DISEASES OF AORTA, CAROTID ARTERIES, AND STROKES

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OUTLINE:

I. Case report

II. Statistics Czech Republic

III. Basics of anatomy

IV. Aorta

1. Most common/serious diseases

III. Carotid arteries

1. Most common/serious diseases

2. Carotid arteries and strokes – controversies

III. Summary

CASE REPORT

- **42y old man examined for sudden retrosternal pain, which began approx. 1 hour before admission after strenuous effort (lifting heavy luggage). The pain is excrutiating, is spreading to the back and there is minimal effect of administration of nitroglycerine applied by ambulance staff. He never experienced similar problems. He is treated for hypertension for 5 years by enalapril (ACE inhibitor). There is no cardiovascular disease in family history. He does not smoke, does not drink alcohol, has no other addiction(s). He is coach of basketball team and very active in sports.**

CASE REPORT

- **Physical findigs:**

Very tall man with long upper extremities, anxious, sweating.

Vital signs: BP-Right UE -125/75, Left UE– 175/90 mm Hg, HR-114/min, regular, RR-22/min

Over right carotid artery systolic bruit. Over aortic valve diastolic murmur with maximum in 3rd intervertebral space left from sternum.

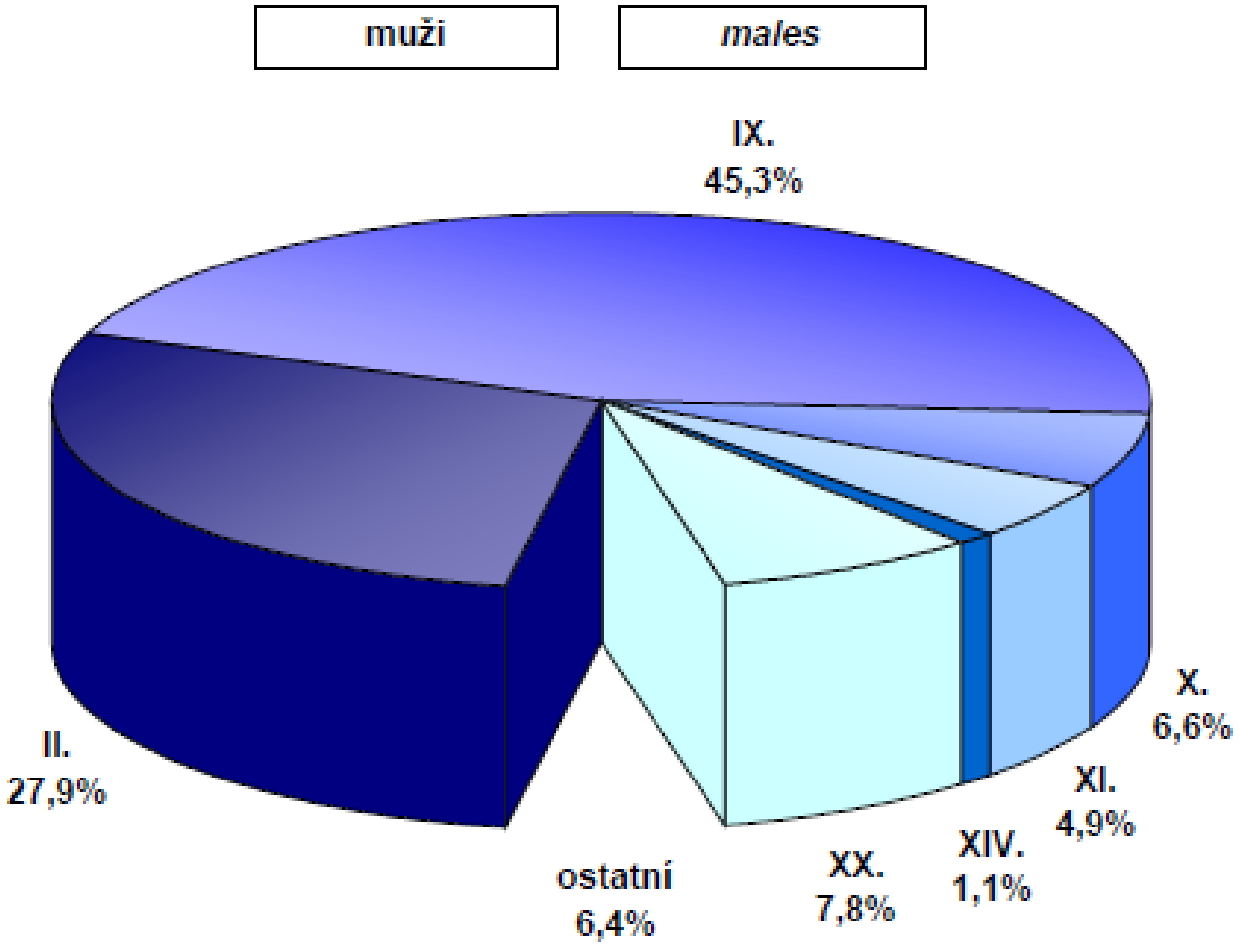
Chest X-ray - widening of mediastinum.

FURTHER STEP(S) ?

FURTHER STEP(S):

