Chapter – VI

Management of Diabetes Mellitus
CHAPTER VI

MANAGEMENT OF DIABETES MELLITUS

The prevalence of diabetes mellitus is increasing worldwide, and non-insulin dependent (type II) diabetes mellitus has acquired epidemic proportions in many ethnic groups and in many countries, it is predicted that the prevalence of insulin-dependent (type I) diabetes mellitus and type II diabetes mellitus by the year 2010 will be 23.7 million and 293.3 million, respectively. The burden of this disease on human health is a major concern everywhere, and its economic impact on the public health system is serious. Thus continued efforts to establish early diagnosis and preventions of diabetes mellitus and its complications must be given high priority.

Ever since the epoch making discovery of insulin, the life expectancy of patients with diabetes has steadily increased over the years. This has led to the realisation of chronic angiopathic complications of diabetes, which were otherwise unheard of in the pre insulin era. Despite modern advances in the management of diabetes, chronic complications of diabetes remain a serious cause of concern because of substantial increase in morbidity and mortality and reduction in quality of life. Diabetes is truly a costly disease mainly because of its chronic complications.

TABLE NO: 6-1

CHRONIC COMPLICATIONS OF DIABETES

<table>
<thead>
<tr>
<th>• Mortality increase by 2-3 folds</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Heart disease and stroke increased by 2-3 folds.</td>
</tr>
<tr>
<td>• Blindness 10 times more common than in the general population.</td>
</tr>
<tr>
<td>• Gangrene and amputation about 20 times more common than in the general population</td>
</tr>
<tr>
<td>• Second leading cause of fatal kidney disease.</td>
</tr>
<tr>
<td>• Other chronic disabilities (e.g., neuropathy, infections and sexual dysfunctions).</td>
</tr>
<tr>
<td>• Hospitalisation increased 2-3 folds.</td>
</tr>
</tbody>
</table>

Source: WHO expert committee on Diabetes mellitus, 1980.

Prevention of complications can be primary and secondary. Primary prevention can be defined as prevention of onset of complications associated with the disease. The chronic complications of diabetes can be microvascular e.g., retinopathy, nephropathy and neuropathy, and macrovascular e.g. cerebro vascular, coronary artery and peripheral vascular disease. Microvascular complications seen in diabetic are specific and are seen exclusively in the presence of persistent hyperglycemia. However, macrovascular complications are not specific as they are seen even in non diabetics. Presence of diabetes only accelerates the macrovascular complications. Ticking clock metaphor states that unlike microangiopathy where the clock starts ticking with the onset of diabetes, in case of macroangiopathy, the clock may start ticking a decade or two earlier.

Secondary prevention can be defined as arresting the progress of pre-existing complication and thus preventing the occurrence of end point of the particular complications e.g. blindness due to retinopathy, endstage renal failure due to nephropathy and leg amputation due to neuropathy or peripheral vascular disease.

Primary prevention of macrovascular complications is a difficult proposition because by the time the diagnosis of diabetes is made, process of atherosclerosis has already set in. However, identification of high risk individuals and aggressive control of modifiable risk factors should be emphasised. Life style modifications, good metabolic control, tight blood pressure control, drug therapy like aspirin and lipid lowering agents are some of the important strategies.
TABLE NO: 6-2
STRATEGIES FOR PRIMARY PREVENTION OF MACROVASCULAR COMPLICATION

<table>
<thead>
<tr>
<th>Life style modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet</td>
</tr>
<tr>
<td>Exercise</td>
</tr>
<tr>
<td>Optimisation of body weight</td>
</tr>
<tr>
<td>Cessation of Smoking</td>
</tr>
<tr>
<td>Reduction in mental stress</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metabolic Control of Diabetes</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Optimum Control Of Blood pressure</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Drug therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
</tr>
<tr>
<td>Lipid lowering agents</td>
</tr>
</tbody>
</table>

It is quite rational that any strategy is likely to be more effective in primary than in secondary prevention – secondary prevention can yield desirable results only if complications are picked up when they are young. Hence emphasis should be on early detection by regular screening for complications.

One should aim at keeping, blood pressure as close to normal as possible to reduce the risk of death from long term complications of diabetes, especially heart disease and stroke and reduce disability due to microvascular complications.
### TABLE NO: 6-3

**ANNUAL SCREENING FOR COMPLICATIONS OF DIABETES**

<table>
<thead>
<tr>
<th>Target organs</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retina</td>
<td>Visual acuity</td>
</tr>
<tr>
<td></td>
<td>Ophthalmoscopy</td>
</tr>
<tr>
<td>Renal</td>
<td>Micro albumin estimation</td>
</tr>
<tr>
<td></td>
<td>Macro albumin estimation</td>
</tr>
<tr>
<td>Peripheral nerves</td>
<td>Foot examination</td>
</tr>
<tr>
<td></td>
<td>10 gm Monofilament for detection of loss of protective sensations</td>
</tr>
<tr>
<td></td>
<td>Biothesiometry</td>
</tr>
<tr>
<td></td>
<td>Plantar pressure measurement</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>ECG</td>
</tr>
<tr>
<td></td>
<td>Blood Pressure: Supine and Standing</td>
</tr>
<tr>
<td></td>
<td>Estimation of serum lipids</td>
</tr>
<tr>
<td>Peripheral vessels</td>
<td>Palpation of all peripheral pulsation and Foot examination.</td>
</tr>
<tr>
<td></td>
<td>Ankle / Brachial pressure measurement (ABI)</td>
</tr>
</tbody>
</table>

However, it is not uncommon to see a diabetic presenting with marked visual loss due to advanced retinopathy with meticulously maintained blood glucose records over the last several years without even one mention of retinal examination and this story holds true for end stage renal failure and diabetic foot as well. On the other hand about 10 per cent of the patients have evidence of retinopathy at the time of diagnosis, obviously because of undetected type 2 diabetes for several years. This unfortunately deprives them from primary prevention of microvascular complications. The concept that optimum management of diabetes is beyond mere blood glucose control needs to be inculcated in the minds of both patients and treating physicians.
Managing diabetes has been described as probably the most complex and demanding of any common disease, for it requires a combination of one or all of the following.

