The main goals of diabetes treatment are to prevent acute and long term complications and to improve quality of life (QOL) and avoid premature diabetes associated death.

Successful diabetes management relies on successful patient engagement as well as medical treatment, and regular assessment of education needs is as important as medical care.

Barrett (2011)

Introduction

Chapter 1 contains a brief outline of diabetes pathophysiology and diabetes management. It is the only place you will find these issues discussed in this book. Having a firm knowledge about these issues is essential for health professionals (HPs) to provide competent diabetes care. However, the main focus of the book is on the person with diabetes, not the disease, and encouraging HPs to reflect on and constantly evaluate their practice. These factors are encompassed in Barrett’s (2011) second statement; however, holistic, individualised care is missing from the statement and these are essential to achieve optimal outcomes.

Overview of diabetes

Diabetes mellitus (diabetes) occurs when the body’s capacity to utilise glucose, fat and protein is disturbed due to insulin deficiency or insulin resistance. If enough insulin is not produced or insulin action is defective, fat and protein stores are mobilised and converted into glucose to supply energy.
However, fat metabolism requires insulin; therefore, insulin deficiency results in disordered fat metabolism and the intermediate products, ketone bodies, accumulate in the blood and cause ketosis, especially in type 1 diabetes (T1DM). Mobilisation of protein stores leads to weight loss and weakness and causes lethargy.

Different types of diabetes have different underlying causal mechanisms and present differently. Generally, young people are insulin-deficient and have T1DM and older people are insulin-resistant and have type 2 diabetes (T2DM). However, the classification of diabetes is not made according to age. T1DM occurs in about 10% of older people often as latent autoimmune diabetes (LADA). Likewise, T2DM is becoming more prevalent in children and adolescents as a consequence of inactivity, obesity and genetic predisposition (Barr et al. 2005; Zimmet et al. 2007). In addition, beta cell failure occurs gradually in T2DM with consequent insulin deficiency; therefore, more than 50% of people with T2DM eventually require insulin (UKPDS 1998). T2DM is the most common type, over 85% of diagnosed people, and approximately 15% of diagnosed people have T1DM. However, there are cultural variations in the prevalence of the two types (EURODIAB ACE Study Group 2000; DIAMOND Project Group 2006; Soltesz et al. 2006).

Prevalence of diabetes

Diabetes affects approximately 0.5–10% of the population depending on the diabetes type, age and ethnic group. Diabetes prevalence is increasing, particularly in the older people and in developing countries. In Western countries, the overall prevalence is 4–6% and up to 10–12% among 60–70-year-olds. The prevalence rises to ~20% in developing countries (Diabetes Atlas 2011). Most countries spend 6–12% of their annual health budgets on diabetes and its consequences. Most of the morbidity and mortality is associated with T2DM.

Overview of normal glucose homeostasis

Glucose homeostasis refers to the delicate balance between the fed and the fasting states and is maintained by several interrelated hormones, especially insulin, glucagon, adrenalin, cortisol, and the incretins, and nutritional status including liver and muscle glucose stores, the type of food consumed, exercise type and regularity, and tissue sensitivity to insulin. Insulin action is mediated via two protein pathways: protein 13-kinase through the insulin receptors in cells, which influences glucose uptake into the cells, and MAP-kinase, which stimulates growth and mitogenesis.
Insulin is secreted in two phases: In the first-phase, insulin secretion begins within 2 min of nutrient ingestion and continues for 10–15 min. A second phase of insulin secretion follows the first phase and is sustained until normoglycaemia is restored. The first phase demonstrates insulin sensitivity and beta cell responsiveness to a glucose load. The first phase helps limit the post-prandial rise in blood glucose. It is diminished or lost in T2DM; consequently, post-prandial blood glucose levels are often elevated (Dornhorst 2001). Post-prandial hyperglycaemia plays a leading role in the development of atherosclerosis, hypertriglyceridaemia, coagulopathies, endothelial dysfunction and hypertension. Together with chronic hyperglycaemia, these factors are responsible for long-term diabetes complications (Ceriello 2000).

