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Review Article.....!!!

MANAGEMENT OF DIABETES MELLITUSMrs. Shinde.S.V^{*}, Ms.Gharge U.A.¹, Ms.Gund P.G.¹, Ms.Gawade A.H.¹, Mr.Deshmukh H.V.¹

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ABSTRACT

Diabetes mellitus (DM) is a metabolic disorder resulting from a defect in insulin secretion, insulin action, or both. Insulin deficiency in turn leads to chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism. It is the most common endocrine disorder. . The main objective of drugs used in diabetes is to correct the underlying metabolic disorder, such as insulin resistance and inadequate insulin secretion. They should be prescribed in combination with an appropriate diet and lifestyle changes.

INTRODUCTION:**DIABETES MELLITUS:**

Available data from many countries of the Eastern Mediterranean Region (EMR) indicate that diabetes mellitus has become a problem of great magnitude and a major public health concern. Studies have demonstrated that, in some countries, diabetes affects up to 10% of the population aged 20 years and older. This rate may be doubled if those with impaired glucose tolerance (IGT) are also included

The manifestations of diabetes cause considerable human suffering and enormous economic costs. Both acute and late diabetic complications are commonly encountered. Long-term complications represented by cardiovascular diseases, cerebrovascular accidents, end-stage renal disease, retinopathy and neuropathies are already major causes of morbidity, disability and premature death in countries of this Region.

The development of long-term complications is influenced by hyperglycaemia. Poor control of diabetes accelerates their progression. Thus, to prevent complications, good control of diabetes is essential and the management of diabetes should therefore aim to improve glycaemic control beyond that required to control its symptoms.

Diabetes is the most common endocrine disorder and by the year 2010, it is estimated that more than 200 million people worldwide will have DM and 300 million will subsequently have the disease by 2025.¹⁵⁻¹⁷ The diagnostic criteria and the classification of diabetes was first put forward by the World Health Organization (WHO) in 1965¹⁸ then by the National Diabetes Data Group (NDDG) in 1979,¹⁹ and this was followed by simplified recommendations by the in Scotland suggested that diabetics lacked a single chemical which WHO in 1980.²⁰ .

There are two main types of diabetes:

- 1) Type 1 Diabetes
- 2) Type 2 Diabetes.

Type 1 Diabetes:

- Caused by the immune destruction of the beta cells of the pancreas.
- Antibodies to islet cells and insulin are present at diagnosis.
- Insulin secretion gradually diminishes.
- May present at any age, but most common in childhood and adolescence.
- Insulin by injection is necessary for survival.

➤ **Contributing factors:**

- ❖ Genetic predisposition
- ❖ Environmental triggers (infection or other stress)

Type 2 Diabetes:

- Caused by insulin resistance in the liver and skeletal muscle, increased glucose production in the liver, over production of free fatty acids by fat cells and relative insulin deficiency.
- Insulin secretion decreases with gradual beta cell failure.
- Reductions in blood glucose levels often can be achieved with changes in food intake and physical activity patterns. Oral medication and/or insulin injections are eventually required.

➤ **Contributing factors:**

- ❖ Obesity
- ❖ Age (onset of puberty is associated with increased insulin resistance)
- ❖ Lack of physical activity
- ❖ Genetic predisposition
- ❖ Racial/ethnic background (African American, Native American, Hispanic and Asian/Pacific Islander)
- ❖ Conditions associated with insulin resistance, (e.g., polycystic ovary syndrome)

Type 1 diabetes:

In general, T1D athletes exhibiting poor metabolic control (H_gA_{1c} >9%) should refrain from moderate- or higher-level exercise until adequate blood sugar control has been obtained. This is prudent to avoid the risk of exacerbating hyperglycemia and to minimize the risk of progression to frank diabetic ketoacidosis (DKA).⁴⁴ The duration and intensity of exercise will determine the specific modifications that need to be made in the treatment regimen.

