Diabetes statistical figures have always been alarming, reflecting health threats across the globe

- 387 million people have diabetes; by 2035 this will rise to 592 million
- 77% of people with diabetes live in low- and middle-income countries
- The greatest number of people with diabetes are between 40 and 50 years of age
- 179 million people with diabetes are undiagnosed
- Diabetes caused 4.9 million deaths in 2014; Every seven seconds a person dies from diabetes
- Diabetes caused at least USD 612 billion dollars in health expenditure in 2014 – 11% of total spending on adults
- More than 79,000 children developed type 1 diabetes in 2013
- More than 21 million live births were affected by diabetes during pregnancy in 2013
Diabetes is a deadly disease and very costly

Economical Burden of Diabetes

Agenda

- Diabetes Implications Overview
- Natural history of Diabetes
- Diabetes and CVD
- Definition of Metabolic syndrome
- Pathophysiology of CVD in Diabetes and Metabolic syndrome
- Management concept
The changes leading to Macrovascular complications occur way before the diagnosis of diabetes (1/2)

![Natural History of Type 2 Diabetes](image)

The changes leading to Macrovascular complications occur way before the diagnosis of diabetes (2/2)

![Natural History of Type 2 Diabetes: Disease Progression](image)

Ischemic heart disease is the leading cause of diabetes related death

![Cardiovascular disease and diabetes](image)
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Insulin resistance is the link between Diabetes and Metabolic syndrome

Definitions of Metabolic Syndrome consist of three out of five criteria based on WHO, NCEP ATP III and IDF

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist circumference (visceral adiposity)</td>
<td>&gt;40 in (102 cm)</td>
<td>&gt;35 in (88 cm)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>≥130 mm Hg</td>
<td>≥85 mm Hg</td>
</tr>
<tr>
<td>Systolic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diastolic</td>
<td>≥85 mm Hg</td>
<td></td>
</tr>
<tr>
<td>Triglycerides</td>
<td>≥150 mg/dL</td>
<td></td>
</tr>
<tr>
<td>High-density lipoprotein (HDL) cholesterol</td>
<td>≤40 mg/dL</td>
<td>≤50 mg/dL</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fasting glucose</td>
<td>≥100 mg/dL</td>
<td></td>
</tr>
</tbody>
</table>
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Pathophysiology of CVD in Diabetes and Metabolic Syndrome

- Macrovascular complication due to atherosclerosis (dyslipidemia and endothelial dysfunction)
- Microvascular complication due to dysregulation of vascular tone
- Inflammation
- Oxidative stress
- Hypercoagulability
In Diabetes, an endothelial dysfunction is present leading to the increase in atherogenicity, resulting in Macrovascular disease

In Diabetes, an endothelial dysfunction is present leading to the increase in atherogenicity, resulting in Macrovascular disease

Insulin deficiency and insulin resistance promote dyslipidemia, which causes atherosclerosis

Diabetes Microvascular complication
Diabetes contributes to defects in Autonomic Nervous System, Endothelium and local Metabolism, all of which can result in Microvascular disease.

The Microcirculation is regulated by central and local regulatory mechanisms. The central regulation is via autonomic sympathetic and parasympathetic nerves.

Summary of the changes at microcirculation:

- Dysregulation of vascular tone caused by atomic neuropathy
- Decreased bioavailability of NO, a potent vasodilator
- Increased secretion of the vasoconstricter endothelin-1
- At microvascular level, the vasculature usually at hyper-constricted state
Diabetes is a state of chronic, low-level inflammation

**Adipocyte: An Endocrine Organ**

*Increased production of:*
- PAI-1
- TNF-α
- Resistin
- Angiotensin/endothelin
- IL-6
- CRP
- Leptin
- Adipsin and acylation stimulating protein

*Decreased production of:*
- Adiponectin

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Hyperglycemia and dyslipidemia cause oxidative stress

- Pro-inflammatory cytokines can enhance the production of ROS
- The term ROS refers to a subset of molecules called “free radicals.”
- ROS can directly damage a number of cell components, such as plasma membranes and organelles
- Oxidative stress occurs when the cellular production of ROS exceeds the capacity of anti-oxidant defenses within cells

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Hyperglycemia-induced mitochondrial ROS production activates each of the four major pathways of hyperglycemic damage...

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... oxidative stress is a crucially important concept in the pathophysiology of the cardiovascular complications in diabetes
Up to 80% of patients with diabetes die a thrombotic death

75% of these deaths are the result of an MI, and the remainder are the result of cerebrovascular events and complications related to PVD

The first defense against a thrombotic event is the vascular endothelium

Diabetes has abnormal endothelium and has hypercoagulable state
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Health for all and at all level

- Allocate budget for prevention of Diabetes and metabolic syndrome
- Community-based primary prevention programs
- Create educational program for patients and families
- Mass media campaign

An integrated system is needed to combat this epidemic complex disease

Thank You...