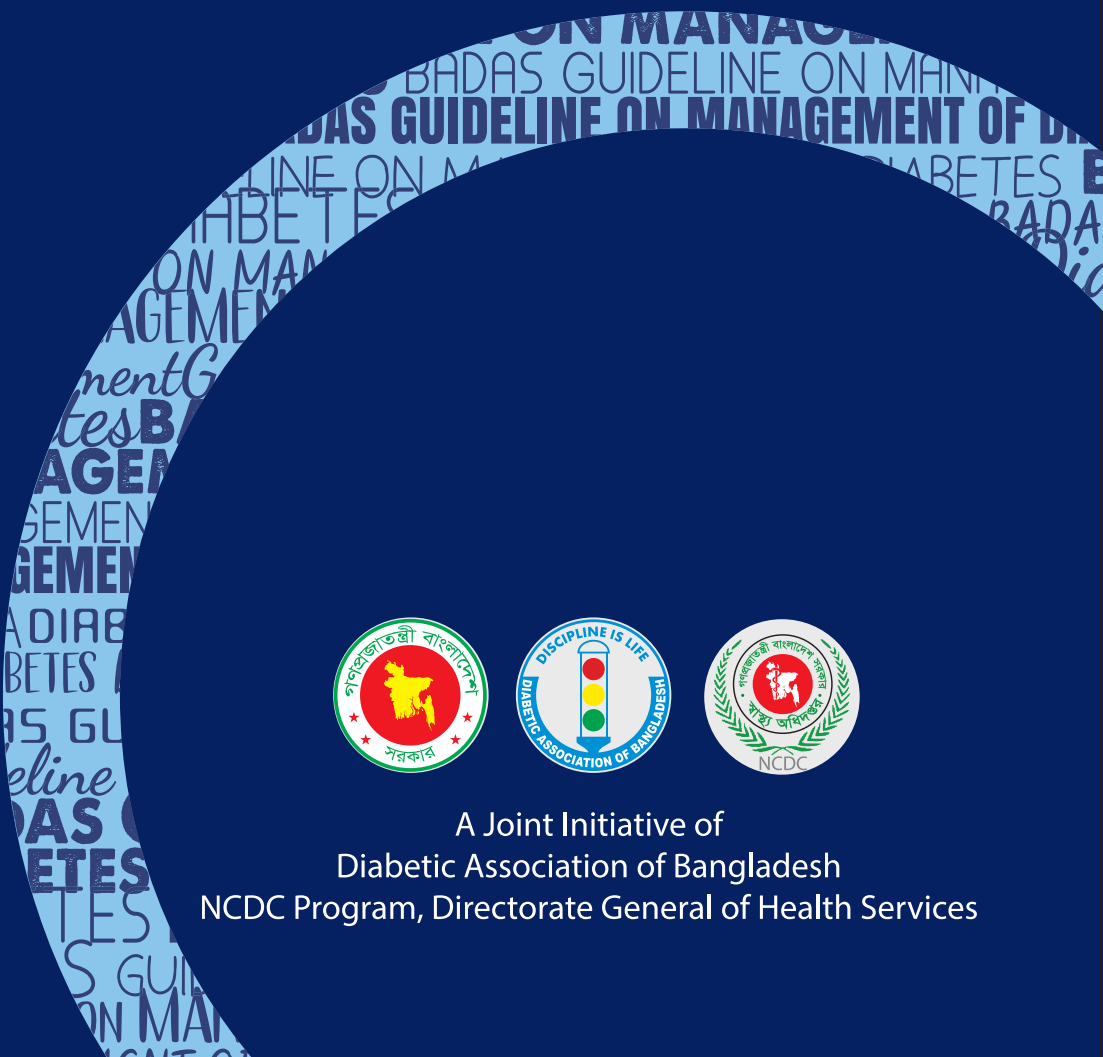
DIABETES CARE

BADAS Guideline 2019



A Joint Initiative of
Diabetic Association of Bangladesh
NCDC Program, Directorate General of Health Services

Diabetes Care
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DIABETES CARE: BADAS GUIDELINE 2019

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President

Diabetic Association of Bangladesh

Message

It gives me immense pleasure to know that BADAS is publishing country's first diabetes care guideline. I express my heartfelt thanks to all the members of the taskforce team and expert committee for putting their effort to develop the guideline.

World is suffering from an epidemic of diabetes and this epidemic is rising faster in developing countries like Bangladesh; hence number of increasing patients need to get access to quality care for getting optimal control. It is well known that to ensure quality care competence building of physician is an utmost need. I believe this guideline will help the physician to choose the right regimen for treating the diabetic patients properly. In this regard I like to thank NCDC Program, Directorate General of Health Services for their support in developing this guideline.

Based on this guideline we are also developing an app-based treatment approach named Diabetes Journey. We believe these initiatives will expand the specialist physicians base and will empower the physicians to enhance the treatment of diabetes ensuring quality care.

I look forward to the success of this guideline.

Professor AK Azad Khan

Secretary General

Diabetic Association of Bangladesh

Message

It is a proud moment for BADAS to launch the Diabetes Care Guideline and Diabetes Journey app which is a simple mobile decision support application for diagnosis and treatment of diabetes.

BADAS is fortunate to have forward-thinking medical, scientific, educational and executive professionals, who strategically lead and focus efforts to ensure the establishment of this "Diabetes Care Guideline".

We are also privileged to have Novo Nordisk as partner on launching of Diabetes Journey app. The app is developed as a supporting tool for healthcare providers and empowers them to select the best treatment for a particular patient aligning with Diabetes Care Guideline.

We look forward for your gracious support to these and make it a grand success.

Md Sayef Uddin

Secretary
Health Care Division
Ministry of Health & Family Welfare
The Peoples' Republic of Bangladesh

Message

I am immensely delighted to know that BADAS is publishing country's first diabetes care guideline and launching an app-based treatment approach called Diabetes journey. I like to take this moment to express my heartfelt gratitude to all members who worked relentlessly to develop the guideline and the app.

The number of diabetic patients is increasing worldwide and also in Bangladesh at an alarming rate. As a result, increased number of patients need to get access to quality care for achieving optimal control. Improving capacity of the physicians is also a demand of the time.

I believe these initiatives will expand the specialist physicians base and will empower the physicians and will help to progress further towards fulfilling the vision to creating digital Bangladesh.

I look forward to witnessing the wide utilization of this guideline and the app.

Md Ashadul Islam

Directorate General
Directorate General of Health Services
Ministry of Health & Family Welfare

Message

Across the world diabetes is a common burden. We are facing same challenges in Bangladesh. About 6.9 million people in Bangladesh have diabetes. This figure would be just doubled by 2045. We are struggling to provide quality care to the diabetic due to limited number of diabetes specialists. I believe this diabetes guideline from Diabetic Association of Bangladesh will guide a physician to select appropriate therapy to manage diabetes as well as boost up the treatment knowledge of physicians and ensure better treatment in individualized care.

This guideline is directly aligning with the objective of non-communicable disease program of the Govt. We are happy to see such type of initiative of BADAS and appreciate their effort to publish this guideline.

We look forward to the success of this and believe it would be a widely used guideline among the physician.

Professor Dr Abul Kalam Azad

Additional Director General
(Planning & Development)
Ministry of Health & Family Welfare

Message

Diabetes mellitus is running in an epidemic scale almost all over the world, Bangladesh is no exception. Day by day number of patients are increasing and they are more prone to be affected by different types of comorbid conditions. Physicians are playing important role to ensure better care. But they face problems to individualize the treatment. I am happy to learn that BADAS has developed a guideline on diabetes care based on treatment algorithm for disease management. This will help and guide a physician for making a decision towards treatment in addition to enriching their knowledge in current treatment approach.

From the Government side, we want to maintain a collaboration with BADAS to take such type of initiative in future which is in line with non-communicable disease control program of the Government.

I sincerely hope this guideline will be helpful to physicians and will serve useful purpose in daily practice.

Prof Dr AHM Enayet Hossain

Chairpersion

Diabetes Care BADAS Guideline 2019

Message

I express my heartiest thanks to all the members of task force and the expert committee of Diabetes Care BADAS Guideline 2019 for their brilliant contribution to publish this guideline.

Diabetes is a chronic lifelong disease. If undetected or uncontrolled, it can lead to life-threating acute emergencies and long-term chronic complications leading to blindness, end-stage renal failure, neurological complications, and cardiovascular disease. Research has proved that all these complications are largely preventable by early detectionand with good control of diabetes. I believe this guideline will guide our physicians to choose the appropriate treatment regimen for the management of their patients properly.

I look forward to the success of this guideline.

Hajera Mahtab

Professor Hajera Mahtab

Content

CHAPTER 1
Overview, Pathophysiology and Epidemiology of Diabetes mellitus

1.1 Overview

Diabetes mellitus (DM) is a chronic/persistent hyperglycemia, due to different degrees of deficiency of insulin secretion, and/or of insulin action. At recent time several other pathological pathways are recognized, specially in type 2 diabetes.

Diabetes mellitus is classified on the basis of etiology into four types:

1. Type 1 diabetes mellitus
2. Type 2 diabetes mellitus
3. Other specific types
4. Gestational diabetes mellitus (GDM)

Type 1 diabetes mellitus tends to occur usually in the young, although it can occur at any age. They are found to be lean. Onset of symptoms is often rapid. It is mostly caused by autoimmune destruction of the beta-cells in the pancreas, resulting in severe reduction of insulin production. Although there does not appear to be a strong genetic link, there is genetic susceptibility to the disease. Environmental factors have also been implicated. Persons with type 1 diabetes are dependent on insulin to survive.

Type 2 diabetes mellitus occurs more often in older age group of people who are overweight/obese and lead sedentary lifestyles. Onset of symptoms is slower, and the disease may go undiagnosed for many years. It is associated with both impairment of insulin secretion and resistance to insulin action. Type 2 diabetes is often associated with a strong genetic predisposition. Lifestyle measures, non-insulin agents and also insulin can be used to control diabetes.

Other specific types cover a group of diabetes where cause of hyperglycemia can be attributed to factors such as drug, endocrine, pancreatic disease or genetic syndrome etc. Clinically these groups of cases will posses features of both diabetes and the underlying causal factors.

Gestational diabetes mellitus (GDM) is glucose intolerance detected in a pregnant woman who was not known to have this abnormality prior to conception. Most of the GDM cases become normal afterwards. But the mother has increased risk of developing GDM in subsequent pregnancies, and permanent diabetes later in life.

Classification of diabetes mellitus

1. Type 1 diabetes mellitus

A. Autoimmune
B. Idiopathic

2. Type 2 diabetes mellitus

A. Insulin resistance predominates over the relative defects in hormone secretion
B. Defects in insulin secretion predominate over the presence of insulin resistance

3. Other specific types of diabetes mellitus

A. Genetic defects in β-cell function
   1. Chromosome 12, HNF-1α (MODY 3)
   2. Chromosome 7, glycosidase (MODY 2)
   3. Chromosome 20, HNF-4α (MODY 1)
   4. Mitochondrial DNA
   5. Others

B. Genetic defects in insulin action
   1. Type A insulin resistance
   2. Leprechaunism
   3. Rabson-Mendenhall syndrome
   4. Lipotrophic diabetes
   5. Others

C. Disease of exocrine pancreas
   1. Pancreatitis
   2. Pancreatectomy/trauma
   3. Neoplasia
   4. Cystic fibrosis
   5. Hemochromatosis
   6. Fibrocalcific pancreatopathy
   7. Others

D. Endocrinopathies
   1. Acromegaly
   2. Cushing syndrome
   3. Glucagonoma
   4. Pheochromocytoma
   5. Hyperthyroidism
   6. Somatostatinoma
   7. Aldosteronoma
   8. Other

E. Pharmacologically of chemically induced
   1. Vacor
   2. Pentamidine
   3. Nicotinic acid
   4. Glucocorticoids
   5. Thyroid hormones

6. Diazoxide
7. B-adrenergic agonists
8. Tiazides
9. Dilantin
10. α interferon
11. Others

F. Infections
1. Congenital rubella
2. Cytomegalovirus
3. Others

G. Infrequent forms of autoimmune diabetes
1. Stiff-man syndrome
2. Antibodies against insulin receptors
3. Others

H. Other syndromes occasionally associated with diabetes
1. Down syndrome
2. Klinefelter syndrome
3. Turner syndrome
4. Wolfram syndrome
5. Friedreich ataxia
6. Huntington's chorea
7. Lawrence-Moon-Biedel syndrome
8. Myotonic dystrophy
9. Porphyria
10. Prader-Willi syndrome
11. Others

4. Gestational diabetes mellitus (GDM)

MODY: maturity onset diabetes of the young

Prediabetes

IGT (impaired glucose tolerance) and IFG (impaired fasting glucose) are referred as 'Prediabetes'. Persons with prediabetes have high risk of development of diabetes (25% IFG and 30% IGT cases become diabetic over time) and cardiovascular diseases. Any type of diabetes can pass through the stages of prediabetes, but it is most obvious in type 2 diabetes. These persons are treated by lifestyle modifications; drugs may be used where indicated. About 40% of IFG and 30% of IGT cases may revert to normal if proper intervention can be given.

Clinical presentation

The spectrum of presentation ranges from asymptomatic to typical features.

Asymptomatic cases are diagnosed by biochemical test only. A vast majority of type 2 diabetes and other types remain asymptomatic over a prolonged period. Routine check-up usually picks up this form of diabetes. Type 1 diabetes is always symptomatic and shows classical features of hyperglycemia.

Typical features of diabetes mellitus start with glycosuria, which begins after the blood glucose level has gone above individual's renal threshold for glucose. Features include polyuria, polydipsia, polyphagia, weight loss and general weakness. These are mostly seen at presentation of type 1 diabetes, though not so common in other types.

Atypical manifestations are non-specific, which include non-healing infection, infertility or repeated pregnancy loss, pruritus vulvae, undue fatigability etc. This is a common mode of presentation in type 2 diabetes.

Specific complications of diabetes may be present at the time of diagnosis. In type 2 diabetes and other forms of diabetes mellitus, presentations may remain asymptomatic for quite a long period resulting in late diagnosis and intervention. So significant proportion of type 2 diabetes cases present with one or more chronic complications. All type 1 diabetes cases are usually diagnosed before development of chronic complications.

