Case reports

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2nd Faculty of Medicine and University Hospital Motol

Patient 1

Middle-aged man

- The patient was found at the sidewalk in the snow **at about 6 am**, he was very confused, he didn't know what had happened.
- He was slightly supercooled (35.5 ˚C), SpO_2 94 %, pulse: 96/min, blood pressure: 150/88.
- He was transported using fast rescue service to University Hospital Motol.

- **blood collection time: 6:48 SAMPLE 1**

					Ref. meze
	Hb Vodivost/Fotometrie Nova SP CCX	144,0	[*]	g/l	132,0-173,0
	Hct Konduktometrie Nova SP CCX	45	[*]	%	39-49
81135	Sodný kation Potenciometrie Nova SP CCX	142	[*]	mmol/l	137-146
81145	Draselný kation Potenciometrie Nova SP CCX	2,9	*[ ]	mmol/l	3,8-5,0
81157	Chloridy Potenciometrie Nova SP CCX	109	[ ]*	mmol/l	97-108
81141	Ca++ - norm. Potenciometrie Nova SP CCX	1,17	[*]	mmol/l	1,13-1,32
81155	Glukóza Amperometrie Nova SP CCX	11,13	[ ]*	mmol/l	3,30-5,80
81137	Močovina Potenciometrie Nova SP CCX	3,9	[*]	mmol/l	2,8-8,0
	FIO2	20,90		%	

- **blood collection time: 7:26 SAMPLE 2**

					Ref. meze
	Chylózní vzorek	+			
81111	ALT Modifikovaná IFCC metoda při 37°C	3,24	[ ]*	ukat/l	0,17-0,78
81153	GGT (GMT) IFCC metoda při 37°C	0,84	[*]	ukat/l	0,14-0,84
81121	Bilirubin celkový Vanadátová metoda	3,7	[*]	umol/l	2,0-17,0
	S-KREA				
81169	Kreatinin Enzymová kolorimetrická metoda	116	[ ]*	umol/l	55-96
	eGFR-krea-(CKD-EPI)	1,17		ml/s/1,73 m2	
81125	Celková bílkovina Biuretová metoda	67,0	[*]	g/l	65,0-85,0
91153	CRP-HS Imunoturbidimetrie	1,3	[*]	mg/l	0,0-5,0
97111	Separace séra	1x			

Blood collection time:

10:00

SAMPLE 3

						Ref. meze
81135	Sodný kation ISE - s ředěním	**136**	*[ ]	mmol/l		137-146
81145	Draselný kation ISE - s ředěním	**3,5**	*[ ]	mmol/l		3,8-5,0
81157	Chloridy ISE - s ředěním	**114**	[ ]*	mmol/l		97-108
81141	Ca++ - norm. ISE	**1,09**	*[ ]	mmol/l		1,13-1,32
81465	Hořčík Kolorimetrická metoda s xylidilovou modří	**0,85**	[*]	mmol/l		0,66-0,91
81563	Osmolalita Kryoskopie	**336**	[ ]*	mmol/kg	opakovaně	285-295
	Osmolalita-počítaná počítaná: 2*(Na)+p-Glu+Urea	**283**	*[ ]	mmol/kg		285-295
81155	Glukóza v plazmě Metoda s HK	**7,0**	[ ]*	mmol/l		3,3-5,8
81111	ALT Modifikovaná IFCC metoda při 37°C	**2,89**	[ ]*	ukat/l		0,17-0,78
81153	GGT (GMT) IFCC metoda při 37°C	**1,00**	[ ]*	ukat/l		0,14-0,84
81165	Kreatinkináza Metoda při 37°C (NAC)	**28,00**	[ ]*	ukat/l	ředěno	0,41-3,24
81117	Amyláza IFCC metoda při 37°C	**1,36**	[*]	ukat/l		0,30-2,28
81121	Bilirubin celkový Vanadátová metoda	**5,9**	[*]	umol/l		2,0-17,0
81123	Bilirubin přímý Vanadátová metoda	**1,9**	[*]	umol/l		0,0-5,1
81137	Močovina Enzymová metoda s ureázou a GDH	**3,9**	[*]	mmol/l		2,8-8,0
	S-KREA					
81169	Kreatinin Enzymová kolorimetrická metoda	**77**	[*]	umol/l		55-96
	eGFR-krea-(CKD-EPI)	**1,86**		ml/s/1,73 m2		
	hs TnI + delta					
81237	hs Troponin I CMIA Architect	**<2,0**		ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
	Absolutní delta hs TnI počítaná hodnota	**nelze spočítat**				
	Relativní delta hs TnI počítaná hodnota	**nelze spočítat**				
93135	Myoglobin Imunoturbidimetrie	**1596,0**	[ ]*	ug/l	ředěno	23,0-72,0
81125	Celková bílkovina Biuretová metoda	**55,6**	*[ ]	g/l		65,0-85,0
91153	CRP-HS Imunoturbidimetrie	**1,2**	[*]	mg/l		0,0-5,0
91481	Prokalcitonin ECLIA Cobas 6000 (e601)	**0,12**	[*]	ug/l		0,00-0,50
97111	Separace séra	**1x**				

Questions A

- What findings from "Sampling 3" could be related to a life-threatening condition?

- Try a differential diagnostic analysis of the causes of these findings.

Blood collection time:

10:00

SAMPLE 3

						Ref. meze
81135	Sodný kation ISE - s ředěním	136	*[ ]	mmol/l		137-146
81145	Draselný kation ISE - s ředěním	3,5	*[ ]	mmol/l		3,8-5,0
81157	Chloridy ISE - s ředěním	114	[ ]*	mmol/l		97-108
81141	Ca++ - norm. ISE	1,09	*[ ]	mmol/l		1,13-1,32
81465	Hořčík Kolorimetrická metoda s xylidilovou modří	0,85	[*]	mmol/l		0,66-0,91
81563	Osmolalita Kryoskopie	336	[ ]*	mmol/kg	opakovaně	285-295
	Osmolalita-počítaná počítaná: 2*(Na)+p-Glu+Urea	283	*[ ]	mmol/kg		285-295
81155	Glukóza v plazmě Metoda s HK	7,0	[ ]*	mmol/l		3,3-5,8
81111	ALT Modifikovaná IFCC metoda při 37°C	2,89	[ ]*	ukat/l		0,17-0,78
81153	GGT (GMT) IFCC metoda při 37°C	1,00	[ ]*	ukat/l		0,14-0,84
81165	Kreatinkináza Metoda při 37°C (NAC)	28,00	[ ]*	ukat/l	ředěno	0,41-3,24
81117	Amyláza IFCC metoda při 37°C	1,36	[*]	ukat/l		0,30-2,28
81121	Bilirubin celkový Vanadátová metoda	5,9	[*]	umol/l		2,0-17,0
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81137	Močovina Enzymová metoda s ureázou a GDH	3,9	[*]	mmol/l		2,8-8,0
	S-KREA					
81169	Kreatinin Enzymová kolorimetrická metoda	77	[*]	umol/l		55-96
	eGFR-krea-(CKD-EPI)	1,86		ml/s/1,73 m2		
	hs TnI + delta					
81237	hs Troponin I CMIA Architect	<2,0		ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
	Absolutní delta hs TnI počítaná hodnota	**nelze spočítat**				
	Relativní delta hs TnI počítaná hodnota	**nelze spočítat**				
93135	Myoglobin Imunoturbidimetrie	1596,0	[ ]*	ug/l	ředěno	23,0-72,0
81125	Celková bílkovina Biuretová metoda	55,6	*[ ]	g/l		65,0-85,0
91153	CRP-HS Imunoturbidimetrie	1,2	[*]	mg/l		0,0-5,0
91481	Prokalcitonin ECLIA Cobas 6000 (e601)	0,12	[*]	ug/l		0,00-0,50
97111	Separace séra	1x				

Osmolal gap

Osmolal gap: 53 mmol / kg

1g of ethanol in 1L of plasma (i.e. 1 promile) increases osmolality by about 23 mmol / kg

P(Ethanol) = OsmGap x 0.0429 (g/L, promile)

53 x 0.0429 = ***2.2737 ‰*** *4 hours after finding the patient*

P(Ethanol) = OsmGap x 0.9457 (mmol/L)

53 x 0.9457 = ***50.1221 mmol/L***

Answers A:

- **The difference between osmolalities** - cryoscopically measured and calculated according to the formula (2x [Na +] + [glucose] + [urea]) > 10 mmol / kg indicates **the presence of osmotically active solutes** (mostly pathological, in a smaller number of therapeutically administered).

