Epidemiology of cardiovascular diseases (CVD)

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Epidemiology

• It reveals the processes that cause the disease and studies what interaction occurs between genetic information of a person and effects of external origin.

• For the population it determines which factors affect the differences in the incidence of the disease among different populations and social groups.
• Interdisciplinary method used to detect the complex etiology of chronic diseases with frequent occurrence in the population, among which are dominated by emerging CVD-based atherosclerosis

• At the same time they belong to the so-called diseases of civilization = disease, whose differences of incidence in the population is associated with changes in the way the existence of civilization
Prevalence a mortality

- Global CVD mortality - about 30%
- In developed countries - CVD mortality approximately ½ of all deaths
- In developing countries - about ¼ of all deaths
- The most common cause of death is coronary heart disease (CHD), followed by cerebrovascular diseases
Structure of cardiovascular mortality in the Czech rep. in 2005 - men

- cévní mozková příhoda: 16%
- ostatní cévní mozková onemocnění: 12%
- akutní infarkt myokardu: 8%
- ostatní formy ICHS: 17%
- srdeční selhání: 29%
- ateroskleróza: 4%
- ostatní kardiovakulární příčiny: 14%
Structure of cardiovascular mortality in the Czech rep. in 2005 - women

- Cévní mozková příhoda: 18%
- Ostatní cévní mozková onemocnění: 11%
- Akutní infarkt myokardu: 10%
- Ostatní formy ICHS: 10%
- Srdeční selhání: 10%
- Ateroskleróza: 4%
- Ostatní kardiovakulární příčiny: 17%

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Development of mortality from CVD in Czech rep.

Zemřeli

0 10 000 20 000 30 000 40 000 50 000 60 000 70 000

Mortality caused by CVD compared with total mortality in Czech rep.

Mortality due to CVD – a percentage to the total mortality

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Atherosclerosis

- Chronic degenerative disease caused by deposition of substances - especially lipids, carbohydrates, blood cells, calcium, etc. in the arterial wall

- Pathological changes occur in the intimate and media layer of arterial wall

- Atherosclerotic process begins in utero and it is ongoing for many years
Stages of atherosclerosis

1. *stage* – Initial lesion, Fatty streak

2. *stage* - Intermediate lesion, Atheroma

3. *stage* – Fibroatheroma, complicated lesion

there is a change in lumen of blood vessels, thus creating a lack of blood flow in the area of blood supply
Atherosclerotic mass gradually narrows the lumen of an artery
RISK FACTORS OF CVD

- CONTROLLABLE
  - ...
  - ...
  - ...
  - ...

- NONCONTROLLABLE
  - ...
  - ...
  - ...
  - ...

More than 200 risk factors in total...
Clinical manifestation of atherosclerosis

- Initial stages have no symptoms
- Depends on location of disability of vascular system
- Depends also on the speed of development - the slower the development the milder clinical manifestations
1. Lifestyle risk factors

- Consumption of tobacco and its products
- Excessive alcohol consumption
- Low physical activity
- Nutrition with high contain of fatty acids, cholesterol and containing excessive amount of energy
- Stress
- ??? others
Tobacco consumption

- Global pandemics
- Risk factor for CVD is also passive smoking
  - reduced coronary flow has been proven after 30 min long stay in a smoky environment
- In countries where there is a ban on smoking in hospitality venues has decreased the number of ACS (acute coronary syndromes) by 17%
- The lower weight of smokers, but larger waist!!!
Effects of nicotine on the basal metabolism

- Nicotine stimulates norepinephrine turnover in brown adipose tissue, thereby increasing the resting metabolism\(^1\)
- In the experiment in mice nicotine activated UCP1 in brown and white adipose tissue by 25-45\(^%\)\(^2\)
  - effect on UCP2 and UCP3 was not observed
- Nicotine and its metabolites have a thermogenic effect, which runs an increased oxidation of fat - 20 minutes of smoking (two cigarettes) increases energy expenditure of about a 20 minutes walk (5.8 km / h)

\(^{1}\) Yoshida T et al. J Nutr Sci Vitam 1990;36:123
Brief intervention = 5 A’s
1. Ask about smoking/tobacco use
2. Advise to quit
3. Assess the vigilance to quit
4. Assist with treatment
5. Arrange controls
Brief intervention:

1. **Ask** – ask about tobacco use and make a note into the medical record, record must be updated at each visit
   - At least once per year (1. what age did you start to smoke/what age have you smoked till, 2. What kind of tobacco do you smoke 3. how many cigarettes do you smoke per day/week)