Diabetic complications

Long term complications are mediated by microvascular (nephropathy, retinopathy, neuropathy) and macrovascular (coronary artery disease, cerebrovascular disease, peripheral vascular disease) changes. A diabetic person is at risk of developing these complications many times more than a non-diabetic person. Children with uncontrolled diabetes may have problem in growth. Pregnancy in women with diabetes threatens both expectant mother and foetus. Acute metabolic derangement may lead to life threatening diabetic comas, such as diabetic ketoacidosis (DKA), hyperglycemic hyperosmolar state (HHS), lactic acidosis, including hypoglycemia.

1.2 Pathophysiology

Type 1 diabetes: Marked impairment of insulin production due to cellular-mediated autoimmune destruction of beta cells is the hall mark. Some of type 1 diabetes cases are of idiopathic in nature.

Type 2 diabetes: Insulin resistance and β-cell failure represent the main pathophysiologic defects in type 2 diabetes. Subjects with type 2 are maximally insulin resistant and have lost over approximately 80% of their β-cell function. In addition, muscle (impaired glucose disposal), liver (increased glucose production), and β-cell (reduced insulin production), the fat cell (accelerated lipolysis), gastrointestinal tract (incretin deficiency/resistance), α-cell (hyperglucagonemia), kidney (increased glucose reabsorption), and brain (insulin resistance)- all play important roles in the development of glucose intolerance in type 2 diabetic individuals. Collectively, these eight pathways comprise the ominous octet.

Other specific types: Pathophysiological process depends on the etiology of the particular type of diabetes.

Gestational diabetes mellitus: This type of diabetes is caused by placental hormones, namely beta HCG, human placental lactogen, estrogen, progesterone etc. antagonizing the action of insulin.

1.3 Epidemiology

Global trend

Diabetes mellitus is now one of the most common non-communicable diseases globally. It is epidemic in many developing and industrializing countries. At Present total number of diabetic person globally is nearly 425 millions with a prevalence of 8.8% in adult population (20 to 79 years). China and India hold the 1st and 2nd position respectively having 114.4 and 72.9 million of total cases of diabetes.

In addition to diabetes, prediabetes also constitutes a major public health problem because of its association with increased risk of diabetes and cardiovascular diseases.

Type 2 diabetes constitutes about 85 to 95% of all diabetes. The increasing trend of type 2 diabetes is associated with changing lifestyle such as dietary changes, reduced physical activity due to rapid economic transition and increasing urbanization along with population aging.

Type 1 diabetes usually accounts for only a minority of the total burden of diabetes though it is also increasing. Total number is above 1.1 million in population under 19 years of age. Though predominant diabetes in the younger age is type 1, type 2 diabetes is on the rise in this population.

Bangladesh trend

Magnitude of diabetes mellitus in Bangladesh is also increasing. At present the total number of diabetic person is nearly 7 million, with prevalence being 8.4% in adult population (20 to 79 years). Almost all are type 2 diabetes.

Morbidity and mortality

About 50% of mortality is due to CVD resulting from damage of large blood vessels.

Diabetes is one of the major causes of premature illness and death in most countries. Cardiovascular diseases, resulting from damage to large blood vessels, cause death of 50% or more of people with diabetes depending on the population. At least one complication usually present in 50% of newly detected diabetes cases.

An estimated 4 million adults die from diabetes-related causes globally, accounting for 10.7% of all deaths in the 20-79 years age group.

In Bangladesh total number of diabetes related death is nearly one hundred thousand death in 2017.

References

- Diabetes Mellitus, Distance Learning Program, 5th edition, BADAS, 2018.
- Standards of Medical care in Diabetes, ADA (American Diabetes Association), 2019.
- Diabetes Atlas, 8th edition, IDF (International Diabetes Federation), 2017.
- Ralph A. DeFronzo. From the Triumvirate to the Ominous Octet: a New Paradigm for the Treatment of Type 2 Diabetes Mellitus. Diabetes 2009; 58(4): 773-795.

Chapter 2
Screening and Diagnosis of Diabetes Mellitus

2.1 Screening for prediabetes and diabetes

Screening for prediabetes and type 2 diabetes in adults

- Testing for prediabetes/type 2 diabetes in asymptomatic people should be considered in adults of any age who are overweight/obese (BMI ≥ 23 kg/m^2 in Asians) and who have one or more of the following risk factors:
    - First-degree relative with diabetes
    - High-risk race/ethnicity, like Bangladeshies
    - History of CVD with Hypertension (≥140/90 mmHg or on therapy for hypertension)
    - HDL cholesterol level <35 mg/dL and/or a triglyceride level >250 mg/dL
    - Women with polycystic ovary syndrome (PCOS)
    - Physical inactivity
    - Other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans (PCOS)
- For all other people (even if without risk factors), testing should begin at age 40 years.

  If results are normal, testing should be repeated at 1-3-year intervals, with consideration of more frequent testing depending on initial results and risk status. Patients with prediabetes (A1C ≥5.7%, IGT, or IFG) should be tested yearly. Women who were diagnosed with GDM should have lifelong testing at least every 1-3 years.
- Immediate testing is required in symptomatic cases.

Screening for prediabetes and type 2 diabetes in children

- Should be considered after the onset of puberty or after 10 years of age, whichever occurs earlier, in asymptomatic children and adolescents who are overweight (BMI ≥85th percentile) or obese (BMI ≥95th percentile) and who have additional risk factors for diabetes:
    - Maternal history of diabetes or GDM during the child's gestation
    - Family history of type 2 diabetes in first- or second-degree relative
    - Race/ethnicity, e.g. Asians

- Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, PCOS, or small-for-gestational-age birth weight)

- If tests are normal, repeat testing at a minimum of 3-year intervals, or more frequently if BMI is increasing, is recommended.
- Immediate testing is required in symptomatic cases.

Screening for type 1 diabetes

- Plasma blood glucose rather than A1C should be used to diagnose the acute onset of type 1 diabetes in individuals with symptoms of hyperglycemia.
- Screening for type 1 diabetes risk with a panel of autoantibodies (autoantibodies to islet cell, insulin, GAD, tyrosine phosphatases, and ZnT8) is currently recommended only in the setting of a research trial or in first-degree family members of a proband with type 1 diabetes.
- Persistence of two or more autoantibodies predicts clinical diabetes and may serve as an indication for intervention in the setting of a clinical trial.

2.2 Diagnosis of prediabetes and diabetes

Diagnosis is based on documentation of glucose intolerance in the individual. Procedures for documenting glucose intolerance include:

1. OGTT
2. Fasting plasma glucose (FPG)
3. HbA1c
4. Random plasma glucose (RPG)

OGTT (Oral glucose tolerance test)

Plasma glucose level is determined by fasting and 2 hours after 75 grams of oral glucose drink. It classifies a person as a diabetic, IGT (impaired glucose tolerance), IFG (impaired fasting glucose), or normal.

Fasting plasma glucose (FPG)

By fasting plasma glucose level, a person can be labeled as a diabetic, IFG or normal. Persons with normal glucose or IFG, if subjected to OGTT, may be found as a diabetic or IGT.

HbA1c

Hba1c is now increasingly being used in diagnosis of diabetes. The test must be highly standardized for using it in this purpose.

Random plasma glucose (RPG)

No preparation is required for this procedure. Plasma glucose levels are estimated from a sample irrespective of last meal. RPG, in presence of classical symptoms of hyperglycemia or hyperglycemic crisis, can confirm diabetes.

Diabetes mellitus

FPG ≥7.0 mmol/L*, &/or

2-hr PG at OGTT ≥11.1 mmol/L*, &/ or

HbA1c ≥6.5%*, &/or

RPG (in presence of classical symptoms of hyperglycemia or hyperglycemic crisis) ≥11.1 mmol/L

*(in absence of unequivocal hyperglycemia, at least 2 abnormal test results are required)

Impaired glucose tolerance (IGT)

2-hr PG at OGTT 7.8-<11.1 mmol/L

[FPG should be <7.0 mmol/L]

Impaired fasting glucose (IFG)

FPG 6.1-<7.0 mmol/L

[2-hr PG at OGTT should be <7.8 mmol/L]

Gestational diabetes mellitus (GDM)

FPG ≥5.1 mmol/L, &/or

1-hr PG at OGTT ≥10.0 mmol/L, &/or

2-hr PG at OGTT ≥8.5 mmol/L

Pre-pregnancy/overt diabetes

FPG ≥7.0 mmol/L, &/or

2-hr PG at OGTT ≥11.1 mmol/L, &/or

HbA1c ≥6.5%, &/or

RPG (in presence of classical symptoms of hyperglycemia or hyperglycemic crisis) ≥11.1 mmol/L

OGTT procedure

- Person should take unrestricted diet containing at least 150 grams of carbohydrate daily for at least previous 3 days.
- The test should be in the morning after 8-14 hours of overnight fast (preferably before 9 am).
- A fasting blood sample prior to glucose drink is collected.
- An oral glucose load of 75 gram for adult (1.75 gram/kg body weight, up to maximum 75 gram for child) is given in 250-300 ml of water. The drink must be completed within 5 minutes.
- A second blood sample is collected at 120th minute after the glucose drink.
- If glucose is not estimated immediately then the blood sample may be preserved with sodium fluoride (6 mg/ml whole blood). Blood should be centrifuged, and plasma separated and frozen until estimation.
- Smoking, tea or physical stress is not allowed during the test.

References

- Diabetes Mellitus, Distance Learning Program, 5th edition, BADAS, 2018.
- Standards of Medical care in Diabetes, ADA (American Diabetes Association), 2019.
- Definition and Diagnosis of Diabetes Mellitus and Intermediate hyperglycemia, a Report of a WHO (World Health Organization) Consultation, 2011.
- Global Guideline for Type 2 Diabetes, Clinical Guidelines Task Force, IDF (International Diabetes Federation), 2012.

Chapter 3
Treatment of Diabetes Mellitus

3.1 Diagnosis, patient factors and goal setting

Confirmation of diagnosis is described in Chapter 2.

Following patient factors should be considered	
• Type of DM	• Degree of hyperglycemia
• Age of the person	• Job and occupation
• Body weight	• Previous anti-diabetic agents (if on any)
• Associated conditions, e.g. acute/chronic complications/ illnesses, pregnancy/ lactation, major surgery, life expectancy etc.	• Socio-economic condition, care-giver support
• Lifestyle of the person	

Targets of treatment

Target of diabetes management	
Blood (plasma) glucose	❒ Fasting/pre-meal <7.0 mmol/L ❒ Post-meal <10.0 mmol/L
HbA1c	<7%
Blood lipids	❒ LDL cholesterol <100 mg/dl ❒ HDL cholesterol >40 mg/dl (male) >50 mg/dl (female) ❒ Triglyceride <150 mg/dl
BP	❒ Systolic <130 mm of Hg ❒ Diastolic <80 mm of Hg
BMI	❒ BMI <23 kg/m^2
Waist circumference (WC)	❒ WC <90 cm (male) <80 cm (female)

* Target of glycemic control may be individualized considering above patient factors

3.2 Treatment regimen and monitoring

Selection and initiation of a treatment regimen

Life style modification

Medical nutrition therapy

An individualized medical nutrition therapy preferably by a registered dietitian, is recommended for all people with diabetes and prediabetes. There is no single ideal dietary distribution of calories among carbohydrates, fats, and proteins for people with diabetes; therefore, meal plans should be individualized while keeping total calorie and metabolic goals in mind.

Weight loss (>5-10%) by combination of reduction of calorie intake and increased physical activity, benefits overweight or obese adults with type 2 diabetes and prediabetes.

- Nutrient-dense carbohydrate sources that are high in fiber, including vegetables, fruits, legumes, whole grains, as well as dairy products should be emphasized who are on insulin therapy. Education on carbohydrate counting should be given.
- People with diabetes and those at risk are advised to avoid sugar-sweetened beverages (including fruit juices) in order to control glycemia, weight. It also reduces their risk for cardiovascular disease and fatty liver.
- Diet should contain sufficient protein from animal and plant sources.
- Dietary fat: Diet rich in monounsaturated and polyunsaturated fats may be considered to improve glucose metabolism and lower cardiovascular disease risk.
- Foods rich in long-chain n-3 fatty acids, such as fatty fish (EPA and DHA) and nuts and seeds (ALA) are recommended to prevent or treat cardiovascular disease.
- There is no clear evidence that dietary supplementation with vitamins, minerals (such as chromium and vitamin D), herbs, or spices (such as cinnamon or aloe vera) can improve outcomes in people with diabetes.
- Adults with diabetes who drink alcohol should do so in moderation (no more than one drink per day for adult women and no more than two drinks per day for adult men) it is better to stop alcohol drinking.
- As for the general population, people with diabetes should limit salt consumption to 6 gm/day.
- Nonnutritive sweeteners can reduce overall calorie and carbohydrate intake but overall, people are encouraged to decrease both sweetened and non-nutritive sweetened beverages and to use other alternatives, with an emphasis on water intake.

