Diabetes Mellitus

Definition
A metabolic disorder of multiple etiology characterized by:

1. Chronic hyperglycemia.

2. Disturbances of carbohydrate, fat, and protein metabolism, which result from defects in insulin secretion or in insulin activity or both.

- Glucose could not enter the cells to be metabolised
- When glucose level rises significantly some of it will be excreted in the urine = glucosuria
- Untreated diabetes could result (acutely) in ketoacidosis or a non-ketonic hyperosmolar state, which may finally lead to the development of stupor, coma, and death.
- The effects of diabetes mellitus include long-term damage to various organs, including:

Eye  Heart  Kidney  Blood vessels  Nerves
Classification of diabetes

1. Type 1 diabetes mellitus
2. Type 2 diabetes mellitus
3. Gestational diabetes mellitus (GDM)
4. Other types of diabetes associated with certain conditions and syndromes (not common)

1. Type 1 diabetes

- Mainly due to autoimmune destruction of the β-cells of the pancreas.
- Rarely could be idiopathic: patients are prone to Ketoacidosis where no pathology or etiology is known.
- Can develop at any age, but tends to develop in younger age groups.
- Most of these persons are diagnosed before the age of 35 years, i.e. typically the younger population.
- The rate at which destruction of the β-cells takes place varies – it could be rapid in some individuals or slow in others.
- Therefore, the onset of the disease is often acute or sub-acute.
- The slower progressive form usually occurs in adults, and is referred to as latent autoimmune diabetes in adults (LADA).

Insulin

In People with type 1 diabetes insulin is needed for survival and to prevent:

- Rapid and severe dehydration
- Ketoacidosis
- Catabolism
- Death
Clinical features

Clinical Presentation Type 1 Diabetes Mellitus

- Any age: usually young
- Onset: abrupt
- Not usually obese
- Weight loss
- Polyuria & polydipsia
- Polyphagia versus anorexia
- Enuresis
- Failure to thrive / dehydration
- Ketonuria
- Diabetic Ketoacidosis

Symptoms of hyperglycemia

- Polyuria
- Polydypsia
- Polyphagia
- Malaise & tiredness
- Weight loss
- Blurring of vision (if the onset is not acute.)
- Repeated infections (if the onset is not acute.)
- Numbness or tingling of hands & feet (if the onset is not acute.)

- Undiagnosed persons, particularly children and adolescents, may present with diabetic Ketoacidosis (Ketones are found, and can lead to the symptoms of abdominal pain, nausea, vomiting, and/or coma.
- Severe hyperglycaemia and ketoacidosis develop rapidly in the presence of infections and stress
- Persons with type 1 diabetes are usually of normal weight, or underweight.
2. Type 2 diabetes

- Pancreas doesn’t produce enough insulin or cells ignore it (insulin resistance)
- Most people with diabetes have type 2 (85%)
- Generally occurs in those over 40 years old
- Associated with obesity & runs in families to some extent
- 30%-50% will require insulin injections
- No Autoimmune destruction of $\beta$-cell.
- Obesity (insulin resistance).
- No DKA (sometimes with stress i.e. infection).
- Pass undiagnosed.
- Macro- & micro-vascular complications.
- Insulin is normal or high.

Symptoms of hyperglycemia

- Loss of weight
- Polydipsia
- Polyphagia
- Polyuria
- Malaise and tiredness
- Repeated infections
- Tingling or numbness of the hands and feet
- Blurring of vision
Potential mechanisms in the development of Type II diabetes:

- Lack of exercise/high-fat diet
- Central obesity
- Genetic factors
- Poor pancreatic development

Flowchart:

- Insulin resistance
- Insulin secretion
- Blood glucose
- Beta cell function

Lack of exercise/high-fat diet leads to insulin resistance, which affects insulin secretion and blood glucose levels. Genetic factors and central obesity also contribute to these processes.
Cardinal clinical & metabolic features of type 2 diabetes:

- Presentation usually in middle-age or later life.
- Obesity common (present in > 75 %)
- Symptoms often mild, absent or unrecognized.
- Relative rather than absolute insulin deficiency.
- Insulin resistance commonly present.
- Ketosis-resistant (contrast with type 1 diabetes)
- Progressive hyperglycaemia – even with antidiabetic therapy.
- Insulin treatment frequently required to maintain long-term glycaemic control.
- Hyperglycemia-related tissue damage may be present at diagnosis.
- Other features of the “insulin resistance syndrome’ – eg hypertension, dyslipidaemia-often present.
- High risk of macrovascular complications- which are the main cause of premature mortality.
Factors that may influence the prevalence of glucose intolerance and type 2 diabetes