- **Betablockers (i.v.)**
- **TEE, CT, MR**
- **Operating theatre**

STANDARDIZED MORTALITY, CZECH REPUBLIC



II Tumours

IX Cardiovascular disease

X Respiratory disease

XI Gastrointestinal disease

XIV Genitourinary disease

XX Environmental disease

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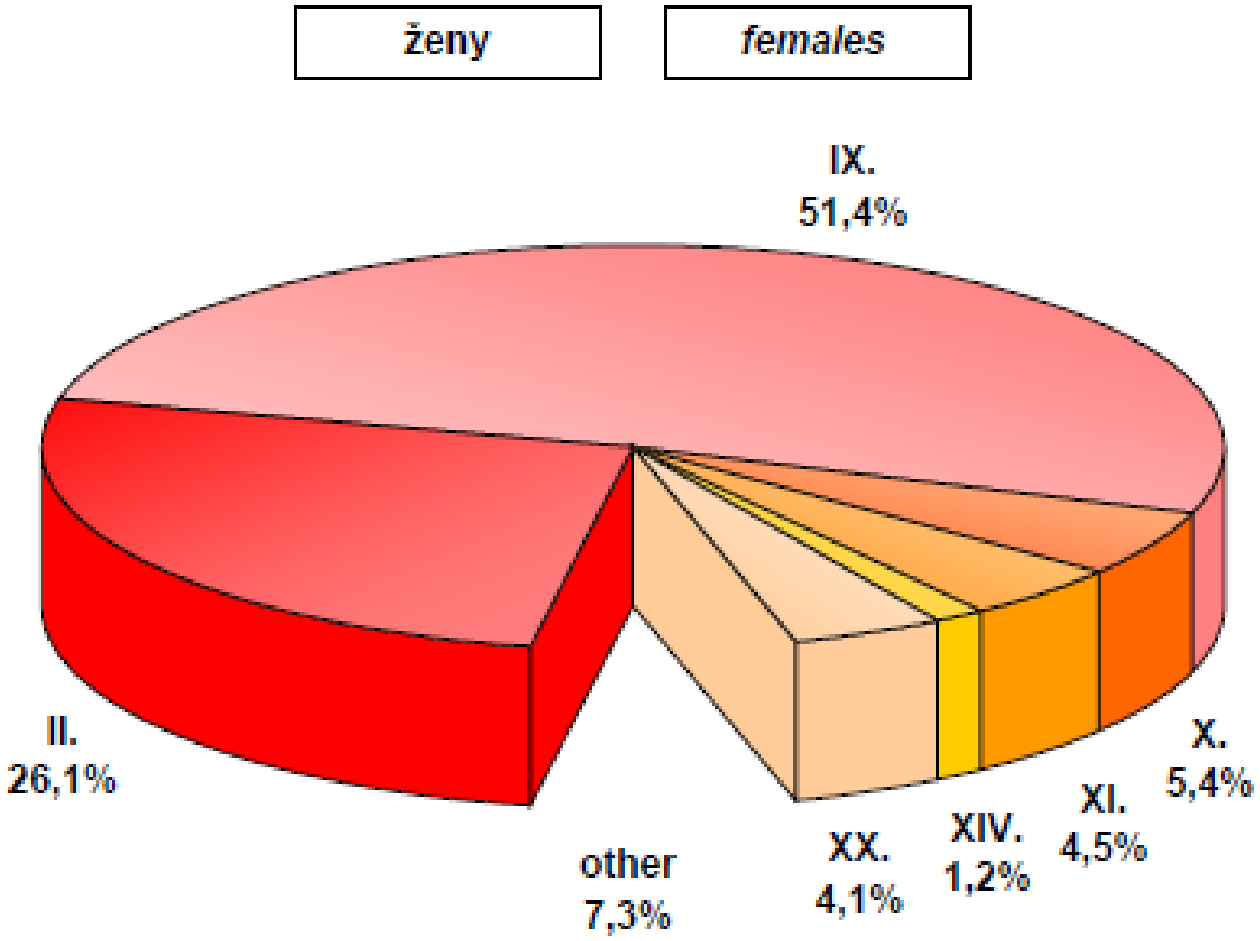

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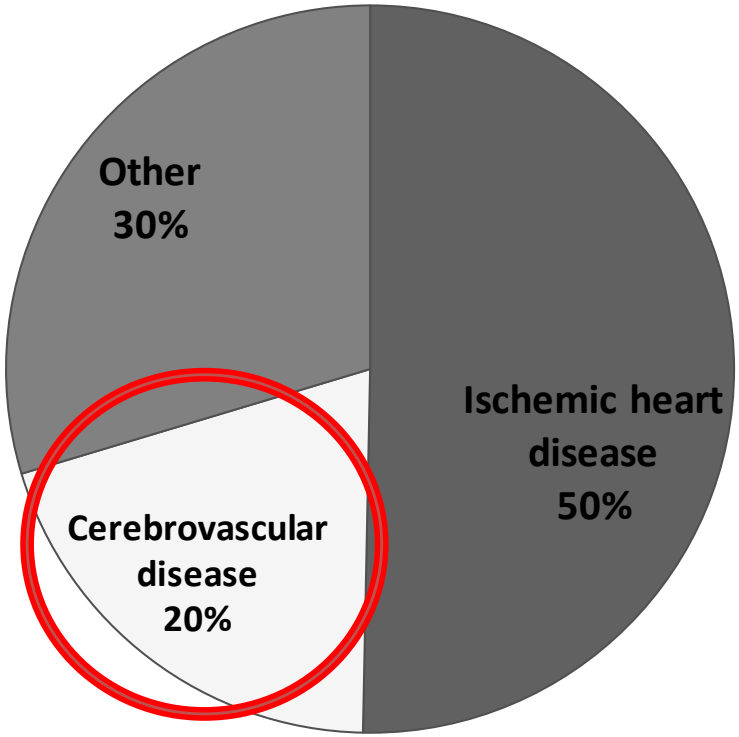
REPRESENTATION OF VARIUS DISEASES ON MORTALITY FROM CARDIOVASCULAR DISEASES - MEN



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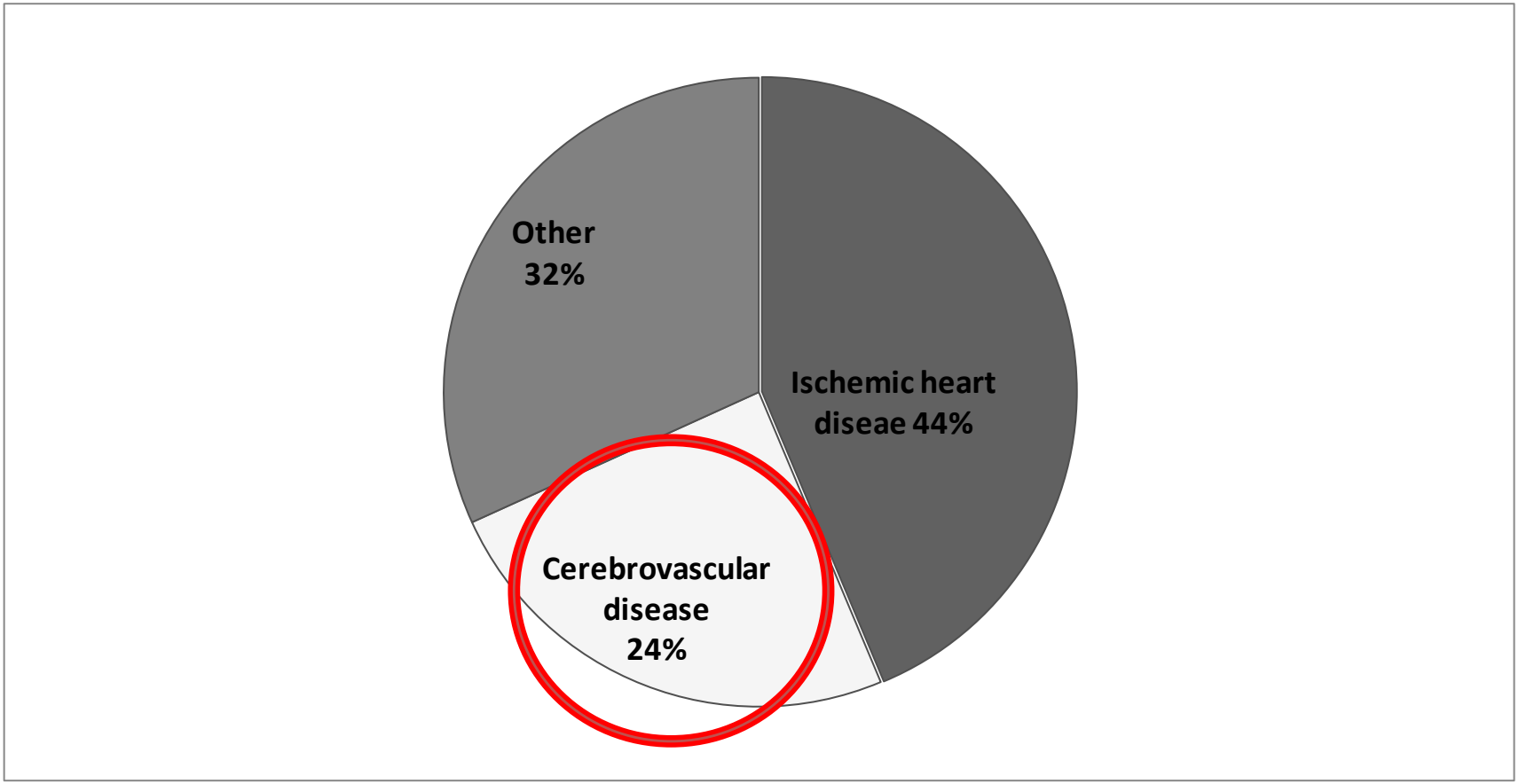
REPRESENTATION OF VARIUS DISEASES ON MORTALITY FROM CARDIOVASCULAR DISEASES - WOMEN