- Complex nutritional practices
- Weight management
- Exercise
- Frequent monitoring of blood and urine glucose
- Foot care, special precautions
- Use of oral antidiabetic drugs of insulin
- Learning technological skills such as home blood glucose monitoring

Problems can occur in adhering to treatment, in attempting to prevent complications and in adjustment to complications if and when they occur. It is therefore difficult to adhere to such a complex management protocol 'to forestall some far-off poorly perceived danger particularly when they are made uncomfortable in the process'.

"The concept of mental well-being as an integral component of Ayurvedic system of medicine..., the latter type of morbidity (is quieted) by spiritual knowledge, philosophy, fortitude, remembrance and concentration. Similarly, the emphasis has shifted from illness-centered medicine to patients centered medicine"\(^2\).

In tune with the need for multifaceted management, many professionals including the physician, dietitian, lab personnel, diabetes educator, as well as the family and society around the individual provide diabetes care, directly or indirectly. Proper management of diabetes interacts with so many aspects of life; one needs to consider the nature of medical systems, the ways of health maintenance and health seeking behaviour and finally the sociocultural factors that can influence health care behaviour.

Human societies have different beliefs and practices related to illness. Within the society, there is also a medical cultural system, analogous to the

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religious or political systems. It 'includes the ways that a person is recognised as ill', the ways they present this illness to other people, the attributes of those health personnel present their illness to, and the ways that the illness is dealt with. Now a few management techniques is given in the subsequent pages.

DIET

DIET should be the mainstay of all diabetic management!

- In order to ensure compliance, the prescribed diet should be individualized.
- It must be realistic, flexible, and take into consideration the patient's likes and dislikes, to as large an extent as possible, and must suit the patient's lifestyle. It is important to educate the patient about the basic requirements of the diet and judge compliance at regular intervals.

Points to be considered in planning a diet for a diabetic patient:

- Daily energy intake must be estimated after considering such factors as age, sex, actual weight in relation to desirable weight, activity and occupation. Adequate calories for the existing weight gradually raised for the expected weight, due to allowance for activity. 1000 calories for age one and +100 kcal for each additional year of age for young diabetics should be given. Diet low in calories and high in fibre should be suggested for obese diabetics. An obese middle aged or elderly person can have 1000 – 1600 kcal and elderly and not overweight can have 1400-1800 kcal and an active young person can have 1800-3000 kcal. The total intake of calories is more important for a diabetic than the exact proportions of protein, fat and carbohydrate in the diet. A diabetic should maintain standard body weight or slightly lower.

- Dietary calories should be 60 – 70 per cent from protein and 15 – 25 per cent from fat. The minimum amount of carbohydrate should be 100 gm to prevent ketosis.

- Simple sugars should be restricted since they are easily absorbed and have a high glycaemic index. Avoid glycaemic peaks.
Insulin is adjusted depending upon the need. Calorie distribution is adjusted according to type of insulin.

Fat with high poly unsaturated fatty acids like vegetable oil is preferred (sunflower oil, corn oil, gingelly oil) than animal fat and hydrogenated fat which contain more saturated fatty acids. Fish and chicken are preferred than meat and egg. Turmeric, Bengal gram, onion and garlic have cholesterol lowering effect. Avoid atherogenic diet.

High protein intake helps to increase insulin production and promotes satiety.

Vitamins and minerals are supplemented to meet daily requirement (especially fat soluble vitamins).

Whole wheat is preferred to rice because it contains "Ascarbose" which allow carbohydrate to be absorbed slowly.

Timely intake of in between meal snacks should be stressed to avoid Hypoglycemia. Three main meals and three between meal snacks can be taken.

Foot exchange lists should be followed to prevent hypo and hyperglycemia.

The exchange system should be followed to avoid monotony, dietary constancy and flexibility.

Complex carbohydrate and fiber should be included in the diet. 25-40gm of dietary fiber can be included for each 1000 kcal consumed.

Influence of chew count, glycaemic indices, type and form of food in altering the blood sugar level should be recognized.

The water soluble fibre has greatest hypoglycemic and hypocholesterolemic effect. The diet should include legumes, whole grain and fenugreek seeds.

Constant carbohydrate/calorie meal plan (CCMP) instead of "free diet" or "rigid diet" should be recommended.

Patients should avoid fasting and feasting.

Regulation of meals is needed for persons taking insulin. Meal should be spaced to consider with the availability of insulin.
• In insulin or an oral hypoglycemic agent is not required, marked obesity is not present or hyperglycemia is relatively mild, it may not be necessary for the patient to follow such accurate diets.

• Sodium intake is to be no more than 6gm daily. Sodium is restricted to 3gm in hypertensive diabetic patients.

• Instead of simple sugar artificial sweeteners may be suggested.

### TABLE 6.4

**SAMPLE DIET PLAN**

<table>
<thead>
<tr>
<th>MEAL</th>
<th>MENU</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early morning</td>
<td>Tea, Marie biscuit</td>
<td>1 Cup (Use skimmed milk)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Biscuits</td>
</tr>
<tr>
<td>Breakfast</td>
<td>Mix – vegetable Polao /</td>
<td>1 Small Plate</td>
</tr>
<tr>
<td></td>
<td>Dhal / Upma, Protinex</td>
<td>1 Cup</td>
</tr>
<tr>
<td></td>
<td>With Low fat milk</td>
<td>200 ml</td>
</tr>
<tr>
<td>Mid day</td>
<td>Fruit</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Channa sundal</td>
<td>1 Cup</td>
</tr>
<tr>
<td>Lunch</td>
<td>Salad</td>
<td>1 Small plate</td>
</tr>
<tr>
<td></td>
<td>Option I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chapatti / Rice</td>
<td>2 / 1 plate</td>
</tr>
<tr>
<td></td>
<td>Vegetable poriyal</td>
<td>1 Cup</td>
</tr>
<tr>
<td></td>
<td>Dhal</td>
<td>1 Cup</td>
</tr>
<tr>
<td></td>
<td>Low fat Curd</td>
<td>1 Cup</td>
</tr>
<tr>
<td></td>
<td>Option II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pesarattu – 2</td>
<td>2 Cup</td>
</tr>
<tr>
<td></td>
<td>Green gram whole</td>
<td>½ Cup</td>
</tr>
<tr>
<td></td>
<td>Rice</td>
<td>1 Cup</td>
</tr>
<tr>
<td></td>
<td>Fenugreek seeds</td>
<td>2 Teaspoon</td>
</tr>
<tr>
<td></td>
<td>Dhal Sambhar</td>
<td>1 Cup</td>
</tr>
<tr>
<td></td>
<td>Curd rice</td>
<td>½ Cup</td>
</tr>
<tr>
<td>Evening</td>
<td>Protinex in low fat milk</td>
<td>200ml (Use skimmed Milk)</td>
</tr>
<tr>
<td></td>
<td>Vegetable sandwich</td>
<td>2 Slices of bread</td>
</tr>
<tr>
<td>Dinner</td>
<td>Salad</td>
<td>1 small plate</td>
</tr>
<tr>
<td></td>
<td>Chapatti / Rice</td>
<td>2 / 1 plate</td>
</tr>
<tr>
<td></td>
<td>Green leafy vegetable</td>
<td>1 Cup</td>
</tr>
<tr>
<td></td>
<td>Dhal / Fish / Chicken</td>
<td>1 cup / 1 piece / 50 gm</td>
</tr>
<tr>
<td></td>
<td>Curry</td>
<td></td>
</tr>
<tr>
<td>Bed Time</td>
<td>Apple &amp; Rice Kheer</td>
<td>200 ml</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carrot &amp; Rice kheer</td>
<td></td>
</tr>
</tbody>
</table>

