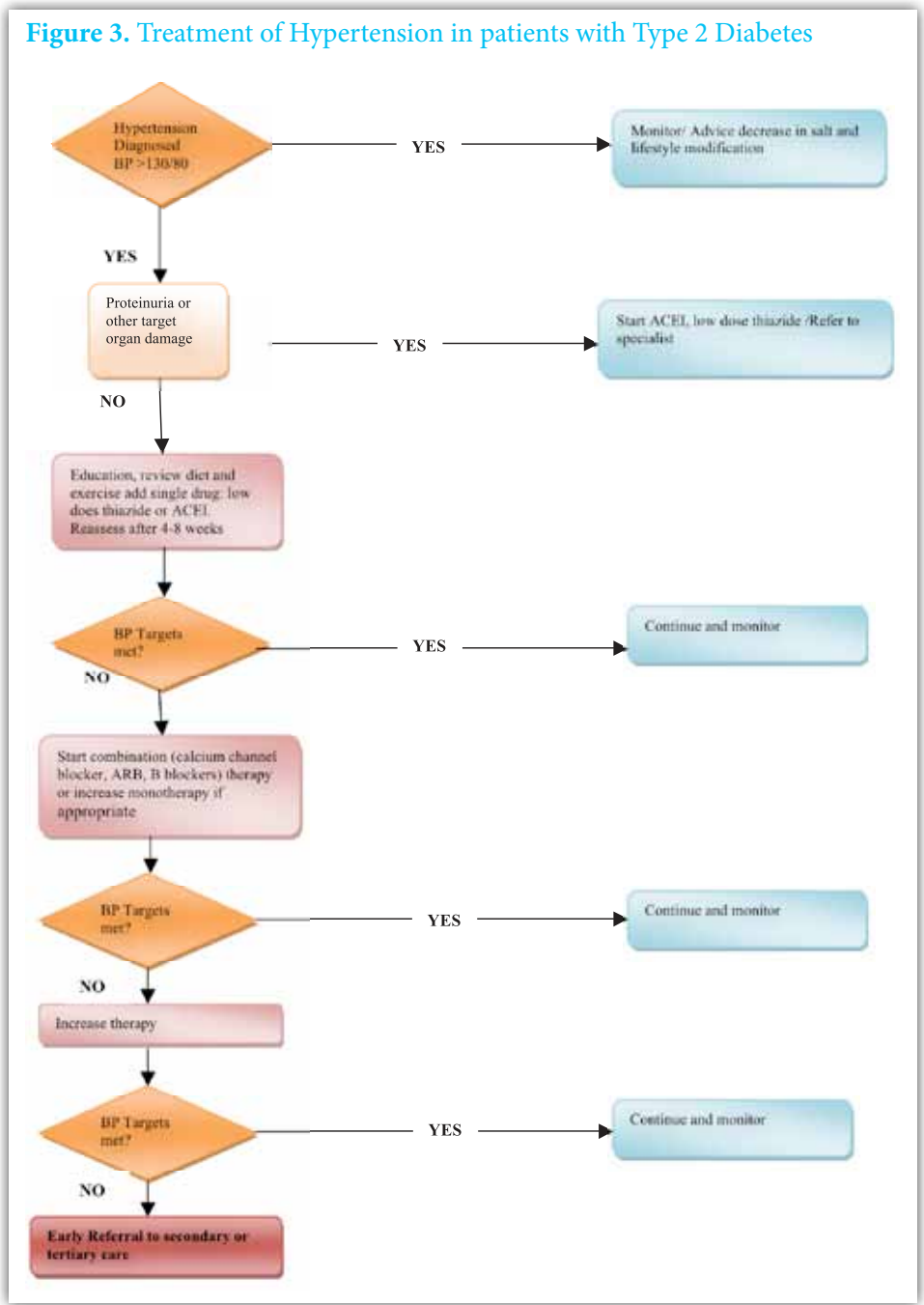
5.1 Hypertension

Principles of management of hypertension in diabetes mellitus

- Determine blood pressure in people with Type 2 diabetes at every visit, using standard techniques (measure with a mercury sphygmomanometer and the right-sized cuff with the patient seated after 5 minutes).
- Classify blood pressure status using a BP of 130/80 mmHg or more as hypertensive.
- If hypertensive, perform clinical evaluation to exclude secondary causes of hypertension. If a secondary cause is suspected, refer for comprehensive evaluation,
- Assessment should include staging and risk stratification. Look for other components of metabolic syndrome and complications of both diabetes and hypertension.
- Integrate management of hypertension and that of diabetes, starting with education lifestyle modifications (physical exercise, diet and weight loss) and setting goals,
- Diet in people with Type 2 diabetes and hypertension should be low in sodium, rich in vegetables and fruits, and low in dairy products.
- With the initial diagnosis, relevant lifestyle modifications should be instituted. If this fails to control the blood pressure, monotherapy should be commenced and if unsuccessful, combination therapy will be required to achieve the target blood pressure level.
- If renal impairment is present (serum creatinine > 133 µmol/L), GFR < 60 and microalbuminuria, aim for BP – 125/75 mmHg
- Note the potential problems with certain anti-hypertensives:
 - Diuretics in large doses inhibit insulin release
 - Beta blockers may blunt or mask symptoms of hypoglycaemia and exacerbate peripheral vascular disease
 - Dyslipidaemias may be worsened by beta blockers and diuretics,
 - Impotence and postural hypotension may be precipitated or aggravated by alpha blockers and centrally acting agents (e.g. methyl dopa).

- Angiotension converting enzyme (ACE) inhibitors may induce hyperkalaemia, renal failure, a persistent cough and lower glucose levels.
- Individualize hypertensive therapy to achieve good control.
- Multiple agents are frequently required.
- Monitor serum creatinine and potassium once a year and more frequently if there is evidence of renal impairment,

Figure 3. Treatment of Hypertension in patients with Type 2 Diabetes



Levels of severity of hypertension

- i. if >130/80mmHg, Monitor Closely
- ii. <180/120 mmHg – Treat with oral Anti-Hypertensive Therapy (AHT)
- iii. > 180/120 mmHg – bring BP down to near normal below 160/100 mmHg within 48 hrs, if pt has end organ damage, the BP needs to be brought down in 1.5 hrs.

