

Review

Diabetes mellitus

Samreen Riaz

Department of Microbiology and Molecular Genetics, Punjab University, New Campus, Lahore. Pakistan. E-mail: samreen@mmg.pu.edu.pk.

Accepted 16 April, 2009

Diabetes is a life-long disease marked by elevated levels of sugar in the blood. It is the second leading cause of blindness and renal disease worldwide. Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by ineffectiveness of the insulin produced. It is a silent killer disease and affects millions of peoples in the world. This article focuses on the causes, types, factors affecting DM, incidences, preventive measures and treatment of the acute and chronic complications of diabetes other than those directly associated with hypoglycemia and severe metabolic disturbances.

Key word: Diabetes mellitus, types, symptoms, causes, treatments.

INTRODUCTION

Diabetes mellitus is a disorder that affects the body's ability to make or use insulin. Insulin is a hormone produced in the pancreas that helps transport glucose (blood sugar) from the bloodstream into the cells so they can break it down and use it for fuel. People cannot live without insulin (ADA, 2007).

Diabetes results in abnormal levels of glucose in the bloodstream. This can cause severe short-term and long-term consequences ranging from brain damage to amputations and heart disease (ADA, 2007).

Root causes of diabetes mellitus (DM)

The root causes of diabetes are complex. Most cases begin with one of two processes:

Metabolic: Unhealthy lifestyle factors such as over-eating, physical inactivity and obesity can impair the body's ability to use insulin. This is called insulin resistance. Uncontrollable risk factors including genetics, family history and age can also be involved. Metabolic forms of diabetes include:

Type 2 diabetes: This accounts for 90 - 95% of diabetic cases, according to the U.S. National Institutes of Health (NIH). Some of these patients have had prediabetes that went uncontrolled. Once considered a disease of middle and old age, type 2 is also becoming more common in youths as the incidence of childhood obesity grows.

Gestational diabetes: Hormonal changes contribute to this condition which can develop in any previously non-diabetic woman during pregnancy, especially those who are overweight.

AUTOIMMUNE

The body's immune system can mistakenly destroy the insulin-producing beta cells of the pancreas. The causes of autoimmune diabetes are poorly understood, but genetics and family history play a role, and viruses or other environmental factors are believed to figure in. Autoimmune forms of diabetes include:

Type 1 diabetes: Formerly known as juvenile diabetes, this form generally develops in children and young adults.

Latent autoimmune diabetes of adulthood: This variation of type 1 can occur later in life. Individuals with autoimmune diabetes who overeat, are sedentary, gain weight or have certain genes can, like people with metabolic forms of diabetes, develop insulin resistance. This state is known as double diabetes.

Diabetes can also result from another disease, such as pancreatitis, or even from a medical treatment, including pancreatectomy (surgical removal of the pancreas) or certain medications. This is known as secondary diabetes. In addition, there are uncommon inherited disorders that cause diabetes, such as maturity-onset diabetes of the young and Wolfram syndrome. Most cases of diabetes

last the rest of a person's life. However, gestational diabetes generally ends when the pregnancy does, and some cases of secondary diabetes are also temporary (Cefalu et al., 2007).

Factors contribute in DM

Diabetes involves chronic levels of abnormally high glucose (hyperglycemia). Many patients, especially those with type 2 diabetes, also have elevated blood pressure (hypertension), chronic high levels of insulin (hyperinsulinemia) and unhealthy levels of cholesterol and other blood fats (hyperlipidemia). All of these factors contribute to the long-term complications of diabetes, which include:

Vascular disease (diabetic angiopathy), atherosclerosis, heart conditions and stroke: These cardiovascular disorders are the leading cause of death in people with diabetes.

Kidney disease (diabetic nephropathy): Diabetes is the chief cause of end-stage renal disease, which requires treatment with dialysis or a kidney transplant.

Eye diseases: These include diabetic retinopathy, glaucoma and cataracts. Diabetes is a leading cause of visual impairment and blindness.

Nerve damage (diabetic neuropathy): This includes peripheral neuropathy, which often causes pain or numbness in the limbs, and autonomic neuropathy, which can impede digestion (gastroparesis) and contribute to sexual dysfunction and incontinence. Neuropathy may also impair hearing and other senses.