Adjustments in both dietary intake and insulin dosing are essential for optimal performance and prevention of deleterious glucose fluctuations. Waiting 60 to 90 minutes after a meal before exercising and monitoring blood glucose both during and after exercise are important baseline management measures. With respect to diet, CHO-rich, low-glycemic-index (see later section) meals should be consumed 1 to 3 hours before exercise.^{38,45} Immediately before and during an exercise bout, consumption of additional CHO (17 g at initiation and 17 g every 15 minutes for 60 minutes for exercise at 65% V_{o2} max) is beneficial in maintaining glucose levels during exercise and particularly after exercise in patients with both T1D and T2D.⁴⁶

The consumption of a low-glycemic-index diet improves metabolic regulation, 47 because these foods require less insulin for optimal glucose utilization. Such foods give a low and slow glucose rise when consumed and include raw cornstarch, nonstarchy vegetables, fruits, nuts, milk, and fructose and lactose sugars. Characteristic High-glycemic-index foods that give rise to rapid and high-glucose responses include white bread and glucose sugars.⁴⁸ Provided that the diet contains enough CHO (at least 35% of total calories) to maintain normal glycogen levels, low-calorie diets can be used in this population without affecting exercise tolerance.⁴⁹

Comfort with insulin adjustments with exercise is essential for athletic success and prevention of acute complications. If pre-exercise blood glucose is 100 to 250 mg/dL, it is generally safe to begin exercising.⁵⁰ American Diabetes Association guidelines⁴² for regulating.

The glycemic response to exercise include the following:

1. Metabolic control before exercise—avoid exercise if fasting glucose is greater than 250 mg/dL and ketosis is present; use caution if glucose is greater than 300 mg/dL with no ketosis; ingest added CHO if glucose levels are less than 100 mg/dL.
2. Blood glucose monitoring before and after exercise—identify when changes in insulin or food intake are necessary, and learn the glycemic response to different exercise conditions.
3. Food intake—consumes added CHO to avoid hypoglycemia with exercise; CHO-rich foods should be readily available during and after exercise. the dose of the intermediate-acting insulin should be reduced (NPH insulin, onset 1–3 hours, peak 4–10 hours).

Insulin absorption is more rapid and less predictable when injected into the leg before exercise.⁵³ The abdomen is the preferred site for athletes because of its ease of access during meals and more predictable absorption time.

Type 2 diabetes:

For T2D athletes, the primary goals for management include not only preserved performance and prevention of hypo- and hyperglycemia but also improved insulin sensitivity and uptake of glucose in skeletal muscle, with a concomitant improvement in postprandial blood glucose. The major metabolic problem for active T2D patients is a reduced capacity to store excess glucose as muscle glycogen.⁵⁷ Consequently, the most important effect of exercise for improving glucose regulation is the lowered glycogen storage in skeletal muscles.⁴⁵ Ideally, if energy stores remain low, the calories consumed in the next meal can be stored as glycogen rather than contributing to hyperglycemia.

T2D athletes on diet therapy alone should be able to exercise with no further caution than individuals with normal glucose tolerance provided no major vascular complications are present.⁵⁸ No pre-exercise CHO intake is necessary. In general, far lower CHO intake during exercise is required of T2D athletes, as these patients have a lower rate of glucose metabolism and a much lower risk of hypoglycemia with exercise training relative to T1D patients. CHO intake for these athletes should only be undertaken during exercise to prevent hypoglycemia, particularly as weight reduction is desirable, and limited CHO intake will be beneficial to this goal. The major adjustment for T2D athletes involves adjustment of oral hypoglycemic therapy as dictated by their glucose values. These medications are reviewed later in this article.

Children:

Current ADA recommendations⁵⁰ for the management of T1D in active children include the following:

1. Eat 15 to 30 minutes before vigorous activity or activity of longer than 30 minutes duration (15 g of CHO are generally adequate for 30 minutes of moderate-intensity activity).
2. Always carry a CHO source.
3. Decrease insulin typically by 10% to 20% before sport activity, with adjustments over time based on glucose values and intensity of training.

Medications:

Medication management of the diabetic athlete requires a delicate balance between maintenance of adequate glucose levels to allow for sport activity while minimizing the likelihood of hypoglycemia. Insulin and medications that stimulate insulin production increase the risk for hypoglycemia and must be used with caution in this population.

The following subsection is a brief review of available medications for use in active diabetics.