5.2 Diabetes and other Cardiovascular Diseases

People with diabetes are 2-4 times more likely to develop cardiovascular disease than people without diabetes. Two major processes lead to cardiovascular disease: atherosclerosis and hypertension.

The clinical spectrum of cardiovascular disease is:

a) Coronary heart disease:

- Angina (which may be silent).
- Acute coronary artery syndrome.
- Congestive cardiac failure.
- Sudden death.

b) Cerebrovascular accident:

- Stroke.
- Transient Ischaemic Attacks.
- Dementia.

c) Peripheral vascular disease:

- Intermittent claudication.
- Foot ulcers.
- Gangrene.

Assessment:

- Annual assessment for cardiovascular risk factors.
- Referral to a secondary and/or tertiary institution for evaluation is required in people presenting with typical and atypical but suggestive symptoms of angina, features of congestive cardiac failure, unexplained breathlessness, cardiomegaly, arrhythmias, transient

- ischaemia attacks or intermittent claudication of the legs.
- Evaluation for coronary artery disease will include ECG, X-ray of the chest (in people with breathlessness) and if warranted an echocardiogram, stress test and coronary angiography Evaluation for Cerebrovascular disease will include carotid Doppler and carotid angiography
 - Evaluation for peripheral vascular disease will include Doppler and angiography of the lower limbs

5.3 Lipids disorders in Diabetes

The risk of coronary artery disease and other macrovascular disorders is 2 - 5 times higher in people with diabetes than in non-diabetic subjects and increases in parallel with the degree of dyslipidaemia.

Table 8. Desired level of lipids in patients with diabetes

Lipids		
Total cholesterol	<4.8 mmol/l	<93.6 Mg/dl
LDL cholesterol	<-2.6 mmol/l	<-46.8 Mg/dl
HDL cholesterol	>1.2 mmol/l	>19.8 Mg/dl
Triglycerides	<1.7 mmol/l	<30.6 Mg/dl

Assessment

Measure fasting lipids including total cholesterol, triglycerides and HDLC and LDLC

How often:

- If normal, annually.
- If abnormal or on treatment, every 3-6 months.

What to do if results are abnormal:

- Use non-pharmacological interventions as initial treatment:
- Improve blood glucose control
- Reduce saturated fat intake
- Ensure regular moderate exercise

- Reduce weight if indicated
- Avoid alcohol intake if triglycerides elevated
- Referral to dietitian.
- Discourage smoking.

If the above interventions are unsuccessful after 6 months, refer or start pharmacotherapy:

- Statins for raised LDLC
- Fibrates for raised triglycerides
- Nicotinic acid or Fibrates for low HDLC.

Management:

- Manage underlying associated cardiovascular risk factors.
- Life-style modification.
- Initiate aspirin therapy.
- Consider the use of beta-blockers, Angiotensin Converting Enzyme (ACE) inhibitors, Angiotensin Receptor Blockers (ARBs) and tight glycaemic control post myocardial infarction.
- ECG, Coronary angiography, angioplasty or coronary artery bypass graft (CABG) where indicated. (take to section on cardiovascular comp)

Recommendation for use of Aspirin

The use of aspirin in people with Type 2 diabetes reduces cardiovascular events, and is indicated in the following:

- Secondary prevention for coronary and cerebrovascular diseases.
- Primary prevention for people with Type 2 diabetes over the age of 40 years, having:
 - Family history of ischaemic heart disease (IHD)
 - Cigarette smoking
 - Hypertension
 - Obesity
 - Proteinuria
 - Dyslipidaemia.

However, contraindications may prevent its use, especially the presence or history of peptic ulcers, dyspepsia, heartburn or bleeding and asthma.

Aspirin should not be used in uncontrolled and malignant hypertension of more than 160/100 mmHg.

Hemorrhagic stroke must be ruled out before initiating aspirin therapy in patients with acute cerebrovascular accident.

The recommended daily dose is 75 -162 mg of aspirin per day.

5.4 Management of Chronic Microvascular Complications

Microvascular complications mainly involve the kidney, eyes, lower extremities and nerves. They may be present at the time of diagnosis of diabetes as the detection of the diseases is frequently delayed. These complications can be prevented or their progression delayed by optimal treatment of hyperglycaemia and hypertension.

Screening for the complications and prompt interventions reduce the risk of major outcomes such as blindness and leg amputations. **Diabetes is one of the most common causes of chronic kidney disease.** In Africa most patients with diabetic end-stage renal disease die of uraemic complications because of limited renal replacement therapy facilities.

Persistent microalbuminuria is a marker for the development of overt nephropathy in diabetes as well as being a well-established marker of increased cardiovascular risk,

Patients with microalbuminuria who progress to macroalbuminuria (> 300 mg/24 h.) are likely to progress to end-stage renal disease over a period of years. Intervention at the stage of microalbuminuria can retard the progression to end-stage renal disease.

Detection and surveillance

Check for proteinuria yearly using reagent strips.

- For patients who test positive exclude urinary tract infections by using urine strips to check for nitrites and leucocytes or urine microscopy and culture and treat infection if present.
- During the next visit, recheck for presence of infection, if none test for proteinuria. If proteinuria (trace or greater) is present and there is no infection, refer for renal evaluation.
- For patients who test negative for proteinuria check for microalbuminuria annually using reagent strips (Semi-quantitative methods e.g. Micral II test strips and Clinitek 50 test strips) or the albumin-creatinine ratio. If negative repeat test annually, if positive start ACEI or ARB treatment and optimize blood pressure control to less than 125/75mmHg.
- Measure serum creatinine annually, and if raised, refer for renal evaluation.

General recommendations

- Intensify management of modifiable risk factors,
- Smoking must be stopped,
- Metformin should not be used once the serum creatinine is more than 160 $\mu\text{mol/l}$ (1.8 mg/dl).
- Treat urinary infections aggressively.
- Avoid drugs toxic to the kidney, (e.g. .Non steroidal anti inflammatory agents, Aminoglycosides)

Treatment

Treat blood pressure aggressively with a target of 125/75 mmHg.

Use ACE inhibitors or ARBs as first-line drug therapy where possible. These drugs should not be used in pregnancy.