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DISEASES OF AORTIC ARCH

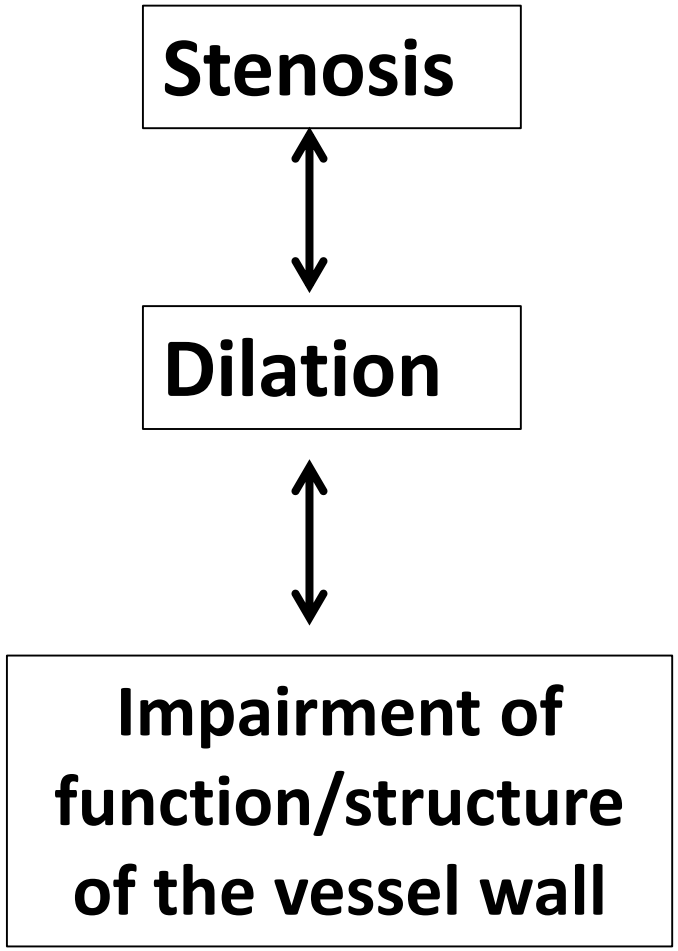
PATOPHYSIOLOGY:

Atherosclerosis (FH)

Genetic disease of the vessel wall:cystic medionecrosis, …

Genetic disease of aortic arch (coarctation, duplex aortic arch, situs visc.inv., …)

+ Inflammatory disease



SYMPTOMS:

STROKES – ischemic and/or hemorrhagic

Chest pain, sudden death, hemorrhagic shock

Hypertension

DISEASES OF BRANCHES OF AORTIC ARCH

- **Atherosclerosis**
- **Cystic medionecrosis/degenerative connective tissue diseae (dissection, aneurysma)**
- **Inflammatory changes – infection, autoimmune d., Inborn errors: Berry aneurys (CNS), duplex aortic arch, coarctation, …)**
- **Trauma**

MOST COMMON SYMPTOMS

STROKES/TRANSITORY ISCHEMIC ATTACKS:

Ischemic – emboli, stenosis/occlusion of carotid/vertebral arteries

Hemorrhagic – IC aneurysm, A-V malformations

DISSECTION OF ASCENDING AORTA:

Coronary syndrome, ischemic stroke, ischemia of distal parts of the body (GIT, LE).

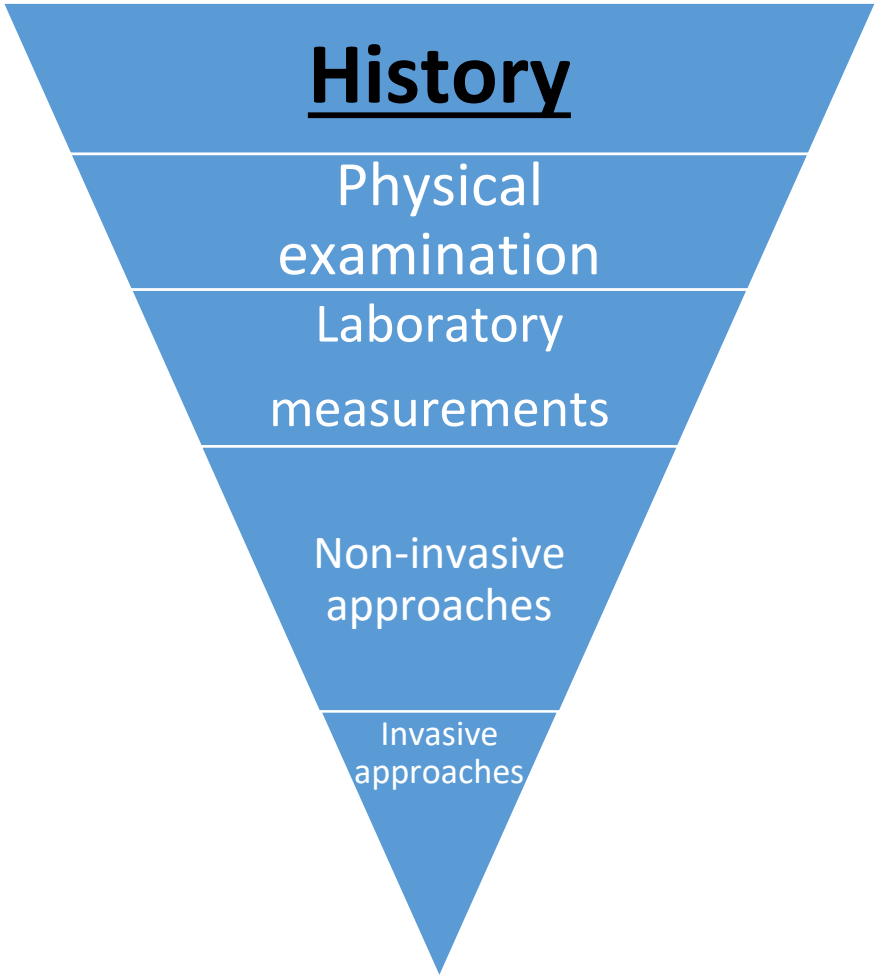
ANEURYSM:

Emboli

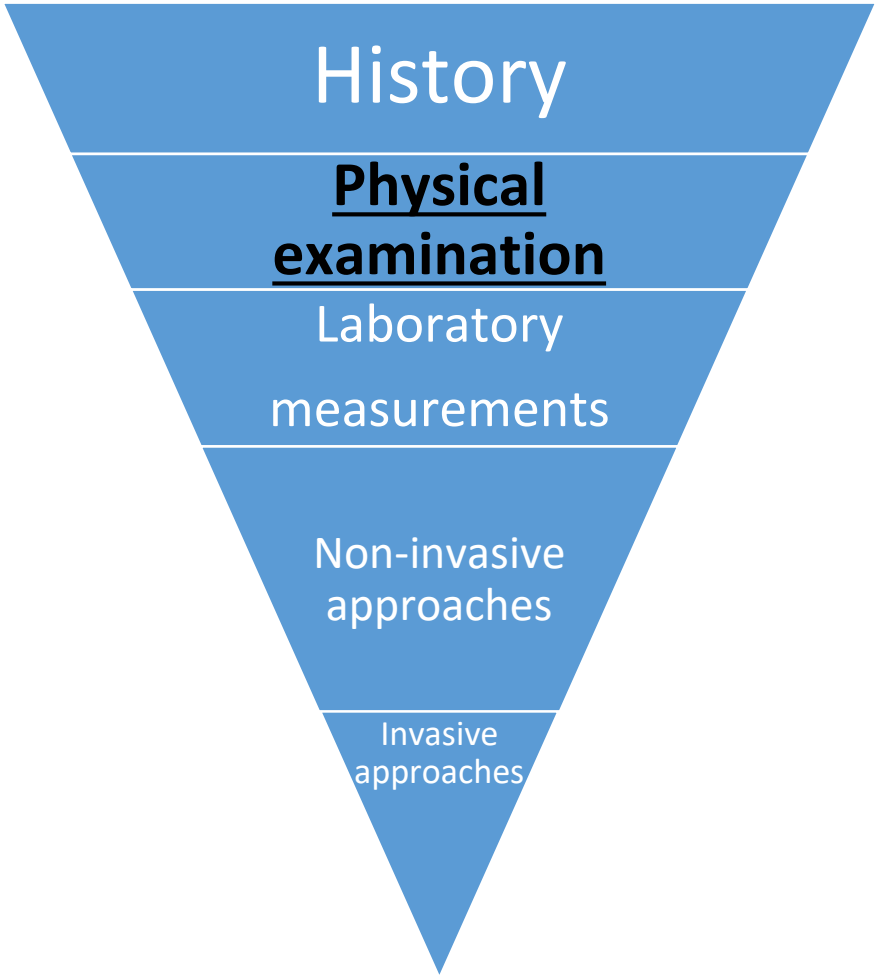
Compression (oesogagus, …)

CLINICAL APPROACH

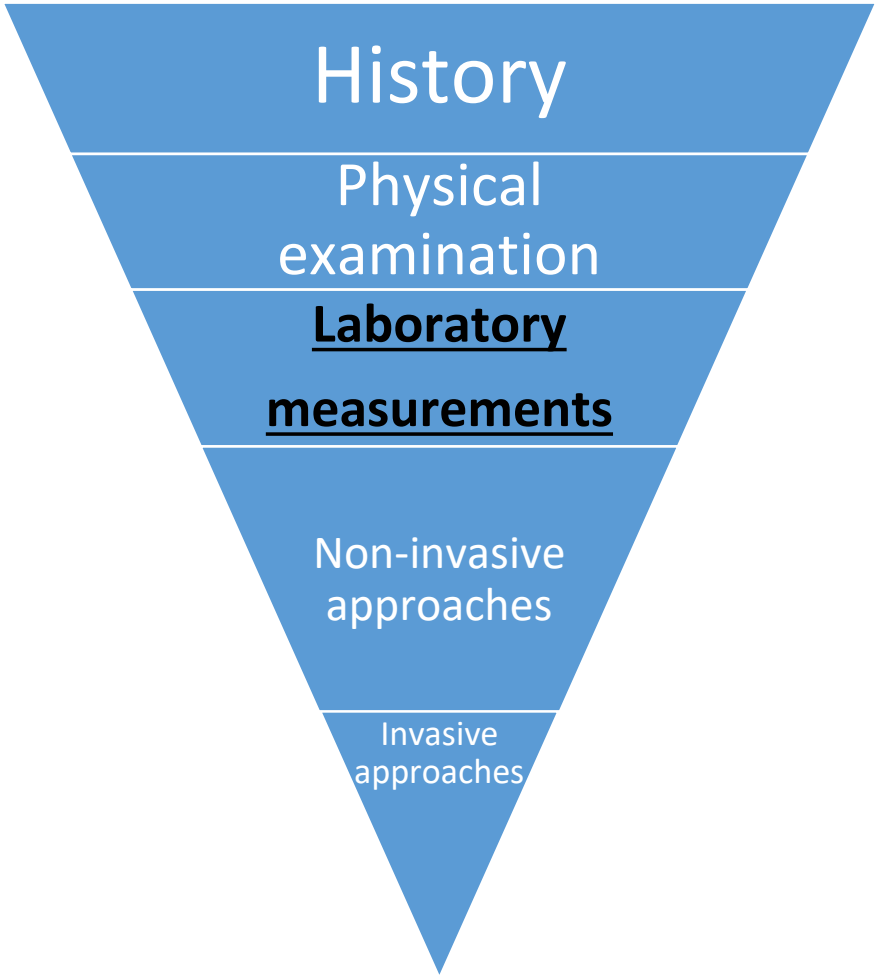
- **History: hypertension, strokes/transitory ischemic attacks, chest pain**
- **Physical findings – asymetry of the body, hypertension, left/right blood pressure difference (more than 20 mm Hg)**
- **Laboratory findings (inflammation?)**
- **Noninvasive methods**
- **Invasive methods**