Pathophysiological aspects:

- **Type 2 DM** is characterized by insulin insensitivity as a result of insulin resistance, declining insulin production, and eventual pancreatic beta-cell failure. This leads to a decrease in glucose transport into the liver, muscle cells and fat cells. There is an increase in the breakdown of fat with hyperglycemia^{15, 16}.
- **Type 1** diabetic patients are usually young (children or adolescents) and not obese when they first develop symptoms. There is an inherited predisposition, with a 10-fold increased incidence in first-degree relatives of an index case, and strong associations with particular histo compatibility antigens (HLA types). Studies of identical twins have shown that

genetically predisposed individuals must additionally be exposed to an environmental factor such as viral infection.



Diagnosis



The diagnosis of diabetes carries considerable consequences and should therefore be made with confidence. If the patient has classical symptoms (such as increased thirst and urine volume,

unexplained weight loss, pruritus vulvae or balanitis) or drowsiness or coma, associated with marked glycosuria, the diagnosis can be readily established by demonstrating fasting hyperglycaemia. The diagnosis can also be established if a random blood glucose estimation exceeds the diagnostic values. Indicated in Figure 1.

The requirements for diagnostic confirmation for a person presenting with severe symptoms and gross hyperglycaemia will differ from those of the asymptomatic patient whose blood glucose levels are just above the diagnostic cut-off values. For the asymptomatic patient, at least one additional test result with a value in the diabetic range is desirable.

Clinical diagnosis should never be based on the presence of glycosuria alone. The diagnosis of diabetes in pregnancy follows the same criteria.

An OGTT is performed if the diagnosis is uncertain and the blood glucose values are in the equivocal range. It is often sufficient to measure the blood glucose values only after fasting and 2 hours after a 75 g oral (anhydrous) glucose load.

Treatment should not only consider lowering the blood glucose level but also should focus on the correction of any associated CVD risk factors such as smoking, hyperlipidemias, and obesity as well as monitoring of blood pressure and ~treatment of hypertension.

Management of non-insulin-dependent diabetes mellitus (NIDDM) requires teamwork. The doctor should work closely with the nurse and other members of the diabetes health care team, whenever available, and with the person with diabetes.