- **High levels of creatine kinase (CK) and myoglobin** indicate significant **skeletal muscle damage**. Acute myocardial infarction can be ruled out due to the negative finding of hsTroponin I, hsTnI (if it was an AMI, hsTnI would also be increased at the time of CK increase).

Substances that increase osmolality above 3 mmol/kg water at a potentially lethal dose

Substance	Potentially lethal concentration (mg/l)	Osmolal gap (mmol/kg vody)
etanol	3500	81
etyléter	1800	70
izopropanol	3400	60
metanol	800	27
aceton	550	10
trichloretan	1000	4
paraldehyd	500	4
etylenglykol	210	3,4
chloroform	390	3,4

(Weiss, 1988)

Osmolal gap in the case of our patient: **53 mmol/kg**, osmolality is most increased by ethanol, which is also the most common cause of this condition.

In addition, ethanol could be smelled from our patient's breath.

- **6:48**
- The patient (35 years old) is better oriented, says that he was drinking hard alcohol all night (whiskey - 1-2 bottles) + he was smoking marijuana.
- He then quarreled with his girlfriend.
- With the cry "I am the Devil" he jumped out of the window (3rd floor).

- **Sample 2 with the uncovered ethanol test result (in 7:26)**

					Ref. meze
	Chylózní vzorek	+			
81723	Ethanol	64,46		mmol/l	
	Enzymatická metoda s ADH				
81111	ALT	3,24	[ ]*	ukat/l	0,17-0,78
	Modifikovaná IFCC metoda při 37°C				
81153	GGT (GMT)	0,84	[*]	ukat/l	0,14-0,84
	IFCC metoda při 37°C				
81121	Bilirubin celkový	3,7	[*]	umol/l	2,0-17,0
	Vanadátová metoda				
	S-KREA				
81169	Kreatinin	116	[ ]*	umol/l	55-96
	Enzymová kolorimetrická metoda				
	eGFR-krea-(CKD-EPI)	1,17		ml/s/1,73 m2	
81125	Celková bílkovina	67,0	[*]	g/l	65,0-85,0
	Biuretová metoda				
91153	CRP-HS	1,3	[*]	mg/l	0,0-5,0
	Imunoturbidimetrie				
97111	Separace séra	1x			

2,9 ‰

→ *1.5 h after finding the patient: 2.9 ‰ ethanol*

Questions B

- In "Sample 1", try to explain the cause of **hypokalemia and hyperglycemia**.

- In „Sample 2", try to explain the cause of **increased creatinine and ALT.**

- **blood collection time: 6:48 SAMPLE 1**

					Ref. meze
	Hb Vodivost/Fotometrie Nova SP CCX	144,0	[*]	g/l	132,0-173,0
	Hct Konduktometrie Nova SP CCX	45	[*]	%	39-49
81135	Sodný kation Potenciometrie Nova SP CCX	142	[*]	mmol/l	137-146
81145	Draselný kation Potenciometrie Nova SP CCX	2,9	*[ ]	mmol/l	3,8-5,0
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81141	Ca++ - norm. Potenciometrie Nova SP CCX	1,17	[*]	mmol/l	1,13-1,32
81155	Glukóza Amperometrie Nova SP CCX	11,13	[ ]*	mmol/l	3,30-5,80
81137	Močovina Potenciometrie Nova SP CCX	3,9	[*]	mmol/l	2,8-8,0
	FIO2	20,90		%	

- **blood collection time: 7:26 SAMPLE 2**

					Ref. meze
	Chylózní vzorek	+			
81111	ALT Modifikovaná IFCC metoda při 37°C	3,24	[ ]*	ukat/l	0,17-0,78
81153	GGT (GMT) IFCC metoda při 37°C	0,84	[*]	ukat/l	0,14-0,84
81121	Bilirubin celkový Vanadátová metoda	3,7	[*]	umol/l	2,0-17,0
	S-KREA				
81169	Kreatinin Enzymová kolorimetrická metoda	116	[ ]*	umol/l	55-96
	eGFR-krea-(CKD-EPI)	1,17		ml/s/1,73 m2	
81125	Celková bílkovina Biuretová metoda	67,0	[*]	g/l	65,0-85,0
91153	CRP-HS Imunoturbidimetrie	1,3	[*]	mg/l	0,0-5,0
97111	Separace séra	1x			

Answers B:

- **Possible causes of hypokalemia (2.9 mmol/L):** exposure to ethanol and marijuana
- **Ethanol** reduces ADH secretion and has a diuretic effect, high serum concentration may cause electrolyte imbalance (e.g. hypokalemia, hypophosphatemia, hypomagnesemia)
- **Cannabinoids** (especially synthetic) can cause tachycardia, palpitations, chest pain, nausea, agitation and hypokalemia (caused by the transfer of potassium into the cells, potentiated by an excessive supply of carbohydrates together with cannabinoids).

Answers B:

- Possible causes of **hyperglycemia (11.13 mmol/L):**
  - **The consequence of alcohol consumption can be ruled out** because the patient drank distillate. This could only be a compensatory response to significant hypoglycaemia.
  - **Diabetes mellitus (DM):**
    - The patient was probably not hungry. The blood glucose value exceeded 11 mmol/L, which is the diagnostic value for DM. If the patient shows clinical symptoms (eg polyuria, polydipsia, etc.), dg DM is very likely. The diagnosis should be confirmed by fasting glucose, the value should be ≥ 7.0 mmol/L. Furthermore, we could supplement the examination of glycated hemoglobin HbA_{1c}, the value of ≥ 48 mmol/mol indicates DM.

→ dg DM or impaired glucose tolerance in the patient is likely **(later impaired glucose tolerance confirmed)**

The effect of alcohol on glycemia

- It depends on what kind of alcohol it is and how much carbohydrate it contains.
- Beer contains carbohydrates (malt sugar) and increases blood glucose, sweet and semi-sweet wines also increase blood glucose (contain sugar).
- Dry wine and spirits can lower blood glucose (do not contain carbohydrates). This is because such alcohol is generally preferentially metabolized in the liver and prevents the breakdown of insulin (also in the liver). Insulin works longer in the body and may cause severe hypoglycemia. Furthermore, alcohol prevents the breakdown of glycogen in the liver, so there is no normalization of glycemia.

Answers B:

- Possible causes of **increased creatinine (116 µmol/L):**
  - In the patient: > 20-times increased serum **myoglobin** (above the upper limit of the reference range). Free myoglobin from the bruised muscles is filtered by the glomeruli (which can even directly clog) and causes obturation in the tubules by peeling tubular cells that are overfilled with resorbed myoglobin. Impairment of renal function (acute renal failure) may be the result.
  - **Alcohol** has a significant diuretic effect, and dehydration of the patient may also have contributed to an increase in creatinine.

Answers B:

- **Possible causes of elevated ALT (3.24 ukat /L):**
  - ALT is found mostly in the liver, in other organs (skeletal muscle, myocardium and others) the activity is lower, in contrast to AST located only in the cytoplasm.
  - The increase in ALT **is most often caused by liver damage,** in the case of our patient it could also be related to **alcoholic excess** (in this case, the increase together with AST is usually up to twice the upper limit of the reference range). GGT would probably also increase (due to release from bile duct cell membranes; *significant increase in GGT - about 5-10 times or more - in chronic alcohol use due to induction of increased synthesis in damaged hepatocytes during adaptation to alcohol*). A slight increase in ALT (along with AST) may also be associated with obesity (which was not the case in our patient).
  - In our patient, GGT is still in the reference range (at the upper limit, chronic alcohol abuse can be ruled out)
    AST (in further sampling) is also increased… 3.97 ukat /L.
  - The increase in ALT probably occurred due to **massive skeletal muscle damage** (but for muscle damage, an increase in AST is more typical)**, the effect of alcohol is also involved**

- **urine collection time: 7:29**

Poznámka k materiálu:
Masivní nález ery - sediment nelze hodnotiti!