Physical activity

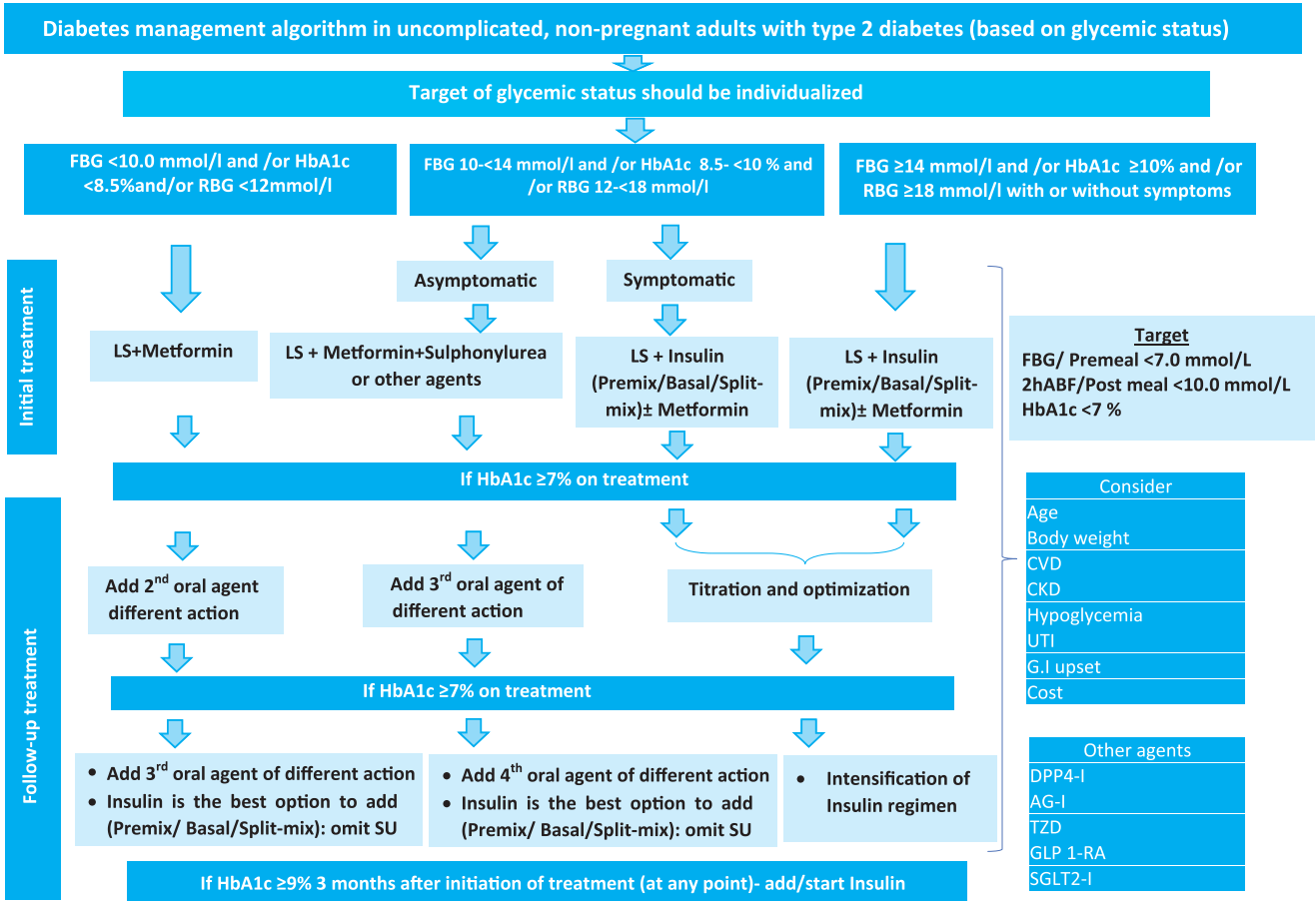
Adults with diabetes should perform in 150 min or more of moderate intensity aerobic activity per week, spread over at least 5 days/week, with no more than 2 consecutive days without activity. Shorter durations (minimum 75 min/week) of moderate intensity or interval training may be sufficient for younger and more physically fit individuals. Adults with diabetes should engage in 2-3 sessions/week of resistance exercise on nonconsecutive days. All adults, and particularly those with type 2 diabetes, should decrease the amount of time spent in daily sedentary behavior, prolonged sitting should be interrupted every 30 min. Physical activity or exercise is encouraged to do same time in a day.

Flexibility training and balance training are recommended 2-3 times/week for older adults with diabetes. Yoga and tai chi may be included based on individual preferences to increase flexibility, muscular strength, and balance.

Some practical points on exercise

- Exercise recommendation for persons with diabetes is the same, as for persons without diabetes, where an exercise programme includes a proper warm-up and cool-down period. A warm-up should consist of 5-10 minutes of aerobic activity (eg. walking) at a low-intensity level; it prepares the heart for exercise. After a short warm-up, muscles should be gently stretched for another 5-10 minutes for preparing the muscle and preventing muscle injury. A cool down period of 5-10 minutes should follow the main activity session. It gradually brings the heart rate down to pre-exercise level.
- Persons with diabetes who do not have complications and have good blood glucose control, can do all levels of exercise, including leisure activities, recreational sports and competitive professional performances. The emphasis must be given on adjusting the therapeutic regimen with the level of exercise and diet, and avoiding hypoglycemia.
- In children, extra attention needs to be paid to balance glycemic control with activity level and for this the support of parents, teachers and trainers may be necessary. Their meal and activity in school are important.
- Persons with diabetes must view exercise as a vital component for the management. Exercise along with a reduced calorie intake may enhance weight loss. The combination of diet, exercise and behavioural modification is the most effective approach to weight control. Normally low to moderate intensity long duration exercise is recommended for weight loss.
- The diabetic patient with peripheral neuropathy, loss of protective sensation, and osteoarthritis of back and knee should not engage in repetitive weight bearing exercises, eg. prolonged walking, treadmill, jogging etc. as these activities may result in blistering, ulceration and fracture. Non-weight-bearing exercises, eg. swimming, cycling, rowing, etc. may be better.

- Persons with severe Charcot's joint should avoid weight-bearing exercises, as it can result in multiple fractures and dislocation of the ankles and feet even without the patient being aware of it.
- In patients who have proliferative and moderate to severe non-proliferative diabetic retinopathy, strenuous activity may precipitate vitreous haemorrhage or tractional retinal detachment. These individuals should avoid anaerobic exercise and physical activity that involves straining, jarring or Valsalva-like maneuvers (eg. weight lifting, boxing, heavy competitive sports etc). In these persons low impact exercises like swimming (but not diving), walking or stationary cycling may be recommended.
- Patients with stable coronary heart disease should perform exercise of moderate intensity. Persons with uncontrolled hypertension should withhold exercise until control of blood pressure.
- If the person develops symptomatic hyperglycemia or ketosis exercise should be postponed. If blood glucose goes below 5.5 mmol/L the person should take extra 15-30 grams carbohydrate before exercise.
- One should not do exercise during any significant acute illness or uncompensated major chronic illnesses.
- During pregnancy moderate exercise (eg. walking at moderate speed for 30 minutes a day at a time or in divided fashion) is advised. Vigorous exercise or exercises causing pressure in the abdomen should be avoided.



*LS– Lifestyle; SU- Sulphonylurea
After adding any OAD, uptitrate the dose by 1-2-week interval with SMBG

Source: Study findings of Changing Diabetes Barometer (CDB), an ongoing research program of BADAS

Classification of oral antidiabetic drugs (OADs)			
Class	**Name**	**Duration of action (hr)**	**Mode of excretion**
A. Secretagogues			
Sulphonylureas	**1st generation** (Not in use at present)		
	Tolbutamide	6-12	Mostly urine
	Chlorpropamide	24-72	Urine
	2nd generation		
	Glibenclamide	24	Urine & faeces
	Glipizide	8-12	Mostly urine
	Gliclazide	8-12	Urine & faeces
	Glimepiride	24	Urine & faeces
Non-sulphonylureas	**Meglitinide analogue**		
	Repaglinide	4-5	Mostly faeces
	d-phenylalanine derivative		
	Nateglinide	4-5	Mostly urine
B. Insulin sensitizers			
Biguanides	Metformin	8-12	Mostly urine
Thiazolidinediones	Pioglitazone	24	Urine & faeces
	Rosiglitazone	24	Urine & faeces
C. Alpha-glucosidase inhibitors			
	Acarbose	4	Faeces & urine
	Miglitol	4	Urine
	Voglibose	NA	Mostly faeces
D. DPP-4 inhibitors			
	Sitagliptin	24	Mostly urine
	Vildagliptin	24	Mostly urine
	Linagliptin	24	Mostly faeces
	Saxagliptin	24	Urine & faeces
	Alogliptin	24	Mostly urine
E. SGLT-2 inhibitors			
	Dapagliflozin	24	Mostly urine
	Canagliflozin	24	Mostly faeces
	Empagliflozin	24	Urine & faeces
	Ertugliflozin	24	Urine & faeces
F. Other agents			
Dopamine-2 agonists	Bromocriptine	24	Mostly faeces
Bile acid sequestrants	Colesevelam	24	Faeces

NB. Various combination preparations are also available.

Selection issues of an oral agent

Drug	Advantage	Hazard	Limitation
Sulphonylureas	Potent; reduce pre- & post-prandial BG	Hypoglycemia; weight gain	Impaired hepatic, renal function
Non-sulphonylureas	Less hypoglycaemia; reduce post-prandial BG	Weight gain	Impaired hepatic, renal function
Biguanides	Improve insulin sensitivity; weight friendly ; reduce pre- (mostly) & post-prandial BG; favourable effect on lipid & NAFLD	GI upset; lactic acidosis	Impaired hepatic function; eGFR <45- avoid; eGFR <30- contraind.
Thiazolidinediones	Improve insulin sensitivity; reduce pre- (mostly) & post-prandial BG; favourable effect on lipid (pioglitazone) & NAFLD	Weight gain; fluid retention; IHD & raise LDL (rosiglitazone)	ALT ≥ 2.5 times; heart failure
Alpha-glucosidase inhibitors	Weight friendly; reduce post-prandial BG	GI upset	Impaired hepatic function; eGFR <30 (excpt voglibose); inflam. bowel disease; malabsorption states
DPP-4 inhibitors	Weight friendly; reduce pre- & post-prandial (mostly) BG	GI upset; upper RTI; pancreatitis	Impaired renal function (except linagliptin)
SGLT-2 inhibitors	Weight-friendly; reduce pre- & post-prandial BG	UTI; genital fungal infection	Impaired renal function
Bile acid sequestrants	Weight-friendly; reduce pre- & post-prandial BG; reduce LDL	Constipation; increase TG	Interfere with absorption of other drugs
Dopamine-2 agonists	Weight-friendly; reduce pre- & post-prandial BG; reduce TG	Dizziness; syncope	Impaired hepatic, renal function

NB. NAFLD- Non-alcoholic fatty liver disease

eGFR ml/min/1.73m^2

Initiation and dose titration of OADs may be done using following table

Name	Starting daily dose	Maximum daily dose	Adjustment
Glibenclamide	1.25-2.5 mg x 1; 30 min ac	20 mg (in 1-2 doses)	Increase by smallest dose every 2 weeks
Glipizide	2.5 mg x 1; 30 min ac	40 mg (in 1-2 doses)	
Gliclazide	40 mg x 1; 30 min ac	320 mg (in 1-2 doses) MR/ExR-120 mg (in 1 dose)	
Glimepiride	1 mg x 1	8 mg (in 1 dose)	
Repaglinide	0.5 mg x 3; 15 min ac	12 mg (in 3 doses)	Increase by smallest dose every 1-2 weeks
Nateglinide	60 mg x 3; 15 min ac	360 mg (in 3 doses)	
Metformin	500 mg x 1; pc; build up dose weekly	2500 mg (in 2-3 doses) ExR-2000 mg (in 1 dose)	Increase (on the built-up) by smallest dose every 4 weeks
Pioglitazone	15 mg x 1, morning	45 mg (in 1 dose)	Increase by smallest dose every 4-6 weeks
Rosiglitazone	4 mg x1(or 2 mg x 2)	8 mg (in 1-2 doses)	
Acarbose Miglitol	25-50 mg x 1-3; within meal; build up dose weekly	300 mg (in 3 doses)	Increase (on the built-up) by smallest dose every 6 week
Voglibose	0.2 mg x 1-3; pc	0.9 mg (in 3 doses)	
Sitagliptin	100 mg x 1, morning	100 mg (in 1 dose)	eGFR <50- 50 mg/day eGFR <30- 25 mg/day
Vildagliptin	50 mg x 2	100 mg (in 2 doses)	eGFR <50- 50 mg/day
Linagliptin	5 mg x 1, morning	5 mg (in 1 dose)	Full dose in renal impairment
Saxagliptin	2.5 mg x 1, morning	5 mg (in 1 dose)	eGFR <50- 2.5 mg/day
Alogliptin	25 mg x 1, morning	25 mg (in 1 dose)	eGFR <60- 12.5 mg/day eGFR<30- 6.25 mg/day
Dapagliflozin	5 mg x 1, morning	10 mg (in 1 dose)	eGFR <60- avoid eGFR <30- contraind
Canagliflozin	100 mg x 1, morning	300 mg (in 1 dose)	eGFR <60- 100 mg eGFR <45- avoid eGFR <30- contraind
Empagliflozin	10 mg x 1, morning	25 mg (in 1 dose)	eGFR <45- avoid eGFR <30- contraind
Ertugliflozin	5 mg x 1, morning	15 mg (in 1 dose)	eGFR <60-avoid eGFR <30-contraind

NB. ac- before meal; pc- after meal.
eGFR ml/min/1.73 m^2.

Classification of insulin

Insulin type	Onset of action	Peak	Duration of action	Appearance
Bolus (prandial) insulins				
Rapid-acting insulin analogues				
• Insulin Aspart	10-15 min	1-1.5 hour	3-5 hours	Clear
• Insulin Glulisine	10-15 min	1-1.5 hour	3-5 hours	Clear
• Insulin Lispro	10-15 min	1-2 hour	3.5-4.75 hours	Clear
Short-acting (Regular) insulins	30 min	2-3 hours	6.5 hours	Clear
Basal insulins				
Intermediate-acting (NPH)	1-3 hours	5-8 hours	Upto 18 hours	Cloudy
Long-acting insulin analogues				
• Insulin Detemir	90 min	N/A	24 hours	Clear
• Insulin Glargine	90 min	N/A	24 hours	Clear
• Insulin Degludec			42 hours	Clear
Premix insulins				
• Biphasic Human Insulin	30 mins	2-8 hours	Upto 24 hours	Cloudy
• Biphasic Insulin Aspart	10-20 mins	1-4 hours	Upto 24 hours	Cloudy
• Insulin Lispro + Insulin Lispro Protamine	10-20 mins	1-4 hours	Upto 24 hours	Cloudy
Coformulation				
• Insulin Degludec + Insulin Aspart	30-90 mins 10-20 min	NA 40-90 min	Beyond 24 hours	Clear

NB. Inhaled rapid acting insulin is also available

Insulin regimens

Regimen	Description
Once daily	NPH or basal analogue
Twice daily	
• Premixed	
• Coformulation	
• Split-mixed	Less mealtime flexibility
Multiple daily injections	
• Basal Plus	Offers more mealtimeflexibility One long acting analogue at bedtime, plus one injection of rapid acting analogue with the largest meal
• Basal bolus	One long acting analogue at bedtime, plus two or three injections of rapid acting analogue with meal
Continuous subcutaneous insulin infusion	Insulin pump

Continuous subcutaneous insulin infusion (CSII)

An insulin pump is an alternative to treatment with MDI. The pump is worn at waist or other convenient places, and insulin is delivered through tube into subcutaneous needle placed over abdomen. Basal insulin is delivered continuously, and the bolus dose is person-activated. Rapid acting insulin analogues are usually used in these devices, both as basal as well as bolus dose.

Sensor-augmented pumps are provided with CGM system. Newer generation pumps automatically shut-off to prevent hypoglycemia when the sensor has fallen below a preset threshold. The newer smart pumps can automatically calculate meal or correction boluses based on insulin-to-carbohydrate ratios and insulin sensitivity factors.