Understand blood glucose values

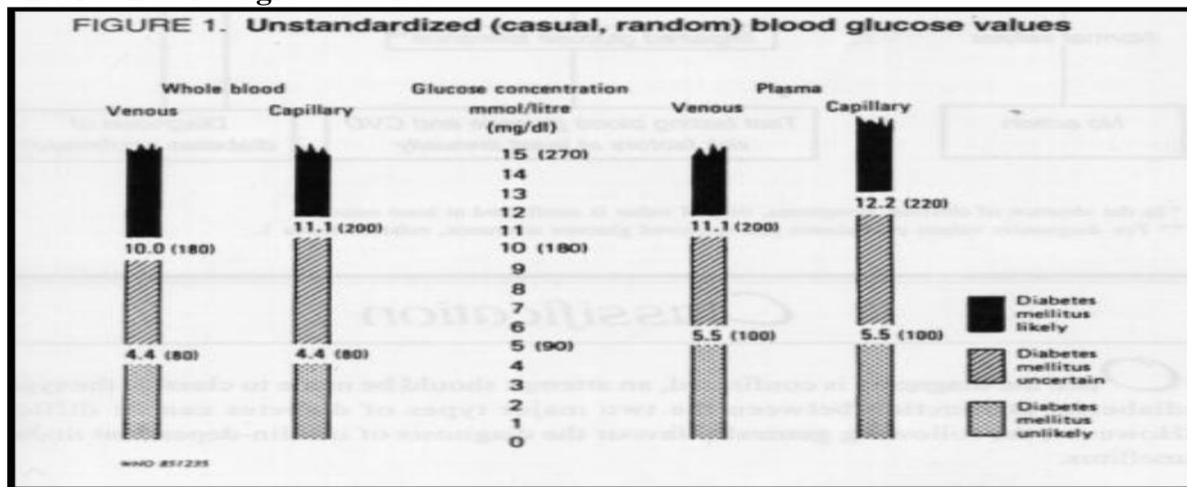


Fig 1: Understood (Casual, random) blood glucose level

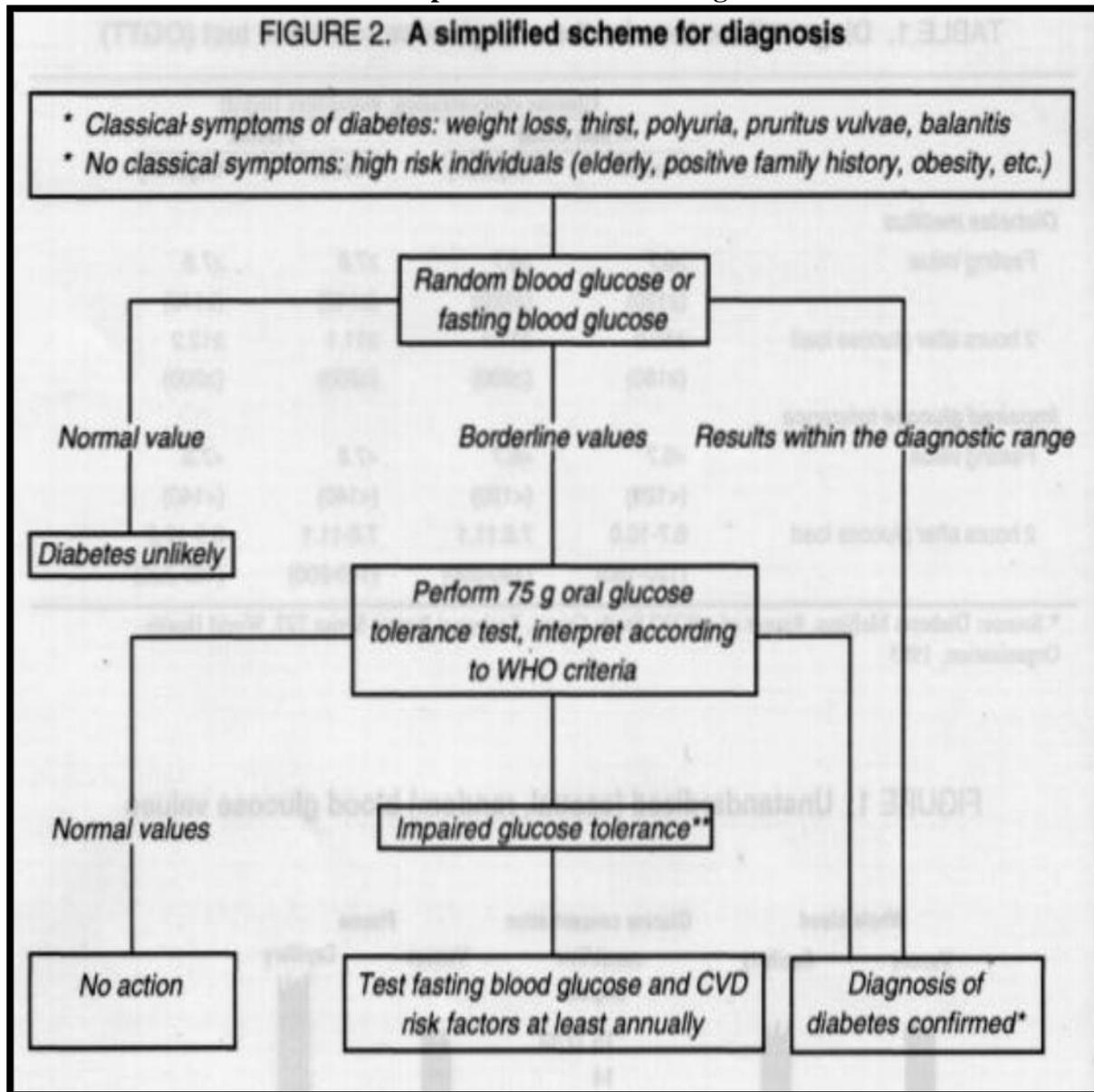


Fig 2: A simplified scheme for diagnosis

* In the absence of obvious symptoms, only if value is confirmed at least once.

* For diagnostic values of diabetes and impaired glucose tolerance

What are the treatment for diabetes?

As yet, there is no “cure” for either type of diabetes, although there are many ways of keeping diabetes under control. Diabetes treatments are designed to help the body to control the sugar levels in the blood. Studies have shown that good control of blood sugar is the key to avoiding diabetic complications.

