Cardiac markers

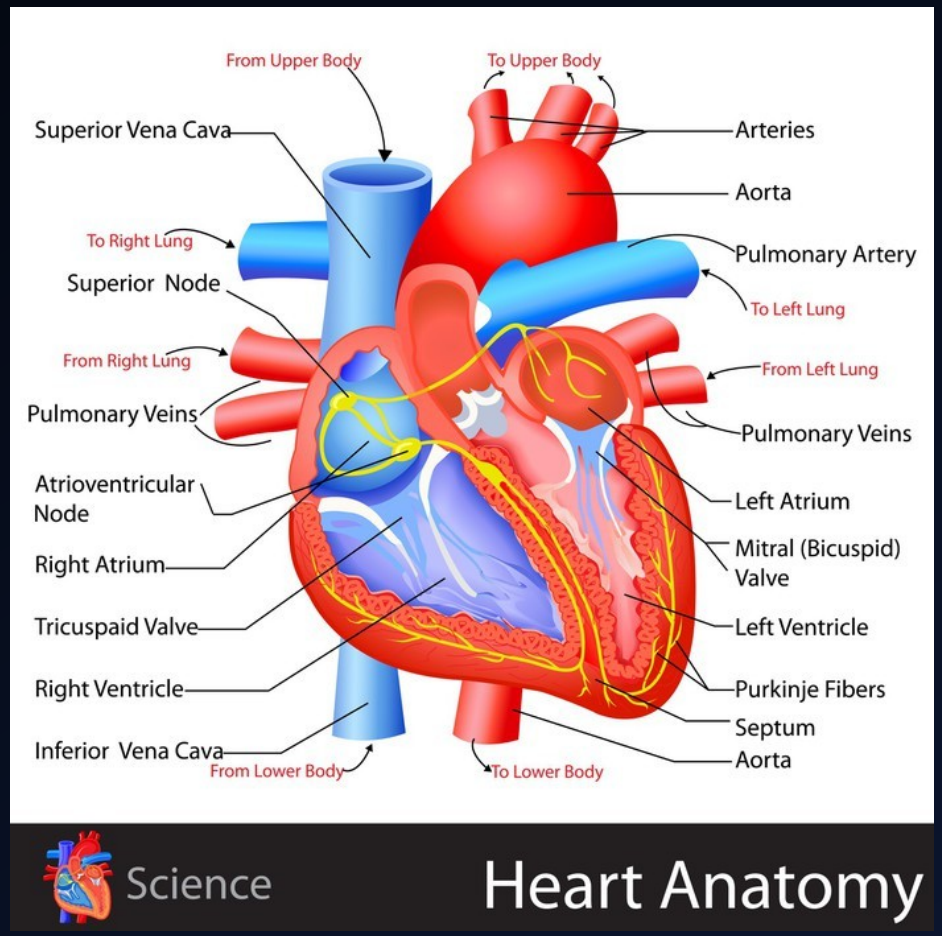
ZDEŇKA ČERMÁKOVÁ
KLM LF MU BRNO
OKB FN BRNO

Cardiac markers

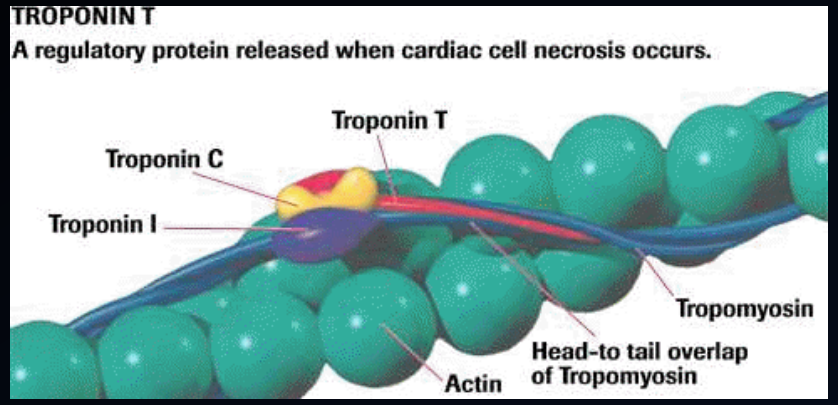
ISCHEMIA, NECROSIS
VOLUME OVERLOAD
MECHANICAL DAMAGE
TOXIC EFFECTS

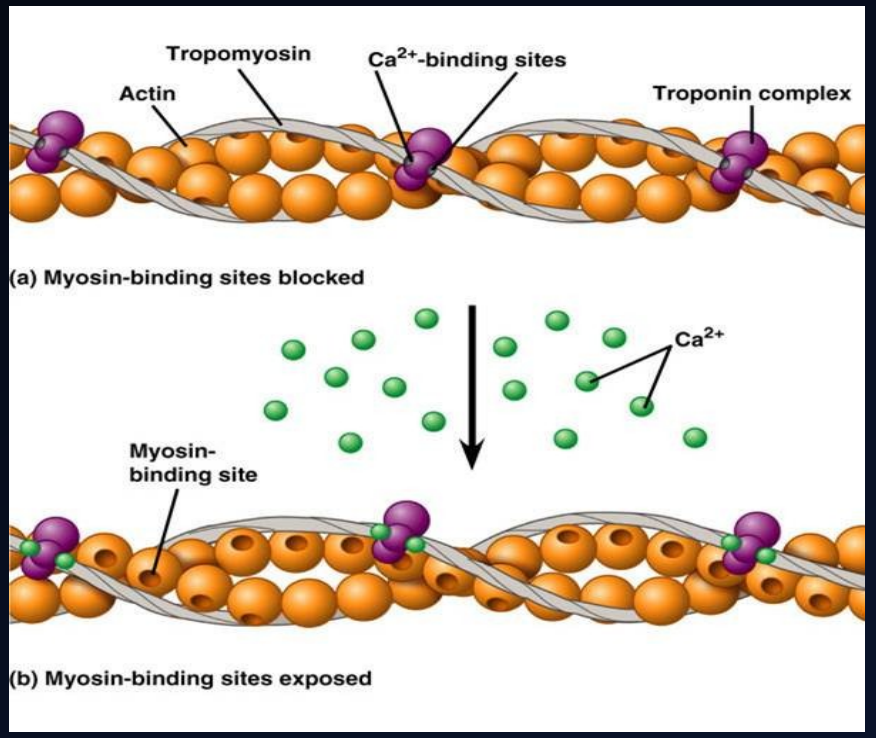
- Markers of acute coronary syndrom
- Markers of chronic heart failure
- Regulation: GDF-15,galektin3