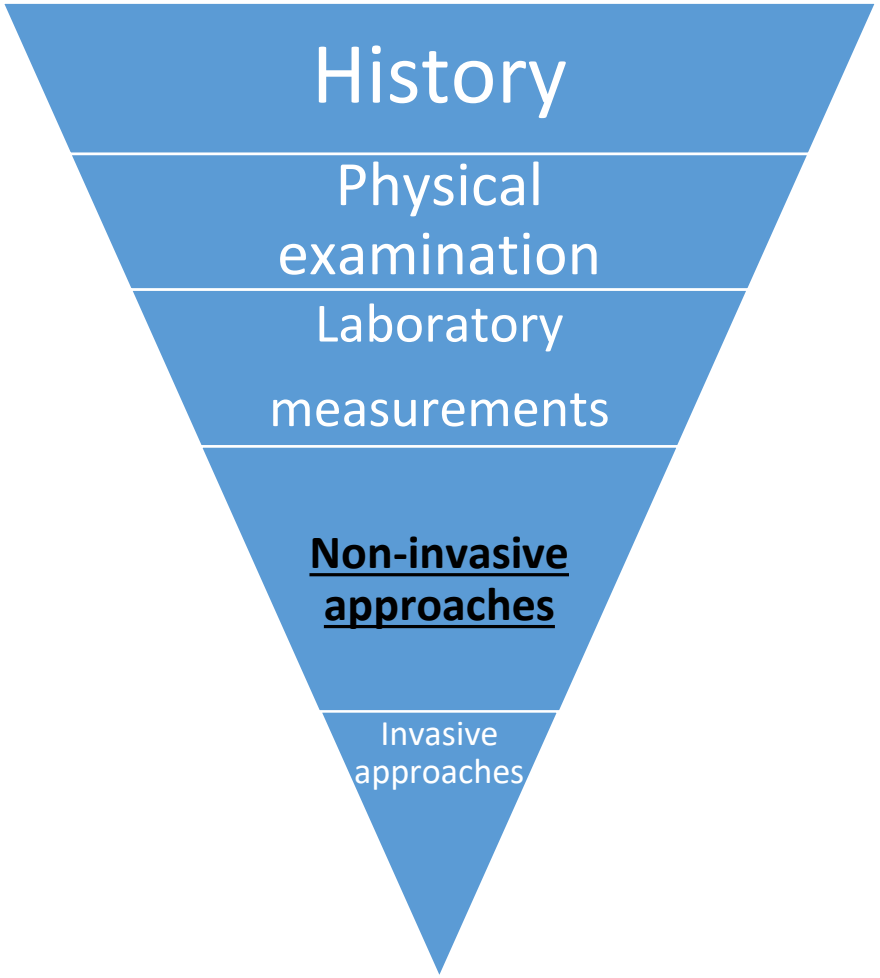
1. **What and where is the main problem (only 1)**
2. **<u>Provocating/alleviating situations/maneuvres</u>**
3. **<u>Accompanying signs/risk factors, …</u>**
4. **Intensity**
5. **Location**
6. **<u>Time course/duration</u> – new, long-lasting, worsening**



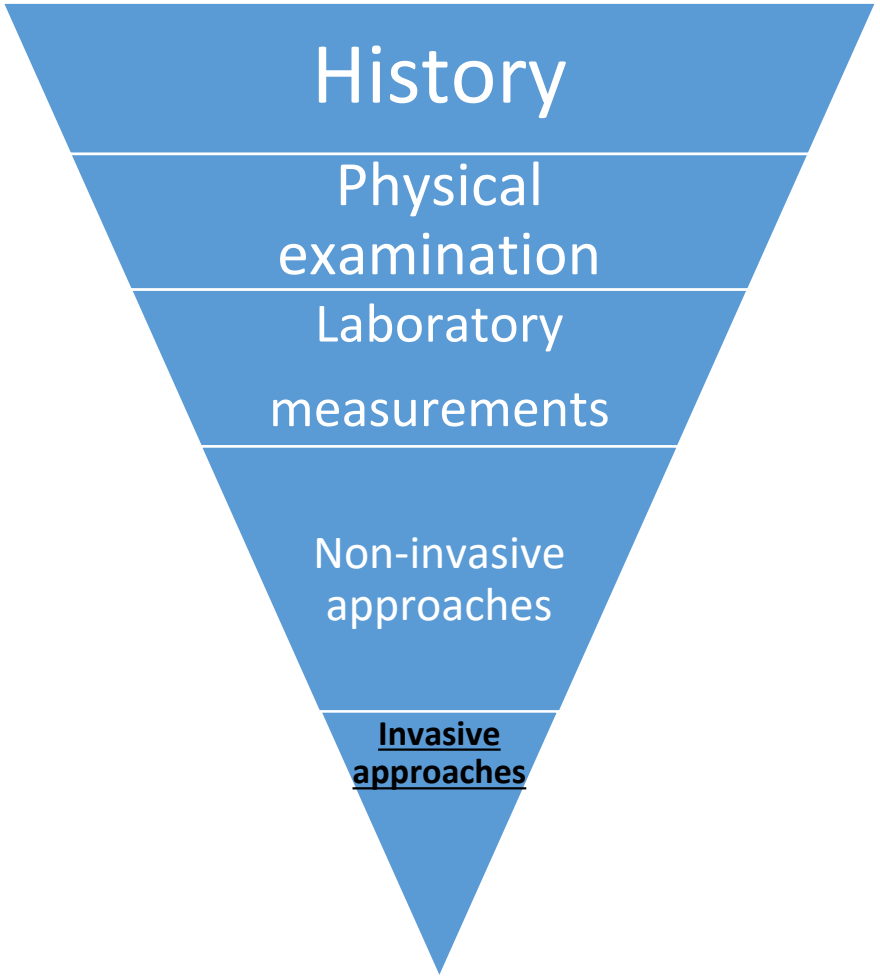
1. **General outlook – well, about to die, …**
2. **Hydration, color, …**
3. **Vital sings BP/difference L/R, Pulse Rate, Respiratory Rate, Temperature, Saturation (02)**
4. **Location**
5. **Focus on suspicious area (auscultation, …)**



1. **Glycemia**
2. **Blood gases (pH, pCO2, Po2, ...)**
3. **Cardiospecific markers**
4. **Blood count**
5. **Inflammatory markers: Sed. Rate, C-reactive protein, procalcitonine, interleukin-6, …**
6. **Minerals (Na, K, Cl, Ca, P, …)**
7. **Renal function – creatinine, urine analysis …**
8. **Status of coagulation INR/QUICK, aPTT, D-Dimers**
9. **Liver tests, bilirubin, amylases, albumin, …**
10. **Toxicology (unconsciousness of unknown origin …)**
11. **Bacteriology, parazitology**
12. **Other specific tests – hormonal status, imunology, ….**



1. **ECG**
2. **Monitoring of ECG, Blood pressure**
3. **X-ray, ….**
4. **Ultrasound studies – carotid arteries, abdominal aorta**
5. **Computer tomography (CT) - brain**
6. **Magnetic resonance (MR)**
7. **Scintigraphy**
8. ***Pozitron emission tomography (PET)***
9. **Functional tests– bicycle/treadmill ECG, tilt test, walking test**