					Ref. meze
	Moč chemicky				
81325	Spec. hmotnost	**1,027**		kg/l	
	pH	**5,0**			
	Leukocyty	**4**			
	Nitrity	**1**			
	Bílkovina	**3**			
	Glukóza	**1**			
	Ketolátky	**1**			
	Urobilinogen	**1**			
	Bilirubin	**-**			
	Kyselina askorbová	**-**			
	Barva	**červená**			
	Zákal	**lehce zakalená**			
	Krev	**3**			
	Elementy v moči				
	Erytrocyty	**20702**	[ ]*	částic/ul	0-10

Questions C

- Try to interpret the patient's urinary finding.
- Try to explain the finding that a patient with the same medical history would have almost all the results physiological (including a urinary erythrocyte test) and **the only pathological result would be a positive blood test (and possibly a slightly elevated protein).**

Answers C:

- Significantly elevated leukocytes, protein, blood, erythrocytes and positive nitrites, indicate a **urinary tract infection** *(Positive erythrocytes and blood could also indicate urinary tract injuries due to a patient´s fall…)*
- **Positive glucose** is consistent with dg DM or impaired glucose tolerance, the finding could also be due to damage to renal tubular cells by myoglobin..
- **Positive ketones** probably after alcohol excess (other options- DM or starvation are less likely).
- If the patient was **positive only for a blood test (not erythrocytes in the urinary elements) and has slightly increased proteinuria, it would be due to myoglobinuria**, because myoglobin (as well as hemoglobin) catalyzes the oxidation of some substrates (e.g. benzidine derivatives, aminophenazone) by hydrogen peroxide (= method for the determination of hemoglobin).

- **8:00**
- **CT scan was performed:**
- Aortic rupture / dissection at the aboral end of the aortic arch with slight leakage of contrast medium
- Contusion changes of pulmonary parenchyma right basal
- Fracture of the right hip bone without dislocation
- Shattering fracture of pubic bone, including both arms

- Interventional radiologists have indicated **urgent introduction of stent graft**
- Performance was without complications

- From the traumatological point of view, **fractures were not indicated for surgical treatment, gradual rehabilitation was recommended**

Next steps:

- Repeated psychiatric and psychological examinations
- Intensive rehabilitation, crutches verticalization in about 3 weeks
- A month after the event, transport to the Psychiatric Hospital Bohnice

Patient 2

4.5-year-old boy

- Current disease: from the morning he breathed more, coughed a little, in the afternoon the mother noticed accelerated breathing (respiratory rate 38 /min), BT 36.8 ˚C
- Medical history: up to 4 years of age he was almost healthy (only 6th childhood disease and 1x tonsillitis), then increased morbidity - 2x obstructive bronchitis, 1x tonsillitis, 1x laryngitis, viral pneumonia 2 months ago
- Due to the anamnesis, the boy was examined in the evening at the emergency of the Motol University Hospital
- Pulse 162/min, BP 110/60, RR 40/min, Sat.O_2 93–94 %

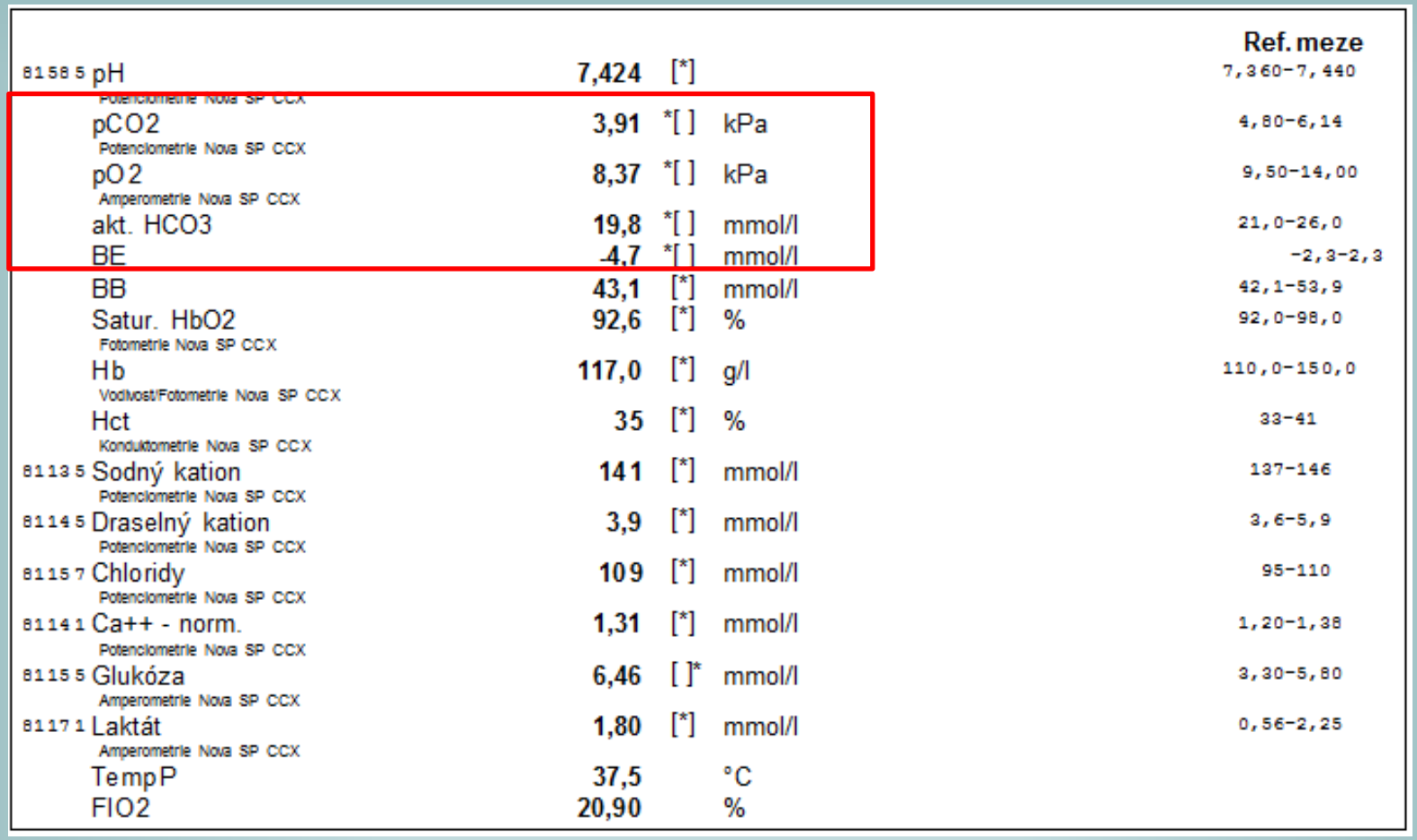
4.5-year-old boy

Blood collection time: 23:30

					Ref. meze
81585	pH Potenciometrie Nova SP CCX	7,424	[*]		7,360-7,440
	pCO2 Potenciometrie Nova SP CCX	3,91	*[ ]	kPa	4,80-6,14
	pO2 Amperometrie Nova SP CCX	8,37	*[ ]	kPa	9,50-14,00
	akt. HCO3	19,8	*[ ]	mmol/l	21,0-26,0
	BE	-4,7	*[ ]	mmol/l	-2,3-2,3
	BB	43,1	[*]	mmol/l	42,1-53,9
	Satur. HbO2 Fotometrie Nova SP CCX	92,6	[*]	%	92,0-98,0
	Hb Vodivost/Fotometrie Nova SP CCX	117,0	[*]	g/l	110,0-150,0
	Hct Konduktometrie Nova SP CCX	35	[*]	%	33-41
81135	Sodný kation Potenciometrie Nova SP CCX	141	[*]	mmol/l	137-146
81145	Draselný kation Potenciometrie Nova SP CCX	3,9	[*]	mmol/l	3,6-5,9
81157	Chloridy Potenciometrie Nova SP CCX	109	[*]	mmol/l	95-110
81141	Ca++ - norm. Potenciometrie Nova SP CCX	1,31	[*]	mmol/l	1,20-1,38
81155	Glukóza Amperometrie Nova SP CCX	6,46	[ ]*	mmol/l	3,30-5,80
81171	Laktát Amperometrie Nova SP CCX	1,80	[*]	mmol/l	0,56-2,25
	TempP	37,5		°C	
	FIO2	20,90		%	