- Diagnosis Treatment Prognosis



Tropomyosin complex

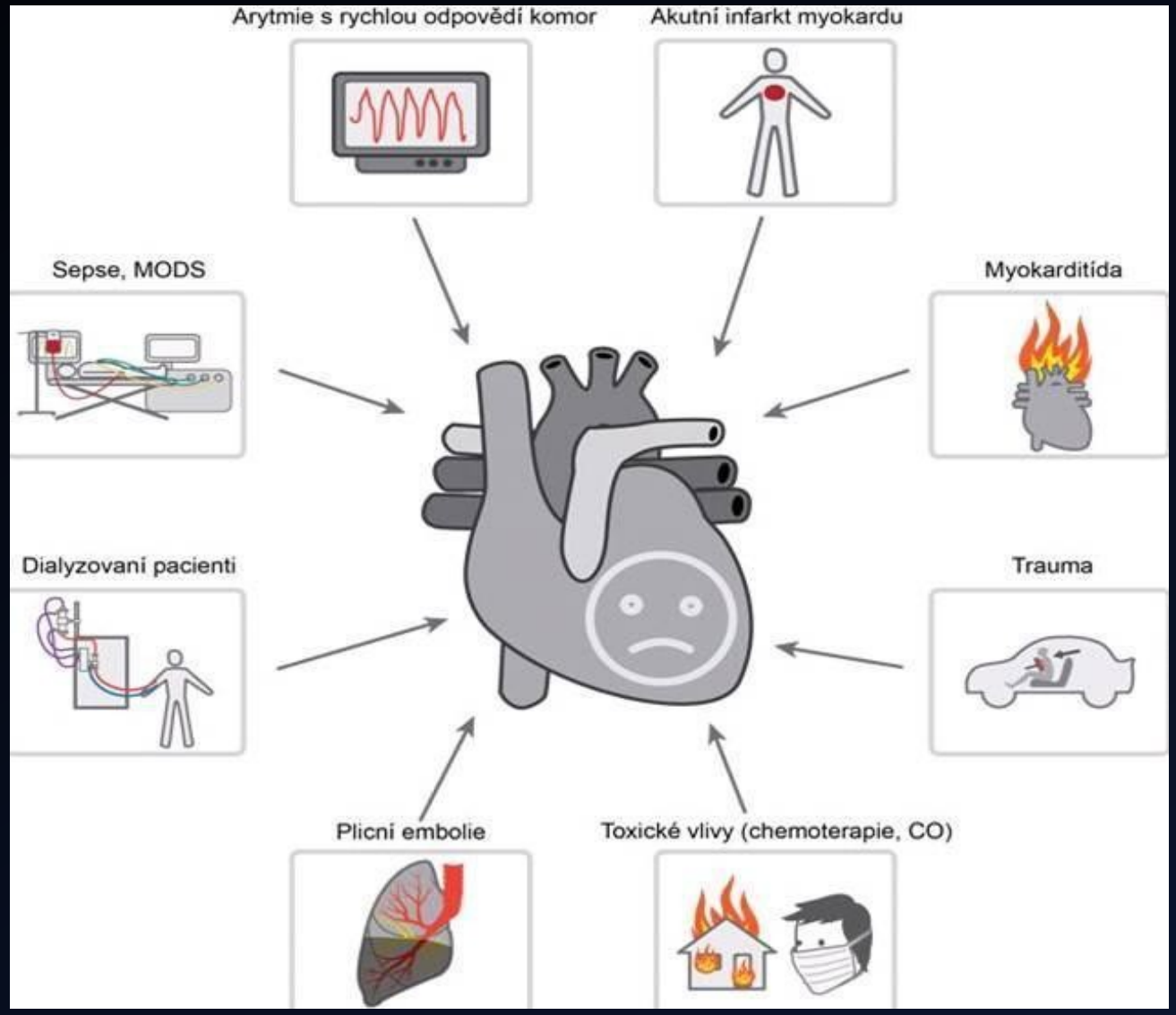


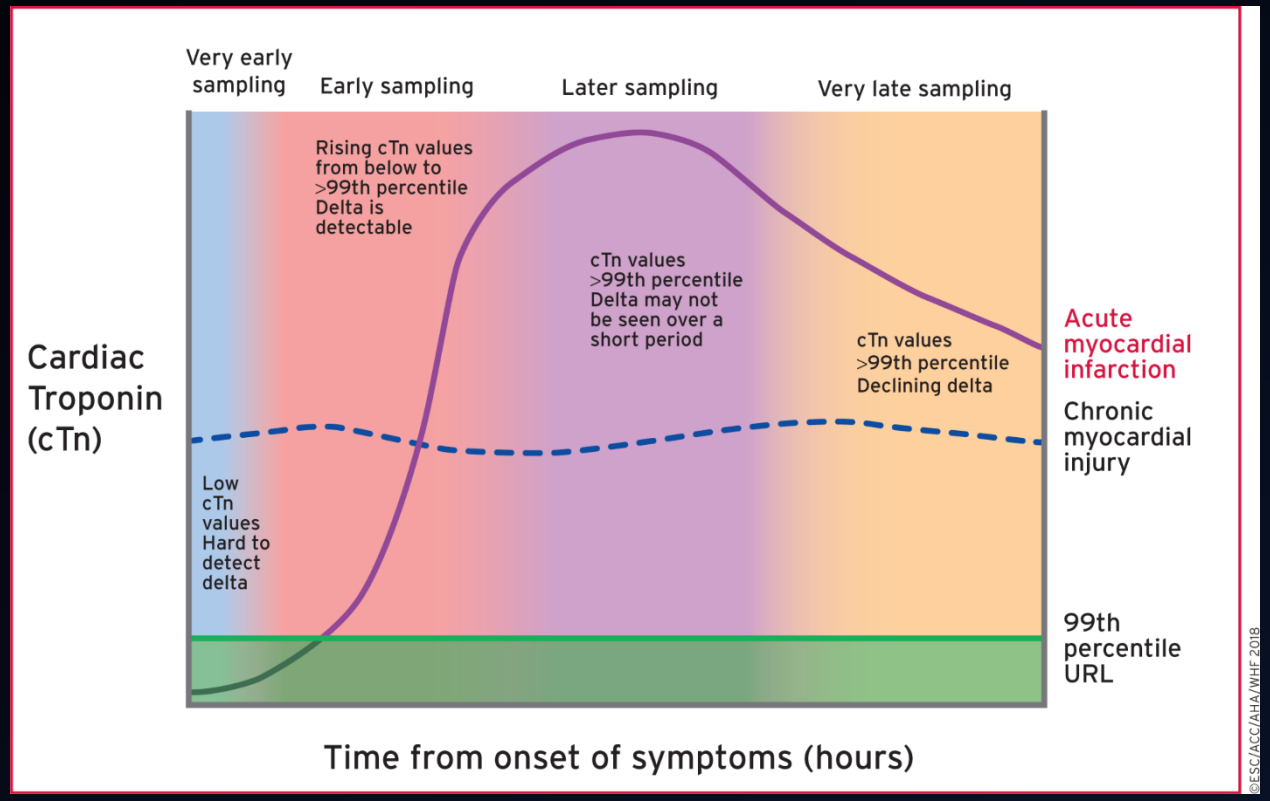


- Strukture of TnT a TnI
  - Cardiac-specific isoforms
  - Imunochemical assay

- TnC - no cardiac specificity

Possible causes of increased hypersensitive troponins



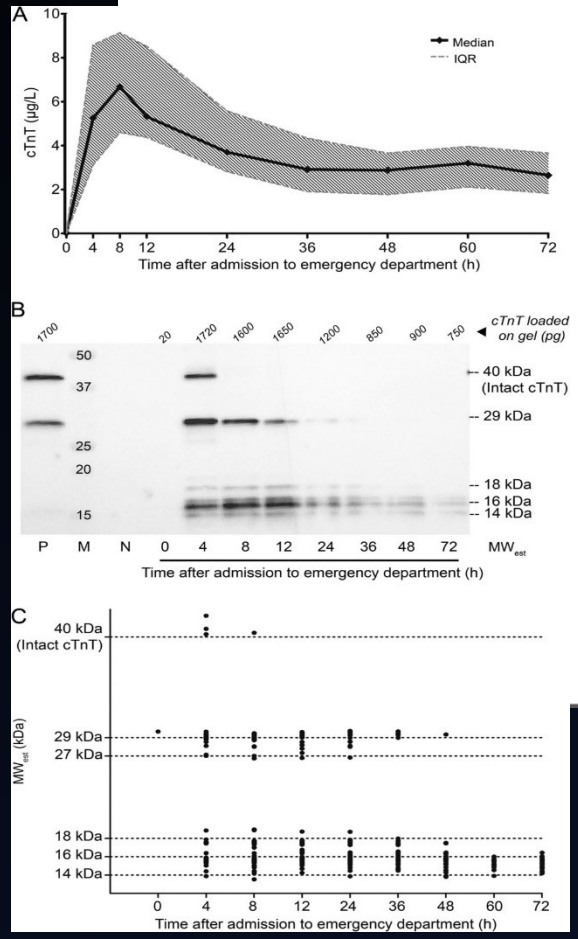


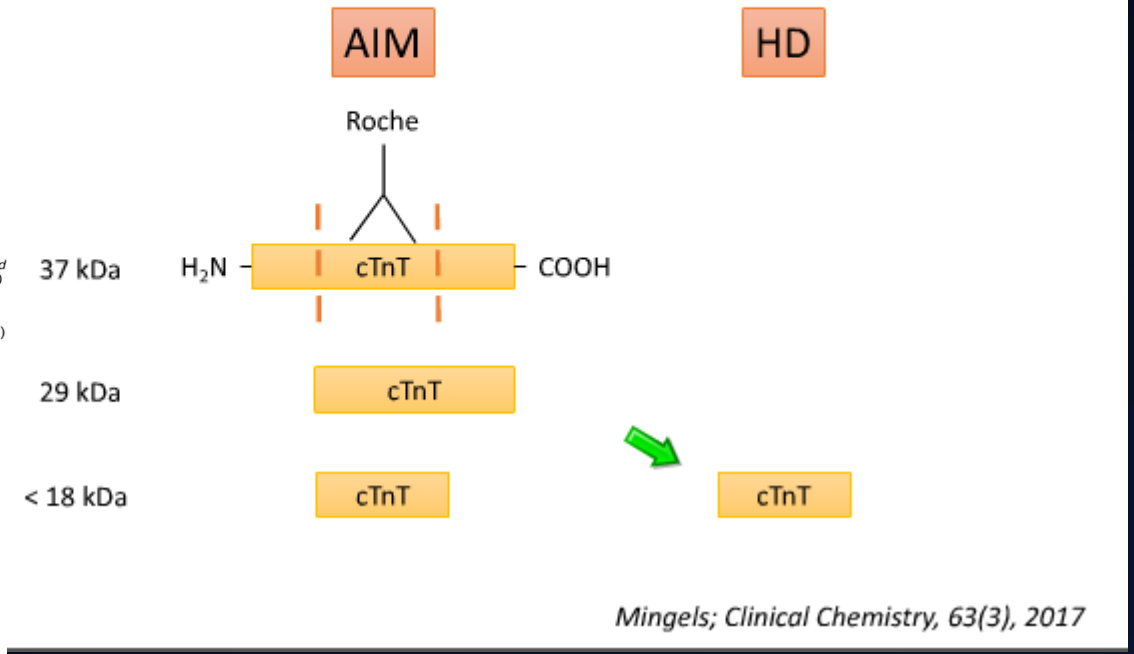
From: Fourth universal definition of myocardial infarction (2018)