Non-calorie sweetener to taste
EXERCISE

- Regular exercise is recommended as an important component of all Diabetes management regimen.
- Regular exercise confers benefits not only on glycemic control, but also on insulin sensitivity, lipid abnormalities, cardiovascular system, physical fitness, psychological well being, optimising body weight and disease prevention.
- It is however being increasingly recognized that exercise programmes carried out without adequate precautions, do carry some risks as well.
- The potential adverse effects can be on the cardiovascular as well as on the musculoskeletal systems. Incautiously carried out severe exercise, may predispose the patient to unexpected hypoglycemia, and also, exacerbate exiting diabetic complications leading to retinal bleeds and significant increases in renal dysfunction.
- These risks can be minimized with pre-exercise screening, individualized exercise programme prescription, careful monitoring and patient education.

A Regular Exercise programme, tailor made for every individual and undertaken after due fitness evaluation, with regular monitoring, is an essential part of modern diabetes management!

PRE – EXERCISE EVALUATION

- All patients should undergo a complete history and examination to identify cardiac, Macro / Micro vascular and neurologic complications. The extent of investigation would depend on the risk level of the patient and would need to be individualized.
- Exercise should not be prescribed to patients with very high blood glucose, and those in ketosis, unless treated adequately.
- Patients with significant retinopathy and renal dysfunction may also need to undergo specific treatment before embarking on an exercise programme.
- Patients with foot infections should avoid exercise until adequately treated.
- Patients with cardiovascular abnormalities should not undertake exercise unless this is in close consultation with cardiologist.
- Other contraindications to exercise as seen in non diabetics also apply to patients with diabetes.

**TYPE OF EXERCISE**
- The exercise should be aerobic and isotonic.
- Although the patient may be allowed to choose his own form of safe, exercise for most patients.
- Isometric exercises, such as weight lifting, etc., are not recommended.

**FREQUENCY AND DURATION**
- The frequency should be around 3-5 days a week, at the least.
- The duration of each exercise session should be around 30-40 minutes, with a five minute warm up and a five minute cooling off period. The duration and frequency may be adjusted to individual needs.

**INTENSITY**
- The intensity of the exercise needs to be individualized.
- Intensity is usually measured in terms of the percentage of the patients maximum heart rate (MHR). Initial exercise should be at a reduced intensity which should then be increased to reach about 60-70% of the MHR. (MHR=220-age of the patient).
- Limiting the intensity of the exercise such that the systolic blood pressure does not exceed 180mm Hg would seem prudent.
- Any patient undergoing an exercise programme, who complaints of any signs or symptoms which would have contraindicated such a programme initially, should discontinue the programme, and have a detailed re-evaluation before restarting the exercise regimen.
• When the patient does start the exercise programme again, the intensity should be such as it the patient were beginning the exercise programme a new. The exercise programme should never be restarted at the intensity at which it was discontinued.

• An excellent parameter to judge, is that the patient should be able to carry out a normal conversation whilst exercising, without getting unduly breathless.

SPECIAL PRECAUTIONS

• Correct footwear is absolutely essential during exercise.

• The clothes worn by the patient should be loose and comfortable

• Feet should be inspected daily and after an exercise schedule.

• Exercise during period of poor metabolic control ( blood glucose more than 250 mg and/or ketosis ) should be avoided.

• Patients taking insulin will need to modify their insulin dosages and diet; this is true also for patients taking long acting sulfonylurea.

• There is a risk for developing hypoglycemia if extremely vigorous exercise is carried out on an empty stomach. It would appear prudent to take an extra snack of complex carbohydrate either, before or immediately after any unexpected vigorous activity or exercise in order to protect against hypoglycemia. If necessary an additional snack in the mid activity, may also be advisable.

• It is not generally widely known that the blood glucose lowering effect of any vigorous exercise/activity is completed. Thus, some patients may need to modify their subsequent dose of insulin or OHA, and also increase their food intake at the meal following the unduly vigorous exercise/activity. Such diet and drug modifications are usually required only whilst undertaking unexpected and unduly vigorous forms of exercise or activity.
EXERCISE PROGRAMME WHICH IS A PART OF ONE'S REGULAR DIABETES MANAGEMENT PLAN WOULD RARELY NEED SUCH MODIFICATIONS

- Close monitoring of the metabolic and cardiovascular parameters is essential, at least, in the initial stages of any exercise programme. Continuous evaluation for musculoskeletal strain is mandatory.

SKIN CARE

Diabetes causes changes in tiny blood vessels that supply the skin with nutrients. Therefore proper skin care is important to prevent bacterial and fungal infections, impaired nerve sensations, dry, itchy skin and other skin disorders. Hence the guidelines for personal hygiene are:

- After bathing the skin should be kept dry, particularly in the skin folds in the armpits, the groin, and under the breasts. Talcum powder can be used to stay dry.
- When bathing, excessive hot water should be avoided and a super fatted soap should be used to lubricate the skin.
- During the cold winter seasons, humidifier can be used to moisten the air. If the humidity is low, lubricating skin oil can be used to moisturise the skin.
- People with impaired nerve sensations are susceptible to infections, particularly in the legs and feet. Therefore professional assistance should be sought for pressure injuries from shoes or changes in the colour of the skin and proper management of open wounds. Since an injury to the feet may not be felt readily by a diabetic person, feet should be checked frequently.
- Excessive exposure to sun should be avoided as the burns are serious to a diabetic because of infection, dehydration and altered diabetic control.