- Age
- Gender
- Ethnicity
- Family
- Obesity
- Diet
- History of diabetes
- Regional adiposity
- Low physical activity
- Lifestyle
- Dyslipidaemia
- History of gestational diabetes
- Hyperinsulinaemia
- Country of residence
- Socio-economic status
- Tobacco use

A higher risk of inheritance is seen in families, indicating a genetic susceptibility:
- General population with diabetes: 0.5%
- Siblings and children of parents with diabetes: 5-10%
- Father with diabetes: 9%
- Mother with diabetes: 3%
- Both parents with diabetes: 30%
- It is significant that adult males seem to carry a considerably higher risk than females.

Type 1 diabetes has been seen to:
- Occur on all continents, but with considerable variations with regard to geographical and ethnic groups.
- The peak age of onset of type 1 diabetes among black African persons is 23 years, which is almost a decade later than that reported for Europeans.
- It is thought that prolonged breast-feeding may protect people against the development of type 1 diabetes, since early exposure to cow’s milk may predispose them to the development of type 1 diabetes.
Type 2 diabetes:
- 50% of type 2 are undiagnosed
- Chronic complications precede diabetes (Retinopathy 7 years)
- Risk factors

Type 1 diabetes:
- More than one antibodies (ICA, IAA, GAD, IA-2)
- No effective method can prevent or delay the disease
- Screening is not cost-effective

Diagnostic criteria for diabetes mellitus
The new criteria

Symptoms of diabetes
(polyuria, polydipsia, and weight loss)
+ Random Blood Sugar (RBS)
casual plasma glucose
= or > 200 mg/dL (11.1 mmol/L)

Fasting plasma glucose (FPG)
at least 8 hours fast
= or > 126 mg/dL (7.0 mmol/L)

Two hours plasma glucose (2hr PG)
after 75 anhydrous glucose in water
= or > 200 mg/dL (11.1 mmol/L)

Testing healthy individuals
HBA1C

Not recommended for diagnosis of diabetes, but valuable for glycemic control of diabetes
Criteria for testing for diabetes in asymptomatic adult individuals

1. Testing should be considered in all adults who are overweight (BMI ≥ 25 kg/m^2*;) and have additional risk factors:
   - physical inactivity
   - first-degree relative with diabetes
   - high-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander)
   - women who delivered a baby weighing > 9 lb or were diagnosed with GDM
   - hypertension (≥ 140/90 mmHg or on therapy for hypertension)
   - HDL cholesterol level < 35 mg/dl (0.90 mmol/l) and/or a triglyceride level > 250 mg/dl (2.82 mmol/l)
   - women with polycystic ovarian syndrome (PCOS)
   - A1C ≥ 5.7%, IGT, or IFG on previous testing
   - other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans)
   - history of CVD

2. In the absence of the above criteria, testing for diabetes should begin at age 45 years.

3. If results are normal, testing should be repeated at least at 3-year intervals, with consideration of more frequent testing depending on initial results and risk status.

*At-risk BMI may be lower in some ethnic groups.
In Type1DM: Long term complications are Not usually present at diagnosis.

<table>
<thead>
<tr>
<th>Macrovascular</th>
<th>Microvascular</th>
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**Brain**
- Cerebrovascular disease
- Transient ischemic attack
- Cerebrovascular accident
- Cognitive impairment

**Heart**
- Coronary artery disease
- Coronary syndrome
- Myocardial infarction
- Congestive heart failure

**Extremities**
- Peripheral vascular disease
- Ulceration
- Gangrene
- Amputation

**Eye**
- Retinopathy
- Cataracts
- Glaucoma

**Kidney**
- Nephropathy
- Microalbuminuria
- Gross albuminuria
- Kidney failure

**Nerves**
- Neuropathy
- Peripheral
- Autonomic
Treatment of Diabetes

Diabetes type 1

Treatment requires a strict regimen that typically includes:

- Carefully calculated diet.
- Planned physical activity.
- Multiple daily insulin injections.
- Home blood glucose testing a number of times per day.

Diabetes type 2

Treatment typically includes:

- Diet control.
- Exercise.
- Home blood glucose testing.
- Oral medication and/or insulin.