Impaired thinking: Many studies have linked diabetes to increased risk of memory loss, dementia, Alzheimer's disease and other cognitive deficits. Recently some researchers have suggested that Alzheimer's disease might be "type 3 diabetes," involving insulin resistance in the brain.

Infections and wounds: Foot conditions and skin disorders, such as ulcers, make diabetes the leading cause of nontraumatic foot and leg amputations. People with diabetes are also prone to infections including periodontal disease, thrush, urinary tract infections and yeast infections.

Cancer: Diabetes increases the risk of malignant tumors in the colon, pancreas, liver and several other organs.

Musculoskeletal disorders: Conditions ranging from gout to osteoporosis to restless legs syndrome to myofascial pain syndrome are more common in diabetic patients than nondiabetics.

Pregnancy complications: Diabetes increases the risk

of preeclampsia, miscarriage, stillbirth and birth defects.

Emotional difficulties: Many but not all of the studies exploring connections between diabetes and mental illness have found increased rates of depression, anxiety and other psychological disorders in diabetic patients. In addition to chronic hyperglycemia, diabetic patients can experience acute episodes of hyperglycemia as well as hypoglycemia (low glucose). Severe cases can cause seizures, brain damage and a potentially fatal diabetic coma. Acute glucose emergencies include:

Insulin shock: This advanced stage of hypoglycemia is typically due to excessive amounts of insulin medication or certain antidiabetic agents.

Diabetic ketoacidosis: A lack of insulin can force the body to burn fats instead of glucose for energy. The result is a toxic byproduct called ketones, along with severe hyperglycemia.

Hyperosmolar hyperglycemic nonketotic state: This involves severe hyperglycemia and dehydration.

These dangerous glucose complications are most common in patients with unstable diabetes, but they can develop even in individuals who do not realize they have diabetes. About one-third of the estimated 20.8 million Americans with diabetes have not yet been diagnosed, according to the U.S. Centers for Disease Control and Prevention (CDCP, 2005).

Incidence of Diabetes Mellitus

The incidence of diabetes has soared worldwide in recent years and is expected to keep growing, with the greatest increase seen in metabolic forms of diabetes, notably type 2. This is blamed largely on the rise of obesity and the global spread of Western-style habits: physical inactivity along with a diet that is high in calories, processed carbohydrates and saturated fats and insufficient in fiber-rich whole foods. The aging of the population is also a factor. However, other factors, such as environment may also be contributing, because cases of autoimmune diabetes (type 1) are also becoming more common.

The estimated number of people with diabetes has jumped from 30 million in 1985 to 150 million in 2000 and then to 246 million in 2007, according to the International Diabetes Federation. It expects this number to hit 380 million by 2025. Seven percent of Americans have diabetes, according to the CDC, which predicts that one in three Americans born in 2000 will eventually become diabetic. Health agencies are warning that diabetes is becoming an unprecedented epidemic even as other major diseases including cancer and nondiabetic heart disease are being controlled.

Diabetes is ranked as the sixth-leading cause of death

in the United States, but the actual ranking may be higher because it is underreported as a cause of death, according to the NIH. Diabetes kills more than 1 million people a year, the World Health Organization reports. It predicts life expectancy to decline worldwide for the first time in two centuries because of diabetes. Experts are urging people to help stem this epidemic by getting regular exercise and controlling their diet and weight.

Humans are not the only species that can develop diabetes. This disease also occurs in dogs, cats and other animals, as increasing numbers of pet owners are discovering.

The word “diabetes” stems from a Greek term for passing through, a reference to increased urination (polyuria), a common symptom of the disease. “Mellitus” is the Latin word for honeyed, a reference to glucose noted in the urine of diabetic patients.

Diabetes mellitus is sometimes referred to as sugar diabetes but usually is simply called diabetes. There is also a rare disease called diabetes insipidus (water diabetes) in which the kidneys release too much water. Like diabetes mellitus, it has excessive urination as a symptom, but these two endocrine disorders are otherwise unrelated (DCCT, 1993).

Types and differences of diabetes

There are several forms of diabetes. Scientists are still defining and categorizing some of these variations and establishing their prevalence in the population. Types of diabetes include:

Type 1 diabetes: An autoimmune disease in which the immune system mistakenly destroys the insulin-making beta cells of the pancreas. It typically develops more quickly than other forms of diabetes. It is usually diagnosed in children and adolescents, and sometimes in young adults. To survive, patients must administer insulin medication regularly.