1. **Measurment of right heart pressures(CVP), intraarterial BP**
2. **Fibroscopy- gastro, broncho, …**
3. **<u>Angiography</u>**
4. **Electrophys. Studies**
5. **Laparascopy**
6. **Sternal puncture**
7. **Biopsy**
8. **Lumbal puncture**
9. **Invasive imaging of body spaces**

CLINICAL MANIFESTATION OF AORTIC DISSECTION

COMPLICATIONS	MECHANISM(s)
Horner syndrome/trias	Compression of sympathetic neurons in upper thorax/neck
Myocardial infarction	Occlusion of the origins of coronary arteries
Hemopericardium, pericardial tamponade	Dissection with retrograde leak to pericardium
Aortic regurgitation/insufficiency	Dissection of the aortic root
Visceral ischemia, hematuria	Dissection of visceral arteries
Hypertension, blood pressure gradient between left/righ upper extremity	Dissection of brachiocephalic aa.
Hemiparesis/plegia	Occlusion of carotid arteries

METHODS FOR EVALUATION OF AORTA AND ITS BRANCHES

ADVANTAGES	DISADVANTAGES
Transthoracal, - esofageal echocardiography (TEE) + Duplex ultrasound	
Movable Potential to assess cardiac valves, ventricular function Without iodine .. contrast (non-invasive)	"Blind spot" in asc. Aorta- crossing of bronchi and esophagus Non-reliable assessment of arteries with smaller calliber, of vessel wall, … TEE – semiinvasive
Computed Tomography	
Reliable assessment of aortic arch and its branches	Less reliable in assessment of car. valves and ventricular function Immovable/immobile Contrast
Magnetic Resonance	
Detail image of the aortic wall, incl. intraluminal hematomas + reliable assessment of aortic branches and their tributaries, no nephrotoxic contrast	Immovable/immobile Limited access for patients with PM, ICD Expensive
Angiografie	
Assessment of coronary arteries	Invasive Limited assessment of real lumen Contrast
Positron emission tomography (PET) Assessment/detection of inflammatory changes	Expensive, less experience, low availability

DISSECTION OF ASCENDING AORTA - etiology

Not well controlled hypertension

Diseases of connective tissue (medionecrosis):

Marfan syndrome, Ehler Danlos syndrome:

+ Loeys–Dietz syndrome

CLASSIFICATION OF AORTIC DISSECTION

Type	Extent of involvement
DeBakey	
I	Begins in **ascending aorta**, propagates to descending aorta
II	**Only ascending aorta**
IIIa	Only descending aorta
IIIb	Descending + abdominal aorta
Stanford	
A	Includes (i) **ascending** aorta
B	Limited to descending aorta

MANAGEMENT:

- **Stabilisation of vital functions**
- **Pharmacological** - analgetics, betablockers, lowering of blood pressure.
- **Surgery/intervention –** replacement/reconstruction of aortic valve/aortic arch, stentgrafts (EVAR) …

MANAGEMENT:

- **Prevention:**
- Early detection of patients/persons at risk – family history, physiognomy, control of risk factors/hypertension
- Physiognomy – extremely long UE, arachnodactyly, kyphoscoliosis, eye involvement – ectopic lens

ANEURYSM OF ASCENDING/THORACIC AORTA

Aneurysm diameter is the main indicator for elective surgical intervention.

Indications for replacement of ascending aorta are influenced by etiology, diameter and rate of growth of the aneurysm, and are as follows:

1.Asymptomatic ascending aortic aneurysm >5.0 cm in diameter.

2.Symptomatic aneurysms irrespective of size.

3.Asymptomatic ascending aortic aneurysm >4.5 cm in patients with Marfan syndrome.

4.Acute dissection or rupture of ascending aortic aneurysm.

5.Pseudoaneurysm or traumatic aneurysm in ascending aorta.

6.Ascending aortic aneurysm >4.5 cm in patients undergoing aortic valve surgery.

7.Growth rate of >0.5 cm/y when ascending aorta is <5.0 cm in diameter.

ANEURYSM OF ABDOMINAL AORTA

- Normal 1.5-2 cm
- More than 3 cm – follow up
- More than 5 (± 0,5) cm – stentgraft/surgery if symptomatic and/or progression by more than 0,5 cm/year
- More than 8 cm – surgery irrespectively of symptoms
- Screening – men older than 65 years, smokers

CAROTID ARTERIES

- **Stenoses/occlusions (atherosclerotic changes, intimomedial hyperplasia)**
- **Dilation (syphilis, mycotic)**
- **Malformations (arteriovenous, tumours, …)**
- **Dissection**
- **Trauma/injuries**

The NEW ENGLAND JOURNAL of MEDICINE

CLINICAL DECISIONS

INTERACTIVE AT WWW.NEJM.ORG

Management of Carotid Stenosis

67y old man, treated for hypertension, dyslipidemia and with antiaggregant therapy during regular follow up presents with bruit over right carotid artery. He does not smoke and drinks alcohol rarely. Without other serious diseases.

BMI 27 kg/m^2, BP: 140/85 mm Hg, HR 72 beats/min.