2. **Advise** – advise to quit in a clear and emphatic way
3. **Assess** – assess the vigilance to quit, if not decided yet, you should motivate:

- explain adequately the benefits of being smoke-free in their particular case (e.g. in terms of clinical findings, diagnosis, problems, prognosis).
- if not willing to quit, intervention ends, we should repeat the recommendation to quit at next visit (in an empathic way!!)
4. **Assist** – assist to quit to those who willing to quit according to time possibilities (offer of support – prepare solution for typical smokers situation, recommendation of NRT (nicotine replacement therapy) or referral to specialized centre for tobacco dependence treatment

5. **Arrange follow up** – according to your time availability
Alcohol consumption I.

- Regular excessive consumption rises level of triglycerides, possibility of irritation/necrosis of pancreas
- Women – tolerate about 50% less alcohol
- The protective effect detected at 10-30 g alcohol / day for men and 10-20 g alcohol / day for women – important to explain the specific amount of a particular beverage (moderate alcohol drinking) – "French Paradox"
Alcohol consumption II.

- For polyphenolic flavonoid content is appropriate especially red wine
- Increases HDL!
Physical activity

- Increased energy expenditure = prevention of obesity
- Aerobic sports are appropriate
- Decreases triglycerides, increases HDL
- If possible daily, but at least 3 times per week in the length of 45 – 60 min.
- Recommended heart rate: $220 - \text{age}$ (our goal is to reach 40 – 60% of this value
- Better fit and fat than unfit and unfat!!!
Nutrition

- Excessive intake of energy with a high content of saturated fatty acids and trans isomers of unsaturated fatty acids (transFA)
- The result is a faster accumulation of body fat and weight gain and thus increased cardiovascular mortality
- CAVE! When buying vegetable margarine monitor the proportion of trans isomers of unsaturated fatty acids (the smallest proportion is the best)
2. Biochemical and physiological characteristics

- Increased total cholesterol (especially LDL)
- Low HDL
- Increased triglycerides
- Increased blood pressure (BP)
- Hyperglycemia, Type 2 diabetes, impaired glucose tolerance and insulin resistance
- Central type of obesity
- Thrombogenic factors
Metabolic syndrome

- At least 3 of these criteria (according to WHO):
  1. Waist circumference > 88 cm in women and > 102 cm in men
  2. BP > 130/85 mmHg
  3. Blood glucose > 6.0 mmol/l
  4. Triglycerides > 1.7 mmol/l
  5. HDL in women < 1.25 mmol/l and in men < 1.0 mmol/l

- There is not explicitly mentioned insulin resistance, even if it is a common feature
Metabolic syndromata and obesity

- The incidence is closely related to body weight using body mass index

\[ \text{BMI} = \frac{\text{body weight} (kg)}{\text{body height}^2 (m)} \]

- Underweight: \(<18.5\)
- Normal weight: \(18.5 - 24.9\)
- Overweight: \(25.0 - 29.9\)
- 1st degree obesity: \(30.0 - 34.99\)
- 2nd degree obesity: \(35.0 - 39.9\)
- 3rd degree obesity: \(>40.0\)
• Prevalence of metabolic syndrome if normal weight < 3%
• If BMI > 35 metabolic syndrome present in 100% of patients
• It is important to capture the first component of the syndrome, because the presence of one component increases the likelihood of other components
The new European Risk Chart based on SCORE data. For high CVD risk, regions are based on total cholesterol levels. Adapted from Conroy et al, Eur Heart J. 2003;24:987-1003. Copyright © 2003 European Society of Cardiology. All rights reserved.
Diabetes mellitus type 1 and type 2

- Chronic illness when the body is unable to utilize glucose as a physiological condition due to absolute or relative deficiency of insulin
- Common sign for both types is hyperglycaemia, as the mechanisms for the removal of glucose into cells are impaired and there are also significant changes in the intermediary metabolism of carbohydrates, lipids and proteins
Diabetes mellitus

• Diabetes emphasizes manifestations of atherosclerosis
• Devastates the quality of life via development of diabetic complications (microangiopathy, macroangiopathic-diabetic foot, metabolic)
• Prevalence in the population of the Czech Republic is approx. 8 – 10%
• The metabolic syndrome is associated mainly with type 2 diabetes – there is a high insulin resistance
Diabetes mellitus