Eur Heart J. Published online August 25, 2018. doi:10.1093/eurheartj/ehy462

Troponin in the blood-mixture of intact molecules and grafts

Troponin v krvi = směs intaktní molekuly a jejích štěpů





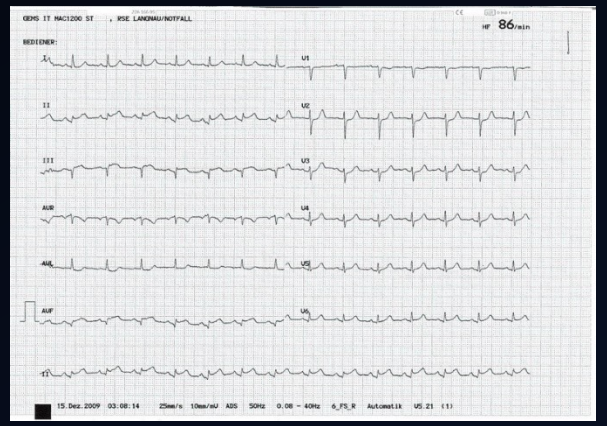
Mingels; Clinical Chemistry, 63(3), 2017

Time-Dependant Degradation Pattern of Cardiac Troponin T Following Myocardial Infarction

Eline P.M. Cardinaels, Alma M.A. Mingels, Tom van Rooij, Paul O. Collinson, Frits W. Prinzen, Marja P. van Dieijen-Visser