Classification of other injectable anti-diabetic agents		
GLP-1 agonists	Exenatide	Type 2 DM; weight-friendly; 10 ug (in 2 doses) ac within 1 hr of meal; increase dose after 4 weeks (max. 20 ug/day)
	Liraglutide	Type 2 DM; weight-friendly; 0.6 mg daily, increase to 1.2 mg after 1 week; max. dose 1.8 mg
	Albiglutide, dulaglutide, lixisenatide, semaglutide are available. Combinations of long acting insulin analogue and GLP-1RA are also available.	
Amylin analogues	Pramlintide	Weight-friendly; use with insulin; immediate ac. Type 1 DM: 15 ug x 3; increase dose after 7 days (max. 60 x 3) Type 2 DM: 60 ug x 3; increase dose after 7 days (max. 120 x 3)

NB. ac- before meal

Monitoring and changing treatment regimen

Blood glucose testing

Self monitoring of blood glucose (SMBG) by glucometer is to be done frequently (covering pre-meal, post-meal and critical periods) in persons who are on multiple dose insulin regimen or insulin pump, specially in type 1 diabetes and pregnancy. For others it is to be done as required according to clinical situations. Continuous glucose monitoring (CGM) can be used in selected persons. Blood glucose monitoring guide to the changes of the doses of drugs. This education should be given to the patient for self-management.

HbA1c

Glycated hemoglobins are formed by non-enzymatic condensation of glucose with globin component of hemoglobin. This generally reflects glycemic status over the preceding 2-3 months. RBC turnover (blood loss, hemolysis, blood transfusion, pregnancy etc.) and hemoglobin variants must be considered while testing HbA1c. HbA1c guides change in therapeutic regimen.

- A1C test should be done at least two times a year in patients who are meeting treatment goals (and who have stable glycemic control).
- A1C test is to be done quarterly in patients whose therapy has changed or who are not meeting glycemic goals.
- More stringent A1C goals may be set for selected individuals if this can be achieved without significant hypoglycemia or other adverse effects of treatment (i.e. polypharmacy), e.g. those with short duration of diabetes, type 2 diabetes treated with lifestyle or metformin only, long life expectancy, or no significant cardiovascular disease.
- Less stringent A1C goals may be appropriate for persons with history of severe or repeated hypoglycemia, hypoglycemia unawareness, limited life expectancy, advanced microvascular or macrovascular complications, extensive comorbid conditions, or long-standing diabetes in whom the goal is difficult to achieve despite diabetes self-management education, appropriate glucose monitoring, and effective doses of multiple glucose-lowering agents including insulin.

References

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- Comprehensive Type 2 Diabetes Management Algorithm, AACE (American Association of Clinical Endocrinologists) Task Force, 2019.
- Global Guideline for Type 2 Diabetes, Clinical Guidelines Task Force, IDF (International Diabetes Federation), 2012.

Chapter 4
Acute Complications of Diabetes Mellitus

4.1 Hypoglycemia

It is defined biochemically with blood glucose level below 3.9 mmol/L (70 mg/dl) with clinical features of autonomic over activity and neuroglycopenia.

Some diabetics, especially those with persistent high blood glucose, may develop clinical features (particularly autonomic) of hypoglycemia at a higher blood glucose level. It occurs more in Type 1 than Type 2 diabetes.

Levels of hypoglycemia

Level 1: blood glucose <3.9 mmol/L - 3.0 mmol/L

Level 2: blood glucose <3.0 mmol/L

Level 3: A severe event characterized by altered mental and/or physical status requiring assistance

Causes of hypoglycemia

- Taking excess dose of insulin
- Excess intake of anti-diabetic medications, specially insulin secretagogues
- Delay, omission or undue reduction of a meal
- Unusual exercise
- Over intake of alcohol
- Severe renal or hepatic impairment

Consequences of hypoglycemia

- Recurrent hypoglycemia may cause behavioral change and cognitive impairment
- In Type 2 diabetes - increased incidence of life-threatening cardiovascular events and mortality (cardiovascular and all cause)
- In Type 1 diabetes - increased mortality (4-10% of deaths)

Hypoglycemia unawareness

Occurs in individuals with long standing type 1 diabetes, autonomic neuropathy, medications (like non-selective beta-blockers), or very tight glycemic control. Nocturnal hypoglycemia occurs at night, usually between 11pm and 5 am.

Clinical features of hypoglycemia

Clinical features of hypoglycemia according to severity		
Types of features	**Severity of hypoglycemia**	
	Mild to moderate **Level 1**	**Severe** **Level 2,3**
Autonomic	Sweating, palpitation, tremor, irritability, hunger.	
Neuroglycopenic	Headache, visual disturbance	Confusion, drowsiness, behavioral abnormality convulsion, coma

Treatment of hypoglycemia

Level 1: Mild to moderate hypoglycemia

- Treated by the patient him/herself or by a family member
- It is usually relieved by 15 gm glucose or equivalent food, e.g. a glass of soft drink or fruit juice or snacks or meal (if it is due). These measures are usually adequate to raise blood glucose to reasonably safe limit (5.5 mmol/L).
- The food/drink is repeated every 15 minutes until the patient is stable.
- If recurrent hypoglycemia follows, hospitalization should be considered.
- Modification in ongoing treatment should be considered.

Level 2,3: Severe hypoglycemia

- 100 ml of 25% dextrose is given intravenously under medical supervision.
- If hypoglycemia is due to longer acting anti-diabetic medications then 10% dextrose infusion should be started to prevent recurrent hypoglycemia.
- Ongoing activity of the anti-diabetic medication may lead to recurrence of hypoglycemia.Hence, food ingestion is to be ensured after initial recovery.
- If recovery does not occur, addressing additional causes and modification in treatment should be done.
- In person with type 1 diabetes, glucagon 1 mg intramuscularly or subcutaneously can be given.
- Patient with severe hypoglycemia may need to keep under supervission in hospital.

Hypoglycemia unawareness

- Frequent blood glucose should be monitored to prevent hypoglycemia.
- Each patient with hypoglycemia should be evaluated and provided with appropriate education to prevent and manage future episodes.

Nocturnal hypoglycemia

- Reduction of evening dose of insulin
- Changing time of evening insulin dose with dinner time
- Taking bed time snacks may be considered
- These adjustments are made in conjunction with blood glucose monitoring

4.2 Diabetic ketoacidosis (DKA)

Diabetic ketoacidosis (DKA) is a medical emergency in diabetic patients. It is commonly found in type1 diabetes but it also occurs in other types of diabetes during stressful situations. It results from lack of insulin and an increase in counter-regulatory hormones that lead to hyperglycemia and subsequent lipolysis.

Precipitating factors

Common precipitating factors

- Intercurrent Infection
- Discontinuation of insulin therapy
- Inadequate insulin therapy
- Pancreatitis, myocardial infarction, cerebrovascular accident, pulmonary embolism
- Stressful conditions like trauma, pregnancy
- New-onset type 1 diabetes

Clinical features

- Develops rapidly (hours to days)
- Symptoms of uncontrolled diabetes precedes
- Dehydration is the most obvious clinical feature with dry skin and tongue, low BP, rapid weak pulse
- Acidotic breathing is characteristic; there may be acetone smell in breath
- Weakness, vomiting, impairment of level of consciousness, acute abdomen are also found

4.3 Hyperglycemic hyperosmolar state (HHS)

HHS is a combination of severe degree of hyperglycemia, dehydration and hyperosmolality without significant ketonuria, usually seen as complication of elderly type 2 diabetes patients. Here residual insulin reserve prevents ketosis.

Precipitating factors of HHS: Similar as DKA.

Others are

- Compromised fluid intake
- Drugs, eg glucocorticoids, diuretics etc

Clinical features

- Develops slowly (days to weeks)
- Symptoms of uncontrolled diabetes precede
- Dehydration is profound
- Impairment of consciousness is common

Diagnostic criteria for DKA and HHS				
	DKA			HHS
	Mild	Moderate	Severe	
BG	>13.8 mmol/L	>13.8 mmol/L	>13.8 mmol/L	>33.3 mmol/L
Arterial PH	7.25-7.30	7.00-<7.24	<7.00	>7.30
S. bicarbonate mEq/L	15-18	10-<15	<10	>18
Urine ketone	Positive	Positive	Positive	Small
Effective serum osmolality	Variable	Variable	Variable	>320 mOsm/kg
Anion gap	>10	>12	>12	Variable
Mental status	Alert	Alert/ drowsy	Stupor/coma	Stupor/coma

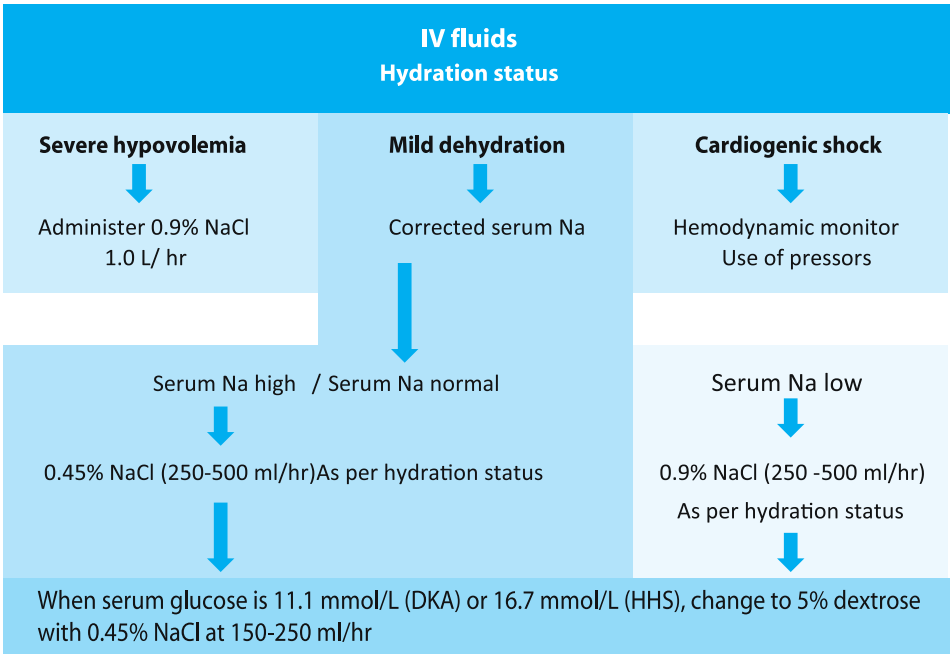
NB: Effective serum osmolality: 2 [measured Na^+ (mEq/L) + Glucose (mmol/L); Anion Gap: (Na^+) –[Cl^- + HCO_3 (mEq/L)]

Protocol for management of adult person with DKA or HHS.

Initial Evaluation

- Check blood glucose/capillary glucose, serum/urine ketones: to confirm hyperglycemia and ketonemia/ketonuria.
- Obtain blood for metabolic profile.
- Start IV fluids: As per protocol.

IV Fluid Protocol



N.B.: Corrected Na for hyperglycemia= measured Na + [1.6 (Glucose in mg/dl– 100) / 100]

Potassium & bicarbonate

Potassium
Establish adequate renal function
(urine output around 50 ml/hr)

K^+<3.3 mEq/L	K+ = 3.3- 5.2mEq/L	K^+>5.2mEq/L
↓	↓	↓
Hold insulin and Administer 20-30 mEq/hr K^+ until **K^+>3.3 mEq/L**	Administer 20-30 mEq K in each litre of IV fluids. Target K^+= 4-5 mEq/L	Do not give K^+, check K^+ every 2 hourly.

Bicarbonate

pH ≥6.9		pH <6.9
↓		↓
No HCO_3		100 mmol in 400 ml H_2O + 20 mEq KCL, infuse for 2 hours Repeat every 2 hours until pH ≥ 7.Monitor K every 2 hrs

Insulin protocol

Regular short acting insulin, IV route (DKA & HHS)

0.1 U/kg. B.Wt. as IV bolus

↓

0.1 U/kg. B.Wt./hr IV continuous insulin

↓

If serum glucose does not fall by at least 10% in first hour, give 0.14 U/kg as IV bolus, then continue previous treatment.

↓

DKA

When serum glucose reaches 11.1 mmol/L, reduce infusion rate to 0.02-0.05 U/kg/hr IV. Target BG is in between 8.33-11.1 mmol/L until resolution of DKA.

0.14 U/kg. B.Wt./hr as IV continuous insulin infusion

↓

HHS

When serum glucose reaches 16.7 mmol/L, reduce infusion rate to 0.02-0.05 U/kg/hr IV. Target BG is in between 11.1- 16.7 mmol/L until patient is mentally alert.

Other evaluations

- Serum electrolyte, BUN, venous pH, creatinine and glucose should be checked 2 hourly until resolution of the crisis.
- After resolution of DKA/HHS and person is able to eat, SC multidose insulin should be initiated. Subcutaneous insulin should be started at least 1-2 hour before stopping IV insulin.
- Precipitating cause should be addressed.

Criteria for improvement of DKA

1. No dehydration
2. No vomiting
3. Able to take food
4. No ketone in urine
5. Anion gap normal
6. Patient is well oriented, hemodynamically stable

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Chapter 5
Chronic Complications of Diabetes Mellitus

Chronic complications of diabetes encompass a wide spectrum of microvascular (nephropathy, retinopathy and neuropathy) and macrovascular (coronary artery disease, cerebrovascular disease and peripheral vascular disease) disorders.

5.1 Diabetic nephropathy

It is a specific form of micro-angiopathy of kidney which is characterized by

- Persistent loss of albumin in urine (albuminuria)
- Progressive renal insufficiency (declining eGFR) with or without hypertension

Albuminuria

Albumin-to-creatinine ratio (ACR) is the preferred method to detect elevated protein in urine. The recommended method to evaluate albuminuria is to measure urinary ACR in a spot urine sample (preferably morning fasting sample before exercise).

ACR is calculated by dividing albumin concentration in milligrams by creatinine concentration in grams.

- Normal: ACR <30 mg/g, normal to mildly increased.
- Microalbuminuria: ACR 30-300 mg/g, moderately increased albuminuria.
- Macroalbuminuria: ACR >300 mg/g, severely increased albuminuria.

Table: Albuminuria categories in CKD.