CRP statim	7.0 mg/l	0.0-8.0

- **What is the problem with an acid base balance (taking into account laboratory and clinical findings)?**



					Ref. meze
81585	pH	7,424	[*]		7,360-7,440
	Potenciometrie Nova SP CCX				
	pCO2	3,91	*[ ]	kPa	4,80-6,14
	Potenciometrie Nova SP CCX				
	pO2	8,37	*[ ]	kPa	9,50-14,00
	Amperometrie Nova SP CCX				
	akt. HCO3	19,8	*[ ]	mmol/l	21,0-26,0
	BE	-4,7	*[ ]	mmol/l	-2,3-2,3
	BB	43,1	[*]	mmol/l	42,1-53,9
	Satur. HbO2	92,6	[*]	%	92,0-98,0
	Fotometrie Nova SP CCX				
	Hb	117,0	[*]	g/l	110,0-150,0
	Vodivost/Fotometrie Nova SP CCX				
	Hct	35	[*]	%	33-41
	Konduktometrie Nova SP CCX				
81135	Sodný kation	141	[*]	mmol/l	137-146
	Potenciometrie Nova SP CCX				
81145	Draselný kation	3,9	[*]	mmol/l	3,6-5,9
	Potenciometrie Nova SP CCX				
81157	Chloridy	109	[*]	mmol/l	95-110
	Potenciometrie Nova SP CCX				
81141	Ca++ - norm.	1,31	[*]	mmol/l	1,20-1,38
	Potenciometrie Nova SP CCX				
81155	Glukóza	6,46	[ ]*	mmol/l	3,30-5,80
	Amperometrie Nova SP CCX				
81171	Laktát	1,80	[*]	mmol/l	0,56-2,25
	Amperometrie Nova SP CCX				
	TempP	37,5		°C	
	FIO2	20,90		%	

It is a **respiratory alkalosis** due to hypoxemic (partial) respiratory insufficiency (type I) with a decrease in pO2 and pCO2 (due to hyperventilation) completely compensated by the kidneys.

Later, viral pneumonia with an uncomplicated course developed.

Patient 3

71-year-old woman

- Patient with long-term nicotine abuse (25-40 cig./day) examined on urgent admission for progressive dyspnea
- She was examined in a pulmonary clinic a few years ago, then she did not go there
- The general practitioner sometimes prescribes beta-mimetics to temporarily improve her breathing
- Objectively: oriented, cooperating, plethoric appearance, obesity
- BP 170/90, pulse 100/min, Sat.O_2 74 %, mild tachypnoea, BT 36,8 ˚C
- Emphysematous position of the chest, bilaterally with wheezing and basally crepitation, regular heart rate, slightly accelerated
- Abdomen above the level, anasarca, suspected ascites, lower limbs with diffuse solid swelling

71-year-old woman

Blood collection time: 10:00

					Ref. meze
81585	pH Potenciometrie Nova SP CCX	7,303	*[ ]		7,360-7,440
	pCO2 Potenciometrie Nova SP CCX	7,31	[ ]*	kPa	4,40-5,73
	pO2 Amperometrie Nova SP CCX	6,61	*[ ]	kPa	9,50-14,00
	akt. HCO3	27,4	[ ]*	mmol/l	18,4-26,0
	BE	0,9	[*]	mmol/l	-2,3-2,3
	BB	48,7	[*]	mmol/l	44,0-53,0
	Satur. HbO2 Fotometrie Nova SP CCX	79,4	*[ ]	%	92,0-98,0
	Hb Vodivost/Fotometrie Nova SP CCX	177,0	[ ]*	g/l	117,0-155,0
	Hct Konduktometrie Nova SP CCX	54	[ ]*	%	35-45
81135	Sodný kation Potenciometrie Nova SP CCX	134	*[ ]	mmol/l	137-144
81145	Draselný kation Potenciometrie Nova SP CCX	5,2	[*]	mmol/l	3,9-5,3
81157	Chloridy Potenciometrie Nova SP CCX	106	[*]	mmol/l	98-107
81141	Ca++ - norm. Potenciometrie Nova SP CCX	1,16	[*]	mmol/l	1,16-1,29
81155	Glukóza Amperometrie Nova SP CCX	6,70	[ ]*	mmol/l	4,60-6,40
81171	Laktát Amperometrie Nova SP CCX	2,00	[*]	mmol/l	0,50-2,00
81137	Močovina Potenciometrie Nova SP CCX	4,2	[*]	mmol/l	2,9-8,2
	FIO2	20,90		%	

