Diabetes mellitus type 2

Diabetes mellitus type 2 is a long term metabolic disorder that is characterized by high blood sugar , insulin resistance , and relative lack of insulin . Common symptoms include increased thirst , frequent urination , and unexplained weight loss . Symptoms may also include increased hunger , feeling tired , and sores that do not heal . Often symptoms come on slowly . Long @-@ term complications from high blood sugar include heart disease , strokes , diabetic retinopathy which can result in blindness , kidney failure , and poor blood flow in the limbs which may lead to amputations . The sudden onset of hyperosmolar hyperglycemic state may occur ; however , ketoacidosis is uncommon .

Type 2 diabetes primarily occurs as a result of obesity and not enough exercise . Some people are more genetically at risk than others . Type 2 diabetes makes up about 90 % of cases of diabetes , with the other 10 % due primarily to diabetes mellitus type 1 and gestational diabetes . In diabetes mellitus type 1 there is an absolute lack of insulin due to breakdown of islet cells in the pancreas . Diagnosis of diabetes is by blood tests such as fasting plasma glucose , oral glucose tolerance test , or A1C .

Type 2 diabetes is partly preventable by staying a normal weight , exercising regularly , and eating properly . Treatment involves exercise and dietary changes . If blood sugar levels are not adequately lowered , the medication metformin is typically recommended . Many people may eventually also require insulin injections . In those on insulin , routinely check blood sugar levels is advised , however this may not be needed in those taking pills . Bariatric surgery often improves diabetes in those who are obese .

Rates of type 2 diabetes have increased markedly since 1960 in parallel with obesity . As of 2013 there were approximately 368 million people diagnosed with the disease compared to around 30 million in 1985 . Typically it begins in middle or older age , although rates of type 2 diabetes are increasing in young people . Type 2 diabetes is associated with a ten @-@ year @-@ shorter life expectancy . Diabetes was one of the first diseases described . The importance of insulin in the disease was determined in the 1920s .

Signs and symptoms

The classic symptoms of diabetes are polyuria (frequent urination) , polydipsia (increased thirst) , polyphagia (increased hunger) , and weight loss . Other symptoms that are commonly present at diagnosis include a history of blurred vision , itchiness , peripheral neuropathy , recurrent vaginal infections , and fatigue . Many people , however , have no symptoms during the first few years and are diagnosed on routine testing . People with type 2 diabetes mellitus may rarely present with hyperosmolar hyperglycemic state (a condition of very high blood sugar associated with a decreased level of consciousness and low blood pressure) .

Complications

Type 2 diabetes is typically a chronic disease associated with a ten @-@ year @-@ shorter life expectancy . This is partly due to a number of complications with which it is associated , including : two to four times the risk of cardiovascular disease , including ischemic heart disease and stroke ; a 20 @-@ fold increase in lower limb amputations , and increased rates of hospitalizations . In the developed world , and increasingly elsewhere , type 2 diabetes is the largest cause of nontraumatic blindness and kidney failure . It has also been associated with an increased risk of cognitive dysfunction and dementia through disease processes such as Alzheimer 's disease and vascular dementia . Other complications include acanthosis nigricans , sexual dysfunction , and frequent infections .

Cause

The development of type 2 diabetes is caused by a combination of lifestyle and genetic factors . While some of these factors are under personal control , such as diet and obesity , other factors are not , such as increasing age , female gender , and genetics . A lack of sleep has been linked to type 2 diabetes . This is believed to act through its effect on metabolism . The nutritional status of a mother during fetal development may also play a role , with one proposed mechanism being that of altered DNA methylation . The intestinal bacteriæ Prevotella copri and Bacteroides vulgatus have been connected with type 2 diabetes .

Lifestyle

A number of lifestyle factors are known to be important to the development of type 2 diabetes , including obesity and being overweight (defined by a body mass index of greater than 25) , lack of physical activity , poor diet , stress , and urbanization . Excess body fat is associated with 30 % of cases in those of Chinese and Japanese descent , 60 ? 80 % of cases in those of European and African descent , and 100 % of cases in Pima Indians and Pacific Islanders . Those who are not obese often have a high waist ? hip ratio . Smoking also appears to increase the risk of type 2 diabetes mellitus .
Dietary factors also influence the risk of developing type 2 diabetes . Consumption of sugar @-@ sweetened drinks in excess is associated with an increased risk . The type of fats in the diet are also important , with saturated fats and trans fatty acids increasing the risk , and polyunsaturated and monounsaturated fat decreasing the risk . Eating lots of white rice appears to also play a role in increasing risk . A lack of exercise is believed to cause 7 % of cases . Persistent organic pollutants may also play a role .