Albuminuria categories in CKD		
Category	**ACR(mg/g)**	**Terms**
A1	<30	Normal to mildly increased
A2	30-300	Moderately increased*
A3	>300	Severely increased**

*Relative to young adult level. ACR 30-300 mg/g for >3 months indicates CKD.
**Including nephrotic syndrome (albumin excretion ACR > 2220 mg/g)

Stages of CKD by eGFR		
Stages	**Description**	**eGFR (ml/minute/1.73m^2)**
1	Renal damage + normal or raised GFR	⩾90
2	Renal damage + mildly decreased GFR	60 to 89
3	Moderately decreased GFR	30 to 59
4	Severely decreased GFR	15 to 29
5	Kidney failure	<15 or on dialysis

Screening and follow up

- Full clinical check-up during each visit, specially blood pressure, pedal edema etc.
- Urinary albumin excretion (UAE) and eGFR/CCr estimation. Two of three samples of UAE should be abnormal in 3-6 months.
- Blood urea, creatinine, total protein, serum albumin, electrolytes, uric acid, Ca++, PO_4 estimation.
- Serum creatinine and eGFR should be measured at least annually. Otherwise screening and follow-up with only urine albumin will miss >20% of progressive renal disease.
- Monitoring of other urinary complications eg UTI (including asymptomatic), bladder dysfunction (autonomic bladder) etc.
- Monitoring by sonography - kidney size, progressive increase in echogenicity of cortex.
- Renal biopsy - is indicated in nephropathy in absence of retinopathy, heavy proteinuria, rapid unexplained deterioration of renal function etc.
- Consultation from nephrologist at appropriate time.

Treatment

- Good glycemic control reduces incidence of diabetic nephropathy and delays its progression.
- Control of hypertension is very important because uncontrolled hypertension causes rapid progression of diabetic nephropathy. Nephropathy itself makes hypertension refractory to anti-hypertensive drugs, thus necessitates intensive and combination regimens. Target of BP is <130/80 mm of Hg.
- ACE inhibitors and ARBs are drugs of first choice to reduce or revert nephropathy. But these two drugs must not be combined. Check electrolytes and creatinine 2 weeks after starting.

- Protein intake up to 0.8 gm/kg/day of ideal body weight may be appropriate in advanced kidney disease, but not in early nephropathy.
- Correct high phosphate, uric acid.
- Fluid and electrolyte balance should be maintained.
- Iron supplementation often fails to correct anemia in renal failure. Iron along with erythropoietin provide optimum response.
- Treat infection, care urinary flow.
- Check HBsAg and anti-HCV and if negative vaccination against HBV is required.
- Renal replacement therapy: Should start earlier (eGFR 15 ml/min unlike 10 ml/min in non-diabetic) because most patients with ESRD have severe organ involvement and fluid overload which are often difficult to treat. A-V fistula should be done at appropriate time.
- Renal replacement therapy includes dialysis and renal transplantation.
- Dialysis comprises hemodialysis and peritoneal dialysis (intermittent or continuous ambulatory peritoneal dialysis).
- Renal transplantation comprises only kidney transplantation and dual transplantation of pancreas with kidney.

Referral criteria

Patients should be referred to nephrologist if they have:

- An eGFR<30 mL/min/1.73 m^2
- Uncertainty about the etiology of kidney disease
- Difficult management issues
- Rapidly progressing kidney disease

Decision making path

Diabetic person

Kidney function tests

- ❒ at diagnosis and then once a year in type 2 diabetes
- ❒ yearly at or after 5 years (or earlier) of diagnosis in type1 diabetes

Screening tests

Urinary albumin and serum creatinine

Evidence of nephropathy

(with classification)

1. Establish and maintain HbA1c <7%
2. Treat hypertension and maintain BP <130/80 mm of Hg
3. Look for other micro-angiopathies

Referral to nephrologist

if the CKD is in stage 4 or rapidly declining renal function

5.2 Diabetic retinopathy

Classification of diabetic retinopathy

Names of diabetic retinopathy	Characteristic lesions
Early non-proliferative diabetic retinopathy (NPDR)	Microaneurysm, dot & blot hemorrhage, hard exudate.
Moderate to severe non-proliferative diabetic retinopathy (NPDR)	Cotton wool spots/soft exudate, venous beads & loops, intraretinal microvascular abnormalities (IRMA)
Proliferative diabetic retinopathy (PDR)	Neovascularization of disc (NVD), Neovascularization elsewhere (NVE), vitreous hemorrhage, tractional retinal hemorrhage.
Maculopathy	Edema, exudate or hemorrhage in and around macula.

Screening and follow-up

- Person with type 1 diabetes: an initial dilated, comprehensive eye examination by an ophthalmologist or optometrist within 5 years after of diagnosis and then annually. If retinopathy is progressing or sight-threatening, then examinations should be done frequently.
- Person with type 2 diabetes: an initial dilated, comprehensive eye examination by an ophthalmologist or optometrist at the time of the diabetes diagnosis and then annually. If retinopathy is progressing or sight-threatening, then examinations should be done frequently.
- Women with preexisting type 1 or type 2 diabetes: if planning pregnancy, should have screening for retinopathy before pregnancy. If pregnant, should have eye examination every trimester.
- Retinal Photography is not a substitute for a comprehensive eye examination.
- Referred to ophthalmologist when required.

Decision making path

Diabetic person

Eye examination

- ❒ at diagnosis and then once a year in type 2 diabetes
- ❒ yearly at or after 5 years (or earlier) of diagnosis in type 1 diabetes

(when no retinopathy is documented)

Ophthalmoscopy of dilated eye

with fundus photo when needed

Evidence of retinopathy

(with classification)

1. Establish and maintain HbA1c <7%
2. Treat hypertension and maintain BP <130/80 mm of Hg
3. Look for other micro-angiopathies

Referral to ophthalmologist

if the retinopathy is beyond early NPDR

5.3 Diabetic neuropathy

Screening

- Assessment
  - Starting at diagnosis of type 2 diabetes
  - 5 years after the diagnosis of type 1 diabetes
  - At least annually thereafter
- Assessment methods
  - Symptoms
  - Assessment of either temperature or pinprick sensation (small fiber function) and vibration sensation using a 128-Hz tuning fork (for large-fiber function).
  - To identify feet at risk for ulceration and amputation: 10-g monofilament testing.
- Symptoms and signs of autonomic neuropathy should be assessed.

Treatment

- Optimize glycemic control.
- Pregabalin, duloxetine, or gabapentin are recommended as initial pharmacologic treatments for neuropathic pain.

Referral criteria

- Difficult to treat cases

5.4 Diabetic foot

- Comprehensive foot evaluation should be done at least annually to identify risk factors for ulcers and amputations.
- Patients with sensory loss or prior ulceration or amputation should have their feet examined at every visit.

History

- Prior history of ulceration, amputation, charcot foot, angioplasty or vascular surgery, cigarette smoking, retinopathy.

- Current symptoms of neuropathy (pain, burning, numbness) and vascular disease (leg fatigue, claudication).

Examination

- Inspection of the skin
- Assessment of foot deformities
- neurological assessment: 10-g monofilament testing with at least one other assessment: pinprick, temperature, vibration
- Vascular assessment: pulses in the legs and feet. With symptoms of claudication or decreased or absent pedal pulses: ankle-brachial index, further vascular assessment as appropriate eg, doppler study

Management

- A multidisciplinary approach is recommended eg endocrinologist, vascular surgeon, orthopedic surgeon, neurologist, diabetes educator, foot care nurse, podiatrist etc.
- Provide general preventive foot self-care education to all patients with diabetes.
- Specialized therapeutic footwear is recommended for high-risk patients with diabetes including those with severe neuropathy, foot deformities, or history of amputation.

Refer to foot care specialists

- history of prior lower-extremity complications
- loss of protective sensation
- structural abnormalities
- peripheral arterial disease

5.5 Cardiovascular diseases

Screening

- Screening for coronary artery disease in the presence of any
  - Atypical cardiac symptoms (e.g., unexplained dyspnea, chest discomfort)
  - Signs or symptoms of vascular disease including carotid bruits, transient ischemic attack, stroke, claudication, or peripheral arterial disease
  - Electrocardiogram abnormalities (e.g., Q waves).

Treatment

- With known atherosclerotic cardiovascular disease:
  - ACE inhibitor or angiotensin receptor blocker.
  - In patients with prior myocardial infarction, b-blockers should be continued for at least 2 years after the event.
- In patients with type 2 diabetes with stable congestive heart failure, metformin may be used if estimated glomerular filtration rate remains >30 mL/min but should be avoided in unstable or hospitalized patients with congestive heart failure with hypoxia.
- Among persons with type 2 diabetes who have established atherosclerotic cardiovascular disease, sodium–glucose cotransporter 2 inhibitors or glucagon-like peptide 1 receptor agonists are recommended as part of the antihyperglycemic regimen.
- Among persons with atherosclerotic cardiovascular disease at high risk of heart failure or in whom heart failure coexists, sodium–glucose cotransporter 2 inhibitors are preferred.

5.6. Hypertension

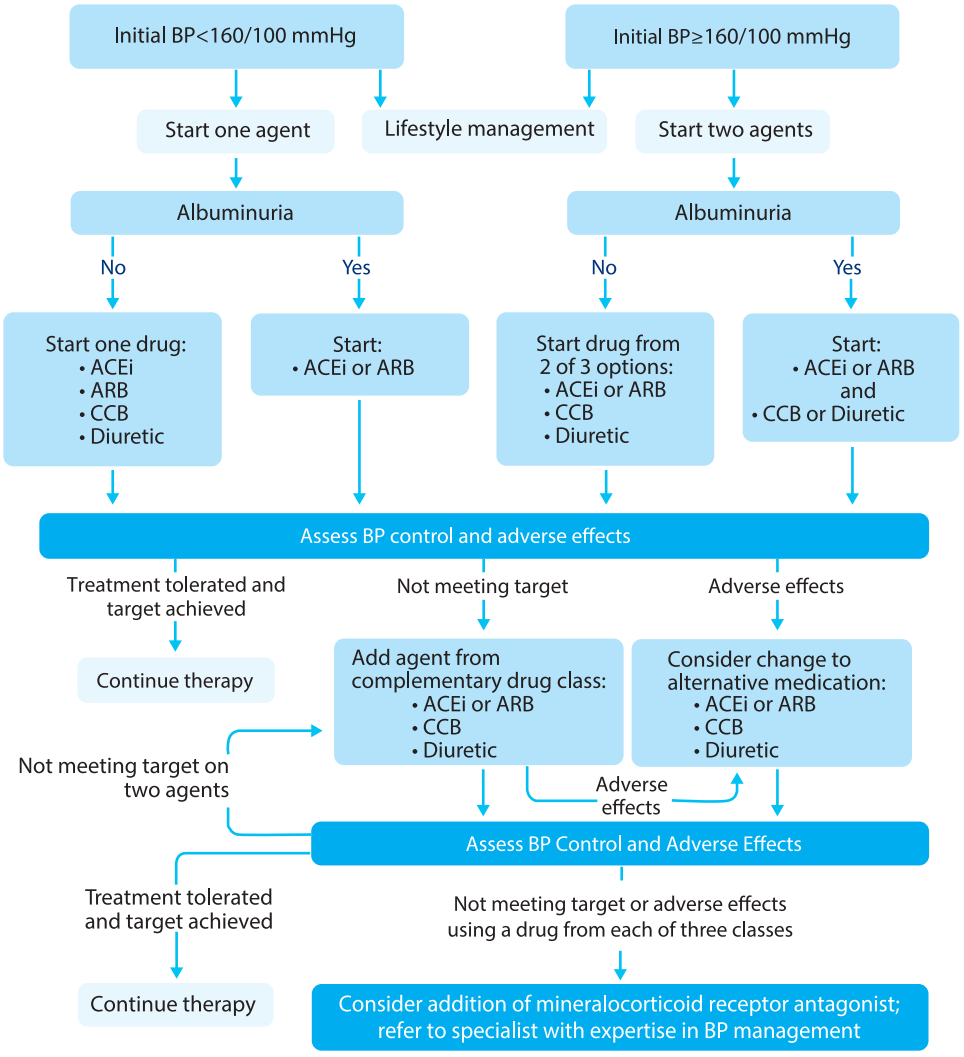
Classification of blood pressure

BP category	Systolic BP		Diastolic BP
Normal	<120 mmHg	and	<80 mmHg
Elevated	120-129 mmHg	and	<80 mmHg
Hypertension: Stage 1	130-139 mmHg	or	80-89 mmHg
Hypertension: Stage 2	≥140 mmHg	or	≥90 mmHg

Screening, follow-up and treatment target

- Blood pressure should be measured at every routine clinical visit.
- Person with diabetes and hypertension at higher cardiovascular risk (existing ASCVD or 10-year ASCVD risk >15%): blood pressure target is <130/80 mmHg.
- Person with diabetes and hypertension at lower risk for cardiovascular disease (10-year ASCVD risk <15%): blood pressure target is <140/90 mmHg.

Hypertension treatment protocol



5.7 Dyslipidemia

Screening and monitoring of lipid profile

- At the time of diabetes diagnosis, if not taking statins or other lipid-lowering therapy
- At an initial medical evaluation
- At every 5 years, if under the age of 40 years
- More frequently if indicated
- At initiation of statins or other lipid lowering therapy
- 4–12 weeks after initiation or a change in dose, and annually thereafter

Target

It is set to protect from cardiovascular risks, that depends on:

- DM which is considered as CAD risk equivalent
- Presence of cardiovascular disease
- Presence of ASCVD risk factors which include LDL cholesterol >100 mg/dL (2.6 mmol/L), high blood pressure, smoking, chronic kidney disease, albuminuria and family history of premature ASCVD

Targets of blood lipids in person with diabetes	
Lipid	**Target level**
LDL	<70-100 mg/dl
Triglyceride	<150 mg/dl
HDL	>40 mg/dl (male), >50 mg/dl (female)

Treatment

- Lifestyle modification:
    - Weight loss if indicated
    - Reduction of saturated and trans fats
    - Increase of dietary omega-3 fatty acids, viscous fiber, and plant stanols/sterols intake
    - Increased physical activity
- Pharmacological therapy:

Pharmacological therapy based on age, ASCVD or ASCVD risk factors		
Age	**ASCVD or 10-tear ASCVD risk >20%**	**Along with lifestyle modification, Recommended pharmacological therapy**
<40	No	None or moderate intensity statin may be considered based on risk-benefit profile or presence of ASCVD risk.
<40	Yes	High intensity statin; if LDL ≥70 mg/dl despite of therapy consider combining with ezetimibe.
≥40	No	Moderate intensity statin or high intensity statin may be considered based on risk-benefit profile or presence of ASCVD risk.
≥40	Yes	High intensity statin; if LDL ≥70 mg/dl despite of therapy, consider combining with ezetimibe.