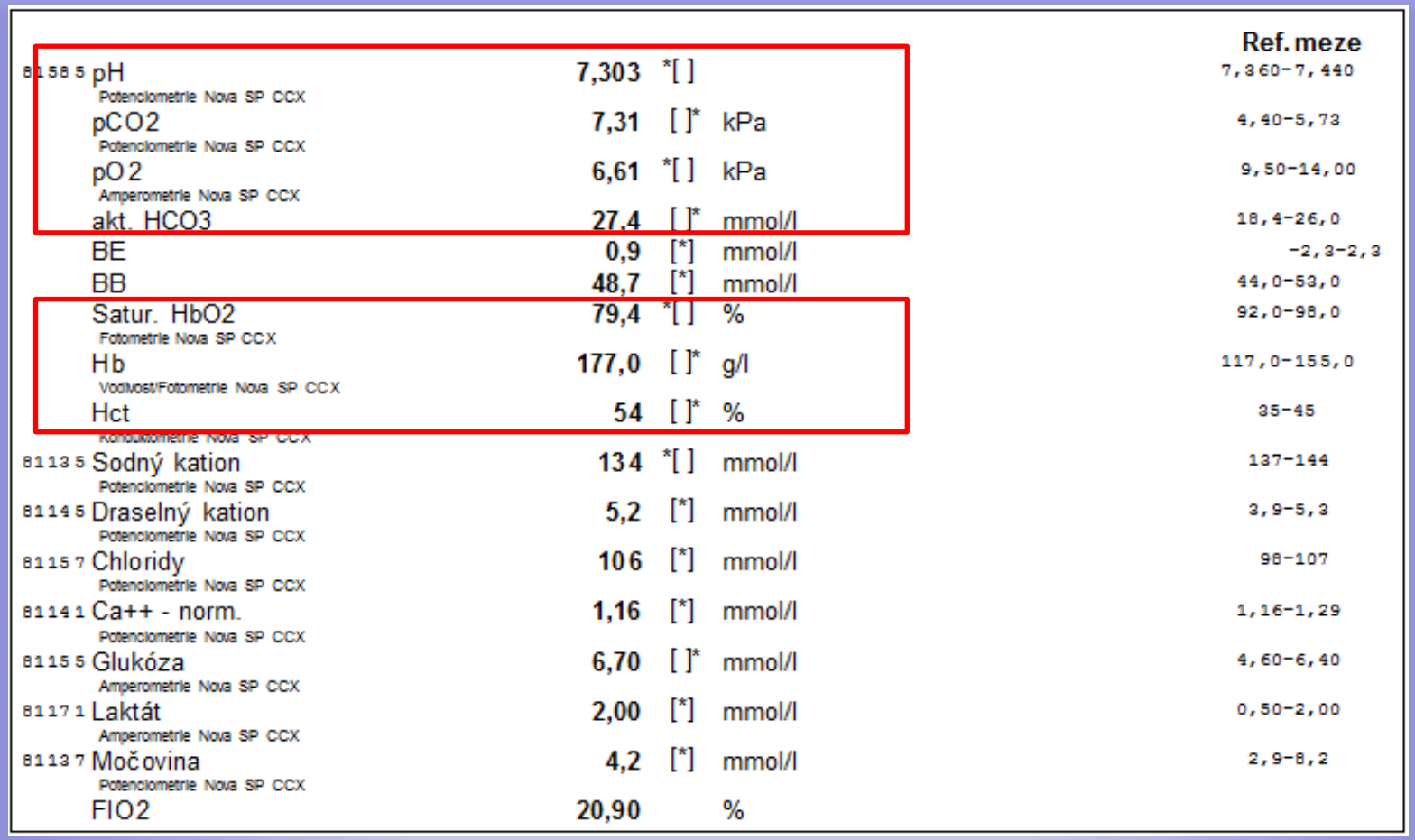
Further examination

Transthoracic echo: **significant dilatation of hypertrophic right ventricle and its syst. dysfunction**, mild left ventricular hypertrophy

Chest X ray: Lungs airy, without foci and infiltrations, with accentuated vascular drawing. **Heart magnified.** The lung base on the right is obscured by a **small amount of fluid.**

					Ref. meze
	Hemolýza	++			
81111	ALT Modifikovaná IFCC metoda při 37°C	0,18	[*]	ukat/l	0,10-0,63
81153	GGT (GMT) IFCC metoda při 37°C	0,47	[*]	ukat/l	0,15-0,92
81121	Bilirubin celkový Vanadátová metoda	18,3	[*]	umol/l	3,0-19,0
	S-KREA				
81169	Kreatinin Enzymová kolorimetrická metoda	61	[*]	umol/l	42-80
	eGFR-krea-(CKD-EPI)	1,46		ml/s/1,73 m2	
81731	NT - proBNP ECLIA Cobas 6000 (e601)	6133,0	[ ]*	ng/l	20,0-125,0
81125	Celková bílkovina Biuretová metoda	65,3	[*]	g/l	62,0-77,0
91153	CRP-HS Imunoturbidimetrie	3,5		mg/l	0,0-5,0
97111	Separace séra	1x			

- **What is the problem with an acid base balance (taking into account laboratory and clinical findings)?**
- **Explain other pathological findings.**



					Ref. meze
81585	pH Potenciometrie Nova SP CCX	7,303	*[ ]		7,360-7,440
	pCO2 Potenciometrie Nova SP CCX	7,31	[ ]*	kPa	4,40-5,73
	pO2 Amperometrie Nova SP CCX	6,61	*[ ]	kPa	9,50-14,00
	akt. HCO3	27,4	[ ]*	mmol/l	18,4-26,0
	BE	0,9	[*]	mmol/l	-2,3-2,3
	BB	48,7	[*]	mmol/l	44,0-53,0
	Satur. HbO2 Fotometrie Nova SP CCX	79,4	*[ ]	%	92,0-98,0
	Hb Vodivost/Fotometrie Nova SP CCX	177,0	[ ]*	g/l	117,0-155,0
	Hct Konduktometrie Nova SP CCX	54	[ ]*	%	35-45
81135	Sodný kation Potenciometrie Nova SP CCX	134	*[ ]	mmol/l	137-144
81145	Draselný kation Potenciometrie Nova SP CCX	5,2	[*]	mmol/l	3,9-5,3
81157	Chloridy Potenciometrie Nova SP CCX	106	[*]	mmol/l	98-107
81141	Ca++ - norm. Potenciometrie Nova SP CCX	1,16	[*]	mmol/l	1,16-1,29
81155	Glukóza Amperometrie Nova SP CCX	6,70	[ ]*	mmol/l	4,60-6,40
81171	Laktát Amperometrie Nova SP CCX	2,00	[*]	mmol/l	0,50-2,00
81137	Močovina Potenciometrie Nova SP CCX	4,2	[*]	mmol/l	2,9-8,2
	FIO2	20,90		%	

It is a **respiratory acidosis** due to hypoxemic-hypercapnic (global) respiratory insufficiency (type II) with **a decrease in pO_2 and an increase in pCO_2** due to hypoventilation partially compensated by the kidneys (retain HCO_3^-).

The patient was diagnosed with chronic obstructive pulmonary disease (COPD) with associated complications.

Secondary polycythemia (indicated by increased Hb and Hct) due to increased production of erythropoietin, which stimulates the bone marrow to increase red blood cell production **= due to impaired oxygen supply to tissues.**

High NT-proBNP = marker of heart failure (dg right heart failure is in accordance with the results of imaging methods and clinical manifestations).

- **Diuretics** with a negative fluid balance, control of the internal environment and potassium substitution (during diuretic therapy) were recommended for medication.
- **Bronchodilator therapy** was initiated.
- For hyposaturations, **an oxygen test** was added, a suitable O2 flow was 1 l / min (max 2 l / min).
- On the established diuretic therapy there was a regression of swelling of the abdomen and lower limbs, the diuretics were gradually reduced.

Patient 4

65-year-old man

- Examination at 13:45 at the urgent admission of the Motol University Hospital
- The patient woke up without difficulty in the morning of the day of admission.
- During the morning, he developed paresthesias of his fingertips on his left upper limb, gradually unable to fully lift the limb, scratching his face. He continued to function normally, tripping about his left lower limb about twice, so that he almost fell.
  At the casino, his friends told him he had a left corner of his mouth below.
- The patient negates the headache, visus is in the norm. The patient reports occasional stinging to the heart, which has been going on for a long time.
- The armor of the left hand has been repeated in the past 3 months, always disappearing.

65-year-old man
Medical history

- Social history: he never worked, he lives with his 15-year-old son, he smokes 40 cigarettes a day and does not drink alcohol
- Past medical history: condition after coronary stent insertion 4 years ago, arterial hypertension
- He is taking antihypertensives, he doesn't know what, he was taking about 5 other drugs he received after the stent was inserted, he said: he hadn't taken them for at least a year - he stopped.

65-year-old man

					Ref. meze
81585	pH Potenciometrie Nova SP CCX	7,265	*[ ]		7,360-7,440
	pCO2 Potenciometrie Nova SP CCX	8,57	[ ]*	kPa	4,90-6,70
	pO2 Amperometrie Nova SP CCX	5,68	[*]	kPa	4,80-5,90
	akt. HCO3	29,5	[ ]*	mmol/l	20,1-26,0
	BE	2,3	[*]	mmol/l	-2,3-2,3
	BB	50,1	[*]	mmol/l	44,0-53,0
	Satur. HbO2 Fotometrie Nova SP CCX	68,2	*[ ]	%	70,0-80,0
	Hb Vodivost/Fotometrie Nova SP CCX	167,0	[*]	g/l	132,0-173,0
	Hct Konduktometrie Nova SP CCX	51	[ ]*	%	39-49
81135	Sodný kation Potenciometrie Nova SP CCX	141	[*]	mmol/l	137-144
81145	Draselný kation Potenciometrie Nova SP CCX	4,7	[*]	mmol/l	3,9-5,3
81157	Chloridy Potenciometrie Nova SP CCX	106	[*]	mmol/l	98-107
81141	Ca++ - norm. Potenciometrie Nova SP CCX	1,23	[*]	mmol/l	1,16-1,29
81155	Glukóza Amperometrie Nova SP CCX	6,53	[ ]*	mmol/l	4,60-6,40
81171	Laktát Amperometrie Nova SP CCX	4,30	[ ]*	mmol/l	0,50-2,00
81137	Močovina Potenciometrie Nova SP CCX	8,2	[*]	mmol/l	2,9-8,2
	FIO2	20,90		%	