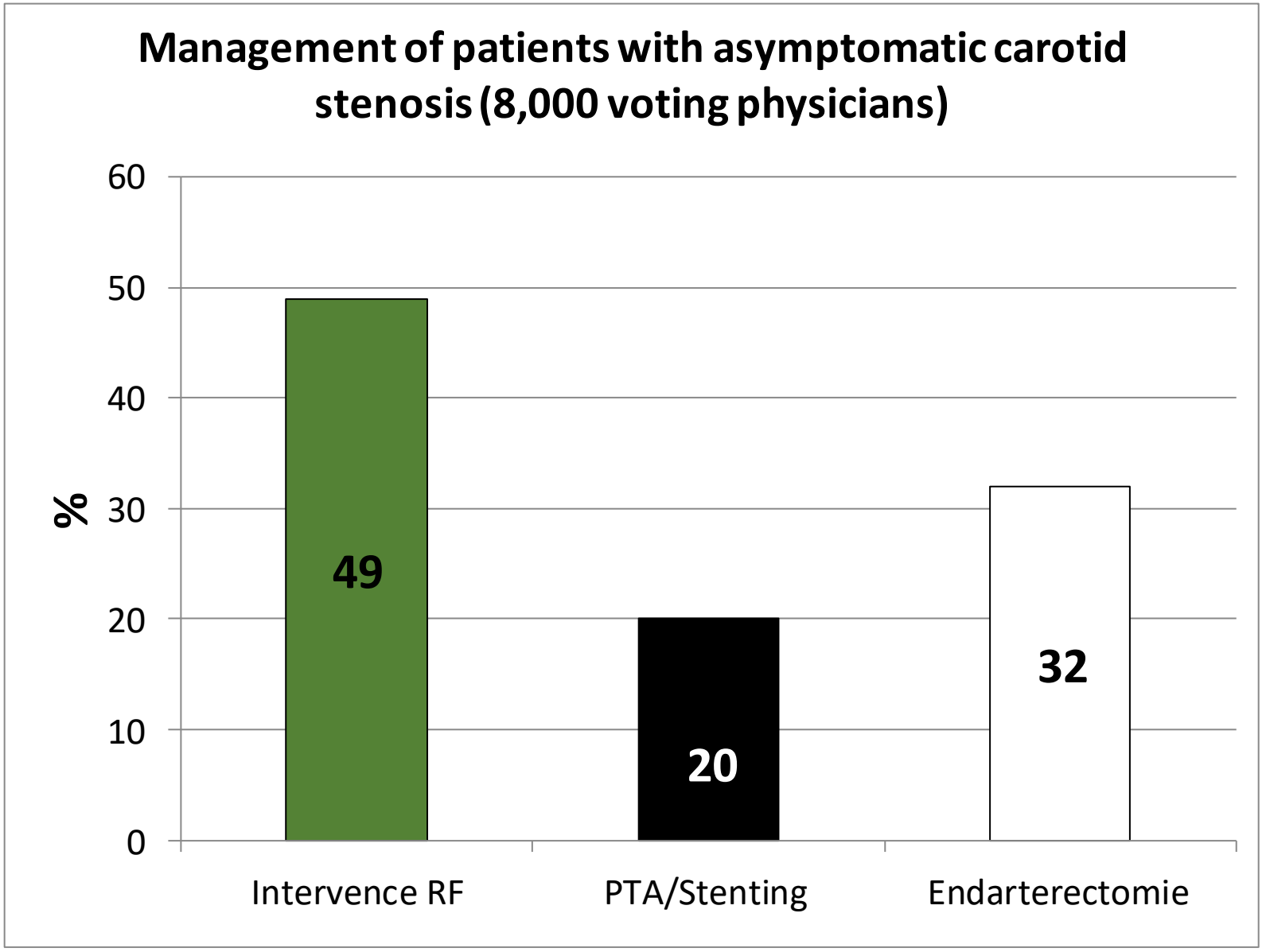
More detailed internal/neurological physical examination without any pathology.

Ultrasound examination of carotid arteries:
Stenosis of right internal cartid artery 70 – 80. Stenosis of left internal carotid artery 20%.

WHAT TO DO WITH THIS PATIENT?

1. Medical management.
2. Carotid stenting.
3. Carotid endarterectomy.

NEJM 2008, 358:1617-1621


Management of patients with asymptomatic carotid stenosis (8,000 voting physicians)
60
50
40
30
20
10
0
%
49
20
32
Intervence RF
PTA/Stenting
Endarterectomie

SUMMARY OF FATAL EVENTS IN CAROTID ENDARTERECTOMY STUDIES

	ENDARTERECTOMY	CONSERVATIVE
Number	2,072	2,394
Follow up	3.1 y	3.1 y
Fatal stroke	18	53; p<0,001
Other fatal cardiovascular events	**181**	**177**
Other fatal events	140	108
Fatal events – total	339 (16.4 %)	338 (14.1 %); p=0.03

ETIOLOGICAL FACTORS OF STROKES

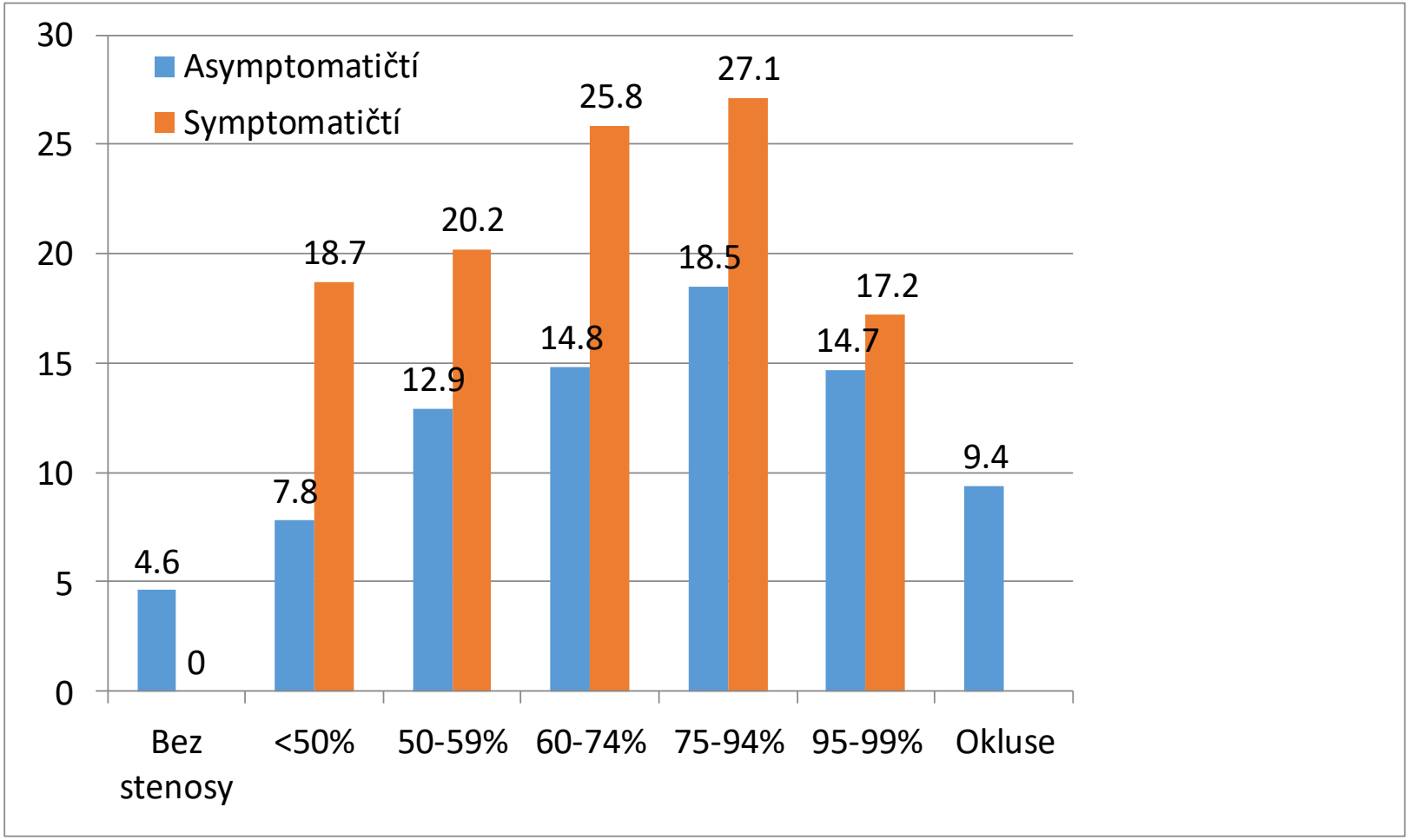
	ATHEROTHROMBOTIC	LACUNAR	EMBOLIC
Hypertension	++	+++	
Ischemic heart d.	+++		++
Periph. artery d.	+++		+
Atrial Fibrillation /Flutter			++++
SS Syndrome			++
Cardiac valve disease			+++
Diabetes mellitus	+++	+	+
Smoking	+++		+
Age	+++	+	+