Approximately 40% of people with type 2 diabetes require insulin injections.
What Is Tuberculosis?

Tuberculosis (TB) is a highly infectious disease that primarily affects the lungs. It can also affect other organs. TB was once called “consumption.” It is the world’s second-most fatal infectious agent, after HIV/AIDS. TB is most common in developing countries, but people in the United States are diagnosed with the condition each year.

Tuberculosis is usually both preventable and curable under the right conditions.

Causes Tuberculosis

The mycobacterium tuberculosis bacterium causes TB. But there are a variety of TB strains. Some strains are resistant to medication.

Bacteria are transmitted by air. They can be transmitted when a person sneezes, coughs, speaks, or sings. A nearby person can then inhale the TB bacteria.

People with strong immune systems may not experience TB symptoms, even though they carry the bacteria. This is known as latent or inactive TB. Inactive TB is not contagious. Active TB, however, can make you and other people sick.

Who Is at Risk for Tuberculosis?

An estimated 95 percent of all diagnosed TB cases are in developing countries. The condition chiefly affects young adults.

People who use tobacco or are long-term drug or alcohol abusers are more likely to get TB. People who have been diagnosed with HIV/AIDS or who suffer from malnourishment are also at greater risk. Diabetes, end-stage kidney disease, and certain cancers are other risk factors.
Some medications can also put a person at risk. These include medications that help prevent organ transplant rejection. Other medications that increase risk include those taken by patients with cancer, rheumatoid arthritis, Crohn’s disease, and psoriasis.

Travel to regions where TB rates are high also carries the risk of infection. These include:

- sub-Saharan Africa
- India
- Mexico
- China
- Parts of the former Soviet Union
- Islands of Southeast Asia
- Micronesia

**Symptoms of Tuberculosis**

Some people carry the TB bacteria but do not experience symptoms. This condition is known as latent TB. Latent TB can develop into active TB.

Active TB causes many symptoms. Many are related to the respiratory system, including coughing up blood or sputum. Patients may experience a cough that lasts for over three weeks. They may also experience pain with coughing or even breathing normally, especially in the chest.

Other possible symptoms include unexplained fatigue, fever, night sweats, appetite loss, and weight loss.

While TB usually affects the lungs, it can also affect other organs, such as the kidneys, spine or brain. For example, tuberculosis of the kidneys may cause blood in the urine.
Diagnosis of Tuberculosis

Doctors can use TB skin tests and blood tests to determine whether a person is carrying the TB bacteria. A TB skin test involves injecting 0.1 mL of a purified protein derivative of TB into the skin.

After two to three days, the patient returns to the doctor’s office. If the area around the injection is raised, the patient may be TB-positive. However, this test is not perfect. Some people do not respond to the TB test even if they have TB. People who have recently received the TB vaccine may test positive but not have TB.

A blood test is sometimes recommended to determine whether a patient has latent or active TB. These tests may not be available in all areas.

Other diagnostic tests include a chest X-ray, which checks for small spots in the lungs. These spots are a sign of TB infection and indicate that the body is trying to isolate TB bacteria. A physician may also order tests on sputum or mucus extracted from deep inside the lungs to check for the bacteria.

Treatment of Tuberculosis

Although most bacterial infections are treated with antibiotics over the course of a week or two, TB is different. Patients diagnosed with TB take one or more medications for six to nine months. The full treatment course must be taken, otherwise it is highly likely TB could come back. If TB does recur, it may be resistant to previous medications taken.

Because some TB strains are resistant to certain drug types, a doctor may prescribe multiple medications, including:

- isoniazid
- ethambutol (Myambutol)
- pyrazinamide
- rifampin (Rifadin, Rimactane)

High-dose antibiotics can harm the liver. Patients should be aware of liver-injury symptoms, such as:

- appetite loss
- dark urine
- fever lasting longer than three days
- unexplained nausea and/or vomiting
- jaundice (yellowing of the skin)

Notify your doctor immediately if notice any symptoms.
Prevention of Tuberculosis

Most people in high-risk regions receive TB vaccinations as children. The vaccine is called Bacillus Calmette-Guerin, or BCG. This vaccine does not protect against all TB strains. It is not commonly given in the United States.