A number of factors contribute to hyperglycaemia:

- Impaired glucose utilisation (IGT)
- Reduced glucose storage
- Inadequately suppressed glucose-mediated hepatic glucose production
- High fasting glucose (FPG)
- Reduced post-prandial glucose utilisation

In turn, hyperglycaemia leads to elevated free fatty acids (FFAs), which inhibit insulin signalling and glucose transport, but FFAs are a source of metabolic fuel for the heart and liver.

**Signs and symptoms of diabetes**

T1DM usually presents with the so-called classic symptoms of diabetes mellitus:

- Polyuria
- Polydipsia
- Lethargy
- Weight loss
- Hyperglycaemia
- Glycosuria
- Blood and urinary ketones; sometimes the person presents in diabetic ketoacidosis (DKA), a serious life-threatening emergency. DKA also develops during illnesses in T1DM. Insulin is essential to prevent DKA and increased doses are often required during illness. In hospital settings, insulin is usually administered in an intravenous insulin infusion.

T2DM is an insidious progressive disease that is often diagnosed when the person presents with a diabetes complication such as neuropathy, cardiovascular disease, nephropathy or retinopathy, or when the individual
consults a HP for an illness or during health screening programmes. It is not ‘just a touch of sugar’ or ‘mild diabetes’. In fact, T2DM is also known as ‘the silent killer’, because the individual may not notice any symptoms. Therefore, population screening and education programmes are essential to enable early diagnosis and management.

The symptoms of T2DM are often less obvious than in T1DM; however, once T2DM is diagnosed and treatment is commenced, people often state they have more energy and feel less thirsty. Other signs of T2DM, especially in older people, include recurrent Candida infections, incontinence, constipation, dehydration and cognitive changes.

People most at risk of developing T2DM:

- Are overweight: abdominal obesity, increased body mass index (BMI), and a high waist–hip ratio. The specific parameters for these factors differ among some ethnic groups.
- Binge eating often precedes T2DM and contributes to obesity; however, the prevalence of eating disorders is similar in T1 and T2 diabetes (Herpertz et al. 1998).
- Are over age 40; but note there is increasing prevalence of T2DM in younger people.
- Have close relatives with T2DM.
- Are women who had gestational diabetes (GDM) or large babies.
- Currently smoke or smoked in the past (Kong et al. 2007).
- Are hypertensive, which is an independent predictor of T2DM (Conen et al. 2007).
- Insulin deficiency could be partly due to the enzyme PKC epsilon (PKCe), which is activated by fat, and inhibits insulin production (Biden 2007).

The majority of people with T2DM require multiple therapies to achieve and maintain acceptable blood glucose and lipid targets over the first 9 years after diagnosis (UKPDS 1998). Between 50% and 70% require insulin, which is often used in combination with oral glucose lowering medicines (GLM). This means diabetes management becomes progressively more complicated for people and increases the risk of medicine-related errors and adverse events as well as medicine non-compliance (see Chapter 11). The self-care regimen often becomes more demanding when the person is older, when their ability to self-manage may be compromised, which increases the likelihood of non-compliance and the costs of managing the disease for both the patient and the health system.

**Gestational diabetes**

Diabetes occurring during pregnancy is referred to as gestational diabetes (GDM). GDM causes varying degrees of carbohydrate intolerance that first occurs or is first recognised during pregnancy. GDM occurs in 1–14%
of pregnancies. The exact cause of GDM is unknown, but several factors are implicated including the same factors that predispose people to T2DM, as well as the number of previous pregnancies, previous large babies and short stature (Langer 2006).

**Diagnosing diabetes**

T1DM usually presents with symptoms, especially rapid weight loss, thirst and polyuria. A blood glucose test confirms the diagnosis. Sometimes C-peptide, a marker of insulin production, and islet cell antibodies (ICA), glutamic acid carboxylase (GAD) or tyrosine phosphatase (IA-2A) antibody tests are performed. Some or all of these antibodies are present in 85% of people with T1DM.

T2DM may also present with symptoms of hyperglycaemia and the diagnosis can be confirmed by laboratory blood glucose testing where a random plasma glucose >11.1 mmol/L and symptoms are diagnostic of T2DM. If the person is asymptomatic, fasting blood glucose >7 mmol/L on at least two occasions is required to confirm the diagnosis. Some guidelines indicate the diagnosis can be made if blood glucose is >6.5 mmol/L (American Diabetes Association (ADA)). The ADA does not advocate routine oral glucose tolerance test (OGTT) on the basis that the revised fasting level is sensitive enough to detect most people at risk of diabetes. Australia supports the continued use of the OGTT when the diagnosis is equivocal and to detect GDM (Hilton et al. 2002; Twigg et al. 2007).