ETIOLOGICAL FACTORS OF STROKES

	ATHEROTHROMBOTIC	LACUNAR	EMBOLIC
Hypertension	++	+++	
Ischemic HD	+++		++
Periph. Artery D.	+++		+
Atrial Fibrillation /Flutter			++++
SS Syndrome			++
Cardiac valve disease			+++
Diabetes mellitus	+++	+	+
Smoking	+++		+
Age	+++	+	+

+ HEMORRHAGIC:
HYPERTENSION + AV MALFORMATION

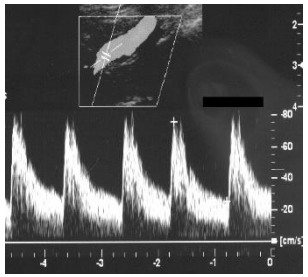
RISK OF STROKE ACCORDING TO SYMPTOMS AND SEVERITY OF STENOSIS

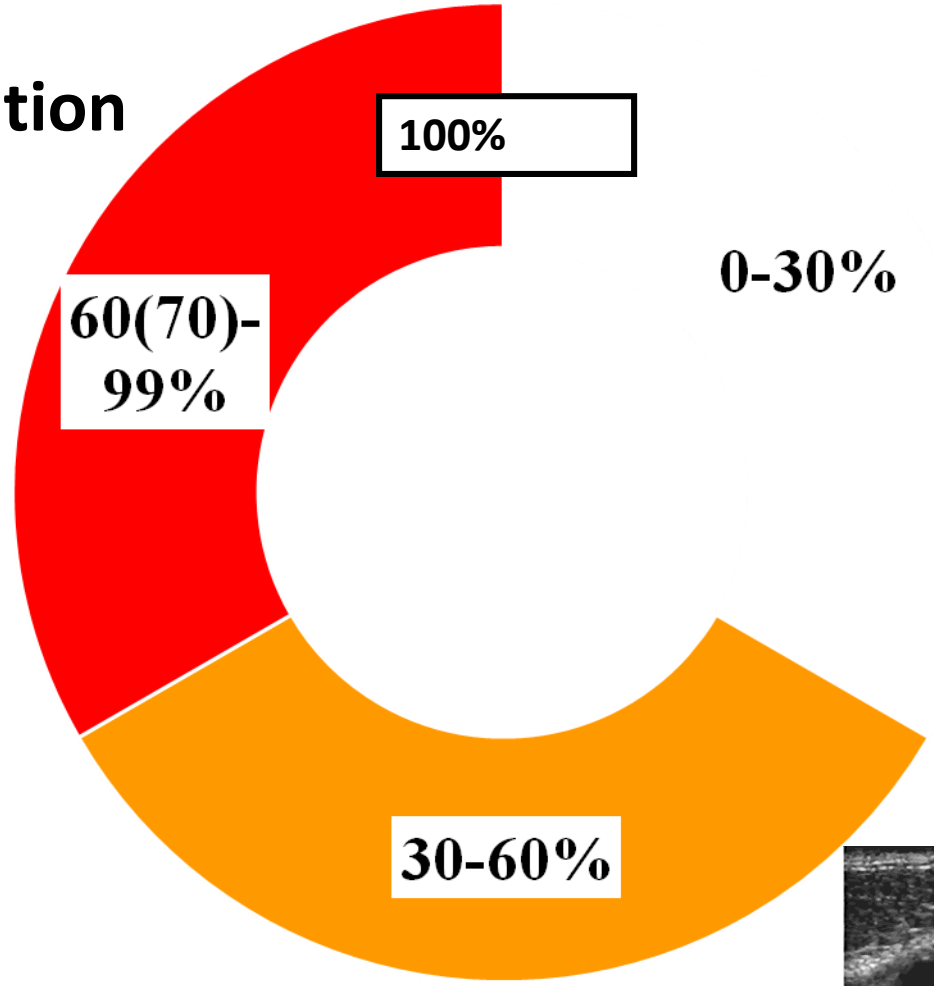


NASCET, Inzitari D., NEJM, 2000, 1693

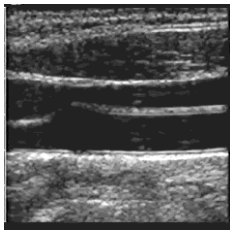
MANAGEMENT OF CAROTID ARTERY STENOSIS

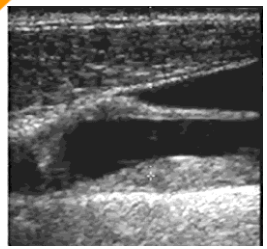
Revascularization





Only small changes/occlusion „only“ pharmacological therapy





Pharmacological therapy

RECOMMENDED RATE OF COMPLICATION OF SURGERY/INTERVENTIONAL CENTRE

Asymptomatic carotid stenosis.

Complication less than 3 (1%)

(Incl. complications during angiography)

Symptomatic less than 6/3 %

MAIN SYMPTOMS OF CAROTID DISEASE

- Amaurosis fugax (partial blindness)
- Weakness/immobility of extremities on one side (unilateral)
- Speech abnormalities
- Lesions on CT/MR

- **Significant and asymptomatic stenosis of carotid artery should be impulse for aggressive management of cardiovascular risk factors, irrespectively of further surgery/intervention.**

CRITICAL MANAGEMENT OF CVD RF IN ALL PATIENTS WITH CAROTID STENOSIS

- **Nonsmoker**
- **Blood pressure: 130-140/80-90 mm Hg (in elderly and in the case of occlusion of carotid artery/arteries systolic BP 140-150 mm Hg + low/slow approach)**
- **LDL cholesterol less than 1.3 mmol/l, + HDL/TG ratio more than 1**
- **Control of diabetes**

CRITICAL MANAGEMENT OF CVD RF IN ALL PATIENTS WITH CAROTID STENOSIS

- **Statins**
- **Antihypertensives**
- **Antiaggregants**
- **Antidiabetic drugs**

20letý pacient vyšetřen na KJ IKEM

- **Po tréninku karate (úder do hrudi) mírná bolest na hrudi, točení hlavy, jinak zcela bez obtíží. V anamnéze četné luxace kolenních kloubů, st.p. operaci pectus excavatum**
- **Fyz. nález – mírná kyfoskolióza, výška 172, váha 60 kg, TK 140/80 mm Hg na obou HK , i jinak zcela v normě – hypertelorismus**
- **RA – matka a babička z matčiny strany zemřely náhle v 29 letech možná na disekci aorty.**

Melenovsky V, et al. Aortic dissection in a young man with Loeys-Dietz syndrome. J Thorac Cardiovasc Surg. 2008 May;135(5):1174-5