Genetics

Most cases of diabetes involve many genes , with each being a small contributor to an increased probability of becoming a type 2 diabetic . If one identical twin has diabetes , the chance of the other developing diabetes within his lifetime is greater than 90 % , while the rate for nonidentical siblings is 25 ? 50 % . As of 2011 , more than 36 genes had been found that contribute to the risk of type 2 diabetes . All of these genes together still only account for 10 % of the total heritable component of the disease . The TCF7L2 allele , for example , increases the risk of developing diabetes by 1 @.@ 5 times and is the greatest risk of the common genetic variants . Most of the genes linked to diabetes are involved in beta cell functions .
There are a number of rare cases of diabetes that arise due to an abnormality in a single gene (known as monogenic forms of diabetes or " other specific types of diabetes ") . These include maturity onset diabetes of the young (MODY) , Donohue syndrome , and Rabson @-@ Mendenhall syndrome , among others . Maturity onset diabetes of the young constitute 1 ? 5 % of all cases of diabetes in young people .

Medical conditions

There are a number of medications and other health problems that can predispose to diabetes . Some of the medications include : glucocorticoids , thiazides , beta blockers , atypical antipsychotics , and statins . Those who have previously had gestational diabetes are at a higher risk of developing type 2 diabetes . Other health problems that are associated include : acromegaly , Cushing 's syndrome , hyperthyroidism , pheochromocytoma , and certain cancers such as glucagonomas . Testosterone deficiency is also associated with type 2 diabetes .

Pathophysiology

Type 2 diabetes is due to insufficient insulin production from beta cells in the setting of insulin resistance . Insulin resistance , which is the inability of cells to respond adequately to normal levels

of insulin , occurs primarily within the muscles , liver , and fat tissue . In the liver , insulin normally suppresses glucose release . However , in the setting of insulin resistance , the liver inappropriately releases glucose into the blood . The proportion of insulin resistance versus beta cell dysfunction differs among individuals , with some having primarily insulin resistance and only a minor defect in insulin secretion and others with slight insulin resistance and primarily a lack of insulin secretion .

Other potentially important mechanisms associated with type 2 diabetes and insulin resistance include : increased breakdown of lipids within fat cells , resistance to and lack of incretin , high glucagon levels in the blood , increased retention of salt and water by the kidneys , and inappropriate regulation of metabolism by the central nervous system . However , not all people with insulin resistance develop diabetes , since an impairment of insulin secretion by pancreatic beta cells is also required .

= = Diagnosis = =

The World Health Organization definition of diabetes (both type 1 and type 2) is for a single raised glucose reading with symptoms , otherwise raised values on two occasions , of either :
fasting plasma glucose ? 7 @.@ 0 mmol / l (126 mg / dl)
or
with a glucose tolerance test , two hours after the oral dose a plasma glucose ? 11 @.@ 1 mmol / l (200 mg / dl)
A random blood sugar of greater than 11 @.@ 1 mmol / l (200 mg / dL) in association with typical symptoms or a glycated hemoglobin (HbA1c) of ? 48 mmol / mol (? 6 @.@ 5 DCCT %) is another method of diagnosing diabetes . In 2009 an International Expert Committee that included representatives of the American Diabetes Association (ADA) , the International Diabetes Federation (IDF) , and the European Association for the Study of Diabetes (EASD) recommended that a threshold of ? 48 mmol / mol (? 6 @.@ 5 DCCT %) should be used to diagnose diabetes . This recommendation was adopted by the American Diabetes Association in 2010 . Positive tests should be repeated unless the person presents with typical symptoms and blood sugars > 11 @.@ 1 mmol / l (> 200 mg / dl) .

Threshold for diagnosis of diabetes is based on the relationship between results of glucose tolerance tests , fasting glucose or HbA1c and complications such as retinal problems . A fasting or random blood sugar is preferred over the glucose tolerance test , as they are more convenient for people . HbA1c has the advantages that fasting is not required and results are more stable but has the disadvantage that the test is more costly than measurement of blood glucose . It is estimated that 20 % of people with diabetes in the United States do not realize that they have the disease .