Type 1 diabetes used to be called juvenile diabetes and insulin-dependent diabetes mellitus (IDDM). However, those terms are not accurate because children can develop other forms of diabetes, adults sometimes develop type 1, and other forms of diabetes can require insulin therapy.

A variation of type 1 that develops later in life, usually after age 30, is called latent autoimmune diabetes of adulthood (LADA).

Sometimes patients with autoimmune diabetes develop insulin resistance because of weight gain or genetic factors. This condition is known as double diabetes.

Type 2 diabetes: A disorder of metabolism, usually involving excess weight and insulin resistance. In these patients, the pancreas makes insulin initially, but the body has trouble using this glucose-controlling hormone. Eventually the pancreas cannot produce enough insulin to respond to the body’s need for it.

Type 2 diabetes is by far the most common form of diabetes, accounting for 85 to 95% of cases in developed nations and an even higher percentage in developing nations, according to the International Diabetes Federation.

This disease may take years or decades to develop. It is usually preceded by prediabetes, in which levels of glucose (blood sugar) are above normal but not high enough yet for a diagnosis of diabetes. People with prediabetes can often delay or prevent the escalation to type 2 diabetes by losing weight through improvements in exercise and diet, as the Diabetes Prevention Program and other research projects have demonstrated.

Type 2 diabetes used to be called adult-onset diabetes and non-insulin-dependent diabetes mellitus (NIDDM). Those terms are not accurate because children can also develop this disease, and some patients require insulin therapy.

Gestational diabetes: A temporary metabolic disorder that any previously nondiabetic woman can develop during pregnancy, usually the third trimester. Hormonal changes contribute to this disease, along with excess weight and family history of diabetes. About 4% of pregnant women develop gestational diabetes, according to the American Diabetes Association.

Gestational diabetes can cause problems for the mother and baby, including preeclampsia, premature delivery, macrosomia (oversized infant), and jaundice and breathing difficulties in the infant. This disease typically ends when the pregnancy does, but it increases the risk of type 2 diabetes later in life for the mother and the child.

Secondary diabetes: Diabetes caused by another condition. The many potential sources of secondary diabetes range from diseases such as pancreatitis, cystic fibrosis, Down syndrome and hemochromatosis to medical treatments including corticosteroids, other immunosuppressives, diuretics and pancreatectomy.

Maturity-onset diabetes of the young (MODY). An uncommon disease caused by a genetic defect inherited from a parent. It is usually diagnosed before age 25 in people of normal weight. MODY is sometimes classified as a form of type 2 or secondary diabetes but is often considered a separate condition.

There are also rare syndromes (clusters of conditions) that include diabetes, notably:

Wolfram syndrome: A genetic disorder that involves insulin-dependent diabetes, vision problems, deafness and diabetes insipidus.

Autoimmune polyglandular syndrome (APS): Group of autoimmune endocrine diseases. Two of the three forms of APS feature type 1 diabetes.

Unstable diabetes, also known as brittle or labile diabetes, is a term that may be used to describe any case of poorly controlled diabetes regardless of the type.

All of these conditions involve diabetes mellitus (“sugar

diabetes"). Diabetes insipidus ("water diabetes") is an unrelated endocrine system disorder in which the kidneys release too much water (Frank, 2004; Jawa et al., 2004).

Risk factors and causes of diabetes

The causes of diabetes are complex and only partly understood. This disease is generally considered multifactorial, involving several predisposing conditions and risk factors. In many cases genetics, habits and environment may all contribute to a person's diabetes.

To complicate matters, there can be contrary risk factors for the various forms of the disease. For example, autoimmune diabetes (type 1 and latent autoimmune diabetes of adulthood, LADA) is more common in white people, but metabolic diabetes (type 2 and gestational diabetes) is more common in people of other races and ethnicities. Type 1 is usually diagnosed in children, but advancing age is a risk factor for type 2 and gestational diabetes.