DOI: 10.1373/clinchem.2012.200543 Published June 2013

Diagnosis of AMI



History

ECG

Laboratory cTn

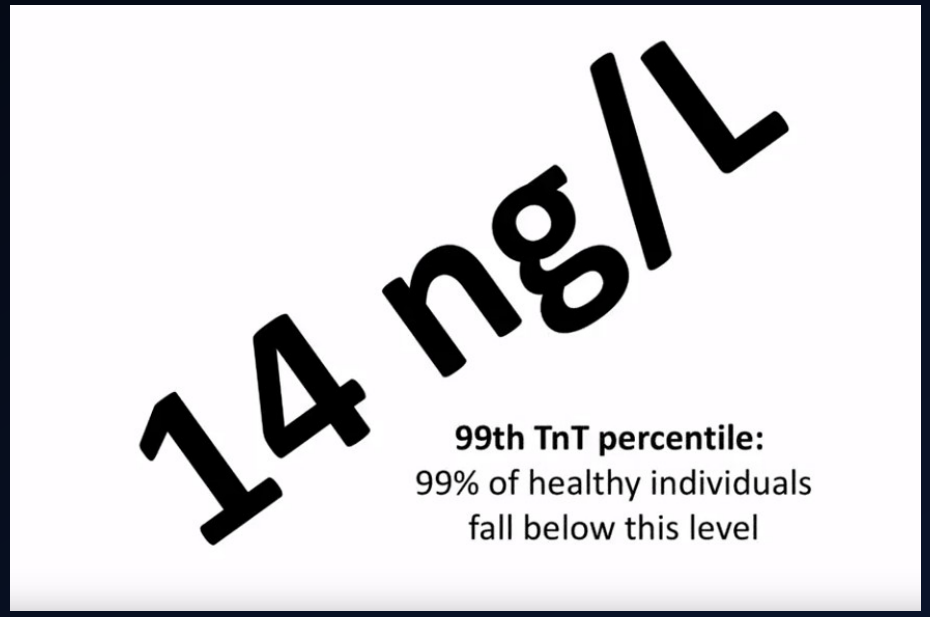
- cTn >cut off
- dynamics

Advantages of TnI, TnT in MI diagnostics

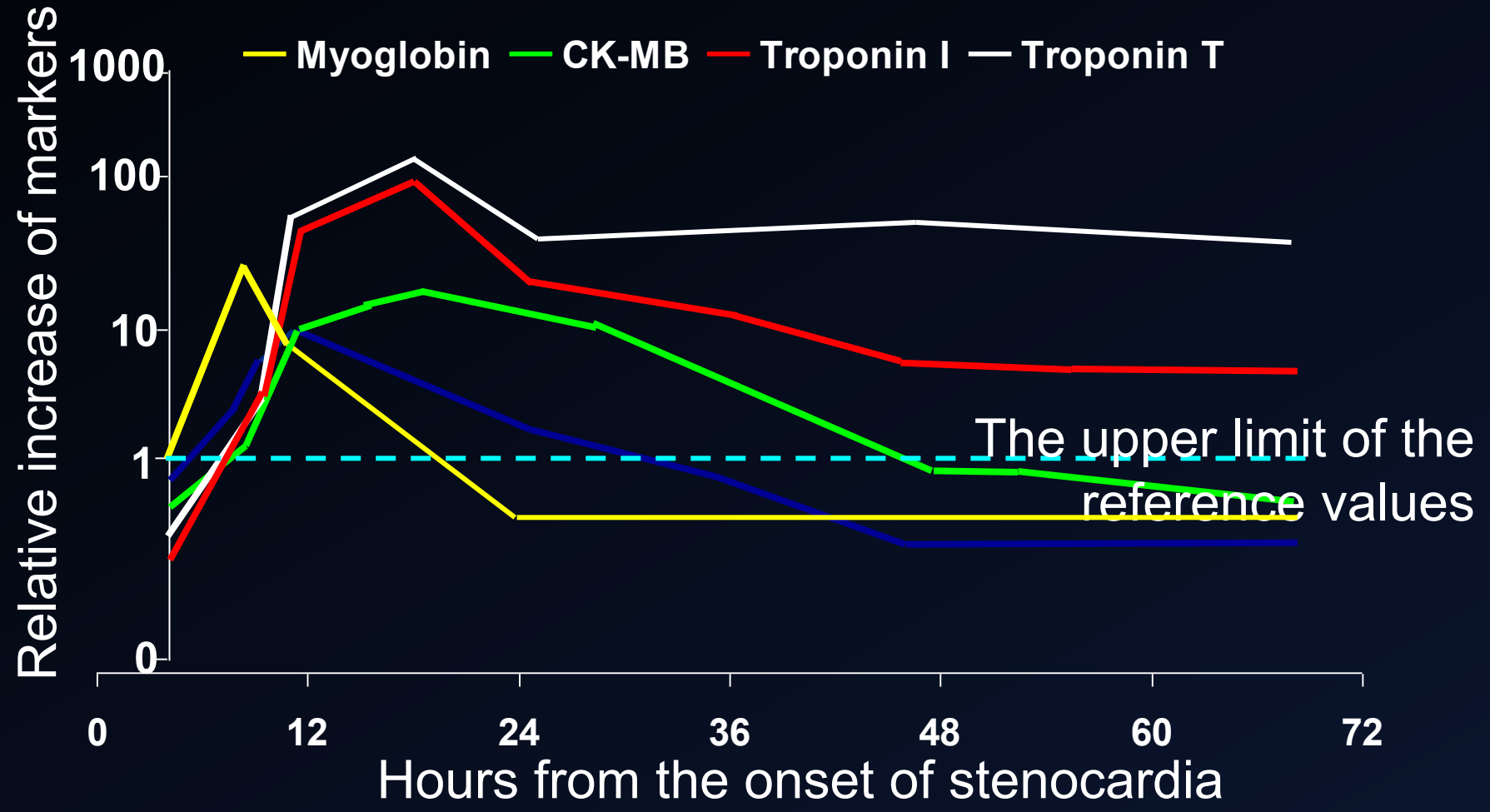
- High specifity
  - Myocardial isoforms
- High sensitivity
  - Very small MI lesions
- Dynamics of Tn concentration changes
  - Multiple increase Tn level after MI
- Increased Tn level continues 1-2 weeks
  - Delayed dignostics of MI

Clinical application of hs troponin T

- First specimen at the time of first contact
- Repeat specimen (to review the change) in 3 hours (1-2 hours)
- 99.percentil application
- Application of the "delta" principle
  - Absolute - 10ng / l
  - Relative 20% (above 50ng / l)
    50% 99(below 50ng/l)
- Prognosis



Time course of cardiac markers



Casuistry 1

- *Men, 64 years old, brought by emergency medical service at 12:30*
- *Strong retrosternal pain, spreading to the neck, sweating*

  (at 5 o´clock in the morning)
- *Duration about 20 minutes, relief after vomiting*

- *In last 2 weeks occasional feeling of pressure on the chest during exercise (duration of about 10 minutes)*

Vyšetření	Jedn.	2018 24.08 15:40	2018 24.08 13:39	2018 24.08 12:46
Urea	mmol/l			3.8
Kreat.	umol/l			70
CKD-EPI	ml/s			1.58
Na	mmol/l			140
K	mmol/l			4.4
Cl	mmol/l			107
Bi-celk.	umol/l			7.5
ALT	ukat/l			0.52
AST	ukat/l			2.02
GGT	ukat/l			0.63
ALP	ukat/l			1.63
Trop.T	ng/l	1997	1193	954
Glukóza	mmol/l			7.8
CRP	mg/l			8.3