Further examination

AngioCT of the brain: postischemic and postmalatic changes l.dx., without acute bleeding or expansion

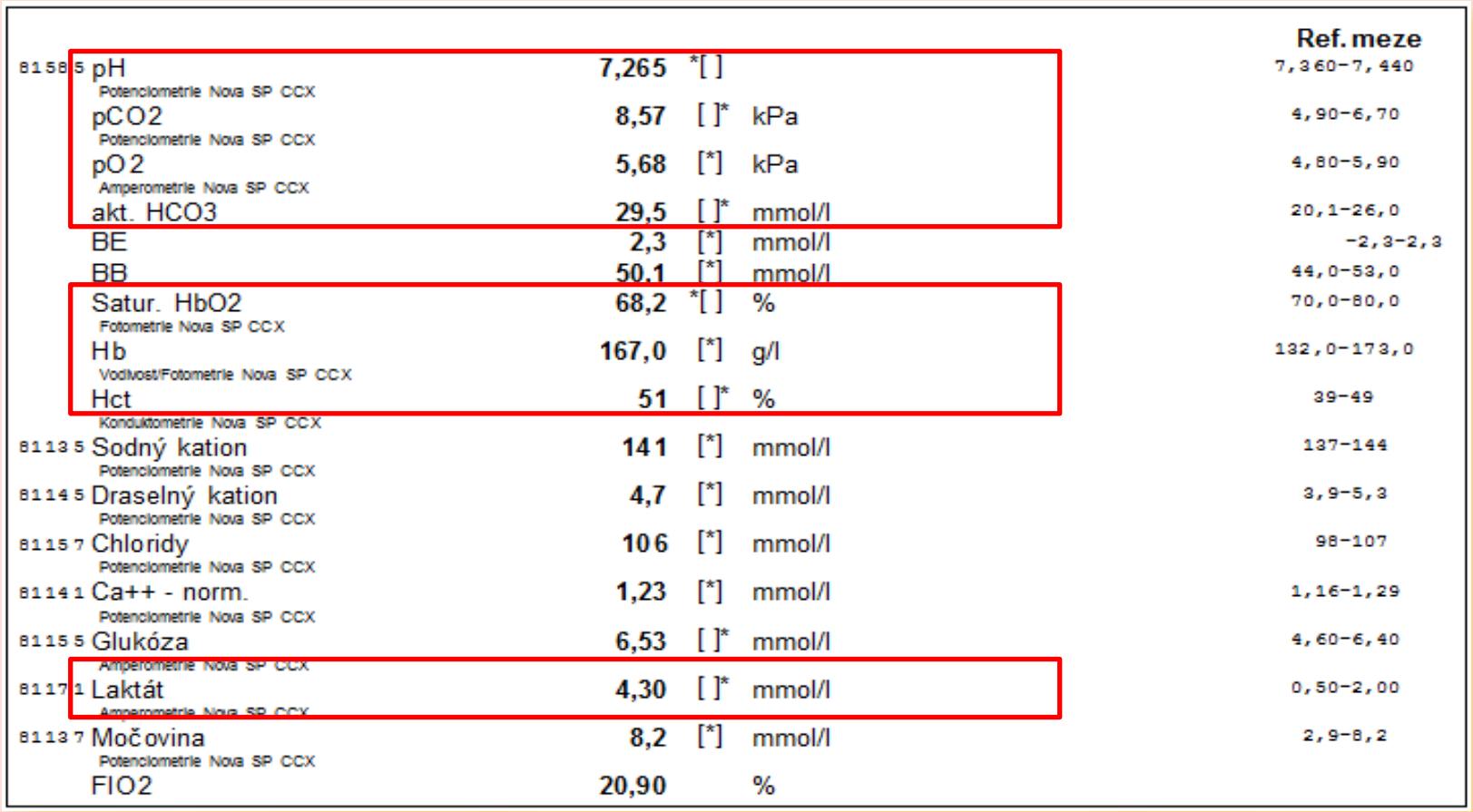
ECG monitoring: accidentally detected **paroxysmal arrhythmia** – bigeminy

Chest X ray: Lungs airy, increased lung transparency, without foci and infiltrations. Heart unmagnified. **Conclusion: pulmonary emphysema**

Further examination

						Ref. meze
81111	ALT Modifikovaná IFCC metoda při 37°C	0,39	[*]	ukat/l		0,10-0,63
81153	GGT (GMT) IFCC metoda při 37°C	0,37	[*]	ukat/l		0,15-0,92
81121	Bilirubin celkový Vanadátová metoda	8,0	[*]	umol/l		3,0-19,0
	S-KREA					
81169	Kreatinin Enzymová kolorimetrická metoda	109	[ ]*	umol/l		55-96
	eGFR-krea-(CKD-EPI)	1,01		ml/s/1,73 m2		
	hs TnI + delta					
81237	hs Troponin I CMIA Architect	7,2	[*]	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
	Absolutní delta hs TnI počítaná hodnota	**nelze spočítat**				
	Relativní delta hs TnI počítaná hodnota	**nelze spočítat**				
81125	Celková bílkovina Biuretová metoda	73,2	[*]	g/l		62,0-77,0
91153	CRP-HS Imunoturbidimetrie	15,8	[ ]*	mg/l		0,0-5,0
97111	Separace séra	1x				
81611	Triacylglyceroly GPO-PAP	2,21	[ ]*	mmol/l		0,40-1,98
81471	Cholesterol CHOD-PAP	4,6	[*]	mmol/l		3,4-5,0
	HDL-CHOL					
81473	HDL cholesterol Přímá metoda	0,71	*[ ]	mmol/l		0,72-2,53
	non-HDL cholesterol Vypočítaná hodnota	3,89	[ ]*	mmol/l		<3,80
81527	LDL cholesterol Přímá metoda	3,49	[ ]*	mmol/l		1,50-3,00
93135	Myoglobin Imunoturbidimetrie	80,8		ug/l		12,0-92,0
81731	NT - proBNP ECLIA Cobas 6000 (e601)	456,5	[ ]*	ng/l		20,0-125,0

- **What is the problem with an acid base balance (taking into account laboratory and clinical findings)?**
- **Explain other pathological findings.**



					Ref. meze
81585	pH Potenciometrie Nova SP CCX	7,265	*[ ]		7,360-7,440
	pCO2 Potenciometrie Nova SP CCX	8,57	[ ]*	kPa	4,90-6,70
	pO2 Amperometrie Nova SP CCX	5,68	[*]	kPa	4,80-5,90
	akt. HCO3	29,5	[ ]*	mmol/l	20,1-26,0
	BE	2,3	[*]	mmol/l	-2,3-2,3
	BB	50.1	[*]	mmol/l	44,0-53,0
	Satur. HbO2 Fotometrie Nova SP CCX	68,2	*[ ]	%	70,0-80,0
	Hb Vodivost/Fotometrie Nova SP CCX	167,0	[*]	g/l	132,0-173,0
	Hct Konduktometrie Nova SP CCX	51	[ ]*	%	39-49
81135	Sodný kation Potenciometrie Nova SP CCX	141	[*]	mmol/l	137-144
81145	Draselný kation Potenciometrie Nova SP CCX	4,7	[*]	mmol/l	3,9-5,3
81157	Chloridy Potenciometrie Nova SP CCX	106	[*]	mmol/l	98-107
81141	Ca++ - norm. Potenciometrie Nova SP CCX	1,23	[*]	mmol/l	1,16-1,29
81155	Glukóza Amperometrie Nova SP CCX	6,53	[ ]*	mmol/l	4,60-6,40
81171	Laktát Amperometrie Nova SP CCX	4,30	[ ]*	mmol/l	0,50-2,00
81137	Močovina Potenciometrie Nova SP CCX	8,2	[*]	mmol/l	2,9-8,2
	FIO2	20,90		%	

It is an examination of ABB from venous sampling (according to the reference range). It is a combined disorder - **metabolic lactic acidosis** (anaerobic glycolysis predominates in hypoxic brain tissue and lactate increases) and **respiratory acidosis** in COPD with CO_2 accumulation. The disorder is **partially compensated by the kidneys.**

Note:
In the case of a more extensive stroke with attenuation of the respiratory center, **respiratory acidosis** would be the result of the stroke.