DENTAL CARE

Oral hygiene is an important aspect of overall diabetic care. Teeth and mouth tissues must be in good health to prevent dental problems that could have serious complications, such as gingivitis. In order to keep the mouth and teeth in good condition, following care should be taken.
• Dentist should be consulted twice a year. Teeth should be cleaned regularly.
• Regular brushing of the teeth twice a day is a must. If possible, teeth should be brushed while away from home after meals by keeping a tooth brush in the purse or pocket.

Professional advice should be sought in care of sores, scratches or other injuries that appear in the mouth. Hard tooth brushes should not be used as it irritates delicate oral tissue.

EYE CARE

To preserve the vision, eyes and vision should be checked periodically by an ophthalmologist. In the case of a diabetic who wear glasses, then the prescription should be up to date.

❖ If the vision is blurred or changed markedly, then the physician should be consulted for early treatment.
❖ If there are signs of diabetic changes, the ophthalmologist or retinal specialist advises an angiogram test. In this test, a dye is injected into the arm and pictures are taken of the eyes to indicate blood vessel changes. Early treatment of these vascular changes with laser or other techniques has been extremely important in preventing progressive eye changes that occur in long time diabetes.
❖ Wear protective eyewear while manipulating machinery that may cause flying particles. Wear sunglasses while outdoors in bright sunlight.
❖ Do not rub the eyes unnecessarily. In case of shaving, applying make-up, or removing foreign objects from the eye, the hands should be clean.
❖ Avoid straining the eyes. There should be adequate lighting when reading, writing, or working.

RETINOPATHY

Retinopathy due to diabetes is one of the leading causes of blindness. Cells lining the retinal blood vessel walls abut each other in “tight junctions”, much like tiles on a wall. Normal concentration of a protein called occludin is
needed to maintain the integrity of these tight junctions. In diabetic rodents
the amount of occuludin is known to be decreased by 35 per cent. The
leakage from these junctions results in macular edema, the type of
retinopathy more commonly seen in type 2 diabetes mellitus and less
amenable to laser treatment. Leakage from these tight junctions is perhaps
mediated by histamine. Histamine is thought to inhibit Occuludin, a key
protein that regulates junction permeability. Occuludin is greatly reduced in
retinas of diabetics. Furthermore, the nerve cells in retina (neurons and glial
cells) also interact with the vascular cells. Glial cells (nerve connective
properties) become functionally impaired in diabetics at about the same rate
that occuludin reduces.

Besides disturbance of tight junctions, there are certain abnormalities
of glial cells; more specifically the Muller cells. In diabetics these cells are
known to over-express a protein called glial fibrillary acidic protein (GFAP),
which is a hallmark of 'reductive astrocytosis'\textsuperscript{107}. Muller cells express GLUT-1
and thus are affected by hyperglycemia. The proliferative retinopathy has its
genesis from retinal ischemia, the first even probably being that of a capillary
closure. The pericytes as well as endothelial cells have a role in this initial
event. Closure of capillaries is caused by microthrombosis and leucostasis.

Patients with type 1 diabetes should be screened annually for
retinopathy five years after the onset of diabetes. Patients with type 2
diabetes should have an initial examination (dilated ophthalmoscopy by an
ophthalmologist) for retinopathy shortly after the diagnosis of diabetes is
made and subsequently repeated annually.

When planning pregnancy, women with preexisting diabetes should be
counseled on the risk of development and/or progression of diabetic
retinopathy. Women with diabetes who become pregnant should have a
comprehensive eye examination in the first trimester and close follow-up
throughout pregnancy. This does not apply to women who develop
gestational diabetes, because such individuals are not at increased risk for
diabetic retinopathy.
Patients with macular edema, moderate to severe non-proliferative retinopathy, or any proliferative retinopathy require the prompt care of an ophthalmologist who is knowledgeable and experienced in the management of diabetic retinopathy.

**TABLE 6.5**

**MANAGEMENT OF DIABETIC RETINOPATHY**

**PCP SCREENING**

- **Initial Exam**
  - Type 1
  - Type 1
  - Type 1

**FIRST EXAM**

- Five years after onset
- At diagnosis
- Prior to conception or early in first trimester

**ROUTINE VISIT**

Non-dilated fundoscopic exam

- **INDICATIONS FOR REFERRAL**
  - Sudden visual changes
  - Blurring or disturbed vision
  - Difficulty with night vision reading
  - Floaters
  - Neovascularization near disc
  - Rapidly progressing background or proliferative retinopathy

- **Ophthalmology referral required?**
  - YES → **OPHTHALMOLOGY**
  - NO

- One year since last ophthalmology exam?
  - YES

**FOOT CARE**

- Daily feet inspection, including areas between the toes.
- Regular washing of feet with careful drying, especially between the toes.
• Temperature of the water should always be less than 37°C.
• Avoidance of barefoot walking in-or outdoors and wearing of shoes without socks.
• Chemical agents or plasters to remove corns and calluses should not be used.
• Daily inspection and palpation of the inside of the shoes.
• If vision is impaired, the patient should not try to treat the feet (e.g. nails) by themselves.
• Lubricating oils or creams should be used for dry skin, but not between the toes.
• Daily change of stockings.
• Wearing of stocking with seams inside or preferably without any seams at all.
• Cutting nails straight across.
• Corns and calluses should not be cut by patients, but by a health care provider.
• The patient must ensure that the feet are examined regularly by a health care provider.
• The patient should notify the health care provider at once if a blister, cut, scratch or sore has developed.

Inappropriate foot wear is a major cause of ulceration. Appropriate footwear (adapted to the altered biomechanics and deformities) is essential for prevention. Patients without loss of protective sensation can select off-the-shelf footwear by themselves. In patients with neuropathy and/or ischemia, extra care must be taken with the fitting, particularly when foot deformities are also present. The shoe should not be too tight or too loose. The inside of the shoe should be 1-2 cm longer than the foot itself. The internal width should be equal to the width of the foot at the site of the metatarsal phalangeal joints and the height should allow enough room for the toes. The fitting must be evaluated with the patient in standing position, preferably at the end of the day. If the fitting is too tight due to deformities or if there are signs of abnormal loading of the foot (e.g. hyperemia, callus, ulceration), patients
should be referred for special foot-wear (advice and/or construction), including insoles and orthoses.