NB: Intensity of statin therapy may need to be adjusted according to individual patient response to medication (eg side effects, tolerability, LDL cholesterol levels, etc).

- Statin therapy is contraindicated during pregnancy.

5.8 Use of antiplatelet agents

- Aspirin therapy (75–150 mg/day) as a secondary prevention strategy in those with diabetes and a history of atherosclerotic cardiovascular disease.
- Patients with atherosclerotic cardiovascular disease and documented aspirin allergy, clopidogrel (75 mg/day) should be used.
- Dual antiplatelet therapy is reasonable for a year after an acute coronary syndrome and may have benefits beyond this period.

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Chapter 6
Special Situations in Diabetes Mellitus

6.1 Diabetes in pregnancy

Gestational diabetes mellitus (GDM) is caused by placental hormones, namely beta HCG, human placental lactogen, estrogen, progesterone etc. antagonizing the action of insulin.

Global prevalence of GDM is16.2% of live births in population of 20-49 years.

Following factors are to be considered as the risk factors of developing GDM:

- BMI ≥23 kg/m^2 (based upon ethnicity)
- Age ≥25 years
- First degree relative with diabetes
- History of delivery of baby >9lb or LGA (large for gestational age) or bad obstetric history
- Previous history of GDM, A1C ≥5.7%, IGT or IFG
- Physical inactivity
- Family origin with high prevalence of diabetes as in South Asians
- HTN or therapy for HTN, HDL <35 mg/dl and or TG >250 mg/dl, PCOS, Acanthosis negricans, history of CVD.

Screening

- All pregnant women of our country should be routinely screened for GDM as our population falls under high risk group. As a screening test, use of GCT (glucose challenge test) is not necessary. One step 75g 2h OGTT should be used for screening and diagnosis of GDM.
- At first antenatal visit a diagnostic OGTT plus risk factor assessment should be done for all. During 24th to 28th weeks, 2nd OGTT is to be done for those who are normal in initial OGTT. This OGTT is mandatory. During 34th to 36th weeks, repeat OGTT may be done for the women with positive risk factors plus previous normal OGTT. This OGTT is optional.

Management

Medical nutrition therapy (MNT)

- MNT Should be started soon after diagnosis of GDM reviewed in each trimester.
- MNT should be aimed to achieve normoglycemia, provide adequate maternal weight gain, provide adequate fetal growth, prevent ketosis and to achieve other general aims of MNT.
- Weight loss with hypocaloric diet is generally not recommended to avoid ketosis and nutritional deficiency.
- Calorie intake should be according to pre-pregnancy body weight

Pre-pregnancy weight (BMI in Kg/m^2)	During first trimester (kcal/kg/day)	During 2nd and 3rd trimester (kcal/kg/day)
<18.5	35	40
18.5 to 22.9	30	35
23 to 27.4	25	30
>27.5	30 –33% calorie restriction	

- Ideal weight gain during pregnancy should be as per following table. Recommended weight gain during pregnancy is based on pre-pregnancy BMI

BMI [kg/m^2]	Recommended wt gain [lbs (kg)]
Singleton pregnancy	
<18.5	28-40 (12.5-18.0)
18.5-24.9	25-35 (11.5-16.0)
25.0-29.9	15-25 (7.0-11.5)
≥30.0	11-20 (5-9.0)
Twin pregnancy	
<18.5	No recommendation
18.5-24.9	37-54 (16.8-24.5)
25.0-29.9	31-50 (14.1-22.7)
≥30.0	25-42 (11.4-19.1)

Meal pattern

Three meals and 3 snacks should be taken including one snack at bed time. This approach can be adopted where help of nutritionist service is not available.

Recommended overall total caloric distribution

- Carbohydrate: 33–40% with low glycemic index
- Protein: ~ 20%
- Fat: < 40%, saturated fat <7% and transfat<1%
- Plate model can be practiced
- Simple sugars should be avoided. Food containing complex carbohydrate intake is recommended
- High dietary fibre and whole grain containing foods should be encouraged.
- Non-calorie sweeteners (aspartame) may be used safely
- Lean protein, oily fish and vegetable consumption should be increased
- Recommended daily requirement of iron- 30 mg, calcium- 1000 mg & folate- 0.6 mg
- Over-nutrition during pregnancy should be discouraged

Physical activity

Women with GDM should be encouraged to be as active as possible throughout the day.if there is no medical or obstetric contraindication following exercise plan can be adopted:

- Moderate activity of 30 minutes/day in 1st trimester is recommended. Walking can be continued till term at a pace that is comfortable.
- Advising intermittent exercise program such as 10 minutes three times a day preferably after a gap of one hour post prandial is another option.
- While doing exercise excessive abdominal muscular contracture should be avoided and should be modified by obvious safety issue
- Upper limb exercise is preferred during 2nd and 3rd trimester. Aerobic exercise is preferred. Walking, cycling and swimming are a few recommended exercises which can be practiced until term if there are no obstetric complications which require bed rest.

Pharmacological management

During first and third trimester

Treatment in 1st an 3rd Trimester GDM plasma glucose targets and treatment protocol by SAFES						
First trimester						
	Plasma Glucose values			Treatment at onset	Change of treatment if target not achieved in	Treatment reviewed & continued
FPG	≥92 mg/dl (≥5.1 mmol/L)	to	109 mg/dl (6.0 mmol/L)	NPT	1 week	NPT+PT
and/or						
2h PPG	≥120 mg/dl (≥6.7 mmol/L)	to	< 140 mg/dl (7.8 mmol/L)	NPT	1 week	NPT+PT
FPG	≥110 mg/dl (≥6.1 mmol/L)	to	<126 mg/dl (7.0 mmol/L)	NPT	3 days	NPT+PT
and/or						
2h PPG	≥140 mg/dl (≥7.8 mmol/L)	to	< 200 mg/dl (11.1 mmol/L)	NPT	3 days	NPT+PT
FPG	≥126 mg/dl (≥7.0 mmol/L)			NPT+PT	x	NPT+PT
and/or						
2h PPG	≥200 mg/dl (≥11.1mmol/L)			NPT+PT	x	NPT+PT

NPT: Non-pharmacological treatment, PT: Pharmacological treatment

Treatment in 2nd trimester						
GDM plasma glucose targets and treatment protocol by SAFES						
Second trimester						
	Plasma Glucose values			Treatment at onset	Change of treatment if target not achieved in	Treatment reviewed & continued
FPG	≥92 mg/dl (≥5.1 mmol/L)	to	109 mg/dl (6.0 mmol/L)	NPT	2 week/1 week Uncomplicated/ complicated	NPT+PT
and/or						
2h PPG	≥120 mg/dl (≥6.7 mmol/L)	to	<140 mg/dl (7.8 mmol/L)	NPT	2 week/1 week Uncomplicated/ complicated	NPT+PT
FPG	≥110 mg/dl (≥6.1 mmol/L)	to	<126 mg/dl (7.0) mmol/L)	NPT	1 week	NPT+PT
and/or						
2h PPG	≥140 mg/dl (≥7.8 mmol/L)	to	< 200 mg/dl (11.1 mmol/L)	NPT	1 week	NPT+PT
FPG	≥126 mg/dl (≥7.0 mmol/L)			NPT+PT	x	NPT+PT
and/or						
2h PPG	≥200 mg/dl (≥11.1mmol/L)			NPT+PT	x	NPT+PT

NPT: Non-pharmacological treatment, PT: Pharmacological treatment

Recommended insulins

- Recombinant human short acting insulin, recombinant human intermediate acting insulin are recommended for use during pregnancy. Among short acting analogue Aspart and Lispro are safe. Among long acting analogue use of detemir is recommended. Use of Glulisine, Glargine and Degludec is not recommended.
- Required initial dose is 0.2 to 0.5 U/kg body weight. Obese women may need higher dose. Treatment should be graded to reach the targets.

Recommended approach to start insulin

Step 1: In case of high fasting blood glucose (FPG), it should be controlled with priority over that of high post meal blood sugar. An intermediate acting human insulin or basal analogue insulin (recommended for use in pregnancy) with a dose of 0.2U/kg at bed time may be a starting dose. Then titrated to reach the target of fasting blood glucose.

Step 2: Raised post meal blood glucose should be controlled by bolus insulin –either by regular / short acting human insulin or by short/ ultra acting analogue with meal(s) (recommended for use in pregnancy) and titrated as frequently to reach the post-meal targets.

- Only bolus insulin may be needed in some cases of GDM when FPG is well controlled with non-Pharmacological therapy.
- Premixed insulin can be considered on individual basis where patients are unwilling to or unable to take basal bolus regimen.

Combined use of human insulin with analogue insulin is not recommended.

Recommended OAD: Use of sulphonylurea during GDM is not recommended .Use of Metformin is discouraged.

Post-partum management

- Mothers who were on low dose insulin (<0.5units/kg/day) can stop and monitor glucose levels. Mothers who were on insulin >1units/kg/day may reduce the dose to 50% and while those on 0.5-1units need individualized clinical decision.
- All mothers with history of gestational diabetes should be counseled about screening for GDM during every subsequent pregnancy.
- Empowering health care professionals (gynecologists, mid-wives, lady health visitors, pediatricians, nurses, diabetes educators) by providing sanitized standard literature and continuing education by conducting training are crucial. In all levels a shared decision making with obstetric team should be considered when necessary.

- After delivery at least 1 fasting and 1 after a meal PG before discharge should be measured in GDM patients who were managed by MNT and FPG and after meals PG should be monitored for at least 24 hours who were managed with insulin. If blood glucose remains elevated, continued monitoring is warranted. Possibility of type 2 diabetes should be considered. If immediate post-delivery (1-3 days), BG is suggestive of diabetes, then should be confirmed by FPG (≥7 mmol/l) or post-prandial BG(≥11.1mmol/l).
- As some case of GDM may represent pre-existing undiagnosed type 2 diabetes and 50% women with GDM may develop type 2 diabetes within 5 to 10 years, women with GDM(not requiring insulin after delivery) should be screened for diabetes 6 weeks post-partum (linked to child immunization) with 75g 2h OGTT using non-pregnant OGTT criteria.
- If BG is normal, reassessment should be done annually with 75g 2h OGTT or A1C. If prediabetes, reassessment should be done 6 monthly and should be put on MNT or metformin should be followed by standard protocol.
- Low dose estrogen-progesterone can be offered for contraception. Progesterone only preparation increases risk of vascular complications.
- Screening for all components of metabolic syndrome should be offered.
- Throughout the period of breast feeding all types of insulins and metformin can be safely used in lactating women. Women with preprgnancy diabetes who are breastfeeding should continue to avoid any drugs for the treatment of diabetes complications that were discontinued for safety reasons in the pre-conception period.

6.2 Diabetes in children

- Diabetes mellitus in childhood and adolescence is most often type 1 diabetes. But they have the chance of developing other specific types of diabetes. Now-a-days type 2 diabetes is developing in the young at a very high rate. Diagnostic and management issues in this group of population are a bit different from that of adult.
- Type 2 diabetes mellitus in children is relatively less common than in adult. But nowadays it is being reported more frequently and is associated with rising rate of obesity among the children.
- Type 2 diabetes was once seen as a disease of adults. Today, this type of diabetes is growing at alarming rates in children and adolescents. Over a 20-year period, type 2 diabetes has doubled in children in Japan, so that it is now more common than type 1.

type 2 diabetes in children is becoming a global public health issue with potentially serious outcomes.

- As the trend of type 2 diabetes is increasing at present it has become important to screen the children for this type of diabetes.

Screening for diabetes in children	
All types DM	Children with symptoms of diabetes
Type2 DM	Children with risk factors of diabetes: ❒ Over-weight (BMI >85th percentile for age & sex) ❒ Family history of type 2 diabetes ❒ Mother was diabetic/GDM during the child's gestation ❒ Some ethnic groups ❒ Features of insulin resistance ● Acanthosis nigricans ● Hypertension ● Dyslipidemia ● Polycystic ovary syndrome ● Low birth weight

- ❒ Children with obesity and one or more risk factors should be screened at the age of 10 years or at onset of puberty. If normal, then screening should be done in every 3 years.
- ❒ Diabetes in children and adolescents, specially type 1, usually presents with classical symptoms. It can easily be diagnosed by RPG. OGTT is seldom required; it should not be performed if diabetes can be diagnosed by RPG or FPG, as excessive hyperglycemia can result.

Principles of diabetes management in childhood

Management of the diabetes in children needs special skill in this field. Treatment modalities do not differ much from those of adults. However, they mostly need insulin because they are either of type 1 diabetes or of other types with severe insulin deficiency.

Targets of diabetes management in the young (based on ISPAD guideline)

Glycemic levels: plasma glucose (mmol/L); HbA1c (%)			
FPG/Pre-meal	Post-meal	Bed time	HbA1c
5.0-8.0	5.0-10.0	6.7-10.0	<7.5
No hypoglycemia			
Target of growth	Within +/- 2.5 SD of growth chart		

Drug treatment of type 1 diabetes only insulin.

Drug treatment of type 2 diabetes

Age group	Option for drug
<10 years of age	Insulin only
10-18 years	Insulin and/or metformin
>18 years	Insulin and/or metformin, and/or other agents, eg. sulphonylureas, thiazolidinediones etc.

Medical nutrition therapy (MNT)

- A meal plan is based on the individual's usual food intake, insulin therapy, exercise patterns etc.
- Timing and amount of food will depend on type of insulin, physical activity, lifestyle and results of blood glucose monitoring.
- All children with diabetes should be referred to a dietitian for counseling at diagnosis of diabetes and also subsequently if they have problem with their diet adjustment.
- Age-specific calorie calculating charts are available for measuring diet allowance.

Diabetes education

- Diabetes education needs to be a continuous process and repeated for it to be effective.
- They are to be trained to develop skill in all aspects of diabetes, especially insulin injection technique, dietary practice, home monitoring of blood glucose etc. Providing emotional support is also very important.
- Infants and toddlers: They are totally dependent on parents and care providers for injections, food and monitoring. Need to be educated on prevention,

recognition and management of acute complications, especially hypoglycemia, because it is very common complication in this age group.

- School going children to be trained on Insulin injections and blood glucose monitoring,recognizing hypoglycemic symptoms and understanding self management, adapt to school programs, school meals, exercise and sports. Teacher/school authority should be involved in this learning process and parents are advised on the gradual development of the child's independence.
- Adolescents: Independent, responsible self-management appropriate to the level of maturity and understanding should be promoted. Strategies to manage transition to adulthood and progressive hand-over of responsibility are to be developed.