Lactic acidosis can also occur in association with chronic lung disease due to tissue hypoxia.

The patient reported occasional "cardiac pricking", examined: **hsTnI and myoglobin**, these markers in the reference range, **AMI was excluded**. "Heart prickling" probably was due to arrhythmia.

The patient was found to have **elevated NT-proBNP,** which could be related **to cardiac failure in COPD** (but the patient did not show clinical signs of heart failure and heart shadow was not dilated)**,**
this marker also increases **with brain damage** (subarachnoid hemorrhage, vasospasm, brain trauma, acute stroke) ⟶
increase in NT-proBNP probably mainly due to past acute ischemic stroke

- Patient hospitalized for 4 days, course without complications.
- He was given antiplatelet therapy (ASA, Clopidogrel), due to dyslipidemia he was given a statin (in increased doses - stricter criteria for high CV risk = secondary prevention).
- Cardiac examination was performed on an outpatient basis (weekly ECG-Holter was used during hospitalization).

Patient 5

71-year-old patient

- **Chief complaint:** patient at cardiovascular risk (st.p. PCI RIA, st.p. AMI) admitted for elective coronary angiography for recurrence of exertional angina pectoris.
- **Medical history:** hypertension on therapy (Betaloc, Prestarium), dyslipidemia (statin), bladder cancer (2015), extirpation cystoscopically + intravesically chemotherapy, recurrence 2017
- Echocardiogram: good systolic function of the left ventricle, without significant valve defect, borderline size of the left atrium

71-year-old patient

Subjectively:

- For the last month, the patient reports exertional chest pain. The pain behind the sternum does not radiate, once or twice the patient's fingers tingled.
- At the same time, the patient reports exertional dyspnea and negates it at rest. He must slow down / stop and the pain will subside within a few minutes.
- Syncopes, palpitations and claudications are negated by the patient.

					Ref. meze
81593	Sodný kation ISE - s ředěním	133	*[ ] delta check: nevýznamný	mmol/l	137-144
81393	Draselný kation ISE - s ředěním	4,5	[*] delta check: nevýznamný	mmol/l	3,9-5,3
81469	Chloridy ISE - s ředěním	105	[*] delta check: nevýznamný	mmol/l	98-107
81337	ALT Modifikovaná IFCC metoda při 37°C	0,46	[*] delta check: nevýznamný	ukat/l	0,10-0,63
81435	GGT (GMT) IFCC metoda při 37°C	0,36	[*] delta check: nevýznamný	ukat/l	0,15-0,92
81621	Močovina Enzymová metoda s ureázou a GDH	7,3	[*] delta check: nevýznamný	mmol/l	2,9-8,2
	S-KREA				
81499	Kreatinin Enzymová kolorimetrická metoda	81	[*] delta check: nevýznamný	umol/l	55-96
	eGFR-krea-(CKD-EPI)	1,39		ml/s/1,73 m2	
81365	Celková bílkovina Biuretová metoda	114,5	[ ]*	g/l ředěno	62,0-77,0
91153	CRP-HS Imunoturbidimetrie	<0,5		mg/l	0,0-5,0
97111	Separace séra	1x			

WBC	* 3.5	x10^9/l	4.0-10.0
RBC	* 2.18	x10^12/l	4.00-5.80
HGB	* 77	g/l	135-175
HCT	* 0.225	l/l	0.400-0.500
MCV	* 103.2	fl	82.0-98.0
MCH	* 35.3	pg	28.0-34.0
MCHC	342.2	g/l	320.0-360.0
RDW	* 15.5	%	10.0-15.2
PLT	226	x10^9/l	150-400
MPV	10.4	fl	7.8-11.0
PCT	0.230	%	0.120-0.350
PDW	11.2	fl	9.0-17.0
NRBC	* 0.3	%	0.0-0.0
NRBC#	* 0.010	x10^9/l	0.000-0.000
P-LCR	26.9	%	15.0-35.0

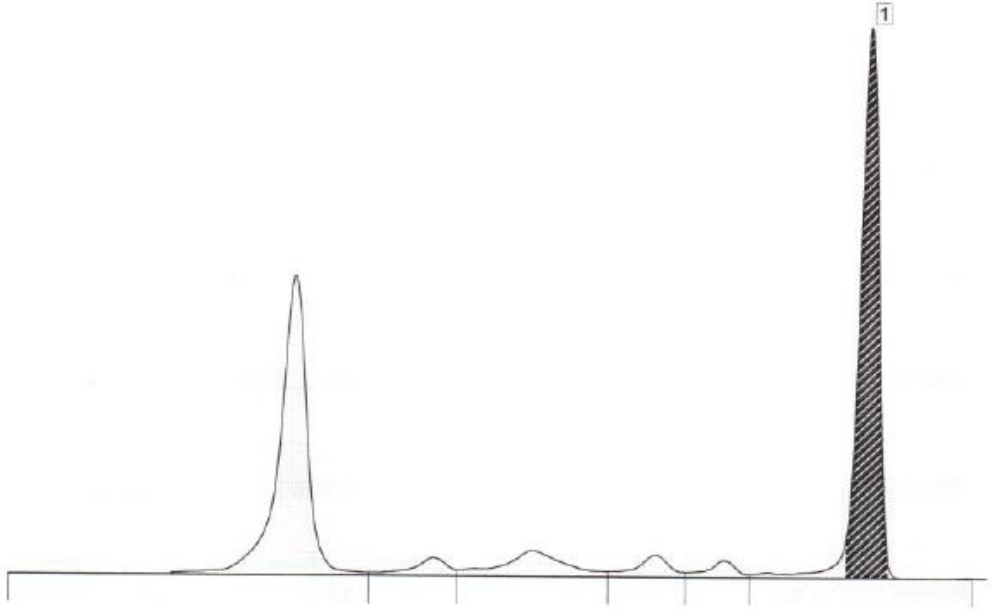
- Significant hyperproteinemia and leukopenia and severe anemia were accidentally detected in a cardiac patient in a laboratory finding.

- What diagnosis is likely, what else would you examine?

- The results indicate the presence of a **pathological protein (paraprotein) in hematooncological disease.**
- With such a significantly increased serum protein together with severe anemia, **multiple myeloma** is considered.
- We recommend **supplementing the electrophoretic examination of serum proteins, determining the level of serum calcium, performing sternal puncture.**
- *In advanced disease,* ***renal function may deteriorate*** *(mainly due to tubulopathy), but creatinine and eGFR are currently normal.*

Sample #: **34** Date: **16/1/2020** ID: **155977**

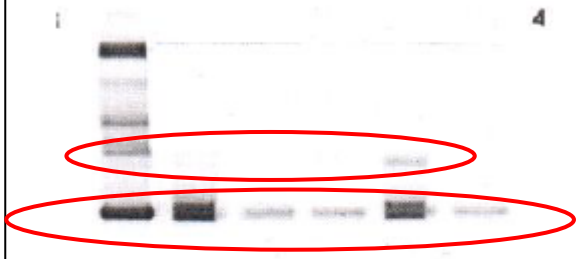
Serum protein electrophoresis



Fractions	%		Ref. %	Conc.	Ref. Conc.
5941-Album	**36,8**	<	55,8 - 66,1	**44,0**	40,2 - 47,6
5942-Alp 1	**2,8**	<	2,9 - 4,9	**3,3**	2,1 - 3,5
5943-Alp 2	**7,2**		7,1 - 11,8	**8,6**	5,1 - 8,5
5944-Beta1	**3,3**	<	4,7 - 7,2	**3,9**	3,4 - 5,2
5945-Beta2	**2,2**	<	3,2 - 6,5	**2,6**	2,3 - 4,7
5946-Gamma	**47,7**	>	11,1 - 18,8	**57,0**	8,0 - 13,5

