

CARDIAC CATHETERIZATION

UNIVERSITY OF DEBRECEN
FACULTY OF MEDICINE
DIVISION OF CLINICAL PHYSIOLOGY



TÁMOP-4.1.1.C-13/1/KONV-2014-0001



Historical perspective

- 1733 Stephen Hales: direct blood pressure measurement in animals
- 1929 Werner Theodor Otto Forssmann: first human right heart catheterisation (1956: Nobel-prize)
- 1953 Sven Ivar Seldinger: percutan technique to obtain safe access to blood vessels
- 1958 F. Mason Sones: coronarography
- 1970 H.J.C. Jeremy Swan and William Ganz: balloon floating catheter
- 1977 Andreas Gruentzig: coronary angioplasty, PTCA

Laboratory for cardiac catheterization



Technical aspects of cardiac catheterization

Personnel

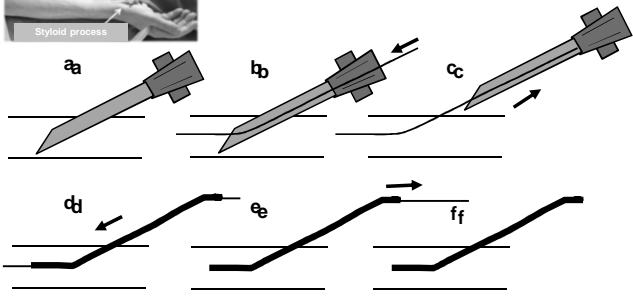
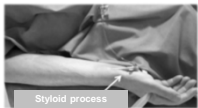
Radiographic equipment

Physiological monitors

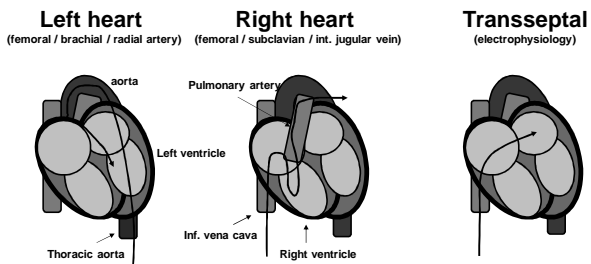
Pressure measurement systems

Catheters

Basic approach for puncture (Seldinger technique)



Catheterization techniques



Angiography

- an imaging method of choice for establishing the presence or absence of coronary artery and heart disease
- provides the most reliable information for making critical decisions about the need for medical therapy, angioplasty, or cardiac surgery

Indications for coronary angiography I

Stable angina pectoris (elective cases):

- Canadian Cardiovascular Society (CCS) III-IV class patients despite maximal conventional antianginal therapy

CCS Angina Grading Scale / the CCS Functional Classification of Angina:

Class I – Angina only during strenuous or prolonged physical activity

Class II – Slight limitation, with angina only during vigorous physical activity

Class III – Symptoms with everyday living activities, i.e., moderate limitation

Class IV – Inability to perform any activity without angina or angina at rest, i.e., severe limitation

- High coronary risk patients + angina pectoris

coronary risk stratification:

high risk (EF < 35%, Exercise Stress Test (EST)-ECG < 4 MET, large reversible perfusion defect on SPECT, dobutamine stress echocardiography (DSE) > 2 segm.)

intermediate risk (EF 35-49%, EST-ECG 4-7 MET, intermed. size perf. defect on SPECT, DSE: 1-2 segm.)

low risk (EF > 49%, EST-EKG > 7 MET, negative SPECT / DSE)

- Patients with manifest non-coronary atherosclerosis (carotis, peripheral) + angina pectoris

Indications for coronary angiography II

Acute myocardial infarction:

- ST elevation myocardial infarction (STEMI):

as soon as possible within 12 hours (or 24 hours with active ischemia) following symptom onset

- non ST elevation myocardial infarction (NSTEMI) or sudden cardiac death (SCD):

within 24 hours following risk stratification/survival

Others:

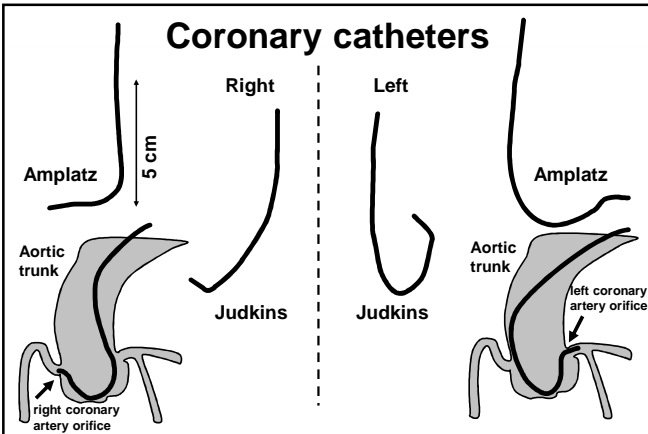
- prior to valvular heart surgery (after 40 years of age)
- cardiomyopathy
- prior to heart transplantation

Relative contraindications of coronarography

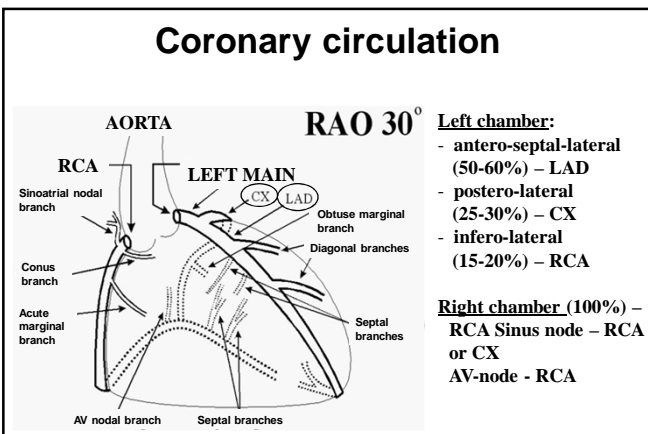
- Acute gastrointestinal or uncontrolled bleeding (exc.: menstruation)
- INR* $\geq 1,8$ (in femoral approach only)
- Renal failure (GFR ≤ 30 ml/min – high risk of contrast nephropathy)
- Recent stroke (≤ 4 weeks)
- Severe electrolyte imbalance (hypokalaemia)
- Uncontrolled acute heart failure, hypertension or arrhythmia
- Pregnancy

*INR (International normalized ratio of prothrombin time of blood coagulation)

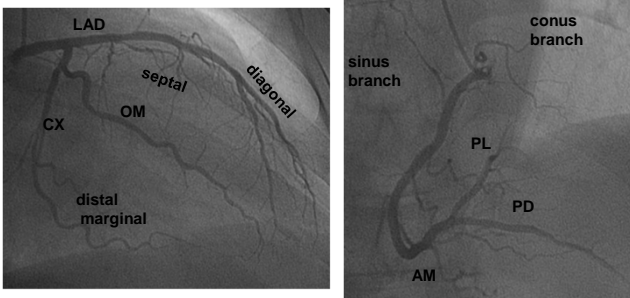
Coronary catheters



Coronary circulation

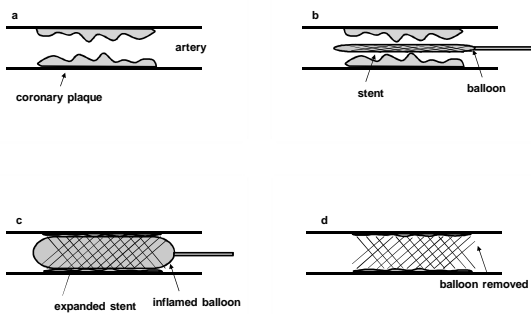


Normal left and right coronary systems



Diagnostic coronary angiography

Steps of coronary stenting



Percutaneous Transluminal Coronary Angioplasty (PTCA)
Percutaneous Coronary Intervention (PCI)

Elective: balloon dilation or stent implantation in coronary stenosis causing myocardial ischaemia (effort angina)

improves quality of life (less angina)