In a high risk patient callus, nail and skin pathology should be treated regularly, preferably by a trained foot care specialist. If possible, foot deformities should be treated non-surgically (e.g. with an orthosis).

A standardised and consistent strategy of evaluating wounds is essential and will guide further therapy. Ill-fitting are the most frequent cause of an ulcer, even in patients with 'pure' ischemic ulcers. Therefore, the shoes should be examined meticulously in all patients.

Most ulcers can be classified as neuropathic, ischemic or neuro-ischemic. This will guide further therapy. Assessment of the vascular tree is essential in the management of a foot ulcer.

Neuropathic ulcers frequently occur on the plantar surface of the foot, or in areas overlying a bony deformity. Ischemic and neuro-ischemic ulcers are more common on the tips of the toes or the lateral border of the foot.

The depth of an ulcer can be difficult to determine due to the presence of overlying callus or necrosis. Therefore, neuropathic ulcers with callus and necrosis should be debrided as soon as possible. This debridement should not be performed in ischemic or neuro-ischemic ulcers without signs of infection. In neuropathic ulcers the debridement can usually be performed without anesthesia.

Effective organisation requires systems and guidelines for education, screening, risk reduction, treatment and auditing. Local variations in resources and staffing will often determine the ways in which care is provided. Ideally, a foot care program should provide:

- Education to patients, carers and health care staff in hospitals.
- A system to detect all patients at risk, with annual foot examination of all known patients.
• Measures to reduce risk, e.g. podiatry and appropriate footwear.
• Prompt and effective treatment.
• Auditing of all aspects of the service, to ensure that actual practice meets standards determined by local implementation of these guidelines.
• An overall structure which is designed to meet the needs of patients requiring chronic care, rather than simply responding to acute problems when they occur.

Ideally a foot care team would consist of a diabetologist, surgeon, podiatrist, educator, and plaster technician, in close collaboration with an orthopedic, podiatric and/or vascular surgeon and dermatologist.

**NEUROPATHY**

Foot complications are one of the most serious and costly complications of diabetes mellitus. Amputation of (part of) a lower extremity is usually preceded by a foot ulcer. A strategy which includes prevention, patient and staff education, multidisciplinary treatment of foot ulcers and close monitoring can reduce amputation rates by 49-85 per cent.

Although the spectrum of foot lesions varies in different regions of the world, the pathways of ulceration are probably identical in most patients. Diabetic foot lesions frequently result from two or more risk factors occurring together. In the majority of patients, diabetic peripheral neuropathy plays a central role; up to 50 per cent of Type 2 diabetic patients have neuropathy. Neuropathy leads to an insensitive and subsequently deformed foot with, possibly, an abnormal walking pattern. In neuropathic patients, minor trauma, caused for example by ill-fitting shoes, walking barefoot or an acute injury, can precipitate a chronic ulcer. Loss of sensation, foot deformities, and limited joint mobility can result in abnormal biomechanical loading of the foot. As a normal response callus is formed, but finally the skin breaks down, frequently preceded by subcutaneous hemorrhage. Whatever the primary cause, the patient continues walking on the insensitive foot, impairing subsequent healing. Peripheral vascular disease, usually in conjunction with minor trauma, may result in a painful, purely ischemic foot ulcer. However, in
patients with both neuropathy and ischemia (neuro-ischemia), symptoms may be absent despite severe peripheral ischemia. Micro-angiopathy should not be accepted as a primary cause of an ulcer.

Five cornerstones of the management of the diabetic foot are regular inspection and examination of the foot at risk, identification of the foot at risk, education of patient, family and healthcare providers, appropriate footwear and treatment of non-ulcerative pathology.

All diabetic patients should be examined at least once a year for potential foot problems, and patients with demonstrated risk factor(s) should be examined more often (every 1-6 months). The absence of symptoms does not mean that the feet are healthy, since the patient can have neuropathy, peripheral vascular disease or even an ulcer without any complaints. The feet should be examined with the patient lying down and standing up, and the shoes and socks should also be inspected.

Following examination of the foot, each patient can be assigned to a risk category, which should guide subsequent management.

There is a progression in risk categories:

- No sensory neuropathy.
- Sensory neuropathy and/or foot deformities or bony prominences and/or signs of peripheral ischemia and/or previous ulcer or amputation.

Education, presented in a structured and organised manner, plays an important role in prevention. The aim is to increase motivation and skills. The patient should be taught how to recognise potential foot problems and what action should be taken. The educator must demonstrate the skills, e.g. how to cut nails appropriately. Education should be provided in several sessions over time and preferably a mixture of methods should be used. It is essential to evaluate whether the patient has understood the message, is he/she motivated to act and has sufficient self-care skills. Furthermore, physicians and other health care professionals should receive periodic education to improve the care delivered to high risk individuals.
NEPHROPATHY

Diabetic nephropathy is the major cause of morbidity and mortality in patients with juvenile-onset diabetes mellitus. Nephropathy develops in approximately 33 per cent of patients with insulin-dependent diabetes mellitus (IDDM) and 5-10 per cent of patients with non-insulin-dependent diabetes mellitus (NIDDM). It is extremely difficult to prevent the progression to renal failure once functional impairment has occurred, which emphasises the importance of identifying and understanding the mechanisms capable of preventing or delaying this progression.
The clinical course of diabetic nephropathy has been classified into three stages:

- Incipient diabetic nephropathy characterised by hyperfiltration, microalbuminuria and variations of blood pressure.
- Clinical nephropathy which is subdivided into early and advanced. Early nephropathy is associated with macroproteinuria, hypertension and glomerular filtration greater than 50 ml/min, while advanced nephropathy corresponds to lower values of creatinine clearance.
- End-stage renal disease when glomerular filtration is less than 30 ml/min.

At the stage of clinical nephropathy, the presence of nephrotic syndrome indicates advanced lesions and is associated with hypertension and renal failure. At this stage, glomerular filtration returns to normal values and continues to decline, in parallel with changes in the frail glomerular structure. After several years, the clinical stage progresses to advanced renal failure. Accentuation of the raised intraglomerular pressure by systemic hypertension has been suggested as an essential cause of progression towards renal failure.