Hyperglycaemia is a common stress response to serious intercurrent illness such as cardiovascular disease and infection, and it can be difficult to diagnose diabetes in such circumstances. However, it is important to control the blood glucose during illness to prevent adverse outcomes, including in non-diabetics. Although people with T2DM rarely develop DKA, they can develop hyperglycaemic, hyperosmolar states (HHS), which still have a high morbidity and mortality rate. Diabetes can present for the first time as HHS in undiagnosed older people.

Other screening and prevention measures include providing the public with information about diabetes, health maintenance programmes, and self-risk assessment tools, for example the Agency for Healthcare Research and Quality (AHRQ), risk tools which are available on the Internet (from http://www.ahrq.gov/ppip/healthywom.htm or http://www.ahrq.gov/ppip/healthymen.htm) and The Australian Type 2 Diabetes Risk Assessment Tool (AUSDRISK) (Diabetes Australia 2010).

The place of HbA$_{1c}$ as a diagnostic tool is still debated. High HbA$_{1c}$ is a strong predictor of diabetes but not of cardiovascular disease after multivariate analysis and after excluding people diagnosed with diabetes within 2–5 years of follow-up (Pradhan et al. 2007). However, Pradhan et al. did not recommend using HbA$_{1c}$ as a single predictor of diabetes risk. HbA$_{1c}$ is a standard test for monitoring metabolic control.
Managing diabetes

Diabetes education and effective self-management are fundamental to achieving optimal diabetes management and outcomes. The value of diabetes education is described in numerous publications. However, diabetes is a complex, multifactorial disease and most people with diabetes, especially those with T2DM, require multiple therapies to manage the underlying pathophysiological changes and their consequences.

Likewise, diabetes treatment often becomes more complicated with increasing duration of diabetes. Thus, a collaborative interdisciplinary health-care team usually delivers diabetes care, and is considered best practice. However, the person with diabetes must play a key role in deciding their management and in undertaking self-care, see Chapter 10. HPs must provide relevant, timely individualised education to help the person, and often the person’s carers undertake the demanding, lifelong, relentless role: diabetes self-care (see Chapters 2, 3, 5 and 6).

The person with diabetes is the most important member of the team followed by their family. Good communication among and between team members and with the person with diabetes/carers is essential to help ensure the individual that their family receives consistent information. Communication might include guidelines and well-defined care pathways. Likewise, it is imperative that information about the individual is shared between and within hospital departments and other health services to facilitate smooth transitions among services.

The diabetes team usually consists of some or all of the following:

- Diabetologist
- Diabetes nurse specialist/diabetes educator and/or diabetes nurse practitioner
- Dietitian
- Podiatrist
- Social worker
- Psychologist
- General practitioner

Other professionals who contribute regularly to diabetes care include the following:

- Ophthalmologist
- Optometrist
- Vascular specialists, orthopaedic surgeons, neurologists, urologists and dentists
- Cultural health workers, for example Australian Aboriginal health workers and traditional healers in Africa
- Exercise physiologists
- Physiotherapists
In addition, hospital staff who care for people in hospital become team members during hospital and emergency room admissions, including the following:

- Doctors
- Nurses
- Dietitians
- Physiotherapists
- Occupational therapists
- Audiologists (Dunning 2011)

Encouraging people to be actively engaged in their care, which includes determining the care goals and management regimen, is an essential responsibility of all team members. The relationship between the individual and HP is a significant determinant of care. While all team members must be skilled communicators, it is unrealistic to expect an individual to have close relationships with all team members.

HPs might regard the one who provides most of the advice and acts as the link among team members as the ‘team leader’. However, most people with diabetes do not have the same concept of ‘diabetes team care’ as HPs. The HP the individual has the strongest relationship with might be the most effective team leader. The team needs to be supported by adequate resources, space and staff to perform optimally.