Insulin resistance, prediabetes and metabolic syndrome are strong risk factors for type 2 diabetes. Other diabetic risk factors and causes include:

Genetics and family history: Certain genes are known to cause maturity-onset diabetes of the young (MODY) and Wolfram syndrome. Genes also contribute to other forms of diabetes, including types 1 and 2.

Family medical history is also influential to varying degrees: For example, a person whose parents both have type 1 diabetes has a 10 to 25% chance of developing that disease, according to the American Diabetes Association, and someone whose parents both have type 2 diabetes has a 50% chance of developing that disease.

Weight and body type: Overweight and obesity are leading factors in type 2 diabetes and gestational diabetes. Excess fat, especially around the abdomen (central obesity), promotes insulin resistance and metabolic syndrome.

Most people with autoimmune diabetes (type 1 and LADA) are of normal weight, and excess weight has not traditionally been considered to be related to these conditions. However, recent research indicates that obesity may hasten the development of type 1 diabetes and that the increasing rate of type 1 diabetes may be at least partly due to the rise of childhood obesity. Furthermore, patients with autoimmune diabetes who gain weight are susceptible to insulin resistance and double diabetes.

Sex: Though men make up less than 49% of the U.S. adult population, they account for 53% of the adult cases of diabetes, according to the National Institutes of Health (NIH). The prevalence of diabetes in American men and women was similar until 1999, when a growing disparity began, according to an analysis of statistics published by

the U.S. Centers for Disease Control and Prevention (CDC). Little or no research has been conducted to explain this trend. One factor may be the documented increase in recent years of low testosterone levels (male hypogonadism), which scientists have linked to insulin resistance.

Level of physical activity: Lack of regular exercise is blamed for much of the twin global epidemics of obesity and diabetes.

Diet: The effect of diet in the development of diabetes is controversial. Some studies have linked heavy consumption of soft drinks and other simple carbohydrates to risk of metabolic diabetes, and foods low in the glycemic index, such as whole grains, to reduced risk. Yet the ADA states that eating foods containing sugar does not cause the disease. The culprit, rather, is the weight gain due to sedentary habits and excess intake of calories, according to the ADA.

Another dispute centers around whether being fed cow's milk early in life might be linked to type 1 diabetes. Some researchers have noted a connection, but others have not. Further scientific research is likely on this topic.

Other diseases: Medical conditions including high blood pressure, hyperlipidemia (unhealthy levels of cholesterol), polycystic ovarian syndrome, asthma and sleep apnea have been linked to type 2 diabetes. Celiac disease (gluten intolerance) and other autoimmune diseases have been linked to type 1. The many conditions that may cause secondary diabetes include pancreatitis, hemochromatosis, endocrine disorders including hyperthyroidism, Cushing's disease and acromegaly, and genetic conditions including cystic fibrosis, Down syndrome and some forms of muscular dystrophy, Diabetic foot and urinary tract infection (Lipsky et al., 2004; Mokabberi and Ravakhah, 2007).

Hormones: These chemical messengers can contribute to diabetes in various ways. For example, stress hormones such as cortisol have been linked to fluctuating glucose levels in type 2 diabetes, and stress hormones in women during pregnancy have been linked to risk of type 1 diabetes in the child. The release of growth and sex hormones during adolescence may make some teens more susceptible to diabetes. A wide range of hormonal treatments including anabolic steroids, growth hormone, estrogens, injected contraceptives, androgen deprivation therapy for prostate cancer and corticosteroids have been linked to secondary diabetes.

Medical treatments: In addition to hormonal therapies, medications including diuretics, beta blockers (another class of antihypertensives), immunosuppressives, antiretrovirals (AIDS/HIV drugs) antipsychotics, lithium, and some antidepressants, anticonvulsants and chemotherapy drugs have been linked to an increased risk of

secondary diabetes. Pancreatectomy and radiation therapy may also result in secondary diabetes. Drugs including pentamidine (used to treat pneumonia) and L-asparaginase (used to treat leukemia) have been linked to type 1 diabetes.

Other chemicals: In addition to these pharmaceuticals, some studies have linked PCBs, other pollutants and certain pesticides including the defoliant Agent Orange and dioxin (its active ingredient) to insulin resistance and type 2 diabetes. Common consumer plastics and plastics ingredients including phthalates and bisphenol A have also been linked to insulin resistance in some cases. Exposure to agricultural pesticides during pregnancy has been tentatively linked to gestational diabetes. A rat poison called pyriminyl has been linked to type 1 diabetes.