The prevention of diabetic nephropathy consists of optimal diabetic control. When nephropathy is present, optimal control of diabetes shows progression towards more advanced stages. In the early stages, dietary measure (protein restriction) appear to be controversial. A normal protein diet (0.8g-1.0g/kg/day) should be maintained during incipient diabetic nephropathy, as there is not sufficient evidence to support the indication for low-protein diets at this stage.

**DYSLIPIDEMIA**

A meal plan designed both to lower glucose levels and to alter lipid patterns and regular physical activity are the cornerstones in the management of lipid disorders. The goal of nutrition therapy should focus on three major
strategies: weight loss if indicated, increased physical activity, and meal plan recommendations individualised for the patient.

Saturated fat intake is targeted to <10 per cent of total calories in persons with acceptable LDL-cholesterol levels and to < 7 per cent of total calories in persons with elevated LDL-cholesterol levels.

The specific goals of treatment are

1) The primary goal of therapy for the diabetic patient is to lower LDL cholesterol to <100 mg/dl and triglycerides < 160 mg/dl.

2) People with diabetes who have triglyceride levels = 1,000 mg/dl are at risk of pancreatitis and other manifestations of the hyperchylomicronemic syndrome. These individuals need special, immediate attention, to lower triglyceride levels to < 400 mg/dl/ Further reduction to Adult Treatment Panel II goals of <200 may be beneficial. Treatment with fibrates, niacin or atorvastatin may be necessary.

3) A secondary goal of therapy is to raise HDL cholesterol to > 35 mg/dl in men and >45 mg/dl in women.

4) The primary goal of therapy for children with risk factors in addition to diabetes is to lower LDL cholesterol to <160 mg/dl.
### TABLE 6.7
DYSLIPIDEMIA

<table>
<thead>
<tr>
<th>Patients Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low Risk</strong></td>
</tr>
<tr>
<td>LDL &lt; 100 mg/dL</td>
</tr>
<tr>
<td>HDL &gt; 45 mg/dL in women &gt; 35 mg/dL in men</td>
</tr>
<tr>
<td>Saturated fat intake &gt; 10% of total calories</td>
</tr>
</tbody>
</table>

| **High Risk** |
| LDL < 100 mg/dL |
| HDL > 45 mg/dL in women > 35 mg/dL in men |
| Saturated fat intake > 10% of total calories |

#### Drug Therapy

- **Elev. TG**: gemfibrozil
- **Elev. LDL**: HMG CoA Reductase inhibitor and/or cholestyramine

Caution must be exercised before combining HMG CoA reductase inhibitors and fibrates because of the risk of rhabdomyolysis.

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**SPECIFIC TARGETS OF TREATMENT IN PEOPLE WITH DIABETES**

Good glycemic control is a key goal of management and delays the onset and progression of microvascular complications. An optimal HbA1c level is as close to a physiological level as possible (aim for < 7%). Postprandial and fasting glucose can also be used to monitor glycemic control.
• People at very high risk (5-year cardiovascular risk >20%) determined clinically with:
  - a previous history of cardiovascular disease
  - the specific lipid disorders of a genetic basis
  - diabetes and overt diabetic nephropathy or diabetes with other renal disease.

Everyone classified clinically at very high risk should begin drug treatment concurrently with intensive lifestyle advice and all efforts should be made to reach optimal lipid levels.

An optimal HbA1c level is as close to a physiological level as possible, aiming to reduce HbA1c to less than 7 per cent. In people with diabetes who have had a cardiovascular event the goal of blood pressure treatment is 140/80 mm Hg. More aggressive blood pressure treatment is recommended for people with diabetes and overt diabetic nephropathy (albumin: creatinine ratio >30 mg/mmol) or diabetes with other renal disease. Lipid management should aim to lower LDL-C less than 2.5 mmol/L.

People with diabetes and a calculated 5-year risk greater than 15 per cent:

Everyone with diabetes should be offered risk factor treatment to lower their 5-year cardiovascular risk to less than 15 per cent. Where possible treatment should aim to achieve the optimal levels. These levels have been set lower in people with diabetes to protect renal function. All people with diabetes and a 5-year cardiovascular risk greater than 15 per cent should be offered low-dose aspirin.

People with diabetes and total cholesterol greater than 8 mmol/L or TC: HDL ratio greater than 8 or blood pressure greater than 170/100 mm Hg

People with diabetes and isolated elevated single risk factor levels are assumed to have a greater than 15 per cent CV risk over 5 years, but should have a risk assessment because, when all risk factors are taken into account, they may have a calculated 5-year CV risk higher than this. These people
should receive intensive lifestyle intervention and lipid-modifying or blood pressure-lowering treatment as appropriate.

**Lifelong treatment is advised for people with diabetes.**
People with diabetes receiving medication should have their lipids and blood pressure, glycemic control, diet and activity level monitored every 3 months until adequate control is achieved, then every 6 months.

**TABLE NO: 6-8**

**STRATEGIES FOR SECONDARY PREVENTION OF COMPLICATIONS**

<table>
<thead>
<tr>
<th>Complication</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retinopathy</td>
<td>Flurosein Angiography, Laser photocoagulation, Vitreous Surgery</td>
</tr>
<tr>
<td>Nephropathy</td>
<td>ACE inhibitors Strict control of blood pressure, Dietary regulation, Renal transplantation</td>
</tr>
<tr>
<td>Neuropathy</td>
<td>Foot Care, Protective footwear, Callus removal, Lifelong surveillance of feet, Specific treatment of foot ulcers</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Life style modification, Specific drug therapy, Angioplasty, Coronary artery bypass</td>
</tr>
<tr>
<td>Peripheral vascular</td>
<td>Colour doppler studies of arterial system, Angiography, Angioplasty, Bypass.</td>
</tr>
</tbody>
</table>

**DIABETES EDUCATION**

The introduction of insulin in the early 1920s dramatically changed the fate of millions of people with diabetes. Almost at the same time, Joslin realised the importance of educating persons with diabetes and their families, and found one of the first diabetes teaching clinics. Joslin's attitude, as quoted by Krall, was 'the diabetic who knows the most lives the longest'³.

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This was said long before education became an accepted part of diabetes treatment and management.

In the early 1980s, the World Health Organization (WHO), stated, 'Education is a cornerstone of diabetic therapy and vital to the integration of the diabetic into society. More recently, a WHO Study Group recommended that 'systematic education of the diabetic patient, as well as healthcare personnel, is vital to improve the health and welfare of diabetics.' The Study Group also noted that the importance of education was not sufficiently recognised. In spite of general agreement concerning the necessity of education in diabetes treatment and management, its adoption has mainly been slow and ineffective.