- EKG: Q V1-5,elevation ST 0,5mm, negative T V1-V5

- Dg: subacute transmural MI

PCI: prox. RIA +DES stent

Casuistry 2

- *Men, 44 years old*
- *Retrosternal pains for about one year, spreading to the neck, troubles in the rest and also during excercise*
- *Dg: IHD dg.VI/2018, sy AP, SKG - PCI ACS+DES,prox. RIA 30%,RC 40%*
- *About 3 weeks after revascularization he was completely trouble-free, then it started to return*

Vyšetření	Jedn.	2018 24.08 14:15	2018 24.08 12:15	2018 24.08 11:11
Urea	mmol/l			5
Kreat.	umol/l			75
CKD-EPI	ml/s			1.76
Na	mmol/l			139
K	mmol/l			4
Cl	mmol/l			106
Osmol.	mmol/kg			282
Bi-celk.	umol/l			6.8
ALT	ukat/l			1.04
AST	ukat/l			0.51
GGT	ukat/l			2.24
ALP	ukat/l			1.79
CK	ukat/l			1.81
Trop.T	ng/l	8	9	5
CB	g/l			66
Albumin	g/l			42.3

EKG : SR, TF 67/min

re SKG VIII/2018: complete revascularization

Ischemic heart disease without signs of ACS

Casuistry 3

- Women 83 years old
- Retrosternal pain, spreading do the neck and head
- Now she feels uncomfortable, weakness, doesnt feel sure when walking

Vyšetření	Jedn.	2018 28.08 06:00	2018 27.08 06:00	2018 26.08 18:17	2018 26.08 18:17
Na	mmol/l	142		137	137
K	mmol/l	3.9		4.3	4.3
Cl	mmol/l	103		97	97
Ca	mmol/l				
Mg	mmol/l				
Osmol.	mmol/kg				
Bi-celk.	umol/l			5.6	5.6
Bil-přím	umol/l				
ALT	ukat/l			0.23	0.23
AST	ukat/l			0.39	0.39
GGT	ukat/l			0.2	0.2
ALP	ukat/l			1.42	1.42
AMS	ukat/l				
Trop.T	ng/l		356	125	

EKG: SR, TF 79/min ,ST depression to 2 mm V3-V5

NSTEMI

Therapy: dual antiagregation (ASA+clopidogrel)

Casuistry 5

- *Men 77 years old*
- *Retrosternal pressure pain, duration about 30 minutes*
- *Last few days same difficulties without dependence on exercise*

- *EMS: supraventricular tachyarhrythmia 170/min, hypertensin*

Vyšetření	Jedn.	2018 09.10 17:26	2018 09.10 14:02
Urea	mmol/l		6.2
Kreat.	umol/l		88
CKD-EPI	ml/s		1.21
Na	mmol/l		141
K	mmol/l		4.7
Cl	mmol/l		107
Bi-celk.	umol/l		7.6
ALT	ukat/l		1.07
AST	ukat/l		1.17
GGT	ukat/l		1.46
ALP	ukat/l		1.14
Trop.T	ng/l	126	60
Glukóza	mmol/l		14.3
CRP	mg/l		3.3