- **Type 1 diabetes** requires insulin. Injected insulin replaces the insulin missing in the body. You will need to learn how to balance your insulin with your food intake and your physical activity. under the care of a diabetes team, who can assist you in managing your diabetes

- **Type 2 diabetes** treatment will vary dependent on your blood sugar levels. Many patients are counseled to change their lifestyle and lose weight. It is important to work with a diabetes educator and dietitian. Treatment begins with changing certain food

choices and beginning an exercise program. Diabetes is a progressive disease, and the treatment may change over time, requiring oral medication; if you are already taking medication, you may need an increased dose or multiple medications, and eventually, you may need to start on insulin.

To find a diabetes educator contact the American Association of Diabetes Educators at 800-832-6874, or on the web: www.diabeteseducator.org

See your doctor every three months until your blood sugar is in control, once it's under control, your numbers and medication regimen should be reviewed every six month.

Every 3-6 months:

- A1C
- A dental exam.

Each Doctor visit:

- Weight and blood pressure.
- Review all medications and supplements.
- Review lifestyle changes, physical activity, how you are coping with your diabetes at home and at work.
- Discuss changes that may be necessary in the future.
- Review problems: vision, numbness, tingling in your hands or feet, low blood sugar reactions, digestive problems, and sexual problem.

Treatment

The Major Component For Treatment Of Diabetes:

1. diet (combined with exercise if possible)
2. insulin treatment.
3. oral hypoglycaemic therapy.

Education of the person with diabetes is an essential component of management in every case.

To ensure appropriate management, the basic knowledge and skills should be acquired by the patient and his family and the health care team should work closely with the patient to achieve this objective and to promote self-care.

The person with diabetes should also be involved in setting therapeutic targets for weight, blood pressure and blood sugar control.

Basic educational requirements for the person with diabetes and his family are outlined.

Basic educational requirements:

The person with diabetes should acquire adequate knowledge and skills in the following:



- ❖ individual therapy targets.
- ❖ individual nutritional requirements and meal planning.
- ❖ type and extent of exercise and physical activity.
- ❖ interaction of food intake and physical activity with oral hypoglycaemic drugs/insulin.
- ❖ improvements in lifestyle, for example harmful effects of smoking, obesity and alcohol Intake.

-Simplified scheme for treatment of NIDDM:

- c. allowing good glycaemic control with blood glucose levels as close to normal as possible.
- d. correcting any associated blood lipid abnormalities.
- e. ensuring consistency and compatibility with other forms of treatment if used, for example oral agents or insulin.

The following principles are recommended as dietary guidelines for people with diabetes:

— Dietary fat should provide 25-35% of total intake of calories but saturated fat intake should not exceed 10% of total energy. Cholesterol consumption should be restricted and limited to 300 mg or less daily.

— Protein intake can range between 10-15% total energy (0.8-1 g/kg of desirable body weight). Requirements increase for children and during pregnancy. Protein should be derived from both animal and vegetable sources.

- Carbohydrates provide 50-60% of total caloric content of the diet. Although it has been traditionally recommended that carbohydrates should be complex and high in fibre, more emphasis should be placed on the total amount of carbohydrates consumed than the source of carbohydrate.

— Excessive salt intake is to be avoided. It should be particularly restricted in people with hypertension and those with nephropathy.

— Artificial sweeteners are to be used in moderation. Nutritive sweeteners (sorbital and fructose) should be restricted.

— The same precautions regarding alcohol intake that apply to the nondiabetic population also apply to people with diabetes. Additionally, however, alcohol tends to increase the risk of hypoglycemia in those taking antidiabetic drugs and should be particularly avoided in those with lipid abnormalities and patients with neuropathy.

Meal planning :

- ❖ Assessment of dietary intake and individual needs of those with diabetes should be made as part of the initial management. Under optimal circumstances, this task is the responsibility of an experienced dietician, in consultation with the treating physician. However, after appropriate training the physician and the nurse can take on this responsibility in places where dietitians are not available.
- ❖ Meals and food intake should be planned in relation to economic factors and local circumstances concerning availability and cultural and social values. Special consideration should be given to meal planning during the month of Ramadan.

- ❖ Dietary counselling should be a continuing process to be reinforced during each visit by all members of the health care team.
- ❖ Meals should be evenly distributed throughout the day. Consistency of food timing and energy intake from day to day should be emphasized, especially by those taking insulin.

Exercise :

Physical activity promotes weight reduction and improves insulin sensitivity, thus lowering blood glucose levels.