Other environmental factors: Some researchers theorize that free radicals may contribute to the development of type 1 and possibly other forms of diabetes. Free radicals are formed as a result of chemical reactions in the body. Smoke, air pollution and even genetics contribute to the formation of free radicals. When these radicals build up, they can destroy cells, including those involved in the production of insulin.

Cold weather is another possible environmental factor in type 1 diabetes. This disease occurs more commonly in cold climates and develops more frequently in the winter than the summer.

Viruses: Some people are diagnosed with type 1 diabetes after a viral infection. Viruses thought to be related to type 1 diabetes include mumps, rubella and coxsackie virus (related to the virus family that causes polio and hepatitis).

Smoking: Cigarette smoking is a risk factor for type 2 diabetes and possibly other forms of diabetes.

Alcohol: Excessive use of alcohol is a risk factor for diabetes. For example, it can cause pancreatitis. However, some research has found that light drinking may decrease the risk of becoming diabetic.

Most of these risk factors can be described as either uncontrollable, such as genetics and age, or controllable, such as exercise and diet. Some, such as obesity, may involve genetics and lifestyle choices. People cannot alter their uncontrollable risk factors, but they can lower their risk of developing diabetes by reducing controllable risk factors through improved health habits.

Signs and symptoms of diabetes

Diabetes often goes undetected because symptoms can be attributed to many other causes and some patients experience no symptoms or fail to heed warning signs. Possible indicators of diabetes include:

- Excessive thirst (polydipsia)
- Excessive urination (polyuria) and dehydration
- Excessive hunger or appetite (polyphagia)
- Unexplained weight loss
- Blurred vision, nearsightedness or other vision problems
- Frequent infections, including skin infections, thrush, gingivitis, urinary tract infections and yeast infections
- Slow healing of sores
- Skin problems, such as itchiness or acanthosis nigricans
- Fatigue, lethargy or drowsiness
- Shakiness or trembling
- Mood swings or irritability
- Dizziness or fainting
- Numbness, tingling or pain in the feet, legs or hands

Type 1 diabetes can develop rapidly and often occurs after an illness, but symptoms may be mistaken for the flu or other common conditions. Type 2 diabetes can take many years to develop and sometimes becomes apparent only after long-term complications occur, such as sexual dysfunction or leg pain that is due to diabetic neuropathy or claudication (caused by peripheral artery disease).

Some people, especially young people with type 1 diabetes, go undiagnosed until they are brought to a hospital with an emergency condition called diabetic ketoacidosis. Indicators of diabetic ketoacidosis include sweet fruity-smelling or wine-smelling breath, confusion and heavy labored breathing (Kussmaul breathing). Sometimes patients are diagnosed with diabetes only after suffering other serious complications including insulin shock, hyperosmolar hyperglycemic nonketotic syndrome or diabetic coma.

To help prevent such complications, people are advised to undergo periodic screening for diabetes with glucose tests, especially if they have risk factors.

Diagnosis methods for diabetes

Physicians use glucose tests to diagnose diabetes. These blood tests measure the level of glucose (blood sugar) in a person's bloodstream.

Often when people have a physical examination they are screened for diabetes with a fasting plasma glucose test (FPG). An FPG is usually performed in the morning because this makes it easier for the patient to fast for the required eight hours.

Glucose is measured in milligrams per deciliter (mg/dl) of blood. FPG results below 100 mg/dl are normal. Glucose between 100 and 125 mg/dl is considered pre-diabetes. Glucose above 125 mg/dl indicates diabetes. To confirm diagnosis, another glucose test should be performed on another day, according to the National Institute of Diabetes and Digestive and Kidney Disorders.

If glucose testing determines that a patient has diabetes, additional tests may be offered to establish the type. For example, a C-peptide test can distinguish

autoimmune from metabolic diabetes. People with type 2 diabetes have C-peptide, which is a byproduct of insulin production, but people with type 1 diabetes and latent autoimmune diabetes of adulthood do not nor have a very low level.

Autoantibody testing can reveal misguided antibodies present in autoimmune but not metabolic diabetes.

Genetic tests can help diagnose conditions such as maturity-onset diabetes of the young and Wolfram syndrome.