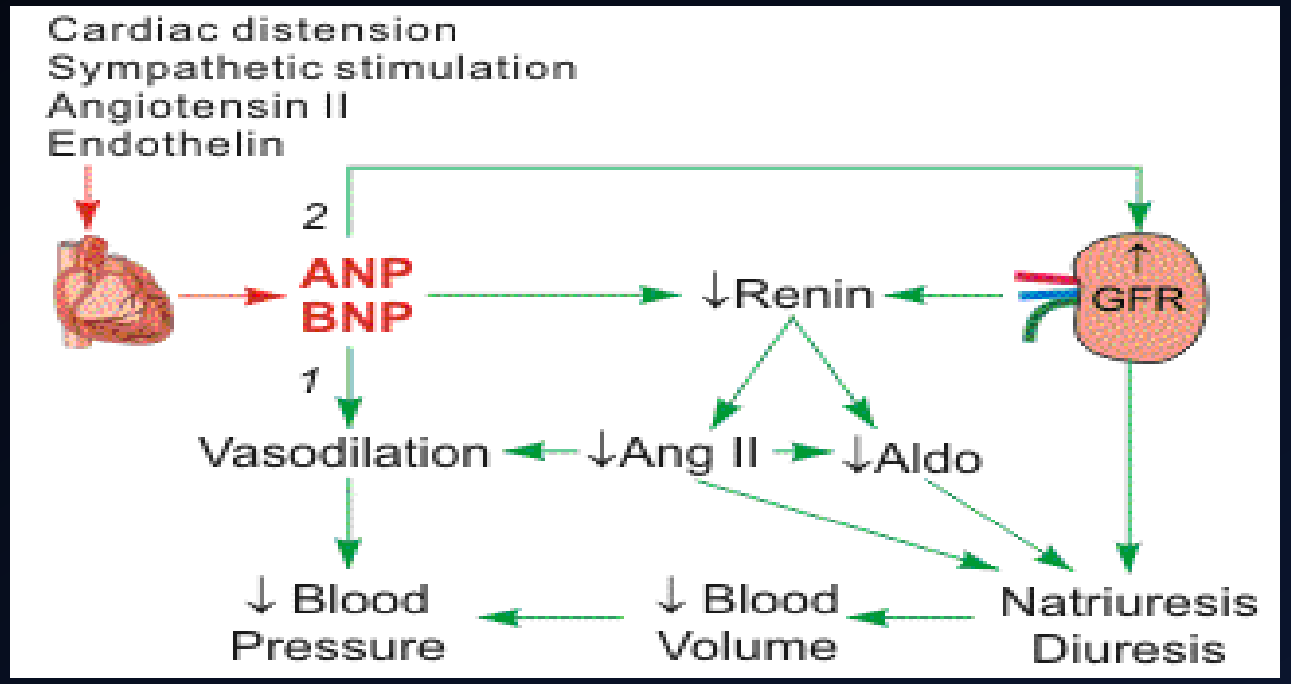
NSTEMI, supraventricular tachyarhythmia

Natriuretic peptides

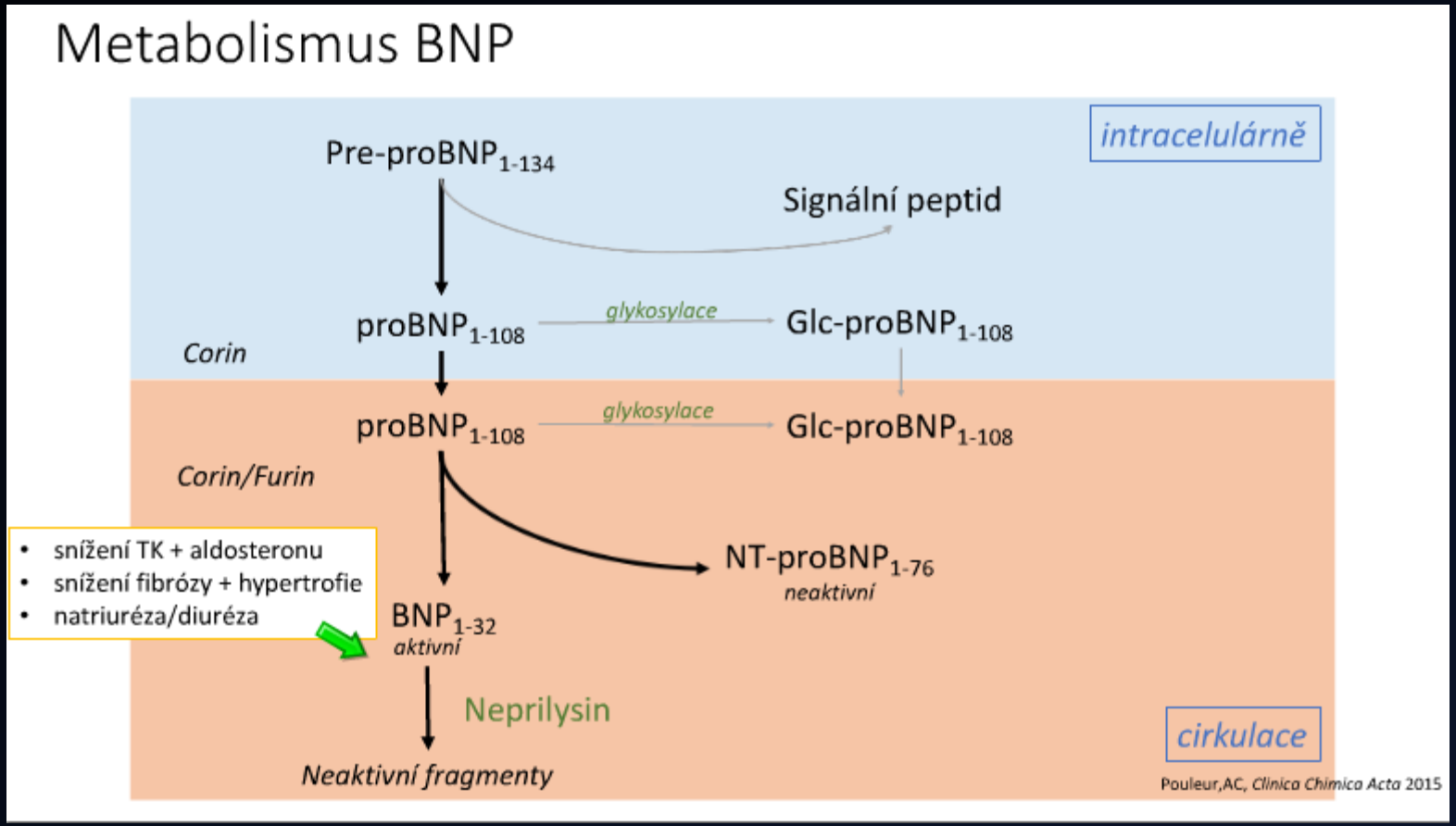
- Protein (peptide) hormones
- Synthesis: myocard
  - Endothelium, kidney
- Protect KV system against volume and pressure overload
- Diuretic, natriuretic and hypotensive effects

Mechanism of NP function

- Kidney:
  - Inhibit Na reabsorption = natriuresis, diuresis
    - ↓ blood volume
  - ↓ renin secretion
    - ↓ aldosteron
- Blood vessels
  - Vasodilatation
- CNS
  - ↓ sympathetic



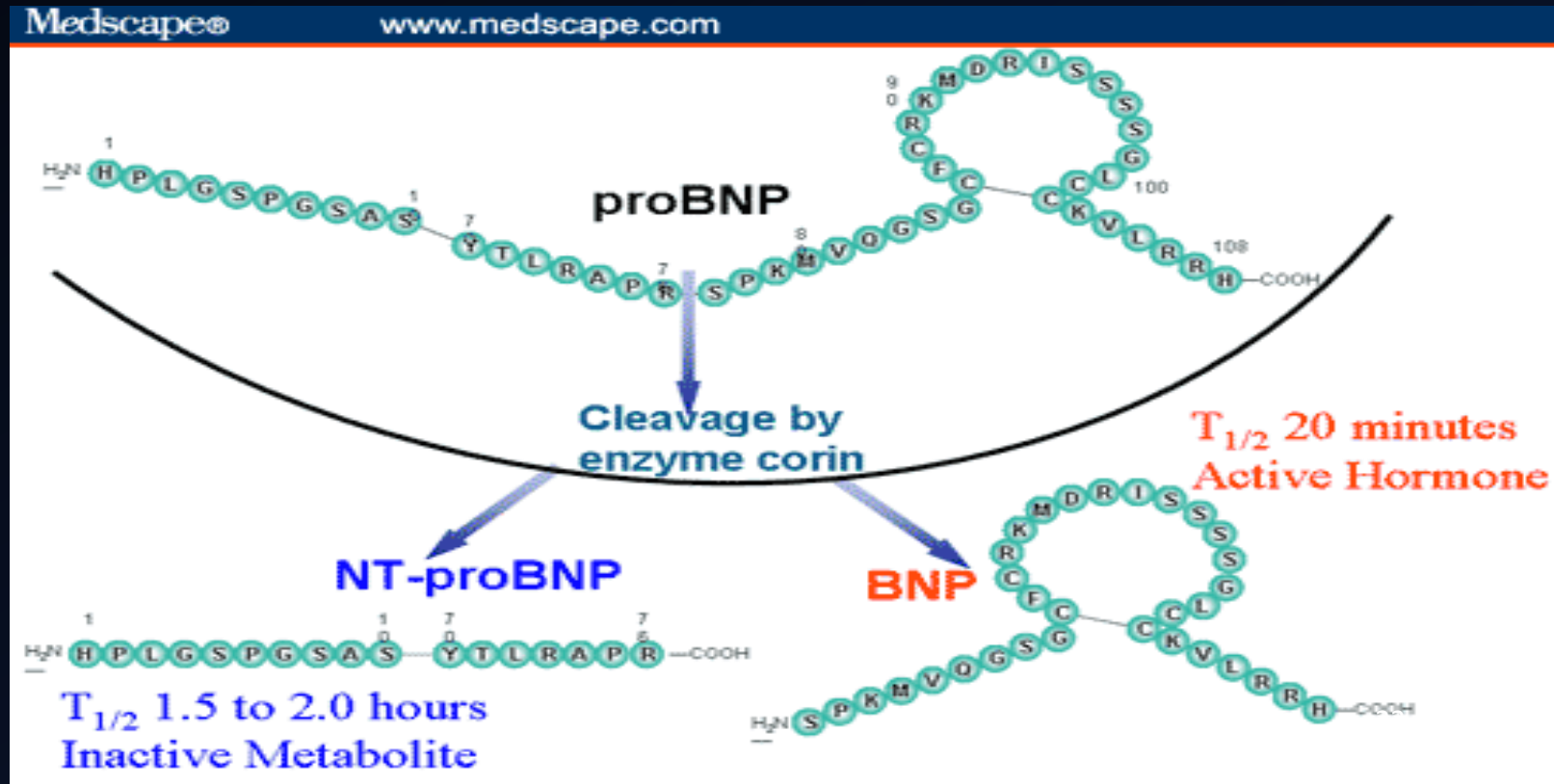
Metabolismus BNP



Synthesis of BNP: pro BNP

- ProBNP - cleaved into 2 fragments: BNP, NT ProBNP
  - BNP: biological active polypeptide (32 AA)
  - NT-proBNP: biological inactive (76 amino acid, N-terminal)
    - Co-secreted with BNP