Together with dietary treatment, a programme of regular physical activity and exercise should be considered for each person. Such a programme must be tailored to the individual's health status and fitness. People should, however, be educated about the potential risk of hypoglycaemia and how to avoid it.

***INSULIN*****People with diabetes should:**

- be taught self-monitoring techniques.
- have their skills checked periodically and reinforced. The precision of blood glucose measurement should be verified at least every six months.
- keep a record of self-monitoring results.

— be assisted in acquiring knowledge and developing skills that enable them to modify treatment according to the results of self-monitoring.

Urine glucose testing :

- may be an effective tool for monitoring diabetes control in situations where frequent blood glucose testing is not possible, although it provides no information on hypoglycaemia;
- is an alternative in people refusing blood testing;
- may be an acceptable method of monitoring in elderly people with a stable condition and for those in whom strict glycaemic control is not important;
- is generally unreliable during pregnancy.

Guidelines for urine testing:

- use a second-void urine specimen.
- The goal is a persistently negative test (in people with normal renal threshold)
- Check blood glucose if urine >2%

• Check urine ketones when:

- Blood glucose is consistently >300 mg
- Urine glucose is consistently >2%
- During intercurrent illnesses

• Frequency of urine glucose testing:

- Daily at fasting
- Before main meals and at bedtime once weekly in stable patients and more

frequentl in poorly controlled cases.

Hypoglycaemia :

Hypoglycaemia is a common complication of drug treatment and is a particular risk in insulin-treated patients. Severe episodes can lead to serious complications and may be potentially fatal if left untreated.

Hypoglycaemia is likely to occur under the following circumstances:

- omission of meals or inadequate food intake.
- with unaccustomed physical exercise.
- overtreatment with insulin or sulphonylureas.
- ingestion of alcohol particularly without food.
- diminishing insulin requirements due to impaired renal function.

Treatment of hypoglycaemia :

- Hypoglycaemia is a medical emergency and should always be treated promptly.
- Blood glucose should be measured, using glucose-sensitive reagent strips to confirm the diagnosis in suspected cases. But if this measurement is not available, immediately treat as hypoglycaemia.
- If the patient is confused and uncooperative or unconscious, give 10-20 grams of 20% or 50% glucose intravenously.

Approach to the Management of Hyperglycemia:

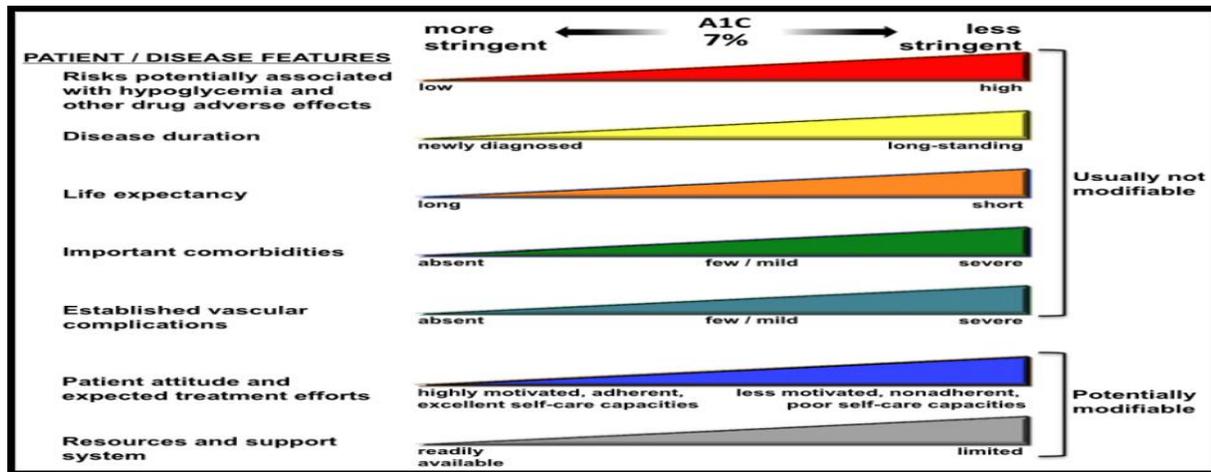


Fig 4: Approach to the Management of Hyperglycaemia

Nephropathy:

Diabetic nephropathy is a major cause of death among people with diabetes and an important cause of morbidity and increased health care costs due to diabetes. It leads to end-stage renal disease requiring dialysis or renal transplantation

This complication may be prevented and progression can be slowed by:

- Strict glycaemic control.
- Vigorous treatment of hypertension.
- Avoidance of nephrotoxic drugs and early and effective treatment of infection.