Other tests, such as thyroid blood tests, may be ordered to find the cause of secondary diabetes.

During pregnancy, usually during the 24th to the 28th week, women may be screened for gestational diabetes with a glucose challenge test, which evaluates the body's ability to metabolize sugar. Blood is drawn an hour after the patient drinks a solution containing 50 g of glucose. If results are abnormal, an additional, more complicated blood test called an oral glucose tolerance test (OGTT) is used to confirm diabetes (Peters et al., 1996).

Treatment options for diabetes

Patients who are diagnosed with diabetes usually require regular monitoring by various healthcare providers to manage their condition and reduce the risk of complications. For example, endocrinologists are physicians who specialize in diabetes and other endocrine disorders. In locations where an endocrinologist is not available, an internist or other physician may treat diabetic patients.

Diabetes care teams also include certified diabetes educators and registered dietitians. Patients need to see an ophthalmologist and a dentist regularly and may be referred as needed to other specialists such as a podiatrist, athletic trainer, cardiologist, nephrologist (kidney specialist) or neurologist.

Diet and exercise are crucial in managing diabetes, especially type 2 diabetes and gestational diabetes. Some patients with metabolic forms of diabetes are able to control their disease using only these lifestyle interventions, which help the body use glucose (blood sugar) and prevent or reduce hyperglycemia. It is also important to avoid smoking, drink enough water to avoid dehydration, and drink alcohol only in moderation and only if approved by the physician.

All people with type 1 diabetes and Wolfram syndrome and eventually all people with latent autoimmune diabetes of adulthood require regular insulin therapy to live. Some people with other forms of diabetes, including gestational diabetes, type 2 diabetes, secondary diabetes and maturity-onset diabetes of the young, also are prescribed insulin. Forms of insulin administration include syringe injections, insulin pumps, insulin pens, jet injectors and inhaled insulin.

Many patients are prescribed antidiabetic agents. The U.S. Food and Drug Administration has approved oral diabetes drugs only to treat type 2 diabetes, but

physicians sometimes use them to treat other conditions including prediabetes, insulin resistance and polycystic ovarian syndrome. Oral diabetes medications include:

- i.) Alpha-glucosidase inhibitors
- ii.) Biguanides
- iii.) Meglitinides
- iv.) Sulfonylureas
- v.) Thiazolidinediones
- vi.) A new group called DPP-4 inhibitors

There are also injected medications known as incretin mimetics and synthetic amylin. Synthetic amylin is the only drug other than insulin approved to treat type 1 diabetes.

In addition, patients may be prescribed a glucagon kit. Glucagon is a hormone that acts against insulin and can be injected in cases of severe hypoglycemia or insulin shock.

Patients with diabetes are often prescribed other medications, including antihypertensive and cholesterol drugs, to treat related conditions. Antihypertensives such as ACE inhibitors and angiotensin-II receptor blockers can help prevent kidney disease (diabetic nephropathy) and are sometimes recommended even for patients who do not have elevated blood pressure. Patients who have or are at high risk for heart conditions may be advised to take low-dose aspirin daily.

People with diabetes need to perform glucose monitoring according to the schedule devised by their care team. Some patients use a glucose meter occasionally, but others, especially those using insulin or antidiabetic agents, must test several times a day. Patients at risk for diabetic ketoacidosis are advised to perform ketone tests.

In addition to these self-tests, patients will have glycohemoglobin tests or fructosamine tests periodically performed by their physician to assess long-term control of glucose. It is also essential to have regular dilated eye exams and dental care, and periodic tests of kidney function such as microalbuminuria testing and glomerular filtration rate.

Other important aspects of treating and monitoring diabetes include:

- i.) Nutrition counseling
- ii.) Daily foot care and skin care
- iii.) Regular physical examinations and foot examinations
- iv.) Regular blood pressure readings and cholesterol tests
- v.) A pneumonia vaccination and annual flu shots
- vi.) A sick-day plan devised by a physician
- vii.) Additional medical care before, during and after pregnancy
- viii.) Cardiac and neurological testing as needed

Following the care plan can help prevent devastating diabetic complications such as leg amputation, blindness, heart attack, stroke and chronic kidney failure.