- Add diuretics if necessary.
- If target blood pressure is not achieved, refer.
- Refer to a dietician
- Reduce salt intake,
- Restrict protein

5.5 Retinopathy

Retinopathy is one of the major causes of blindness. Risk factors for retinopathy include poor glycaemic control, nephropathy, hypertension and pregnancy, as well as a long duration of diabetes. Diabetic retinopathy is preventable, and its progression retarded by improved blood pressure and glycaemic control. Screening for retinopathy and laser therapy can prevent blindness,

Recommendations

- A full eye examination including visual acuity and fundoscopy (preferably after the dilatation of the pupils) should be performed at the initial visit.
- Examinations should be repeated annually or more frequently if retinopathy is progressing,
- Take retinal fundal pictures annually
- A comprehensive eye examination is required in women planning pregnancy, and during the first trimester. Close follow-up is required during pregnancy and for one year thereafter. (This does not apply to women with GDM).
- If retinopathy is present, intensify the management of blood pressure, glycaemia, lipids and stop smoking.

- Give attention to the psychosocial aspects of visual loss when this occurs.
- Refer for specialized eye care if there is:
 - Unexplained deterioration in visual acuity,
 - Cataract present,
 - Proliferative, proliferative or exudative retinopathy.

5.6 Diabetic Neuropathies

Neuropathies are common complications of diabetes. They play an important role in the increased morbidity and mortality suffered by people with diabetes. Once present, it is difficult to reverse, but good glycaemic control can reduce symptoms and slow progression.

There are three major categories:

- Peripheral neuropathy
- Autonomic neuropathy
- Acute onset neuropathies,

Clinical Assessment:

- Detailed history: numbness, tingling, pain.
- Examination of the feet: test for sensation using 10 g monofilament, 128 Hz tuning fork or cotton wool.
- Lying and then standing blood pressure (postural hypotension= Drop in systolic BP > 20mmHg or diastolic >10mmHg) and pulse.

General measures:

- Improve glycaemic control.
- Exclude or treat other contributory factors:
 - Excess alcohol consumption
 - Vitamin B12 deficiency.
 - Chronic renal failure.
 - Poor nutrition.
 - smoking

Treatment

Treatment of symptomatic peripheral neuropathy is extremely difficult, once diagnosed refer to secondary and/or tertiary centre.

Table 9. Some of the drugs used in the treatment of symptomatic peripheral neuropathy

Symptom	Treatment	Drugs
Burning pain	Tricyclic drugs Other drugs	Imipramine, amitriptylline Capsaicin
Lancinating pain	anticonvulsants	Carbamezapine, phenytoin or valproate
Gastroparesis	Prokinetics	Metoclopropamide, domperidone, mosapride and erythromycin

5.7 Foot complications

People with diabetes are at increased risk of foot ulcers and amputations, which are major causes of morbidity and disability. Education, early recognition and prompt management can prevent foot ulcers and amputations

Most common predisposing factors for ulcers and amputations are:

- Peripheral neuropathy with loss of sensation.
- Peripheral vascular disease.
- Deformities and abnormal biomechanics.
- Poor foot hygiene.
- Unsuitable or no footwear.

Cornerstones of Management of Foot Problems

- Identification of the foot “at risk”
- Regular inspection and examination of the foot at risk.
- Education of health workers, people with diabetes and their families.
- Appropriate footwear.
- Early treatment of non-ulcerative and ulcerative problems.

How to reduce foot ulceration and amputations

- Optimize blood glucose, blood pressure and lipid control.
- Ensure good nutrition status to promote healing
- Encourage patient to stop tobacco smoking/use.
- Perform a detailed foot evaluation at presentation and annually.
- People with demonstrated risk factors should be examined every 6

months. The absence of symptoms does not mean that the feet are healthy, since the patient can have neuropathy, peripheral vascular disease or even an ulcer without any complaints.

- The feet should be examined with the patient lying down and standing up.
- The shoes and socks should also be inspected.

Full examination at presentation and annually

ASK FOR: Symptoms of neuropathy (numbness, tingling or pain) peripheral vascular disease (pain in calves on exercise and at rest)

EXAMINE SKIN: Inspect for ulcers, callus, cracking, fragility, dryness, inter-digital maceration and nail pathology

VASCULAR: Skin color, foot and ankle pulses.

NEUROPATHY: check protective sensation using 10 g monofilament

BONES/JOINTS: deformities, e.g. claw toes and hammer toes.

FOOTWEAR: check footwear and socks both inside and outside

How to examine using the 10 g (5.07 Semmes-Weinstein) monofilament

- This should be done in a quiet and relaxed setting.
- First apply the monofilament on the patient's hands (or elbow, or forehead) so that the patient knows what to expect.
- The patient must not be able to see if and where the examiner applies the filament.
- Apply the monofilament perpendicular to the skin surface with sufficient force to cause the filament to bend or buckle.
- The total duration of the approach, skin contact, and removal of the filament should be approximately 2 seconds.
- Apply the filament along the perimeter of, and not on, an ulcer site, callus, scar or necrotic tissue.
- Do not allow the filament to slide across the skin or make repetitive contact at the test site.
- **Press the filament to the skin and ask the patient IF he or she feels the pressure applied (yes/no) and then WHERE the applied pressure is felt (left/right foot).**
- Repeat this application twice at the same site, but alternate this with at least one "sham" application, in which no filament is applied (total three questions per site).
- Protective sensation is present at each site if the patient correctly answers two out of three applications. Protective sensation is absent

with two out of three incorrect answers, and the patient is then considered to be at risk of ulceration.

- Encourage the patient during testing.

At the examination each person's feet must be categorized into: LOW RISK or HIGH RISK.

An example of an easy-to-use foot-screening assessment sheet for clinical examination is provided in ANNEX III. It can be attached to the person's records.

5.8 Sexual dysfunction

Little information is available on prevalence of sexual dysfunction in women. They may have reduced libido and dyspareunia. In men, erectile dysfunction increases in prevalence with increasing age and has a major psychological impact. The common causes of erectile dysfunction are psychogenic factors, medications, glycaemic control, neurological and vascular dysfunction.

Assessment

Ask all people with diabetes at diagnosis whether they are having any sexual dysfunction and thereafter annually. - Men with sexual dysfunction should be referred for vascular investigations.

Therapy

- Counsel the patient and partner.
- Review medications; consider replacing Beta blockers, diuretics, and methyl dopa where possible.
- Phosphodiesterases e.g. sildenafil and tadalafil can be used with caution in some patients with ED. Avoid in patients with heart failure and HIV patients on protease inhibitors.