Diabetes mellitus type 2 is characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency . This is in contrast to diabetes mellitus type 1 in which there is an absolute insulin deficiency due to destruction of [islet cells in the pancreas and gestational diabetes mellitus that is a new onset of high blood sugars associated with pregnancy . Type 1 and type 2 diabetes can typically be distinguished based on the presenting circumstances . If the diagnosis is in doubt antibody testing may be useful to confirm type 1 diabetes and C @-@ peptide levels may be useful to confirm type 2 diabetes , with C @-@ peptide levels normal or high in type 2 diabetes , but low in type 1 diabetes .

= = Screening = =

No major organization recommends universal screening for diabetes as there is no evidence that such a program improve outcomes . Screening is recommended by the United States Preventive Services Task Force (USPSTF) in adults without symptoms whose blood pressure is greater than 135 / 80 mmHg . For those whose blood pressure is less , the evidence is insufficient to recommend for or against screening . There is no evidence that it changes the risk of death in this group of people . They also recommend screening among those who are overweight and between the ages of 40 and 70 .

The World Health Organization recommends testing those groups at high risk and in 2014 the USPSTF is considering a similar recommendation . High @-@ risk groups in the United States include : those over 45 years old ; those with a first degree relative with diabetes ; some ethnic groups , including Hispanics , African @-@ Americans , and Native @-@ Americans ; a history of gestational diabetes ; polycystic ovary syndrome ; excess weight ; and conditions associated with metabolic syndrome . The American Diabetes Association recommends screening those who have a BMI over 25 (in people of Asian descent screening is recommending for a BMI over 23 .

= = Prevention = =

Onset of type 2 diabetes can be delayed or prevented through proper nutrition and regular exercise . Intensive lifestyle measures may reduce the risk by over half . The benefit of exercise occurs regardless of the person 's initial weight or subsequent weight loss . Evidence for the benefit of dietary changes alone , however , is limited , with some evidence for a diet high in green leafy vegetables and some for limiting the intake of sugary drinks . In those with impaired glucose tolerance , diet and exercise either alone or in combination with metformin or acarbose may decrease the risk of developing diabetes . Lifestyle interventions are more effective than metformin . While low vitamin D levels are associated with an increased risk of diabetes , correcting the levels by supplementing vitamin D3 does not improve that risk .

= = Management = =

Management of type 2 diabetes focuses on lifestyle interventions , lowering other cardiovascular risk factors , and maintaining blood glucose levels in the normal range . Self @-@ monitoring of blood glucose for people with newly diagnosed type 2 diabetes may be used in combination with education , however the benefit of self monitoring in those not using multi @-@ dose insulin is questionable . In those who do not want to measure blood levels , measuring urine levels may be done . Managing other cardiovascular risk factors , such as hypertension , high cholesterol , and microalbuminuria , improves a person 's life expectancy . Decreasing the systolic blood pressure to less than 140 mmHg is associated with a lower risk of death and better outcomes . Intensive blood pressure management (less than 130 / 80 mmHg) as opposed to standard blood pressure management (less than 140 / 85 ? 100 mmHg) results in a slight decrease in stroke risk but no effect on overall risk of death .
Intensive blood sugar lowering (HbA1c < 6 %) as opposed to standard blood sugar lowering (HbA1c of 7 ? 7 @.@ 9 %) does not appear to change mortality . The goal of treatment is typically an HbA1c of around 7 % or a fasting glucose of less than 7 @.@ 2 mmol / L (130 mg / dL) ; however these goals may be changed after professional clinical consultation , taking into account particular risks of hypoglycemia and life expectancy . It is recommended that all people with type 2 diabetes get regular ophthalmology examination . Treating gum disease in those with diabetes may result in a small improvement in blood sugar levels .

= = = Lifestyle = = =

A proper diet and exercise are the foundations of diabetic care , with a greater amount of exercise yielding better results . Aerobic exercise leads to a decrease in HbA1c and improved insulin sensitivity . Resistance training is also useful and the combination of both types of exercise may be most effective . A diabetic diet that promotes weight loss is important . While the best diet type to achieve this is controversial , a low glycemic index diet or low carbohydrate diet has been found to improve blood sugar control . Culturally appropriate education may help people with type 2 diabetes control their blood sugar levels , for up to six months at least . If changes in lifestyle in those with mild diabetes has not resulted in improved blood sugars within six weeks , medications should then be considered . There is not enough evidence to determine if lifestyle interventions affect mortality in those who already have DM2 .