Some patients with autoimmune diabetes may be candidates for a pancreas transplant or an experimental islet cell transplant. If successful, these procedures may mean a patient no longer has to take insulin for the lifespan of the transplanted organ or cells (Turner et al., 1996).

Prevention methods for diabetes

There is no known way of preventing autoimmune forms of diabetes (type 1 and latent autoimmune diabetes of adulthood) or genetic conditions such as maturity-onset diabetes of the young and Wolfram syndrome. Genetic tests can reveal who is at risk, and clinical trials are investigating potential methods of preventing type 1, including vaccines and pre-emptive use of insulin.

People can take many steps to reduce their risk of developing metabolic forms of diabetes (type 2 and gestational diabetes). The primary focus is on managing weight through regular exercise and a sensible diet. Such practices also help people with other forms of diabetes avoid insulin resistance and double diabetes. It is also beneficial to control blood pressure and cholesterol, avoid smoking and restrict alcohol.

People with risk factors for diabetes should be screened regularly with glucose tests. Early detection and treatment can avert many diabetic complications.

Those who already have diabetes can help prevent complications such as diabetic retinopathy and diabetic neuropathy by maintaining control over their glucose levels and following other aspects of their care plan, as the Diabetes Control and Complications Trial and many other research projects have affirmed.

Scientists are conducting a great deal of research into the diagnosis, monitoring, treatment and prevention of diabetes. Recent advances include inhaled insulin, new antidiabetic agents, continuous glucose monitoring and implantable insulin pumps. Projects in development range from stem cell research to refinement of an artificial pancreas. Though there is still no cure for diabetes, a disease that was once a death sentence has become a chronic condition that can be managed (Naila et al., 2009).

REFERENCES

- American Diabetes Association (2007). Diagnosis and classification of diabetes mellitus. *Diabetes Care*. 30 Suppl. 1: S42-7. [Medline]. [Full Text].
- American Diabetes Association (2007). Standards of medical care in diabetes. *Diabetes Care*. J. 30 Suppl. 1:S4-S41. [Medline]. [Full Text].
- Cefalu WT, Waldman S, Ryder S (2007). Pharmacotherapy for the treatment of patients with type 2 diabetes mellitus: rationale and specific agents. *Clin. Pharmacol. Ther.* 81(5): 636-649.
- Centers for Disease Control and Prevention. National Diabetes Fact Sheet. United States. (2005). Available at <http://www.cdc.gov/diabetes/pubs/general.htm>.
- DCCT Group (1993). The Diabetes Control and Complications Trial Research Group: the effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N. Engl. J. Med.* 329(14): 977-986.
- Frank RN (2004). Diabetic retinopathy. *N. Engl. J. Med.* 350(1): 48-58.
- Jawa A, Kcomt J, Fonseca VA (2004). Diabetic nephropathy and retinopathy. *Med. Clin. North Am.* 88(4): 1001-1036, xi.
- Lipsky BA, Berendt AR, Deery HG, Embil JM, Joseph WS, Karchmer AW (2004). Diagnosis and treatment of diabetic foot infections. *Clin. Infect. Dis.* 39(7): 885-910.
- Mokabberi R, Ravakhah K (2007). Emphysematous urinary tract infections: diagnosis, treatment and survival (case review series). *Am. J. Med. Sci.* 333(2): 111-116.
- Naila R, Saadia SA, Samreen R, James L, Waheed MA, Tahir S, Paul JT (2009). High dose thiamine therapy for people with type 2 diabetes and microalbuminuria: a randomised, double-blind, placebo-controlled study. *Diabetologia*. Springer Berlin / Heidelberg. 52(2): 208-212.
- Peters AL, Davidson MB, Schriger DL, Hasselblad V (1996). A clinical approach for the diagnosis of diabetes mellitus: an analysis using glycosylated hemoglobin levels. Meta-analysis Research Group on the Diagnosis of Diabetes Using Glycated Hemoglobin Levels. *JAMA*. 276(15): 1246-1252.
- Turner R, Cull C, Holman R (1996). United Kingdom Prospective Diabetes Study 17: a 9-year update of a randomized, controlled trial on the effect of improved metabolic control on complications in non-insulin-dependent diabetes mellitus. *Ann. Intern. Med.* 124 (1 Pt 2): 136-145.