CHAPTER 6

MANAGEMENT OF DIABETES IN SPECIAL SITUATIONS

Special situations

6.1 Pregnancy

- Gestational diabetes mellitus (GDM) is any degree of glucose intolerance first recognized in pregnancy
- If inadequately managed GDM is associated with increased risk of perinatal morbidity and mortality
- Diagnosis and prompt institution of therapy reduces risk of poor outcome

Screening for GDM

- When: Between 24 and 28 ,weeks of gestation
- Whom; Women at high risk for GDM;
 - BMI>25kg/m²
 - Previous history of GDM
 - Glycosuria
 - Previous large baby (> 4000 g)
 - Poor obstetric history
 - Family history of diabetes
 - Known IGT / DFG
 - Grand multipara.
- How: Do 75 g OGTT - After 10 hour overnight fast check fasting blood glucose then give 75g of glucose orally and do a blood sugar level after 2 hours (1 standard level tea spoon =5g)

What level is diagnostic for GDM?

- WHO diagnostic criteria for GDM fasting plasma glucose > 7 mol/L AND/OR
- 2h. plasma glucose > 7.8 mmol/L

Management

Refer to the Diabetes Comprehensive Clinic (DCC) and the High Risk ANC when diagnosis is confirmed, since a combined health-care team (obstetrician, diabetologists or Internist, diabetes educator, pediatrician/neonatologist) is required.

Glycaemic targets for pregnancy:

Blood glucose:

- preprandial 3.5-5.5 mmol/L
- postprandial 5 - 6.7 mmol/L

Pregnancy and pre-pregnancy counseling in diabetics

Major congenital abnormalities are important causes of morbidity and mortality in infants of diabetic mothers. Excellent glycaemic control both before pregnancy and during the 1st to 3rd trimesters has resulted in a marked reduction in the rates of congenital malformation and perinatal morbidity. Since many pregnancies are unplanned, there is still an unacceptably high rate of congenital malformations in these infants.

Care before pregnancy

- Enquire if pregnancy is intended.
- Educate on the need for metabolic control before and during pregnancy.
- Aim at good glycaemic control (HbA1c < 1% above normal range) before pregnancy is planned.
- Teach Self Blood Glucose Monitoring (SBGM) if available.
- Tighten glycaemic control.
- Use contraception until adequate metabolic control.
- Normalize BP (<130/80mmHg) if hypertensive.
- Discontinue ACE inhibitors if being used.
- Stop smoking.
- Inform that insulin may be required when pregnant and OGLAs stopped.
- Refer when pregnant to the high risk ANC.

Pregnancy care

Setup: Joint care – diabetologists/physician, obstetrician, diabetes educator, dietitian, neonatologist/pediatrician (include the process of follow up and antenatal management)

Post Delivery care

- OGTT at 6 weeks
- Post natal management

6.2 Fasting for religious purposes

Fasting for religious purposes is possible in certain circumstances in people with diabetes.

General Principles

- Check the level of glycaemic control using HbA_{1c} or fasting blood glucose. Those in very poor control should be discouraged from embarking upon fasting. Drug dosage adjustment is required for patients with fasting blood glucose ≥ 5 mmol/l.
- If on insulin or insulin secretagogues, drug dosages and timing will require adjustment during the period of food denial to meet calorie intake.
- A total fast is not recommended for anyone with diabetes. Adequate hydration is important even during the period of fasting.
- Self-blood glucose monitoring is mandatory for people with diabetes who elect to fast. Once-a-day monitoring is adequate for patients on diet only or diet with Metformin. In patients on insulin secretagogues, self-blood glucose monitoring should be done at least three times a day. Doctor and patients should agree on how to handle abnormal results of self-blood glucose monitoring before start of fast. If hyperglycaemia is marked, retesting should be more frequent and the urine tested for ketones.
- Vigorous activity should be avoided during period of fast.
- People who fast should have ready access to their health-care providers during the period of fast.
- Fasting should be stopped if patient has frequent hypoglycemia, intercurrent infection, or hyperglycemia.

Types of fasts:

- **Normal** fast or the common fast is when the fasting person abstains from all foods (solid or liquid) but can take water for a limited time.
- **In partial** fast: the subjects abstain from selected foods and drinks. The foods consumed usually consist of fruits, vegetables and water. Choosing to fast or to omit a certain meal each of the fasting days is also taken as partial fast.

- **Absolute fast:** imposes total abstinence from both food (solid or liquid) and water. This should not go beyond a maximum of three days and is not recommended for those people taking insulin secretagogues or insulin.
- **Ramadhan fast:** subjects abstain from all foods and fluids during day time and break their fast from sunset to sunrise.

Table 10. Categories of risks in patients with type 1 or type 2 diabetes who fast:

Very high risk
- Severe hypoglycemia within the last 3 months
-Patient with a history of recurrent hypoglycemia
-Patients with hypoglycemia unawareness
-Patients with sustained poor glyceic control
-Keto-acidosis within the last 3 months
-Type 1 diabetes
-Acute illness
-Hyperosmolar hyperglycemic coma within the previous 3 months
-Patients who perform intense physical labor
-Pregnancy
-Patients on dialysis
High risk
-Patients with moderate hyperglycemia (average blood glucose between 8.3 and 16.7 mMol/l, Hb A1C 7.5–9.0%)
-Patients with renal insufficiency
-Patients with advanced macrovascular complications
-People living alone that are treated with insulin or sulfonylureas
-Patients living alone
-Patients with co-morbid conditions that present additional risk factors
-Old age with ill health
-Drugs that may affect mentation
Moderate risk
-Well-controlled patients treated with short-acting insulin secretagogues such as repaglinide or nateglinide
Low risk
-Well-controlled patients treated with diet alone, metformin, or a thiazolidinedione who are otherwise healthy

6.3 Management of diabetes during fasting

i) People treated with oral hypoglycemic agents and dietary modification:

- Fasting is possible in this situation.
- Usual dietary advice should be followed at this time,
- Patients on metformin, alpha glucosidase inhibitors and thiazolidinediones can continue taking the usual doses at the usual times.

ii) Patients on sulphonylureas:

- If on chlorpropamide, this should be stopped and substituted with a shorter-acting agent.
- If on a second or third generation sulphonylurea (glibenclamide, gliclazide, glipizide, glimepiride), these should be taken before breaking the fast and not before dawn.

iii) Type 2 patients on Insulin;

- If on once daily insulin before bed:
- This can be given as usual
- If on twice daily short- and intermediate-acting insulin:
- Before the dawn meal, give the usual evening dose of short acting insulin and decrease the intermediate dose of insulin by 30%-50%.
- Before the evening meal give the usual morning dose of short-acting and intermediate-acting insulin.
- If on basal bolus regimen;
- Usual doses of the short-acting insulin can be given before the dawn and evening meals, and usual doses of the intermediate-acting insulin can still be given at 10pm.
- Regular SBGM is essential to ensure prevention of hypoglycaemia, and titration of doses should occur according to SBGM results.