Sports and exercise

- Children with type 1 diabetes with good blood glucose control can do all levels of exercise, including leisure activities, recreational sports, and competitive professional performance. Exercise is more important for young type 2 diabetic, especially who are obese. The emphasis must be on adjusting the therapeutic regimen with the level of exercise and diet, and avoiding hypoglycemia.
- Children between 3-5 years of age may take part in free play, walking, running etc.
- Children between 6-9 years of age may start learning to play team sports such as football, cricket etc.
- Children above 10 years of age and adolescents may be able to take part in all complex sports, like basketball, football, tennis, hockey etc.
- In the case of adolescents, hormonal changes can contribute to the difficulty in controlling blood glucose levels. Extra care is required for exercise in this age group.

Hypertension in the young

Hypertension in childhood is defined as systolic or diastolic blood pressure >95th percentile for age, sex and height. 'High-normal' blood pressure is defined as systolic or diastolic blood pressure >90th but <95th percentile for age, sex and height. Elevated blood pressure should be confirmed on 3 separate days.

Treatment of high-normal blood pressure is given through lifestyle measures. If target blood pressure is not reached within 3-6 months, phamacologic treatment should be initiated. Drug treatment should be started as soon as hypertension is confirmed. ACE inhibitor is the preferred agent. The goal of treatment is a blood pressure consistently <90th percentile for age, sex and height, whichever is lower.

Dyslipidemia in the young

Fasting lipid profile should be performed in children soon after diagnosis of diabetes (after diabetes control). If lipids are abnormal, annual monitoring is recommended. If LDL cholesterol values are within the accepted risk levels (<100 mg/dl), a lipid profile should be repeated every 3-5 years.

Initial therapy includes blood glucose control and MNT. After the age of 10 years, statin is recommended in patients who do not reach target (who have LDL cholesteorl >160 mg/dl or >130 mg/dl with a cardiovascular risk factor) with lifestyle changes. The goal of therapy is an LDL cholesterol value <100 mg/dl.

6.3 Diabetes in elderly

People over 60 years of age form about 15% of total population globally. Among total diabetics of the world, 60-year group constitutes about 35%. And among total population over 65 years of age, 25% are diabetics. So they are putting a great impact on general as well as in diabetic populations.

Older people may present in any of the following states			
	Apparently good health	**Intermediate health**	**Poor health**
Life expectancy	More	Intermediate	Less
Physical/mental fitness	More	Intermediate	Less
Independence	More	Intermediate	Less
Management strategy	Less relaxed	Intermediate	More relaxed

Management of diabetes in elderly

Treatment goal		
Category	**FPG (mmol/L)**	**HbA1c (%)**
Good	7.2	<7.5
Intermediate	8.3	<8.0
Poor	10.0	<8.5

Lifestyle modification

- MNT: Adequate fluid is to be ensured to avoid dehydration. Malnutrition or weight loss should be taken care. Tube feeding or parenteral nutrition may be needed in some.
- Physical activity: Older people are encouraged to be active as condition allows, from regular exercise to simple home-based mobility. Risk assessment should be done before recommending activity. Risk of injury with fall and hypoglycemia is to be considered.

Pharmacotherapy

- 'Start low, go slow' is applicable to most medications.
- Agents which preferentially lower postprandial hyperglycemia may be more effective in achieving glycemic goals without increasing the risk of fasting hypoglycemia.
- Metformin is first-line therapy, but it should be used cautiously in people over 80 years of age. Metformin may cause unintended weight loss and higher gastrointestinal side-effects.
- DPP-4 inhibitor/GLP-1 agonist may also be considered.
- Glibenclamide and Glimeiride has the highest risk of hypoglycemia, so should be avoided ; gliclazide has the lowest.
- Glinides and AGI may be considered in postprandial hyperglycemia. Glinides are also useful in erratic eating habits.
- Insulin may provide anabolic benefit in frail ones. Long acting insulin analogue is safe and efficacious in older people. Rapid/short acting insulin targets post-prandial blood glucose better. Visual, motor and cognitive impairments may hamper insulin injection. Insulin pen devices can simplify administration.
- Complex regimens should be avoided to reduce errors.

Acute emergencies in elderly

Hypoglycemia and sick day management plan should be strengthened. Older people are more prone to hypoglycemia. Blood glucose <6.0 mmol/L is to be avoided. HbA1c <7.0% should be taken as warning of possible overtreatment.

Causes of 'hypoglycemia ' in the elderly people:

- Polypharmacy
- Erratic meals, unusual activity
- Renal, hepatic impairment
- Malabsorption, swallowing problems

- Defective counterregulatory system, antecedent/unaware hypoglycemia
- Cognitive impairment, less expression of symptoms, hampered self-management

Like hypoglycemia, timely recognition and management of hyperglycemic emergencies (DKA, HHS) in older people must be ensured.

Comorbidities

Several comorbid conditions are usually present in older people along with complications of diabetes. These may be cognitive impairment, falls, pain, arthritis, fractures, hearing impairment, functional disability, urinary incontinence, obesity, stroke, CHF, periodontal disease, cancer, depression, hypertension, dyslipidemia etc. All these should be addressed as much as possible.

6.4 Diabetes and surgery

Pre-operative assessment

- Pre-operative assessment must be done in close consultation with the physician, surgeon and anesthetist.
- It should include assessment of any diabetic complications or associated conditions, which may increase surgical risk, eg cardiac autonomic neuropathy.
- Drug and dose adjustment depend on drug regime and type of insulin.

Day prior to surgery

- Biguanides should be stopped 24 hours prior to, or on the day of surgery.
- If operation in the early morning usual or lower doses of other antidiabetic medications are continued upto previous evening.
- For major surgeries, the patient may be kept nil per oral (NPO) over-night prior to surgery; in patients with gastroparesis, the duration of NPO should be around 10-12 hours.

Day of surgery

- Anti-diabetic medications are held on the morning of the operation.
- Surgery should be scheduled as early as possible in the morning.
- In all major surgeries glucose-insulin infusion should be started. The unit of insulin to be added to 5 or 10% dextrose or dextrose saline needs to be

individualized and adjusted as per the results of the glucometer readings. Blood glucose should be monitored 1 to 2 hourly; it should be in the range of 6.0-10.0 mmol/L or lower if feasible. Glucose-insulin-potassium infusion may be considered according to situations. Best option I/V insulin syringe pump can be practised in long surgical procedure.

- During minor surgery glucose-insulin infusion may sometimes be required in uncontrolled diabetes, but not in stable state.

During operation

- The choice of the anaesthetic agent is best left to the anaesthetist; there is no preferred choice of anaesthetic agent for diabetics.
- Cardiovascular status should be closely monitored during surgery.
- The glucose-insulin administration is continued where it is required; it is guided by blood glucose monitoring.
- In longer duration operations subcutaneous correction dose insulin may be required according to blood glucose levels.

Post-operative care

- The glucose-insulin administration is continued (where required) till the patient is able to take oral food.
- At this time, if the blood glucose is not under fair control, rapid acting insulin can be given in small doses (as correction dose) subcutaneously, if fasting is high long acting basal insulin may be required.
- Once patient is back on his routine diet and is stable, he can be managed with the regimen he was on prior to surgery.

For minor surgery in well controlled diabetes

- Patient on short acting secretagogues and/or insulin should omit breakfast and the morning dose. The drug(s) should be restarted once patient is back on routine diet after operation.
- Patient on long acting secretagogues may be tried replace with shorter acting secretagogues at least 7 days prior to surgery.
- Per-operative glucose-insulin drip is usually not required.

For major surgery (requiring over-night NPO)

- Diabetes should be controlled by insulin. Per-operative glucose-insulin drip is essential.

- In the post-operative period, once diet is resumed, patients should be shifted to short or rapid acting insulin. Restarting of the patent's previous regimen can be done once the patient is fully stable.

For poorly controlled diabetes (elective surgery)

- Insulin is used to control diabetes in all types of operation
- Hospitalization of the patient at least 3 days before major surgery
- Per-operative glucose-insulin drip is required, especially in major surgery

For emergency surgery

Insulin infusion is started and frequent monitoring of blood glucose is done when operation is performed in patients with blood glucose crossing 14.0 mmol/L.

- Electrolytes, acid base status and urinary ketone levels are checked.
- If feasible surgery is delayed till blood glucose comes below 20 mmol/L and ketonuria disappears. If delaying is not possible, operation with intensive management of diabetic state is to be done.
- It is important to emphasize that with optimal care, surgery in a diabetic is as safe in a person without diabetes.

6.5 Diabetes and sick day

Period of illnesses eg fever, vomiting or diarrhoea, often cause hyperglycemia and ketosis, and sometimes hypoglycemia. To prevent these, certain management principles are followed. These are:

- The person needs to test his/her blood for glucose and ketone. If it is not possible, testing urine for glucose and ketone is very important.
- Fluid balance needs to be maintained; so sufficient intake is necessary. If the blood glucose is low, sweetened fluids, eg fruit juice is to be given to avoid hypoglycaemia. If blood glucose is elevated, low calorie soft drinks, soup or broth may be given.
- The anti-diabetic agents should never be stopped altogether; dose may need to be reduced.
- If the person is on insulin, intermediate or long acting insulin is continued; the dose may need to be reduced. Shorter acting insulin should be adjusted according to blood glucose values and food intake.
- If the person is on OAD the dose is to be readjusted; sometimes the longer acting OADs may need to be replaced by shorter acting ones or insulin.

- These principles are to be followed until the blood glucose is <12 mmol/L and ketone diminishes or disappears.
- In situations with fever, the infective focus should be treated. Treatment for vomiting/diarrhoea may also be required simultaneously.

Special attention

Following conditions require special attention and necessitate hospitalization:

- Vomiting or diarrhoea persists for longer than 6 hours
- Sick for 2 days and not getting better
- Blood glucose remains above 14 mmol/L
- Moderate ketonuria persists despite treatment
- Very young individual
- Abdominal pain
- Hyperventilation
- Co-existing serious diseases

6.6 Ramadan fasting

- Pre Ramadan education is the cornerstone of safe Ramadan fasting.
- Patients and their family members or friends, healthcare professionals who manage or support them, should be educated.
- Educational program should be started around 3 months before Ramadan. Ramadan focused structured education program should include information on risk stratification, diet and exercise, food intake, drugs adjustment, blood glucose monitoring (during day & night), recognition of hypoglycemia and other complications and when to breakfast.
- Studies from home and abroad clearly demonstrated the benefit of Ramadan focus education program in terms of glycemic control, weight loss and reduced hypoglycemia risk.

Modification of OAD during Ramadan

Name of drug	Modification during Ramadan
Metformin	Daily total dose remains unchanged Once daily dose should be taken at Iftar For twice daily dose, should be taken at Iftar and Suhoor For thrice daily dose, morning dose should be taken at Suhoor and combined after noon and evening dose at Iftar Prolonged release preparation should be taken at Iftar
Sulfonylurea	Switch to newer Sulfonylurea (Gliclazide, Glimepiride) wherever possible Glibenclamide should be avoided For once daily dose, the total dose should be taken at Iftar Dose may be reduced in patients with good glycemic control For twice daily dose, full pre-Ramadan breakfast dose should be taken at Iftar and 50% of the dinner dose should be taken in Suhoor
Meglitinides	Thrice daily dosing may be reduced/ redistributed to 2 doses taken with iftar and Suhoor
Acarbose	No dose modification. Pre-Ramadan morning dose is given at Iftar, lunch dose at dinner (if taken), and evening dose at Suhoor
Thiazolidinediones	No dose modification. Can be taken at Iftar or Suhoor
DPP-4 inhibitors	No dose modification. Can be taken at Iftar or Suhoor
SGLT2 inhibitors	No dose modification Should be taken with iftar Extra water should be ingested during non-fasting periods Should not be used in the elderly, patients with renal impairment, hypotensive individuals or those taking diuretics

Changes to insulin regimen during Ramadan

A) Basal insulin (Detemir, Glargine, Degludec or NPH)	
Detemir, Glargine, Deglutec [Usually at bedtime and single dose]	The same dose and time as pre-Ramadan if blood sugar (in SMBG) is high May be reduced if fasting blood sugar is within target
NPH [single or twice dose]	If Single–same breakfast dose should be taken at Iftar if BG is high, Reduce 15-30% if BG is within target For twice daily-same dose of breakfast at Iftar if BG is high, reduce 15-30% if BG within target
B) Rapid/short acting insulin: Bolus [(analogue-Lispro, Glulisine, Aspart)/regular]	
Once, twice or thrice daily	The same pre-Ramadan breakfast dose should be taken at Iftar The lunch dose will be shifted to dinner dose in full during Ramadan if full dinner is taken Reduce pre-Ramadan dinner dose by 20-50% for Suhoor in Ramadan
C) Premix (analogue-30/70, 50/50; conventional 30/70, 50/50, 25/75):May be used once daily or twice in Ramadan	
Single dose Twice daily [breakfast & dinner]	Once daily dose- same dose at Iftar Twice daily doses- the pre-Ramadan breakfast dose will be same for Iftar dose Pre-Ramadan dinner dose may be reduced by 20-50% for Suhoor (depending on prolonged fasting, carb content) and glycemic control

SMBG

Good to do: Pre Suhoor – before taking meal, early morning– 2 hrs after Suhoor, around 10 am, mid-day – 11 am to 2 pm, pre Iftar meal, 2 hrs after Iftar and at any time when there are symptoms of hypoglycemia / hyperglycemia or feeling unwell.

Must to do : Before Iftar, 2 hour after Iftar, Mid-day

Frequency of SMBG should be daily for first 3 days, every 3rd day from next week onwards and every alternateday in the last week.

6.7 Hajj and travel

It could be estimated that Muslims with diabetes performing Hajj may exceed 220000 per year. During Hajj duty, there may be major medical challenges for Muslims with diabetes and their healthcare providers. Risk stratification, medication adjustments, proper clinical assessment, and education before doing the Hajj are crucial.

Changes during Hajj days

During the Hajj, diet, amount of fluid intake and physical activity may be altered significantly. The health risks for pilgrims with diabetes include hypoglycemia, dehydration, foot injuries and infection, hyperglycemia (diabetic ketoacidosis and hyperosmolar state), heat exhaustion and heat stroke, infections (such as chest infection, foot infection and diarrhea), and cardiac events due to increased physical exertion.