- Primary prevention is early detection of impaired glucose regulation (oral glucose tolerance test)
- Secondary prevention is the best possible compensation of DM by diet, oral antidiabetic drugs and finally insulin therapy
- An indicator of DM compensation is glycated haemoglobin (HbA1c)
### 3 levels of compensation:

<table>
<thead>
<tr>
<th>Level of compensation</th>
<th>Value of HbA1c</th>
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<tbody>
<tr>
<td>Perfect compensation</td>
<td>Up to 4,5%</td>
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<tr>
<td>Satisfactory compensation</td>
<td>4,5% - 6,0%</td>
</tr>
<tr>
<td>Unsatisfactory compensation</td>
<td>Over 6,0%</td>
</tr>
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</table>

- Shows the compensation of last time period
Hyperlipidaemias

- We divide those into hypercholesterolaemias, hypertriglyceridemias and mixed hyperlipidaemias.

- They can be further divided into primary (genetic) and secondary (accompanying another primary disease).
Memory aid for remembering serum lipid levels

- Total cholesterol up to 5 mmol/l
- LDL up to 3 mmol/l
- Triglycerides up to 2 mmol/l
- HDL over 1 mmol/l
Atherogenity index

- The ratio of total cholesterol and HDL
- Values from 0 to 4 (most favorable is zero)
Primary prevention is the earliest possible detection of defects of metabolism of lipids.

Important regime measures: treatment of tobacco dependence, increasing physical activity, weight loss, reduce cholesterol and saturated FA in the diet.

Secondary prevention is diet and if diet is not sufficient pharmacotherapy takes places.
Hypertension

- Metabolic disorders presenting with elevated blood pressure and impaired regulation of BP
- BP $\geq$ 135/80 mmHg measured repeatedly!
- The prevalence in the population of the Czech rep. is around 35% (an increase in higher age groups)
- Primary (essential) hypertension 90%, secondary hypertension present in 10% (accompanying endocrine diseases)
Hypertension

- Primary prevention is the earliest possible detection of disease
- Secondary prevention contains dietary correction - especially salt restriction (<5g NaCl/day) and pharmacotherapy (in resistant forms of the combination of various antihypertensives)
Obesity

- Is the second most common cause of death, which can be prevented
- It affects approximately 31% of women and 21% of men in the Czech rep.
- Over the past 10 years, prevalence increased by 4%
- Apple Type = abdominal fat accumulation
- Pear Type = gynoid obesity
- The size of the abdominal waist circumference is an important risk indicator of CVD
Waist circumference and waist-to-hip ratio

- Waist circumference:
  Women: > 80 cm increased risk
  Men: > 94 cm increased risk
- The WHR is a better indicator of cardiovascular risk than BMI
  Women: > 0.85
  Men: > 1.0
% of body fat

- Better indicator than BMI

<table>
<thead>
<tr>
<th>Age</th>
<th>Up to 30 yrs.</th>
<th>30 – 50 yrs.</th>
<th>50 +</th>
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<tbody>
<tr>
<td>Women</td>
<td>14 – 21%</td>
<td>15 – 21%</td>
<td>16 – 25%</td>
</tr>
<tr>
<td>Men</td>
<td>9 – 15%</td>
<td>11 – 17%</td>
<td>12 – 19%</td>
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Obesity

- Propper diet and physical activity, regime....
- Weight reduction – importance of behavioral interventions, and dietary habits, in resistant cases antiobesitic drugs, bariatric surgery...
Clinical case

- Patient M.Z., 48 yrs., administrative worker, BMI 41, likes sweets
- Does not like sports
- Due to workload having lack of time for lunch, but she has a huge dinner
3. Unmodifiable personality characteristics

1) Age – men 45 \( > \) years, postmenopausal age in women
2) Male sex
3) RA early IHD (men aged \( < 55 \) years for women \( < 65 \) years) or other manifestations of atherosclerosis in 1st degree relative
4) Personal history of CVD, other manifestations of atherosclerosis or finding of asymptomatic forms of the disease
Psychosocial factors

- Characteristics of personality
- Depression - the prevalence in Western Europe about 15%, reflected by the sadness, pessimism, guilt, inability to rejoice, possible somatic symptoms
- Anxiety - characterized by a feeling of inner tension, fear, disgust, poor concentration
Depresion and CVD

- Relations can be divided into 2 groups:
  I. Psychological
  II. Biological
I. Psychological