Medications

There are several classes of anti @-@ diabetic medications available . Metformin is generally recommended as a first line treatment as there is some evidence that it decreases mortality ; however , this conclusion is questioned . Metformin should not be used in those with severe kidney or liver problems .

A second oral agent of another class or insulin may be added if metformin is not sufficient after three months . Other classes of medications include : sulfonylureas , thiazolidinediones , dipeptidyl peptidase @-@ 4 inhibitors , SGLT2 inhibitors , and glucagon @-@ like peptide @-@ 1 analog . There is no significant difference between these agents . Rosiglitazone , a thiazolidinedione , has not been found to improve long @-@ term outcomes even though it improves blood sugar levels . Additionally it is associated with increased rates of heart disease and death . Angiotensin @-@ converting enzyme inhibitors (ACEIs) prevent kidney disease and improve outcomes in those with diabetes . The similar medications angiotensin receptor blockers (ARBs) do not . A 2016 review recommended treating to a systolic blood pressure of 140 to 150 mmHg .

Injections of insulin may either be added to oral medication or used alone . Most people do not initially need insulin . When it is used , a long @-@ acting formulation is typically added at night , with oral medications being continued . Doses are then increased to effect (blood sugar levels being well controlled) . When nightly insulin is insufficient , twice daily insulin may achieve better control . The long acting insulins glargine and detemir are equally safe and effective , and do not appear much better than neutral protamine Hagedorn (NPH) insulin , but as they are significantly more expensive , they are not cost effective as of 2010 . In those who are pregnant insulin is generally the treatment of choice .

Surgery

Weight loss surgery in those who are obese is an effective measure to treat diabetes . Many are able to maintain normal blood sugar levels with little or no medications following surgery and long @-@ term mortality is decreased . There however is some short @-@ term mortality risk of less than 1 % from the surgery . The body mass index cutoffs for when surgery is appropriate are not yet clear . It is recommended that this option be considered in those who are unable to get both their weight and blood sugar under control .

Epidemiology

Globally as of 2010 it was estimated that there were 285 million people with type 2 diabetes making up about 90 % of diabetes cases . This is equivalent to about 6 % of the world 's adult population . Diabetes is common both in the developed and the developing world . It remains uncommon , however , in the underdeveloped world .

Women seem to be at a greater risk as do certain ethnic groups , such as South Asians , Pacific Islanders , Latinos , and Native Americans . This may be due to enhanced sensitivity to a Western lifestyle in certain ethnic groups . Traditionally considered a disease of adults , type 2 diabetes is increasingly diagnosed in children in parallel with rising obesity rates . Type 2 diabetes is now diagnosed as frequently as type 1 diabetes in teenagers in the United States .

Rates of diabetes in 1985 were estimated at 30 million , increasing to 135 million in 1995 and 217 million in 2005 . This increase is believed to be primarily due to the global population aging , a decrease in exercise , and increasing rates of obesity . The five countries with the greatest number of people with diabetes as of 2000 are India having 31 @.@ 7 million , China 20 @.@ 8 million , the United States 17 @.@ 7 million , Indonesia 8 @.@ 4 million , and Japan 6 @.@ 8 million . It is recognized as a global epidemic by the World Health Organization .

History

Diabetes is one of the first diseases described with an Egyptian manuscript from c . 1500 BCE mentioning " too great emptying of the urine . " The first described cases are believed to be of type 1 diabetes . Indian physicians around the same time identified the disease and classified it as madhumeha or honey urine noting that the urine would attract ants . The term " diabetes " or " to pass through " was first used in 230 BCE by the Greek Apollonius Of Memphis . The disease was rare during the time of the Roman empire with Galen commenting that he had only seen two cases during his career .

Type 1 and type 2 diabetes were identified as separate conditions for the first time by the Indian physicians Sushruta and Charaka in 400 ? 500 AD with type 1 associated with youth and type 2 with being overweight . The term " mellitus " or " from honey " was added by the Briton John Rolle in the late 1700s to separate the condition from diabetes insipidus which is also associated with frequent urination . Effective treatment was not developed until the early part of the 20th century when the Canadians Frederick Banting and Charles Best discovered insulin in 1921 and 1922 . This was followed by the development of the long acting NPH insulin in the 1940s .