The onset of clinical nephropathy is manifested by proteinuria. However, an earlier marker of the onset of nephropathy is the presence of microalbuminuria (defined as an overnight excretion of 20-200 microg/min or excretion of >30 mg/24-hr) on more than one occasion.

The following action should be taken:

- People with diabetes should have their urine tested for protein at initial assessment and periodically at annual reviews.

- In the absence of proteinuria, a test for microalbuminuria is recommended where local resources permit.
- In the presence of microalbuminuria or gross proteinuria:
 - Full assessment of renal function should be performed periodically
 - Treatment of hypertension should be instituted as early as possible and good control should be achieved. Emphasis should be given to avoidance of nephrotoxic drugs and early and effective treatment of infection
 - Optimal diabetes control should be ensured dietary modifications in the form of reduced protein intake and salt restriction should be considered if the need arises.

Neuropath: Neuropathy is a common complication of diabetes. It causes clinical manifestations and disabilities of diverse spectrum and considerable severity. Both peripheral nerves (sensory and motor) and the autonomic nervous system can be affected. Patients present with distal symmetric al polyneuropathy, focal neuropathy or manifestations of autonomic involvement such as gastroparesis, constipation, diabetic diarrhoea, bladder dysfunction, impotence and orthostatic hypotension.

Foot care

Severe foot lesions requiring amputation are one of the major complications of diabetes. The two main approaches to prevention are: (1) identification of high-risk individuals, and (2) early detection of foot lesions: for example, trauma, infection or ulcers.

Intensified foot care should be ensured for patients at high risk, such as those with:

- symptoms and/or signs of neuropathic involvement
- evidence of peripheral vascular disease
- nephropathy or significant retinopathy
- foot deformities and chronic orthopaedic or rheumatic disorders, and
- poor hygiene.

Instructions on foot care should be an integral part of any educational activity on diabetes.

They should focus on:

- Self-examination
- Avoidance of trauma



- Cessation of smoking, and
- wearing properly fitting shoes.

Efforts should be intensified in respect of high-risk people. Health-care professionals, other than doctors, at the primary health care level should be trained to identify such individuals and recognize early lesions. Patients with suspected or confirmed abnormalities should be sent for medical consultation.

DIABETES AND PREGNANCY

Good glycaemic control has special importance during pregnancy. Maternal and perinatal complications can be reduced if good control is achieved before and during conception. Good biochemical control before pregnancy is important since hyperglycaemia seems to be a major factor in the development of congenital malformations and the risk of these malformations is highest during the first eight weeks of gestation.

Guidelines for the management of diabetes during pregnancy:

- Intensive education and management of the woman with diabetes should start several months before conception to ensure strict control during the early weeks of pregnancy.

Pregnancy may have to be deferred until optimal control is achieved.

- Women well controlled on oral hypoglycaemic drugs should be changed over to insulin and achieve optimal blood glucose control before conception.
- Those well controlled on diet alone may continue on such therapy as long as they are carefully monitored to assess the need for insulin.

Screening for diabetes during pregnancy:

A substantial proportion of women of childbearing age develop gestational diabetes mellitus (GDM). GDM is defined as diabetes which is first detected during pregnancy. In order to prevent maternal and perinatal complications of diabetes, early detection of glucose tolerance abnormalities during pregnancy is important.

The following recommendations on screening for GDM during pregnancy in the Eastern Mediterranean Region were made during the First WHO Regional Meeting on Diabetes in 1992:

Those at high risk include women with:

- Previous GDM or IGT
- A family history of diabetes.
- Adverse obstetric history.— history of giving birth to a big baby.
- History of a congenital malformation affecting the newborn in a previous pregnancy.

The WHO criteria for the diagnosis of glucose tolerance abnormalities can be used during pregnancy.

These recommendations may be modified in different countries of the Region according to local circumstances and resources.

They are also subject to change as more knowledge is gained on the importance of the various risk factors in determining the predisposition to GDM.

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