The person with diabetes must incorporate into his/her lifestyle a wide variety of technical and cognitive skills necessary for maintaining good metabolic control, in order to avoid acute complications and ultimately prevent or slow the progression and micro-and macroangiopathic complications. While patients cannot really be their own physicians, they should at least be capable of becoming able assistants to skilled physicians; the success of therapy depends on their joint knowledge and cooperation. The best reason for educating the person with diabetes is survival. The importance of careful management of diabetes has been demonstrated in the survival of patients. Longevity in patients with diabetes requires frequent medical contact in order to obtain good metabolic control.

A patient who is not knowledgeable about diabetes and cannot carry out instructions is more likely to require medical or even hospital attention as a result of frequent hypoglycemic reactions, recurring bouts of ketoacidosis or complications involving the cardiovascular system, eye, nerves, kidneys and feet. Persons poorly educated regarding diabetes may also be subject to more psychological concerns about diabetes so that they are unable to work efficiently or enjoy normal lives.
There are different methods to educate the diabetic patients; each one has some advantage over the other. One has to use it judiciously according to local needs of uses, available resources, and expected results.

The most commonly practised methods are
1. One to one education
2. Group education
3. Intergroup discussions, conferences
4. Visiting nurse, social workers.
5. Play cards, pictures and paintings
6. Printed literature-leaflets, pamphlets, magazine and books
7. Audio tapes, video tapes.
8. Camps
9. Public awareness programme

The idea is to make the patient feel comfortable, confident, and self reliant. They should be able to cooperate in immediate treatment to relieve the symptoms and attain a normal healthy feeling.

The next step is to encourage them to follow desired life style, learn to select and adhere to proper diet and realise the importance of exercise in their management.

Teaching them monitoring techniques and taking insulin injections makes the life much easier, economical and practical.

Empowering them to take minor decision in day to day situation such as functions and parties, travelling, sick days or in any emergency further lightens the burden on the family, health care team or the state.

Early recognition, appropriate precautions and timely actions to avoid situations like hypoglycemia can save the patients from avoidable disasters.

Subsequently, they have to be enlightened to care for prevention of chronic complications and be prepared to take appropriate treatment.
There is no hard and fast rules or design to organise the education programme. All depends upon the individual set up, available resources and health care policy.

In practice, the best approach may be

One to one teaching at the time of hospital admission of any acute case of diabetes. Once the immediate problem is taken care of, the nurse or the doctor starts educating the patients in monitoring the control and taking the insulin injections. The result of urine or blood test will convince the patient about the role of treatment correlating with the symptoms. On subsequent follow up, they can be supervised what they had learnt and taught every time something more step by step.

Group education should be conducted amongst similar type of patients. It has the advantage of maximum outcome even with limited resources. They have common concerns and problems, which gives them further confidence as if they are not alone to face it.

For those who are unable to attend clinics or education programs due to many other reasons, a visiting nurse or social worker can help them to understand and follow the correct monitoring procedures, treatment modalities, and identification of complications at much earlier stages. Emergency situations have been curtailed considerably and hospital admissions reduced.

Verbal instructions are very short lived. When it is audiovisual it has a greater impact, and also last longer. It is easier to convey short and crisp message through eye catching posters, paintings or leaflets. People of all shades have felt immensely impressed. Cartoon messages are still more effective as it teaches in a lighter vein.

Everyone always likes to have some printed material to refer back when one feels like. One cannot remember everything, and hence need books to confirm. Even to understand anything simple enough or to
recapitulate one need to read it again and again. Diabetic patients are no exception.

The literature should be simple enough, preferably in their own language, and in a style which appeals to their convictions. Sermons are never welcome. So while designing it one has to make it more interesting and appealing. Discussing of real practical problems are more convincing.

It is common experience, that if a big book is given, one hardly has the patience to go through it, but if it is in a form of periodic magazine, one looks forward to receive it, and out of excitement of finding some thing new, one goes through it with interest. It is also handy to keep and refer it whenever required.

Audio tapes and video tapes are the gifts of electronic era. These are equally effective, and useful in continuing education of patients. These can only offer a base on which discussions and interactions can be added to.

Camps for diabetic patients, especially of children and young diabetics are very useful in patients education. They are away from a monotonous routine, have greater fun, learn to regulate their diet and monitor control under closer supervision with adjustment of diet and insulin dose. It is the result oriented efforts that convince them more. It generates a real fellow feeling when they interact with each other. They come back with much greater confidence to deal with day to day situations and feel they are no inferior than any one even their non-diabetic counterpart. Although organisation of camps is a great effort and require substantial resources but the benefits are worth it any time.

Public awareness programme about diabetes, its recent trend of developing into epidemic proportions all over the world, more selective involvement of certain ethnic or socioeconomic group, magnitude of problem for the individual, society and health planners may play a greater part in preventing and managing diabetes mellitus in true sense.
Diabetic's education may be highly cost-effective. Healthcare costs are high in diabetes when both direct and indirect costs such as absence from work, long term disability and premature death are considered. Hospitalisation has been shown to be the largest component to direct costs, greatly contributing to the increasing trend in costs of healthcare. The costs of diabetes are indeed considerable and will continue to increase for various reasons. The costs that are rarely taken into account in diabetes treatment and management include psychological costs viz., loss of body integrity in the presence of complications, e.g. acceptance of disease by family members and social costs viz., reduced social life because of constraints of schedules, feelings, of isolation and solitude. Diabetes education can be targeted to reduce all these costs.

The person most in need of training and education is obviously the patient. However, in order to reach the patient effectively, education must be directed first to the teachers, whoever they may be, for unless the teachers are taught, they cannot teach.

Education in diabetes must start with the physician. Physicians should be particularly well trained to treat acute decompositions such as ketoacidosis, hyperosmolar comas, acute foot problems and renal failure. However they are ill-prepared to face the chronic phases of diabetes. The immediate results of physicians management of patients in life-threatening situations profoundly mark the physicians regarding their efficiency and deeply convince them of their role and of the power of medicine. In the chronic phases of the disease, the biomedical dimension plays only a small part in patients general health.