Indications to breaking the fast:

- If Blood glucose < 3.3 mmol/l at any time
- If Blood glucose < 3.9 mmol/l during first few hours after fast
- If Blood glucose > 16.7 mmol/l at any time
- Neither the insulin injection nor the breaking of the skin for SBGM will break the fast.

Table 11. Summary of advice to Fasting patients with Type 2 diabetes

Treatment regimen	Fasting regimen	When to take Oral Glucose Lowering Agents
Diet only	Total normal or partial fast	Not applicable
Metformin/ thiazolidinediones	Normal or partial fast	With meals
Insulin secretagogues sulphonylureas	Partial fast	Before meals
Daily intermediate or long-acting insulin	Partial fast	Before first meal
Glinides	Normal or partial fast	With meals
Multiple insulin doses using intermediate and short acting	Avoid fasting or pleasure fasting	Not applicable
Long-acting plus bolus fast acting insulin.	Avoid fast or partial fast	Lantus am and analogue with meals

6.4 Management of Type 2 Diabetes during Surgery

No major operative surgery should be undertaken in a person with diabetes at a primary level clinic. Refer these patients, because specialist care is required.

Management

Pre-operatively:

Delay surgery if possible if glycaemic control is poor:

- HbA1c > 9%;
- FBG > 10 mmol/L
- RBG > 13 mmol/L

Optimize glycaemic control if surgery is elective. Screen for complications that may affect surgical risk: Nephropathy, cardiac disease, proliferative retinopathy, neuropathy. Inform surgical team of the complications.

If on diet and or oral agent therapy and well controlled and surgery is minor:

- Omit therapy on morning of surgery.
- Resume therapy when eating normally.

If on insulin therapy or poor glycaemic control or major surgery:

- Use continuous IV insulin (GIK) infusion,
- Start at 8 am and stop when eating normally.
- Monitor blood glucose before, during and after surgery using quality assured method.
- Aim for blood glucose levels of 6 - 10 mol/l.

Glucose-insulin-potassium regimen

- Add 16 IU short-acting insulin and 10 mmol potassium chloride to 500 ml 10% dextrose.
- Infuse IV at 80 ml/h. using a volumetric pump.
- If obese or initial blood glucose is high consider higher dose (20 IU).
- If very thin or usual insulin dose is low consider lower dose (12 IU).

Monitor blood glucose hourly.

- If blood glucose is low or falling reduce dose by 4 IU.
- If blood glucose high or rising increase dose by 4 IU.

Continue the infusion until 60 min after the first meal. Resume usual therapy just after first meal, Check daily for dilutional hyponatremia.

6.5 Diabetes and HIV

There have been reports that persons who are HIV positive and not on anti-retroviral therapy, have double the rates of diabetes, compared to persons who are HIV negative. This may be attributable to a direct effect of HIV on the pancreas, leading to the development of autoimmune disease causing β -cell destruction, or to opportunistic viral infections that can affect the pancreas, such as hepatitis C, Cytomegalovirus's, adenoviruses, and Coxsackie B viruses. Highly active anti-retroviral therapy (HAART), including protease inhibitors, have dramatically improved morbidity and mortality in HIV infected patients, but may also induce glucose intolerance and diabetes in those at risk.

Precaution:

- Avoid Protease Inhibitors as much as possible
- HAART may also cause dyslipidaemias and need more frequent monitoring and intensified regimes.

CHAPTER 7

ACUTE METABOLIC COMPLICATIONS OF DIABETES

7.1 Introduction

The acute metabolic emergencies of diabetes ketoacidosis, non-ketotic hyperosmolar states, hypoglycemia and lactic acidosis may present with a coma or altered levels of consciousness in people with diabetes. Other considerations include stroke, seizures, trauma, drug overdose, infection, and ethanol intoxication.

7.2 Diabetic Ketoacidosis (DKA)

Immediate management – within the First Hour

Initial evaluation (perform immediately):

- History and physical examination
- Airway and breathing - correct hypoxaemia.
- Laboratory tests: arterial blood gases, complete blood count with differential, urinalysis, blood glucose, urea, electrolytes and creatinine, serum ketones.
- Electrocardiography (ECG): Diabetic ketoacidosis may be precipitated by a cardiac event, and the physiological disturbances of diabetic ketoacidosis may cause cardiac complications. An ECG is also a rapid way to assess significant hypokalaemia or hyperkalaemia.
- Chest radiograph and cultures as needed
- Start IV fluid: 1 L of 0.9% sodium chloride per hour initially (15 to 20mL/kg/hour).

Diagnostic criteria for diabetic ketoacidosis:

- Blood glucose level > 13.9mmol/L (250mg/dl)
- Arterial pH < 7.3
- Serum bicarbonate level < 15mEq/L
- Moderate ketonuria and ketonemia

Remember that hyperglycaemia, although usually marked, is not a reliable guide to the severity of acidosis, and in children, pregnant women, malnourished or alcoholic patients, blood glucose may not be much raised.

Initial treatment at primary level

- Insert IV cannula and commence rehydration with 0.9% saline 1000 ml over one hour unless contraindicated.
- Give 10 IU short-acting insulin IV preferably or I/M (not subcutaneously).
- Arrange immediate transfer to an emergency unit.
- Inform the referral unit.