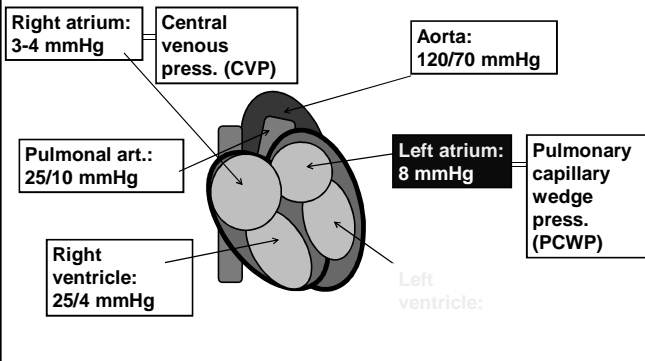
Primary: recanalisation and stenting of an occluded coronary artery causing myocardial infarction

improves survival (decreased mortality)

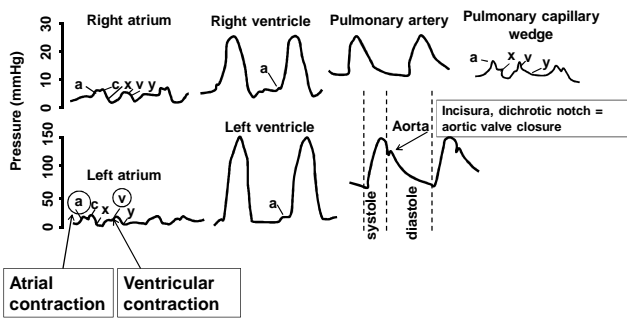
Rescue: myocardial revascularisation following failed thrombolysis

INFERIOR STEMI
with
THROMBUS ASPIRATION

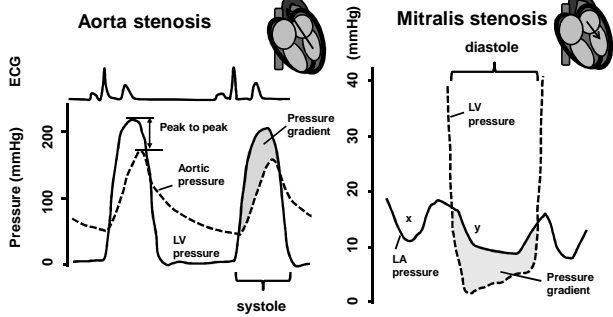
Pressure values in different cardiac cavities



Normal pressure traces



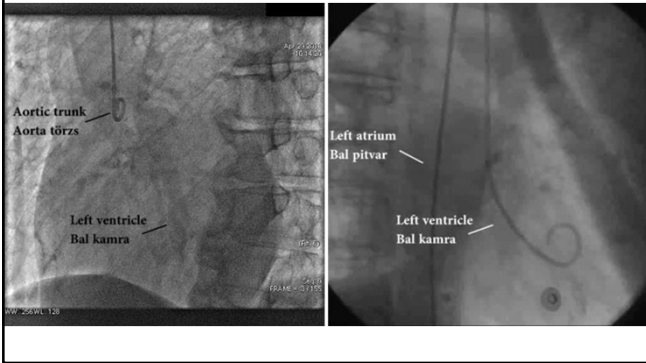
Pathologic pressure traces (pressure gradients)



Assessment of valvular regurgitation

- I. Minimal regurgitant jet seen. Clears rapidly from proximal chamber with each beat.
- II. Moderate opacification of proximal chamber clearing with subsequent beats.
- III. Intense opacification of proximal chamber, becoming equal to that of distal chamber.
- IV. Intense opacification of proximal chamber, becoming more dense than of the distal chamber.