Unfortunately, physicians are not trained to integrate the psychosocial and educational dimensions of chronic diseases with the biomedical aspect. Thus, an important part of the educational effort in the field of diabetes consists of the education of physicians. This places a tremendous responsibility on the physician. A double task has to be accomplished: stronger efforts have to be made both to keep physicians informed regarding
current methods of treatment and diagnosis and to improve their teaching skills, taking into account the psychosocial dimension of the patient.

The responsibility for sharing the burden of education, particularly, in chronic disease, lies with health professionals, from various disciplines. The core members of the 'Diabetes Care Team' are physicians, nurses and dieticians, with important roles played by others including social workers or other behavioural specialists, psychologists, home care providers, foot specialists, nephrologists, cardiologists, ophthalmologists, neurologists, pharmacists & exercise specialists.

**Figure 6.1**

**DIABETIC CARE TEAM**

There is a complicated interrelationship between members of an ideal diabetes care team. As with the pieces of a jigsaw, they must link neatly with each other. This implies a close collaborative effort between the different members of the team, who together develop a common philosophy and continuously evaluate their approach in order to incorporate new and
important trends in healthcare. Therapeutic intervention for diabetes does not rely only on insulin and oral agents; it is also strictly dependent on how the patient has been informed about the disease and how he/she is able to master the various skills required by the treatment. Education therefore plays a fundamental role in the efficacy of diabetes control. Without education of the patient, the whole therapeutic system unravels. All patients need simple basic information about their disease and its possible complications as well as appropriate education for its day-to-day management.

Although the patient with diabetes is the primary target of the educational goal, others must be involved. The patient's family and friends need to be given general information about the disease and its complications. This is particularly true of youngsters, whose parents need to be involved in the therapeutic process. Others who need to be educated are those who might occasionally come into contact with persons with diabetes such as close neighbours, business associates, police, firefighters, employers, employees and fellow workers. They should be aware of potential diabetes problems such as hypoglycemic reactions. Ideally, the patient's social integration would be greatly improved by the community's better understanding of diabetes. Therefore, the community should be continuously informed about this chronic medical condition.

Policy-makers as well as health planners should realise that diabetes and its complications represent a fairly large public health problem that will continue to grow as life expectancy increases. The long term dividends expected from investment in preventive healthcare and health education need to be emphasised because they are less well recognised than the short term benefits of curative medicine. The direct and indirect cost attributable to diabetes is enormous and will continue to increase. Adequate patient education leading to efficient secondary and tertiary prevention could dramatically reduce the cost of diabetes for the individual and for society. Adequate training in educational methods and practical experience in teaching should be a prerequisite for physicians, nurses, dieticians, social
workers and allied health personnel such as primary healthcare workers. This is an ideal situation, but one which is seldom encountered. The education of healthcare personnel should then cover the practical daily needs of the patient. The public health and economic aspects of diabetes should not be overlooked. The importance of promoting self-reliance in the patient should be emphasised. It appears mandatory that the healthcare personnel should know more about patients and think about their disease and its treatment. To encourage the patient's compliance with the treatment, it is important for healthcare providers to find out what the patient's ideas and opinions are, as well as those of the patient's peers and the society in which he/she lives. Patients often have a definition of their disease that may be quite different from the physician's diagnosis. This observation might play an important role in the efficacy of therapeutic programmes. The less the physician's diagnosis and the patient's diagnoses coincide, the more difficult it will be to obtain the patient's adherence to treatment.

Assuming that individuals affected by diabetes must learn self-management skills and make lifestyle changes to effectively manage diabetes and to avoid or retard the complications associated with diabetes, self-management education is a cornerstone of treatment. The goals are an increase in knowledge, changes in attitude and motivation, compliance and improved care.

Self-management

The first level of self-management education should include some guidelines for initial diabetes management. Supplying insufficient information to the patient with too much are equally disastrous. Self-management education needs to be directed to specific groups according to age, type to treatment, type of diabetes and presence or absence of long term diabetic complications. There are special requirements for the elderly, youngsters and their parents, pregnant patients, the blind and amputees.
Patients taking insulin or oral agents need to be taught:
- the facts about their type of diabetes.
- the skills of self-management
- how to adjust to necessary changes in lifestyle
- how to cope with emergencies, particularly hypoglycaemia.

It is recommended that continuous education programmes for children and adolescents and their families, school, teachers and friends be started immediately after diabetes is diagnosed.

Patients not requiring insulin therapy need to be taught:
- the facts about diabetes and its management
- the basic of good nutrition and how to achieve and maintain optimal bodyweight
- the importance of physical activity.

Patients with long term complications need to be taught:
- the facts about the complications, and the purpose and procedures of therapy, particularly those aspects where their active participation is crucial
- the necessary skills to prevent disabling consequences of the complications viz., infection and gangrene of the foot.

The topics that ought to be taught to the family and the patient’s include; the importance of correct food intake, the care of the patient during illness, and the recognition and early correction of emergency situations such as hypoglycemia and hyperglycemica with or without ketoacidosis.

The community, as well as health-policy planners, need to be made aware of diabetes as a public health problem and of the possibility of prevention by control of obesity and by increased physical activity, particularly in high-risk individuals.
Planning of objectives for patient education is crucial, and can only be accomplished when patient’s needs have been identified. Objectives should be clearly specified and properly self-sequenced. Education can be provided in different settings. Outpatient facilities can be used. Inpatient and hospital-based settings offer more room, more resources and more staff, and provide the best opportunities for education programmes. Education can also be tailored to special groups such as young patients, elderly people or the illiterate and those with low educational levels.

Evaluation of the effectiveness of the diabetes education programmes must also be part of the educational strategy. The concept of programme effectiveness has now become the starting point for education in healthcare. Documenting effectiveness enhances the programme’s prognosis for survival. Some key components have to be taken into consideration when evaluating effectiveness. They include the programme itself which has to be evaluated according to local or national standards if present and the results. Although the process of evaluating the effectiveness of an education programme may become a critical task, the information gained is invaluable. It can highlight the positive outcomes of the diabetes management programme and can demonstrate specific effects on the patients.

In summary, education of diabetes mellitus patients and their close family members is of paramount importance. The management of diabetes is incomplete unless the patients are involved in their own care, which can only be possible with continuing education of patients to share greater responsibilities like diet control, doing exercise etc. According to leading diabetologists, the patient has to be his/her own dietitian, nurse and doctor (of course up to a limited degree only). The methods of education are several and each one is complementary and supplementary to the other and when applied together offers the comprehensive care of the patients. It has to be developed and followed according to local needs, but it is a must for every one.