**Diabetes management and management aims**

Management aims are defined in a number of guidelines such as in the Australian Diabetes Society Position Statements, Clinical Management Guidelines for Diabetes in General Practice, and a range of self-management guidelines produced by various countries, for example The International Diabetes Federation Position Statements for T2DM, The UK Diabetes National Service Framework: Standards (2001), Diabetes Australia Plan for a Better Life for People with Diabetes (2004).

The basic aim defined in these guidelines is to maintain quality of life, keep the person free from diabetes symptoms, and prevent complications by controlling blood glucose, blood lipids and blood pressure with as few hypoglycaemic episodes as possible. Blood glucose range should be determined on an individual basis, usually between 3 and 6.5 mmol/L for 90% of tests, especially during acute illness and surgery, T1DM and young people with T2DM and during pregnancy. Regular complication screening and general health checks are very important. The latter include dental checks, mammograms, prostate checks and preventative vaccination, e.g. fluvax and pneumovax.

The regimen should affect the person’s lifestyle and emotional well-being as little as possible, although some modification is usually necessary.
People with T1DM require regular insulin injections to survive. People with T2DM who are obese can sometimes be treated using a combination of diet and exercise, but people managed with diet are not monitored as carefully as those on medicines and have more hyperglycaemia and hypertension medicines (Hippisley-Cox and Pringle 2004).

As indicated, most people with T2DM require oral glucose lowering medicines and often eventually insulin. Individual needs must be considered and can only be known by undertaking a thorough history and physical examination and listening carefully to the individual’s story. To achieve the latter, HPs must be expert listeners and be truly present in the consultation.

Empowerment care models and accepting people with diabetes’ choices may mean the individual decides not to follow the HP’s advice. Such a decision may or may not be in the individuals ‘best interest’ according the HP’s risk criteria, but must be respected and not judged: the HP is responsible for ensuring the individual has all the information they require to make an informed decision. Information must be in a language and format they understand. The HP should check for understanding and document the episode carefully. These are the individual’s rights. The decision about what to do with the information is the individual’s prerogative and responsibility.

**Long-term diabetes complications**

The DCCT in 1993 and the UKPDS in 1998 demonstrated the relationship between the development and progression of diabetes’ long-term complications in T1 and T2DM, respectively. The UKPDS also highlighted the fact that it is important to control blood pressure to reduce the risk of cardiovascular disease. The main long-term complications are as follows:

- **Macrovascular disease:**
  - Myocardial infarction
  - Cerebrovascular accident
  - Intermittent claudication

- **Microvascular disease associated with thickening of the basement membranes of the small blood vessels, e.g.:**
  - Retinopathy
  - Nephropathy, which leads to anaemia and its consequences including tiredness

- **Neuropathy or damage to the autonomic and peripheral nerves:**
  - Peripheral: reduced sensation in hands and especially the feet, which can lead to ulcers, Charcot’s arthropathy and amputation
  - Autonomic: erectile dysfunction, atonic bladder and urine retention, and gastroparesis
● Complications of pregnancy, which can affect the mother and/or the baby:
  ○ Mother: toxaemia, polyhydramnous intrauterine death, Caesarean section
  ○ Baby: congenital abnormalities, premature birth, respiratory distress, hypoglycaemia at birth
● Emotional distress, depression and burnout

Other complications also occur in the long term and need to be monitored. These include hearing loss, dental disease, some forms of cancer associated with obesity, and concomitant endocrine disease. For example, T1DM is an autoimmune disease and people with T1DM have a greater risk of developing other autoimmune diseases such as coeliac disease and hyperthyroidism.

A number of other factors appear to contribute to the development of diabetic complications. These include free radicals (ROS), advanced glycated end products (AGE), changes in cellular signalling and endothelial humoral components that affect coagulation and increase the likelihood of microthrombi.

All HPs who care for a person with diabetes are responsible for monitoring complications status and the effects of complications on their self-care potential and negotiating with the individual to revise the management plan. A full complication assessment should be undertaken at least every 12 months. HPs need to proactively identify opportunities for health and complication screening and education, that is recognise ‘the teachable moment’.

Summary

Diabetes is a complex, changeable and challenging condition. Medical management is essential but must be combined with effective education that enhances the individual’s and their family’s self-care capacity. The latter depends on effective communication and respect.

References