Aortic and mitral regurgitation

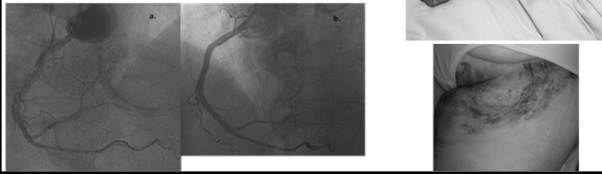


Complications of cardiac catheterization

Incidence is around 1%

Most frequent:

- access site: bleeding, pseudoaneurysm
- contrast nephropathy – can be prevented by hydration
- cerebral embolism
- myocardial infarction, penetration, dissection
- arrhythmia



Case presentation - STEMI

Previous medical history:

Á.L. (birth date: 1966, 46 years of age)

2012 – hypertension (5 mg nebivolol/day)

2013 - dermatology – contact dermatitis

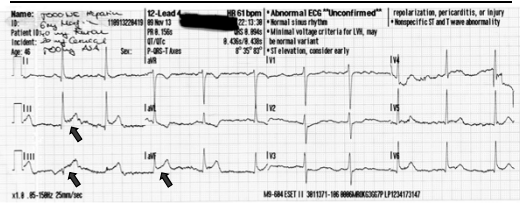
CV risk factors:

- HLP, obesity, DM Ø
- Smoking – cessation 10 years ago, for 20 years 20 cigarettes/day
- Family history of premature coronary artery disease (CAD): neg.

09.11.2013

Presenting symptoms: recurrent chest pain, breathlessness, nausea, vomiting → AMBULANCE

ECG - AMBULANCE



Diagnosis: Acute myocardial infarction (inferior)

Primary treatment:

- 500 mg ASA
- 5000 NE Na-Heparin
- 6 mg morphium → transfer to the ICU of the Cardiology Institute
- 20 mg Cerucal
- 40 mg Furosemid

09.11.2013. Intensive Care Unit Institute of Cardiology

Examinations?

ECG

Cardial markers, necroenzymes (NSTEMI)

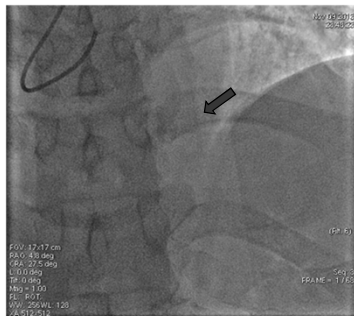
(cardiac troponin I and/or T, creatine kinase (CK, CK-MB), lactate dehydrogenase (LDH))

Echocardiography

Wall motion abnormality, mechanical complications

Regular „triad“: ECG + cardiac troponin + echocardiography

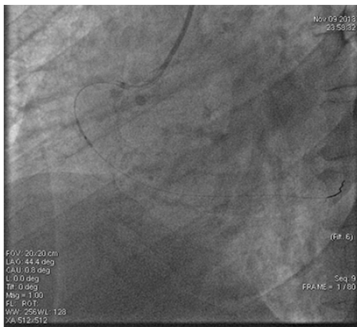
Coronarography – left coronary system



Coronarography – right coronary system



Primary PCI – right coronary



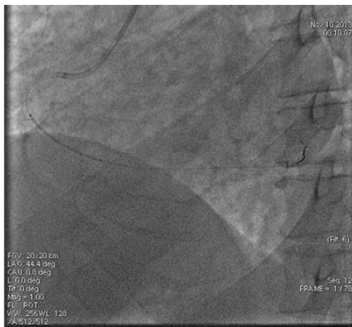
Primary PCI – right coronary



Thrombus-aspiration

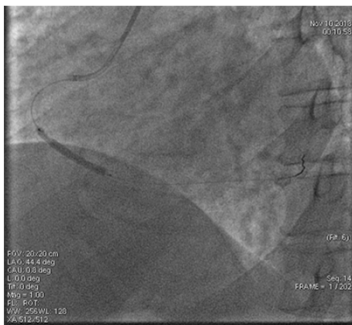


Stent positioning

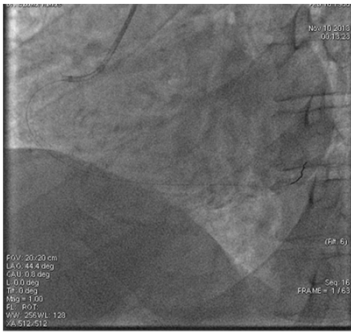


Stent opening

3x30 mm
Integrity BMS



Primary PCI – final result



Events after PCI

14.11.2013.

Discharge from hospital, elective LAD PCI: January 2014