Having the TB bacteria does not guarantee symptoms of active TB. A doctor can prescribe preventive antibiotics to keep active TB from developing. A commonly prescribed medication is isoniazid (INH). Patients must take this medication for six to nine months to fully remove the bacteria.

Patients who have been diagnosed with TB should avoid crowds until the condition is no longer contagious. People with TB can infect between 10 and 15 people per year if precautions are not taken and treatment is not started. Patients can also wear a special surgical mask, known as a respirator, which keeps TB particles from spreading through the air. However, a person with active TB should avoid contact with others until finishing the first three to four weeks of treatment.

Treatment of Tuberculosis

- Spinal pain. Back pain and stiffness are common complications of tuberculosis.
- Joint damage: Tuberculosis arthritis usually affects the hips and knees.
- Swelling of the membranes that cover your brain (meningitis). This can cause a lasting or intermittent headache that occurs for weeks. Mental changes also are possible.
- Liver or kidney problems. Your liver and kidneys help filter waste and impurities from your bloodstream. These functions become impaired if the liver or kidneys are affected by tuberculosis.
- Heart disorders. Rarely, tuberculosis can infect the tissues that surround your heart, causing inflammation and fluid collections that may interfere with your heart's ability to pump effectively. This condition, called cardiac tamponade, can be fatal.
THE LINKS BETWEEN TUBERCULOSIS AND DIABETES

- People with a weak immune system, as a result of chronic diseases such as diabetes, are at a higher risk of progressing from latent to active TB.

- People with diabetes have a 2-3 times higher risk of TB compared to people without diabetes.

- About 10% of TB cases globally are linked to diabetes.

- A large proportion of people with diabetes as well as TB is not diagnosed, or is diagnosed too late. Early detection can help improve care and control of both.

- All people with TB should be screened for diabetes.

- Screening for TB in people with diabetes should be considered, particularly in settings with high TB prevalence.

- People with diabetes who are diagnosed with TB have a higher risk of death during TB treatment and of TB relapse after treatment.

- WHO-recommended treatments should be rigorously implemented for people with TB/diabetes.

- Diabetes is complicated by the presence of infectious diseases, including TB. It is important that proper care for diabetes is provided to those that are suffering from
There is a major distinction between diagnostic testing and screening. When an individual exhibits symptoms or signs of the disease, diagnostic tests are performed, and such tests do not represent screening.

**Purpose of screening**

The purpose of screening is to identify asymptomatic individuals who are likely to have diabetes. Separate diagnostic tests using standard criteria are required after positive screening tests to establish a definitive diagnosis.

**Screening in asymptomatic populations is appropriate when seven conditions are met:**

1) The disease represents an important health problem that imposes a significant burden on the population.

2) The natural history of the disease is understood.

3) There is a recognizable preclinical (asymptomatic) stage during which the disease can be diagnosed.

4) Tests are available that can detect the preclinical stage of the disease, and the tests are acceptable and reliable; 5) treatment after early detection yields benefits superior to those obtained when treatment is delayed;

6) The costs of case finding and treatment are reasonable and are balanced in relation to health expenditures as a whole, and facilities and resources are available to treat newly diagnosed cases.

7) Screening will be a systematic ongoing process and not merely an isolated one-time effort.
For diabetes, conditions 1–4 are met. Conditions 5–7 have not been met entirely because there are no randomized clinical trials documenting the effectiveness of screening programs in decreasing mortality and morbidity from diabetes, and some controversy exists regarding the cost effectiveness of screening and whether screening as currently carried out is a systematic and ongoing process.

**What is screening?**

Screening is a process of identifying apparently healthy people who may be at increased risk of a disease or condition.

They can then be offered information, further tests and appropriate treatment to reduce their risk and/or any complications arising from the disease or condition.

- Long-term consequences of type 2 diabetes include micro vascular (retinopathy, nephropathy, neuropathy) and macro vascular (stroke, myocardial infarction) complications.
- An estimated 65%–80% of people with diabetes will die of a cardiovascular event, many without prior signs or symptoms of cardiovascular disease.
- Type 2 diabetes is a prevalent and costly chronic illness that demands lifestyle interventions, effective monitoring and pharmacologic management.
- Management of risk factors, including physical inactivity, blood pressure and blood lipid levels as well as blood glucose levels, is required to prevent long-term complications.
Ready, Set

Test strips, lancet pen, meter
One strip out
Wash. Put strip in meter.

Go

Easy poke
Blood drop to strip. Read result.
Record.