General recommendations

Before travel

- To consult physician 1–2 months before the Hajj for good control of diabetes mellitus and associated morbidities and attend a medical education session
- To inform the camp manager and/or physician about your disease and medications
- To prepare a checklist of mandatory requirements
- To get adequate knowledge of SMBG and adjustment of medication as necessary
- To complete recommended vaccinations, including influenza and pneumococcal vaccines

- Prepare enough medications, cool pack to store insulin, glucometers
- It is preferable to pack diabetes medications in carry-on bags, not in the checked luggage. This will protect the medicines from temperature changes in luggage stored in cargoes, which may affect the potency of insulin and other medications
- To choose shoes, sandals, and flip-flops with appropriate shapes and sizes (wide-front shoe to avoid extra pressure on the feet and the toes during long walking). Use soaks while barefoot walking is required
- Hajj events are prohibited to perform during menstruation so postponding menstruation during this period is advised. Use of medicines for this should be planned earlier with consultation of physician
- Those with severe non-proliferative and proliferative retinopathy should consult their ophthalmologist before deciding to go to the Hajj

During travel and Hajj

- To carry some carbohydrates to be used during hypoglycemia
- Try to adhere to a healthy balanced diet containing adequate, but not excess, carbohydrates, with appropriate protein and fiber but minimal (monounsaturated) fat
- To drink plenty of water daily and carry enough water stored
- If using insulin, before Ihram to check blood glucose using glucometer and urine ketone using dipstick (for type 1). If needed, a small dose of insulin to cover for hyperglycemia and/or small mealto avoid hypoglycemia should be kept always
- If using insulin before and during long walking, decrease the dose of short and intermediate insulin about 20% or more depending on the distance and effort. For patients on sulfonylurea drugs, this adjustment of daily dose (up to 50% decrease in the corresponding drug doseof previous dose) can be applied
- Before Tawaf (circumambulation around Ka'bah) and Saay (walking between Safa and Marwah), consume some additional carbohydrates (Complex carbohydrate is preferred) if the blood sugar within target
- To consult your medical team promptlyin case of fever, diarrhea, vomiting or any acute medical condition instead of delaying
- Always have an umbrella and try to stay in shaded areas
- Wetting the head and body with water many times during the day is another way to keep the body cool
- Check feet daily before going to bed. To inspect feet daily for lesions such as blisters and bleeding between toes. Using a mirror will help to inspect the bottom of the foot and the heel. If unable to do it, you may seek the help of a relative or a friend

- To use socks or stocking that fit well in the shoe
- Use shoes with flat outside sole
- To use leather shoes with good space for the toes. Athletic and/or running shoes are good choices for walking. Brand-new shoes are not preferred, as new shoes may rub unduly on the feet
- To avoid soaking feet in hot water
- Seek immediate help if you notice any new lesion or swelling of the feet, redness and pain

Medication adjustment

- Metformin, alpha-glucosidase inhibitors, thiazolidinediones, dipeptidyl peptidase-4 (DPP4) inhibitors, glucagon-like peptide-1 (GLP-1) receptor agonists and SGLT-2 inhibitors require no dose adjustment
- The risk of hypoglycemia with sulfonylurea is usually more in the elderly with diabetes and those with renal impairment and medical illnesses. Sulfonylureas should be avoided or used with caution. Also the dose may be adjusted before doing the Hajj physical activity, and newer generations are preferred.
- Insulin treatment is usually linked to increased risk of hypoglycemia, especially during the Hajj and its prolonged walking. Proper adjustment of insulin doses is required during the Hajj in patients with type 1 and type 2 diabetes. The combination of basal (glargine, detemir or degludec) and rapid-acting insulin analogs (lispro, aspart and glulisine) proved to be superior to human insulin formulations (isophane insulin (NPH) and regular) during the Hajj as this regimen may reduce the risk of hypoglycemia.
- Insulin pump therapy has been shown effective in optimizing glycemic control and in reducing the risk of hypoglycemia in patients with type 1 diabetes, so it could be a good choice during the Hajj. In addition, insulin pump allows more flexibility around meal times, as well as lowers the basal dose, minimizing the risk of developing hypoglycemia as a result of exercise (Hajj walking).

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Chapter 7
Prevention of Diabetes Mellitus

Types of prevention of diabetes mellitus

1. Primordial prevention
2. Primary prevention: Refers to avoiding the onset of the disease (diabetes)
3. Secondary prevention: Means early detection of diabetes and prompt initiation of treatment to prevent complications of diabetes
4. Tertiary prevention: Aims to delay and/or prevent further progression of the diabetic complications

Primary prevention

Type 2 diabetes is the commonest form of diabetes. Although a heterogeneous disorder, progression from insulin insensitivity to pre-diabetes, then to diabetes is now well understood.

The risk factors for type 2 diabetes are: a) aging, b) family history of type 2 diabetes, c) over-weight/obesity, d) physical inactivity e) pregnancy, f) intra-uterine and early childhood malnutrition g) stress and h) smoking. Except age and family history all others are amenable to modification. Many of these risk factors are common for other non-communicable diseases (NCDs).

Diabetes prevention programmes focus on lifestyle modification, specifically modest weight loss and increased physical activity.

Primary prevention can be achieved through two basic approaches:

A. Population approach

1. Creation of mass awareness

- Incorporation of basic information in school text book curriculums
- Use of mass media, eg. newspapers, radio, television etc
- Use of social organizations, as religious institutes, voluntary organizations

2. Care of risk factors

- Creation of facilities for performing physical activities, like sports, gyms etc
- Promotion of healthy eating habits, like campaign against `fast food culture'

B. High-risk group approach

This approach of primary prevention can be achieved by Identification and screening of people at risk and intervention

Individuals at high risk of type 2 diabetes mellitus
• BMI above normal (≥23 kg/m^2)
• Age ≥40 years
• 1st degree relative with diabetes
• Habitual physical inactivity
• Waist-hip ratio above normal
• History of GDM or delivery of baby >9 lbs
• Previously identified as IFG/IGT
• Hypertension
• Dyslipidemia- HDL-c <35 mg/dl, TG >250 mg/dl
• Some ethnicties
• PCOS, acanthosis nigricans etc

Intervention for Primary prevention: It is done by ensuring weight management, regular physical activity, medical nutrition therapy and even by using drugs (like metformin) to modify the risk factors. Metformin may be used in persons with prediabetes, with BMI 35 kg/m^2, age <60 years and prior GDM.

Secondary and tertiary prevention

It includes good glycemic control, strict control of blood pressure, proper care of eye and foot. This will prevent further deterioration of organ function and target organ damage.

References

- Prevention of diabetes mellitus, WHO (World Health Organization) Technical Report Series 844, 1994.
- Development Programme for the Prevention & Care of Diabetes in Finland, Finnish Diabetes Association, 2001.

Appendix

Injection technique

Injections are given into the deep subcutaneous tissue at 45-90^0 angle by two-finger pinch of skin. The pinch is recommended to ensure a strict subcutaneous injection; avoiding intramuscular injection. Injections can be given perpendicularly without lifting a skin fold when needles are smaller and there is enough subcutaneous fat. Needles should be inserted fully, otherwise there is a risk of intradermal injections. A wait of 15 seconds after pushing the plunger helps to ensure complete expulsion of insulin through the needle, especially in pens. Cleaning or disinfection of skin is advisable, but may not be necessary unless hygiene is a real problem.

Vials (also the pen devices) of cloudy insulin must always be gently rolled (not shaken) 10-20 times, to mix the insulin suspension. When a mixture of two insulins drawn up (eg regular insulinare mixed with NPH), the regular insulin is to be drawn up into the syringe before the intermediate acting one. The mixture must be administered immediately.

Injection sites

Abdomen (the preferred site when faster and uniform absorption is required and it may be less affected by muscle activity or exercise). Lateral aspect of thigh (the preferred site for slower absorption of longer acting insulin). Lateral aspect of arm (assistance is required for injection). The lateral upper quadrant of the buttocks (used less often). Rotation of injection sites are important within the same area of injection.

Insulin storage

Insulin must never be frozen. Direct sunlight or warming (eg in hot climates) damages insulin. Insulin should not be used if there is change in appearance (clumping, frosting, precipitation,or discoloration). Unused insulin should be stored in a refrigerator(4-8^0 C) to retain its potency up to expiry date. When in use, the insulin may be kept in room temperature (if not too hot) for one month after opening without much loss of efficacy. But it retains its potency much better if kept in refrigerator. In hot climates where refrigeration is not available, cooling jars, earthenware pitcher or cool wet cloth around the insulin will help to preserve insulin activity.

Case history

Case-01

Mr Ahmed, 50 years, schoolteacher, has undergone OGTT. His report shows F-5.7 mmol/L, 2HAG-7.2 mmol/L. He has family history of diabetes. His height is 170 cm and weight is 86 kg. Today his BP is 130/80 mmHg. What is his diagnosis and what is the advice for him?

Case-02

Mr Rozario, 48 years, banker, has undergone annual checkup revealing RBS of 8.6 mmol/L. His physician advised OGTT, which revealed F-6.4 mmol/L, 2HAG-9.7 mmol/L. His height is 172cm, weight 70 kg. He is hypertensive for 5 years. What is the treatment and follow up plan for him?

Case-03

Mrs Sen 52 years, housewife, reported to a physician with general weakness and tiredness. She was advised OGTT which shows F-6.9 mmol/L, 2HAG-15.8 mmol/L. Today her BP is150/90 mmHg, BMI is 26kg/m^2 and her other investigation reports are unremarkable. What will be treatment plan for her?

Case-04

Mr Barua, 60 years, retired service holder, is diabetic for 5 years. He is on Tab Metformin (500 mg) three times daily for last 2 years. Now he reported with following investigations: F-9.2 mmol/L, 2 HABF-19.6 mmol/L, HbA1c-9.2%, ALT-42 U/L, S. creatinine-0.9mg/dl. His BMI is 28kg/m^2. He is very much compliant with his lifestyle advice. What will be the treatment option for him?

Case-05

Mr Alamgir, 45 years old, school teacher, is diabetic for 6 years. As a diabetic his lifestyle is well adjusted. He is on Tab Glimepiride 3 mg daily and Tab Metformin 850 mg three times daily. His recent HbA1c is 10.1% and FBS is 13.4 mmol/L, S. creatinine-1.2 mg/dl, ALT-30U/L; his height is 178 cm, weight-70 kg. What will be the treatment plan for him?

Case-06

Mrs. Khaleda, 52 years, housewife, diabetic for 6 years, hypertensive for 4 years. She also has dyslipidemia. She is gaining weight for last few years. At present her BMI is

34.2 kg/m^2. Her BP is 150/95 mmHg. She is on Inj. Premix insulin 46+0 +24, Tab Vildagliptin plus metformin (50/500 mg) 1+0+1. At present her blood sugar is F-10.2 mmol/L and 2HABF-16.4 mmol/L and HbA1c- 9.2%. What change she needs in her treatment to achieve glycemic target?

Case-07

Mr Latif, 55 years, businessman, is diagnosed as diabetic for last 10 days. His investigations revealed: S .creatinine-1.8 mg/dl, GFR-53.2 ml/min/1.73m^2, S. chol-245 mg/dl, HDL-32 mg/dl, LDL-123 mg/dl, TG-214 mg/dl and ALT-70 U/L. He is now on Inj. Premix insulin-32+0+24, Tab Metformin 500 mg thrice daily, Tab Linagliptin 5 mg once daily. He is hypertensive for three years and his BP is well in target with Tab Losartan 50 mg 0+0+1. What will be the choice of antidiabetic drug for him?

Case-08

Mrs Rahima, 65 years, housewife, reported to emergency department with sudden severe chest pain and on evaluation she had single vessel CAD and required PCI. She is diabetic for 5 yrs. She is on Tab Gliclazide 120 mg/day and Tab Metformin 2 gm daily. Her HbA1c is 7.4%, FBS-8.8 mmol/L, LDL-120mg/dl, ALT-38U/L, S. creatinine-1.2mg/dl. BMI is 28.2 kg/m^2 and BP is 160/90 mmHg. She is hypertensive for 3 years and on Tab Amlodipine 5mg/day. What will be the treatment plan for her considering her comorbidities?

Case-09

Mrs Ruma Sen, a 62-year-old housewife, is living in Dhaka. She is over-weight (BMI 24 Kg/m^2). She has presented with increased thirst, urination, and marked general weakness for one month. There is nothing remarkable on physical examination. Her OGTT was done 5 days back; report shows: FBG- 11.6 mmol/L; 2 hr post-glucose value- 21.1 mmol/L; HbA1c- 9.8%. There is nothing remarkable on other laboratory tests. What will be the treatment plan for her?

Case-10

Mr Akbar Ali, a 45-year-old businessman, is living in Dhaka. His BMI is 25.3 Kg/m^2. He has presented with general weakness for last 2 months. There is nothing remarkable on physical examination. His OGTT was done 3 days back; report shows: FBG- 16.2 mmol/L; 2 hr post-glucose value- 24.1 mmol/L; HbA1c- 14.5%. There is nothing remarkable on other laboratory tests. What will be the management stratigy plan for him?

Abbreviation

ACR	-	Albumin-to-creatinine ratio
AGI	-	Alpha-glucosidase inhibitors
ALA	–	α-Linolenic acid
ALT	-	Alanine aminotransferase
ASCVD	-	Atherosclerotic cardiovascular disease
BG	–	Blood glucose
BMI	–	Body mass index
BP	–	Blood pressure
BUN	–	Blood urea nitrogen
CAD	–	Coronary artery disease
CGM	-	Continuous glucose monitoring
CHF	-	Congestive heart failure
CKD	-	Chronic kidney disease
CVD	-	Cardiovascular disease
eGFR	-	estimated glomerular filtration rate
EPA	-	Eicosapentaenoic acid
DHA	–	ocosahexaenoic acid
DM	–	Diabetes Mellitus
ESRD	-	End-stage renal disease
GAD	-	Glutamic acid decarboxylase
hCG	-	Human chorionic gonadotropin
HbA1c	-	Hemoglobin A1c
HDL	-	High-density lipoproteins
HNF	-	Hepatocyte nuclear factors
IHD	–	Ischemic heart disease
ISPAD	–	International Society for Pediatric and Adolescent Diabetes
LAD	-	Left anterior descending artery
LDL	-	Low-density lipoproteins
MDI	-	Multiple dose injection
MNT	-	Medical nutrition therapy
MODY	-	Maturity onset diabetes of the young
NAFLD	-	Non-alcoholic fatty liver disease
NPH	-	Neutral protamine Hagedorn
PCI	-	Percutaneous coronary intervention
PCOS	-	Polycystic ovary syndrome
RBC	-	Red blood cells
SMBG	-	Self-monitoring of blood glucose
TG	–	Triglycerides
UTI	–	Urinary tract infection

DIABETES CARE

AS Guideline 2019

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