- Half-life:
  - BNP: 18 min
  - NT-ProBNP: 2 h.



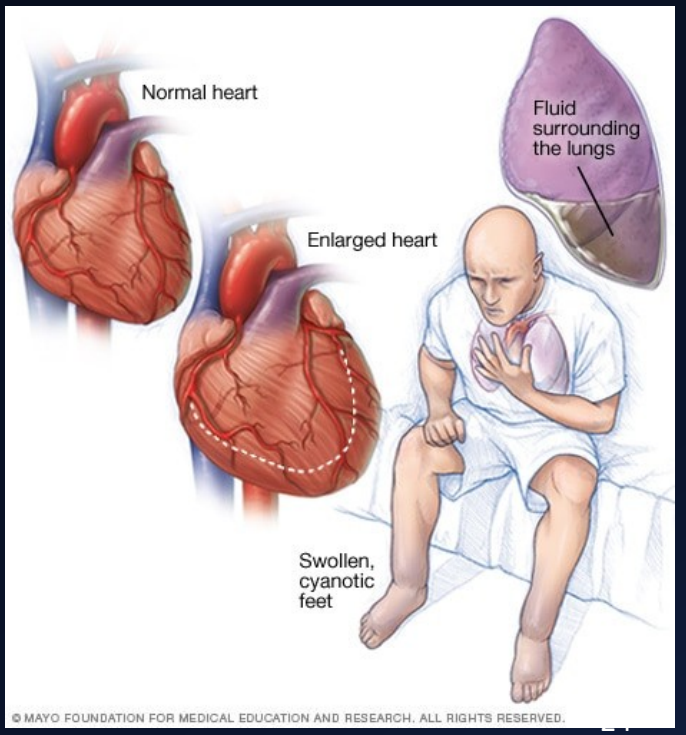
Clinical evaluation of NT-proBNP

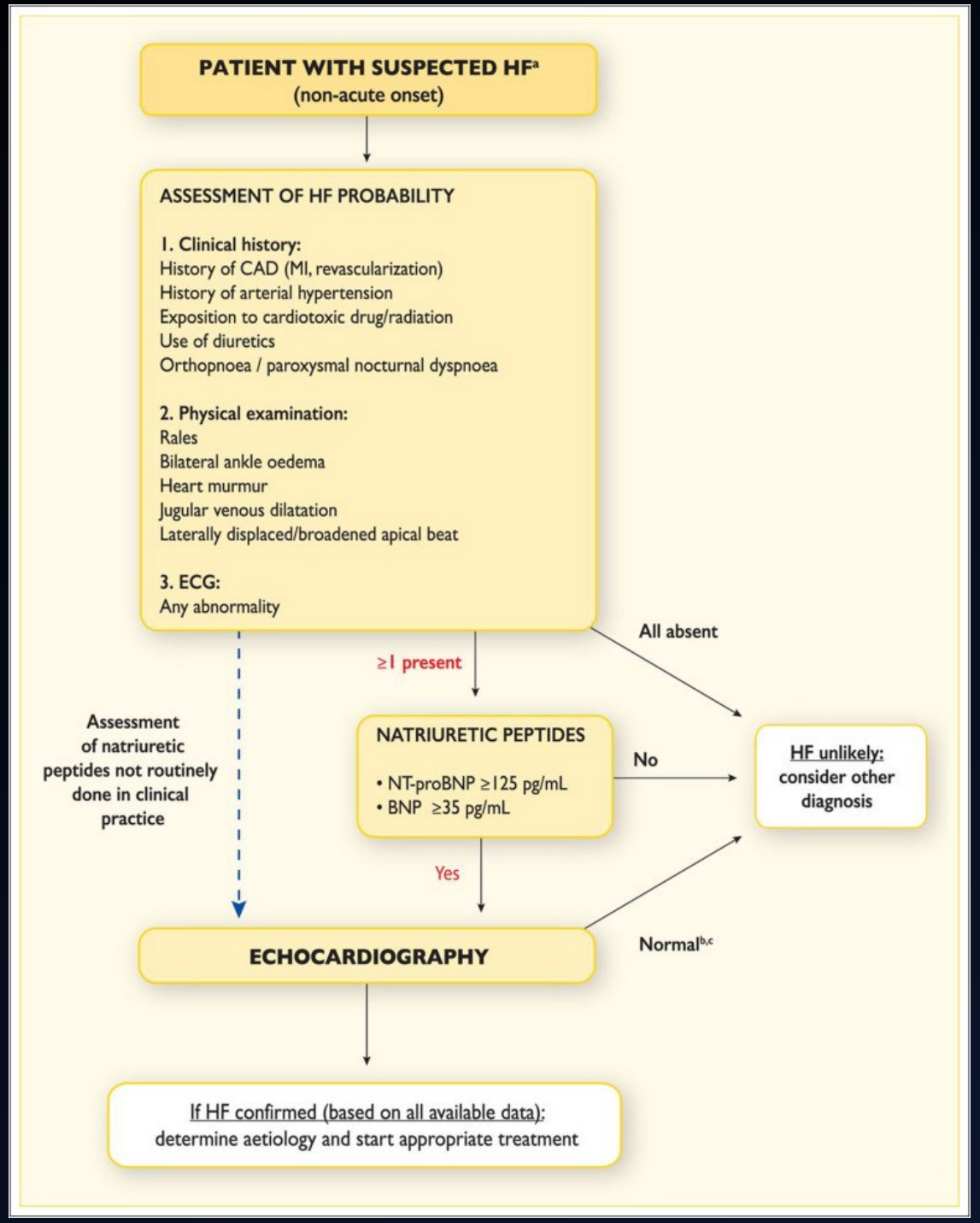
- Dg. of heart failure
- Diff. dg. of dyspnoe

- **Cut-off levels for excluding heart failure (*rule-out*)**
- **Chronic heart failure NT-proBNP < 125 pg/ml**
- **Acute heart failure NT-proBNP < 300 pg/ml**