At secondary level

- Prepare intravenous insulin infusion (see below) and commence at 3 units/hr

Other Interventions/Actions

- Insert an NG tube if impaired consciousness or protracted vomiting.
- Insert a Catheter if oliguric.
- Consider central line if clinically indicated.
- Admits patient to a high dependency area.
- Call for specialist care

Ongoing management – Hours 2 – 4

Reassess patient regularly and monitor vital signs

Intravenous fluids

- Aim to rapidly restore circulating volume and then gradually correct interstitial and intracellular fluid deficits.
- Use isotonic saline (see example below) – infusion rates will vary between patients, Remember risk of cardiac failure in elderly patients.
- If hypotension (SBP < 100 mmHg) or signs of poor organ perfusion are present, use colloid to restore circulating volume.

1000mls 0.9% saline over 2nd hour

500mls 0.9% saline over 3rd hour

500mls 0.9% saline over 4th hour

- Add in 10% dextrose once blood glucose <14 mmol/l. Infuse at 100mls/hr. Do not alternate saline and dextrose. Measure U&Es and venous bicarbonate at the end of hour 2 and hour 4.

Electrolyte replacement

- Despite a considerable total body potassium deficit (300 – 1000 mmol/l), plasma potassium levels are usually normal or high at presentation, because of acidosis, insulin deficiency and renal impairment.
- Potassium concentration will fall following commencement of treatment; expect to give plenty of potassium.
- Target potassium concentration is 4.0-5.0 mmol/l

Severe hypokalaemia complicating treatment of DKA is potentially fatal and is usually avoidable.

Potassium replacement

No potassium in the first litre unless known to be < 3.0 mmol/l thereafter, replace potassium as below:

plasma potassium (mmol/l)	potassium added (mmol/hr)
< 3.5	40*
3.5 – 5.0	20
>5.0, or anuric	No supplements

* must be given in one litre of fluid; avoid infusion rates of KCL >10 mmol/hr

Blood Glucose and Insulin

- Hourly Blood glucose testing
- Aim to ensure a gradual reduction in blood glucose over the first 12-24 hours.
- There is no specific evidence to avoid rapid rates of fall (e.g. >5mmol/hr), but there are some observational data to suggest that excessive rates of fall may be associated with cerebral oedema.
- The target blood glucose concentration for the end of the first day is 10-20mmol/l.
- Make up an infusion of 50 units of soluble insulin (e.g. Humulin S or Actrapid) in 50 mls 0.9% saline (1 unit/ml) and infuse using a syringe driver.
- If blood glucose falls below target (i.e. <9mmol/l) on 3 units/hr, reduce insulin infusion to 2 units/hr. Do not reduce the insulin rate below this.

- If glucose continues to fall, increase the infusion rate of dextrose or the concentration.
- Discuss with the diabetologists/physician or senior medical officer
- Remember that intravenous insulin has a half-life of 2.5 minutes. It is important that the insulin infusion is not interrupted.

Aim for a gradual reduction in blood glucose over 12 hours

- **6 units/hr initially**
- **3 - 4 units/hr when blood glucose < 14 mmol/l**
- **If plasma glucose does not fall in the first hour, the rate of infusion needs increased**
- **Refer or consult a diabetologists/physician**

Consider Precipitating Factors

- Do a full Blood Cell Count (FBC)
- Do a chest radiograph (CXR)
- Do a n Electro cardiograph (ECG)
- Do Urine gram stain and culture
- Do Blood cultures and other infection screen

Correction of acidosis

- Volume resuscitation and insulin infusion will correct metabolic acidosis in the majority.
- Ketonaemia typically takes longer to clear than hyperglycaemia.
- Intravenous sodium bicarbonate should not be used routinely and certainly not without discussing with a senior doctor (there is evidence it may cause harm if there is evidence of cardiogenic shock or other lactate-generating conditions).

Later management – after 4 hours

- Allow oral intake if swallowing safe and bowel sounds present.
- **Aim for a gradual reduction in blood glucose over 12 hours**
 - 6 units/hr initially
 - 3 - 4 units/hr when blood glucose < 14 mmol/l
 - If plasma glucose does not fall in the first hour, the rate of infusion needs increased
- Measure U&Es and venous bicarbonate twice daily, until bicarbonate within the normal reference range.

- Continue with 0.9% saline <250ml/hour until bicarbonate is in the reference range and the patient is eating.
- Continue potassium infusion until target is maintained.

See Appendix IV for Management of Diabetes Ketoacidosis (DKA)

7.3 Diabetic hyperosmolar hyperglycemic state

Hyperosmolar hyperglycemic state is characterized by the slow development of marked hyperglycaemia (usually > 50 mmol/L or 900 mg/dl) dehydration and pre-renal azotemia. Ketonuria may be slight or absent. Two-thirds of cases are in previously undiagnosed cases of diabetes. Infections, diuretic treatment, and drinking glucose-rich beverages, myocardial or cerebral ischemia may all be precipitating factors.

The condition usually affects middle- aged or elderly patients and carries a high mortality.

Treatment

Initial treatment is the same as for DKA. Hyper osmolar hyperglycemic state has a high mortality and immediate referral to secondary or tertiary facility is required.

ECG should be done. Heparin antithrombotic agents should be given in the absence of contraindications.

7.4 Hypoglycaemia

Hypoglycemia is a medical emergency and should be treated promptly if serious complications are to be avoided.

The commonest causes of hypoglycaemia are:

- Taking more exercise than usual.
- Delay or omission of a snack or main meal.
- Poor injection technique.
- insulin overdose
- Eating insufficient carbohydrate.
- Over-indulgence in alcohol.
- sulphonylureas overdose
- /Use of long acting oral antidiabetic agents
- Herbal medication causing liver failure in combination with ADA

Presentation

- Cold clammy skin
- Profuse sweating
- Headache
- Palpitation
- Cerebral signs/ symptoms- confusion , coma

Management:

- Oral glucose /sweetened drink (Not diet drink) if patient is conscious.
- If patient is unconscious, an IV 50% glucose bolus (40 - 50 ml diluted with equal volume normal saline) and followed by 10% glucose infusion if necessary.
- Inject able glucagon if available can also be administered in unconscious patients.
- On recovery, give a long-acting carbohydrate snack.
- Prolonged IV dextrose infusion (5 -10% for 12 - 24 h.) may be necessary if hypoglycemia is as a result of long-acting sulphonylureas/ long and intermediate-acting insulin or alcohol.
- If IV access is impossible, consider nasogastric or rectal glucose; or if available glucagon 1 mg IM.
- On recovery, attempt to identify the cause of hypoglycemia and correct it,
- Assess the type of insulin used, injection sites (since lipohypertrophy can alter the rate of absorption) and injection techniques.
- Enquire into and correct inappropriate habits of eating, exercise and alcohol consumption.
- Review of other drug therapy and renal function,
- Adjustment of insulin or OGLA dosages if appropriate.
- Give IV glucose 20-30gm (e.g. 200-300ml of 10% dextrose, or 40 - 60 ml 50% dextrose diluted with equal volume normal saline)*
- If hypoglycaemia is as a result of sulphonylureas, or if alcohol is strongly implicated, put up a slow dextrose drip (5-10%) for 12-14 hours

CHAPTER 8

LIVING WITH DIABETES

8.0 Living with Diabetes

Diabetes care is a lifelong responsibility. People living with diabetes must change many habits, such as what they eat, when they exercise and how frequently they see your medical providers. They may need to take daily medications or insulin to keep their blood sugar levels in check. Having diabetes means making adjustments at work and at home. But these changes don't mean one won't be able to succeed at work or enjoy a healthy and fulfilling life. People with diabetes have equal rights with those without the condition and should be protected from all forms of discrimination.

8.1 Employment

- A person with diabetes, particularly if treated with insulin, faces many problems in ordinary daily life. Health-care providers should be aware of these problems so that they can give appropriate advice.
- The commonest problem is prejudice from employers. Such prejudice is usually because of ignorance and the belief that all people with diabetes have poor work performance and have regular interruptions as a result of hypoglycaemia.
- This prejudice causes some people with diabetes to try and conceal their diabetes from their employers and workmates. This must be discouraged as concealment may result in grave consequences in case of attacks of hypoglycaemia. Shift work and irregular working hours can present problems but can be overcome.
- A person with diabetes, depending on his or her qualifications, could apply or be eligible for most jobs.

8.2 Driving

- Hypoglycaemia is one of the common medical causes of road traffic accidents.
- There is often discrimination against a person with diabetes applying for a driving license.
- All drivers must act responsibly and schedule their medications and eating pattern to avoid hypoglycaemia.

- Commercial drivers on insulin and insulin secretagogues should be advised to inform their employers and the licensing authorities.
- Advice to drivers:
 - Inform Insurance Company
 - Always keep glucose or sweet eatables in the vehicles
 - Never drink alcohol and drive
 - Never drive if a meal has been missed.

8.3 Insurance

Most people with diabetes are asked to pay additional premiums for life assurance and sickness insurance. Some are denied insurance outright.

There should be unbiased access to insurance policies (life or sickness) at a reasonable cost.

8.4 Sports, recreational and occupational exercise

- Treatment with insulin and oral glucose lowering agents (OGLAs) do not preclude vigorous sports and exercise, unless underlying ischemic heart disease or significant microvascular complications, e.g. advanced retinopathy are present.
- There is a possibility of hypoglycaemia as a consequence of exercise or vigorous sports. Hypoglycaemia may even occur some hours after exercise, possibly because the liver and muscles are still replenishing glycogen stores.
- Exercise or sports may need to be accompanied by extra food or
- Adjustment in OGLA or insulin dosage.
- If vigorous sporting activity is being considered, the person should not have any contraindication to such activity and should be in good metabolic control. Detailed advice from a health provider should be sought to reduce the risk of hypoglycaemia.

ANNEX I

Table of oral glucose lowering agents

Name of Drug	Starting Dose	Maximal Dose	Major Side Effects	Contraindications
SULPHONYL UREAS				
Glibenclamide	2.5mg	15mg	Hypoglycaemia* weight gain skin rashes	Caution in liver and renal disease
Gliclazide	40mg	320 mg	Hypoglycaemia weight gain skin rashes	Pregnancy, caution in liver disease
Glimepiride	1mg	8mg	Hypoglycaemia weight gain skin rashes	Pregnancy, caution in liver and renal disease
Glipizide	5mg	40mg	Hypoglycaemia weight gain skin rashes	Pregnancy, caution in liver and renal disease
Chlorpropamide	250mg	500mg	Hypoglycaemia* weight gain skin rashes	Pregnancy, caution in liver and renal disease
BIGUANIDE				
Metformin	500mg	2550mg	Abdominal pain, nausea, loose bowel motions lactic acidosis	Renal, heart and liver failure; pregnancy
THIAZOLIDINE -DIONES				
Rosiglitazone	4mg	8mg	Liver impairment, fluid retention weight gain, dilutional anaemia	Renal, heart and liver failure; pregnancy
Pioglitazone	15mg	45mg	Liver impairment, fluid retention weight gain, dilutional anaemia	Renal, heart and liver failure; pregnancy
MEGLITINIDES				
Repaglinide	1.0 mg	16mg	Liver impairment, fluid retention weight gain, dilutional anaemia	
ALPHA_GLUCOSIDASE INHIBITORS				
Acarbose	25mg	300mg	Dyspepsia loose bowel motions, flatulence	None

ANNEX II

Table of classes of anti-hypertensive

Class	Indication	Contraindication	Side Effects
ACE inhibitors	LVH, Nephropathy, Cardiac failure, Myocardial infarction	Renal A. Stenosis End stage renal disease, Pregnancy	Cough, First dose hypotension, Angioneurotic oedema, j Hyperkalaemia, Skin rashes, Neutropenia, thrombocytopenia
Angiotensin 11 receptor blockers	LVH, Nephropathy, Cardiac failure, Myocardial infarction	Renal A. Steno sis End stage renal disease, Pregnancy	Hyperkalaemia
Thiazide diuretics	High volume hypertension	Pregnancy	Hyperglycaemia, Hyperuricaemia, Hypercalcaemia, Hypokalaemia, Dyslipidaemia
Loop diuretics	Nephropathy, Heart failure	Pregnancy	Hypokalaemia, Hypomagnesaemia, Hyponatraemia, Hypocalcaemia, Hyperuricaemia, Hypochloreaemic acidosis Ototoxicity
Beta blockers (Preferably selective pi antagonists)	Ischaemic heart disease, Arrhythmias, Hyperthyroidism, Migraine, Essential tremors, Hypertrophic obstructive cardiomyopathy *	Obstructive airway disease, Heart block, Severe heart failure, Raynauds phenomenon, Active peripheral vascular disease, Severe liver disease, Pregnancy	Bronchial constriction, Heart failure
Dihydropyridine (Calcium Channel blockers)	Obstructive airway disease, Peripheral vascular disease	Unstable angina, Acute Myocardial infarction, Aortic stenosis, Hypertrophic obstructive cardiomyopathy Pregnancy	Palpitations, Headaches, Peripheral oedema
Non-dihydropyridine (Calcium Channel blockers a-1 adrenoceptor blocker)	Arrhythmias BPH, Raynauds phenomenon, Pheochromocytoma	WPWS, Heart block, Heart Failure Pregnancy	Worsening of heart failure and heart block
First dose hypotension, Urinary frequency and incontinence, Palpitations			
Centrally acting anti-adrenergic agents	Pregnancy	Parkinsons disease, Pheochromocytoma	Postural hypotension, Drowsiness, Impotence