- Forced change of lifestyle
- Change of dietary habits
- Fear/Uncertainty/Threat
- Sick/forced physical inactivity
- Change in occupancy and performance of social / work / family roles
- Adaptation to new quality
- Impaired compliance
II. Biological

- Hormonal dysbalance: axis hypothalamus-hypophysis-adrenal glands provides body with higher amount of cortisol which negatively influences CV system by progression/exacerbation of CVD /
- Alteration of serotonin metabolism - impaired serotonin homeostasis leads to higher ability to aggregate and thus facilitates the formation of thrombi
II. Biological

- Alteration in autonomic nervous system tone
- Higher sensitivity of sympathetic system leads to higher expression of mRNA for protooncogenes (these can induce production of growth factors and thus progression of atherosclerosis)
- Changes in immune system
Stress

• The reaction of the organism of threatening danger

• Initial simple stress response leading to the activation of the sympatho-adrenomedullar system and testosterone - "Fight or Flight", escape or attack

• Long-term or intermittent stress: activation of the pituitary-adrenocortical system favoring the production of ACTH, corticosteroids and androgens alteration (reduction of testosterone in men and estrogen in women)
• Loss of control of metabolism, reproductive suppression, depression of immune system and depressive states can occur as a result of chronic
• Hard work can lead to chronic fatigue syndrome
Chronic fatigue syndrome

- Dominant symptom is fatigue lasting at least 6 months, or easy becoming tired

- Other symptoms as long-term increased body temperature (=subfebrilia), muscle and joint pain, impaired attention, memory problems, mood lability may be present
Chronic fatigue syndrome

- Most common in women aged 25-45 years
- The exact etiology is unclear, the background of viral infections, immune system disorders and mental problems seems to play a role

- Therapy: Cognitive-behavioral, gradual adaptation to increasing load
Burn-out syndrome

- State of emotional exhaustion and depersonalization, which leads to a decrease in work efficiency

- The main triggers are chronic stress, constant time pressure and high emotional tension
most common in people who have continuous, demanding and intensive contact with people and their work is inadequately remunerated: = **Doctor** (in the Czech rep.), namely:

- Young
- Women
- Single
- Childless
Causes of stress load of doctors

<table>
<thead>
<tr>
<th>Based on the nature of the profession</th>
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<tbody>
<tr>
<td><strong>Physical load</strong></td>
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<tr>
<td>High static load (e.g. Operating room)</td>
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<td>Disturbed sleep patterns</td>
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<td>Irregular food intake</td>
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<td>Contact with drugs, chemicals, etc.</td>
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<td>High risk of infection</td>
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<tr>
<td><strong>Mental load</strong></td>
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<tr>
<td>High work pace</td>
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<td>High responsibility</td>
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<tr>
<td>The need to respond constantly quickly and flexibly</td>
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<tr>
<td>Contact with the suffering and pain</td>
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<tr>
<td>The need to communicate with the patient and his family</td>
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<th>Based on working conditions</th>
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<td>High demands on work performance</td>
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<td>Poor remuneration</td>
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<td>Increase of the inefficient administrative burden</td>
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<td>Professional uncertainty</td>
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<tr>
<td>Symptoms</td>
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# The impact of burn-out sy. on healthcare system

<table>
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<th>Relation patient-doctor</th>
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<tr>
<td>Reduced performance of doctors</td>
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<td>Increased number of medical errors</td>
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<td>Decreased interest of the patient</td>
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<td>Compromise choice</td>
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<th>Healthcare system</th>
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<tr>
<td>Increasing No. of physicians leaving profession</td>
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<td>Reduced willingness for professional growth</td>
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<tr>
<td>Reduced public confidence in the health care system because of the obvious manifestations of the syndrome among physicians (less willingness to communicate impersonal approach, declared cynicism)</td>
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Prevention and therapy

• Personal
• Systematic

• Create a certain “distance” from patients
• Do not suppress your feelings, but talk about them
• Include break
• Separating work from personal life
• Avoid the personal experience of working problems - of relating them to your person
• Do not be afraid of changes
• Count with stressful situations and make them active
• Keep a good social background and relationships with others
• Find meaningful work
• Acquisition and takeover of professional autonomy and support
PREVENTION

- Appropriate time management
- Work autonomy
- Variety and variability of work
- Sufficient assertiveness
- Belief in own abilities and self-assertion
- Perceiving yourself to be able to manage the situation
- “Art” of relaxation
Thanks for attention!

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