Acute heart failure – age dependance (NTpro BNP)

- < 50 years cut-off 450 pg/ml
- 50-75 years cut-off 900 pg/ml
- > 75 years cut-off 1800 pg/ml




PATIENT WITH SUSPECTED HF[a]
(non-acute onset)
ASSESSMENT OF HF PROBABILITY
1. Clinical history:
History of CAD (MI, revascularization)
History of arterial hypertension
Exposition to cardiotoxic drug/radiation
Use of diuretics
Orthopnoea / paroxysmal nocturnal dyspnoea
2. Physical examination:
Rales
Bilateral ankle oedema
Heart murmur
Jugular venous dilatation
Laterally displaced/broadened apical beat
3. ECG:
Any abnormality
All absent
≥1 present
Assessment of natriuretic peptides not routinely done in clinical practice
NATRIURETIC PEPTIDES
• NT-proBNP ≥125 pg/mL
• BNP ≥35 pg/mL
No
HF unlikely: consider other diagnosis
Yes
Normal[b,c]
ECHOCARDIOGRAPHY
If HF confirmed (based on all available data):
determine aetiology and start appropriate treatment

Casuistry 5

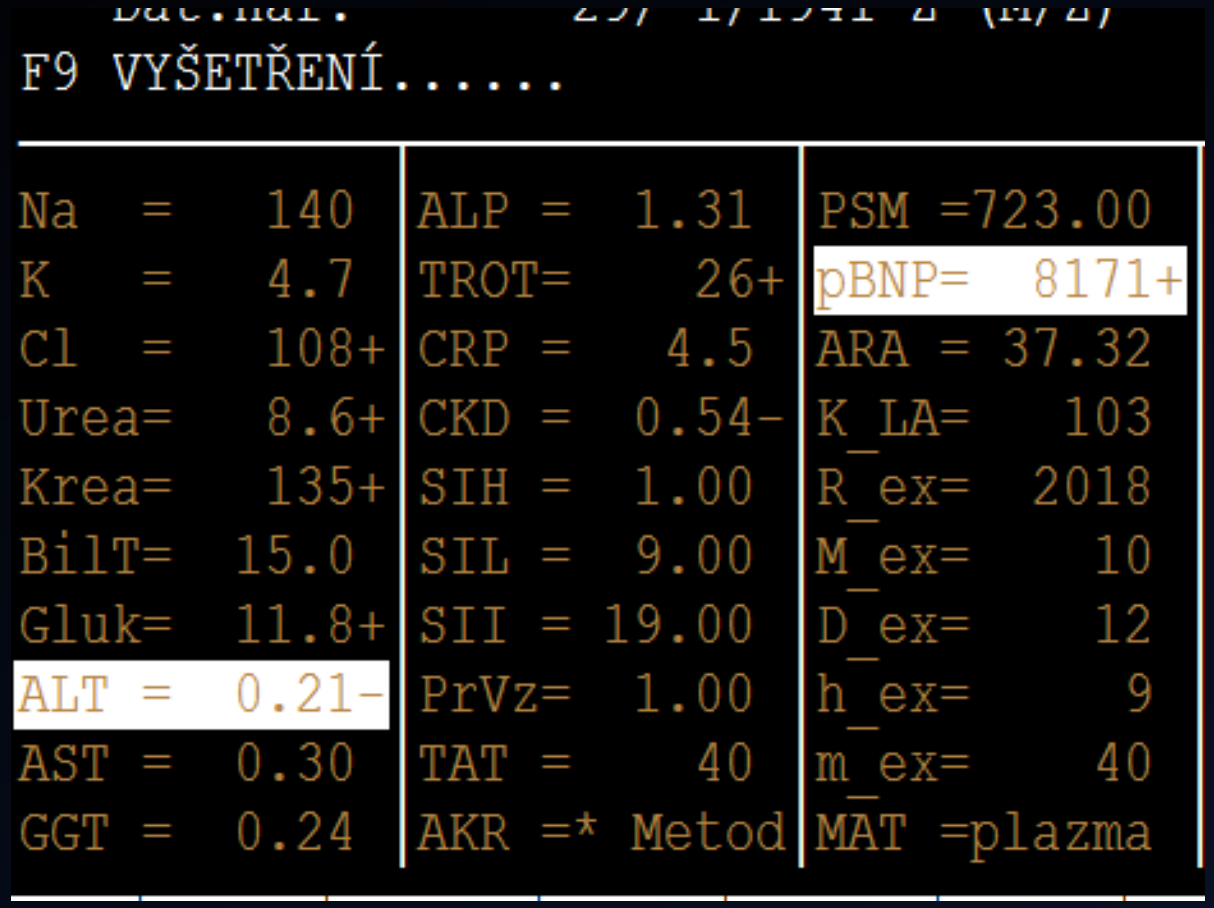
- Woman,77 years old
- Previously amputation of the lower limb for ischemic disease, atrial fibrillation
- Symptoms: dyspnoe, febrilia, sweat

Vyšetření	Jedn.	2018 12.10 08:29	2018 12.10 08:28	2018 12.10 05:59	2018 12.10 05:09
ALT	ukat/l				
AST	ukat/l				
GGT	ukat/l				
ALP	ukat/l				
AMS	ukat/l				
Myoglob.	ug/l				
Trop.T	ng/l		77		
CB	g/l				
Albumin	g/l				
Glukóza	mmol/l				
cB-gluk.	mmol/l			8.7	
CRP	mg/l				58.9
Prokalc.	ng/ml		0.26		
Prealb.	g/l				
Laktát	mmol/l	2.8			
NTproBNP	pg/ml		10789		

Atrial fibrillation with rapid ventricular response, heart failure

Kasuistika 6

- Woman, 77 years old
- Repeatedly hospitalized for chronic heart failure
- Syndrom of angina pectoris, PCI -3x DES
- NSTEMI (2008,2012)
- Since the evening day before, shortness of breath, in the morning retrosternal pain (5:30). During the last week worsening of swelling of lower limbs.



F9 VYŠETŘENÍ.....

Na = 140	ALP = 1.31	PSM =723.00
K = 4.7	TROT= 26+	pBNP= 8171+
Cl = 108+	CRP = 4.5	ARA = 37.32
Urea= 8.6+	CKD = 0.54-	K_LA= 103
Krea= 135+	SIH = 1.00	R_ex= 2018
BilT= 15.0	SIL = 9.00	M_ex= 10
Gluk= 11.8+	SII = 19.00	D_ex= 12
ALT = 0.21-	PrVz= 1.00	h_ex= 9
AST = 0.30	TAT = 40	m_ex= 40
GGT = 0.24	AKR =* Metod	MAT =plazma

Obj: breathlessness, BP 170/60 SF 65 irreg
ECG atrial fibrillation 70/min ,
RTG: S+P – fluidothorax bilat.
Závěr: acute heart failure