ANNEX III

An Example of an Easy-To-Use Foot-Screening Assessment Sheet for Clinical Examination.

Foot-Screening Assessment Sheet For Clinical Examination	
Patient Name.....	Hospital Number:
Year DM Diagnosed.....	
DM Treatment: Diet only/oral agents/insulin/oral agents + insulin.....	
The foot is at risk if any of the below are present in either of the 2 feet	
Skin not intact (ulcer)	Yes/No
Neuropathy:	
-Monofilament undetectable (>)	Yes /No
Callus	Yes /No
Foot pulses	Yes/No
Tibial posterior artery absent	Yes/No
Dorsal pedal artery absent	Yes/No
Any Other	
Previous Ulcer	Yes/No
Amputation	Yes/No
Risk category	
Low-risk patient	
None of the five high –risk characteristics	Yes/No
High –risk patient: One or more of the following	
Loss of protective sensation; Absent pedal pulses; foot deformity:	Yes/No
History of foot ulcer; prior amputation	Yes/No
Referral:	
Any foot with neuropathy, both pedal pulses absent, current or previous ulcer, gangrene or prior amputation	
Low-Risk Foot	Foot care education.
	Foot exam annually.
	Foot-care education.
High-Risk Foot	
	Prescribe special footwear.
	Debridement of callus.
	Examine at each clinic visit.
	Refer to secondary and/or tertiary centre

Bibliography

1. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis IDF, 2006. Diabetes Education Training Manual for Sub Saharan Africa. International Diabetes Federation Africa Region.
2. World Health Organization, Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Report of a WHO Consultation. Part 1: Diagnosis and Classification of Diabetes Mellitus. Geneva: WHO Department of Non-communicable Disease Surveillance, 1999; 1-59.
3. World Health Organization. Screening for Type 2 Diabetes. Report of a World Health Organization and International Diabetes Federation meeting. WHO/NMH/MNC/03.1 Geneva: WHO Department of Non-communicable Disease Management, 2003
4. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis
5. IDF, 2006. Diabetes Education Training Manual for Sub Saharan Africa. International Diabetes Federation Africa Region.
6. UKPDS Group. UK Prospective Diabetes Study 30: Diabetic retinopathy at diagnosis of Type 2 diabetes and associated risk factors. Arch. Ophthalmology 1998; 116:297-303
7. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Canadian Diabetes Association 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. Canadian Journal of Diabetes 2003; 27 (Suppl 2); S14-S16
8. European Diabetes Policy Group 1999. A desktop guide to Type 2 Diabetes Mellitus. Diabet. Med 1999; 16; 716-30.
9. American Diabetes Association. Standards of Medical Care in Diabetes, Diabetes Care 2005; 28 (Suppl 1);S4-S36.
10. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Canadian Diabetes Association 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. Canadian Journal of Diabetes 2003; 27 (Suppl 2).
11. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Canadian Diabetes Association 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. Canadian Journal of Diabetes 2003; 27 (Suppl 2); S18-S23.
12. The Diabetes Control and Complications Trial Research Group. The relationship of glycaemic exposure (HbA_{1c}), to the risk of development and progression of retinopathy in the Diabetes Control and Complications Trial. Diabetes 1995; 44; 968-83.
13. IDF position statement. The role of urine glucose monitoring in diabetes. March 2005. <http://www.idf.org>.
14. UK Prospective Diabetes Study (UKPDS) Group. Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 3) .Lancet 1998; 352: 857-53.
15. European Society and Hypertension European Society of Cardiology. 2003 European Society of Hypertension European Society of Cardiology guideline for the management of arterial hypertension. J.Hypertens2003; 21; 1011-53.

16. UP Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in Type 2 diabetes: UKPDS 38; *BMJ*1998; 317:703-13.
17. Newman H, Colagiuri S, Chen M, Colagiuri E., Evidence Based Guidelines for Type 2 Diabetes: Macrovascular disease. Canberra: Diabetes Australia & NHMRC, 2004. <http://www.diabetesaustralia.com.au>
18. Best J, Colagiuri S, Chen M, Colagiuri R. Evidence Based Guideline for Type 2 Diabetes: Lipid Control. Canberra. Diabetes Australia & NHMRC, 2004. <http://www.diabetesaustralia.com.au>.
19. Samad Shera A. Diabetes Mellitus. National Clinical Practice Guidelines. Pakistan. 1999.
20. NSW Health Department Expert Panel on Diabetes. Principles of care & Guidelines for the management of Diabetes Mellitus. 1996.
21. Colagiuri S. A National Consensus Position. Guidelines for the Prevention and Management of Diabetes in Tonga. 2000.
22. International Diabetes Federation, Western Pacific Region (WPR). Type 2 Diabetes Practical Targets and Treatments Guidelines. 2001.
23. Mbanya JC, Bonnici F, Nagati K. Guidelines for the Management of non-insulin dependent diabetes mellitus (NIDDM) in Africa. 1996.
24. American Diabetes Association: Clinical Practice Recommendations 2003. Diabetes Care, Vol 26, Supplement 1, January 2003.
25. Gaman Recommendations for Management of Diabetes During Ramadan Diabetes Care 28: 2305-2311

Division of Non-communicable Diseases
Afya House, Cathedral Road
P.O. Box 30016 – 00100
Nairobi, Kenya.

Telephone: +254 202 71 7 071

www.pubhealth.go.ke



WORLD **DIABETES** FOUNDATION



International Diabetes Federation
African Region