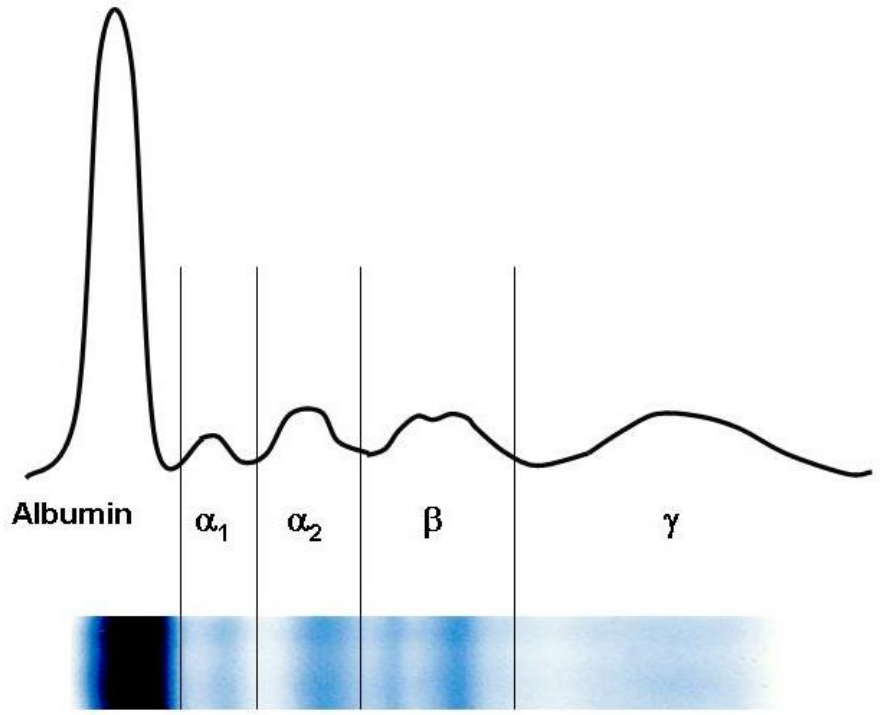
Peaks	%	g/dl
1	45,1	53,9

PPT v gamma



PPT: IgGκ a FLCκ

Serum protein electrophoresis



81593	Sodný kation ISE - s ředěním	133	*[ ]	mmol/l delta check: nevýznamný		137-144
81393	Draselný kation ISE - s ředěním	4,4	[*]	mmol/l delta check: nevýznamný		3,9-5,3
81469	Chloridy ISE - s ředěním	111	[ ]*	mmol/l delta check: změna +6% od 15.01.2020 (105)		98-107
81625	Ca celkový Fotometrie s arsenazo III	2,14	[*]	mmol/l		2,05-2,40
81421	Alkalická fosfatáza IFCC metoda při 37°C (AMP)	1,08	[*]	ukat/l		0,88-2,35
81357	AST Modifikovaná IFCC metoda při 37°C	0,50	[*]	ukat/l		0,16-0,63
81337	ALT Modifikovaná IFCC metoda při 37°C	0,46	[*]	ukat/l delta check: nevýznamný		0,10-0,63
81435	GGT (GMT) IFCC metoda při 37°C	0,35	[*]	ukat/l delta check: nevýznamný		0,15-0,92
81345	Amyláza IFCC metoda při 37°C	0,90	[*]	ukat/l		0,40-2,51
81481	Amyláza pankreat. Kolorimetrická metoda	0,50	[*]	ukat/l		0,22-0,88
81361	Bilirubin celkový Vanadátová metoda	5,1	[*]	umol/l delta check: nevýznamný		3,0-19,0
81363	Bilirubin přímý Vanadátová metoda	1,7	[*]	umol/l		0,0-2,0
81523	Kyselina močová Enzymová metoda s urikázou	366	[*]	umol/l		250-476
81621	Močovina Enzymová metoda s urešázou a GDH	7,6	[*]	mmol/l delta check: nevýznamný		2,9-8,2
	S-KREA					
81499	Kreatinin Enzymová kolorimetrická metoda	85	[*]	umol/l delta check: nevýznamný		55-96
	eGFR-krea-(CKD-EPI)	1,31		ml/s/1,73 m2		
81365	Celková bílkovina Biuretová metoda	119,6	[ ]*	g/l delta check: nevýznamný	ředěno	62,0-77,0
	CZE-ELFO bílkovin					
81397	CZE-Albumin	0,368	*[ ]	rel.j.		0,558-0,661
	CZE-Alfa 1	0,028	*[ ]	rel.j.		0,029-0,049
	CZE-Alfa 2	0,072	[*]	rel.j.		0,071-0,118
	CZE-Beta 1	0,033	*[ ]	rel.j.		0,047-0,072
	CZE-Beta 2	0,022	*[ ]	rel.j.		0,032-0,065
	CZE-Gamma	0,477	[ ]*	rel.j.		0,110-0,188
	CZE-Mezifrakce 1	0,451		rel.j.		
91997	Paraprotein Elektroforéza proteinů s následnou imunofixací	**viz komentář, účtovat**				
91167	Free Kappa Imunoturbidimetrie	2172,1	[ ]*	mg/l		3,3-19,4
91169	Free Lambda Imunoturbidimetrie	3,4	*[ ]	mg/l		5,7-26,3
	Kappa/Lambda	638,85	[ ]*			0,26-1,65
93195	TSH CMIA Centaur	0,661	[*]	mIU/l		0,350-4,800
93189	FT4 CMIA Centaur	12,18	[*]	pmol/l		11,50-22,70
97111	Separace séra	1x				

Komentář:
IF: prokázán PPT typu IgG kappa 53,9 g/l a FLC kappa.

Sternal puncture

Proven infiltration by tumor plasma cells.
After consultation with a hematologist, the condition was classified as **multiple myeloma**.
The plan is to start chemotherapy.

- Which (not very specific) tumor markers are used to monitor patients with hematooncological disease?

- Lactate dehydrogenase
- β2-microglobulin
- Ferritin

Selective coronarography

Conclusion: gross calcified wall changes on coronary arteries, stent in RIA without restenosis. A conservative approach was recommended.

Transthoracic echo

Conclusion: left ventricular systolic dysfunction with an ejection fraction of 40% with acinesis of the apex and adjacent half of the anterosept, thrombus in the apex of the left ventricle 12 x 13 mm. Diastolic dysfunction grade 1.

					Ref. meze
	Moč chemicky				
81325	Spec. hmotnost	**1,010**		kg/l	
	pH	**7,0**			
	Leukocyty	-			
	Nitrity	-			
	Bílkovina	**1**			
	Glukóza	-			
	Ketolátky	-			
	Urobilinogen	**Normal**			
	Bilirubin	-			
	Barva	**žlutá**			
	Zákal	**průhledná**			
	Krev	**2**			
	Elementy v moči				
	Erytrocyty	**842**	[ ]*	částic/ul	0-10
	Leukocyty	**6**	[*]	částic/ul	0-15
	Dlaždicové epit.	**0**	[*]	částic/ul	0-10

Conclusion:

- In the initial blood count, leukopenia and severe macrocytic hyperchromic anemia were substituted by three transfusions.
- Significantly increased level of total protein was found, IgG paraprotein at 53.9 g /L and free kappa chain was confirmed.
- Proven infiltration by tumor plasma cells. The condition was closed as **multiple myeloma**. The plan is to start chemotherapy.
- Echo of the heart was performed with the finding of systolic LV dysfunction with EF LV 40% with akinesia of the apex and adjacent anterosept, as well as a thrombus in the apex of the LV. Supplemented with SKG, without significant stenosis, stent in RIA without restenosis. Anticoagulant therapy LMWH started at a therapeutic dose.
- Microscopic hematuria was detected in the urine, early control was recommended for the possibility of recurrence of the bladder cancer.
- The patient was transferred to another ward for further care and chemotherapy.

Patient 6

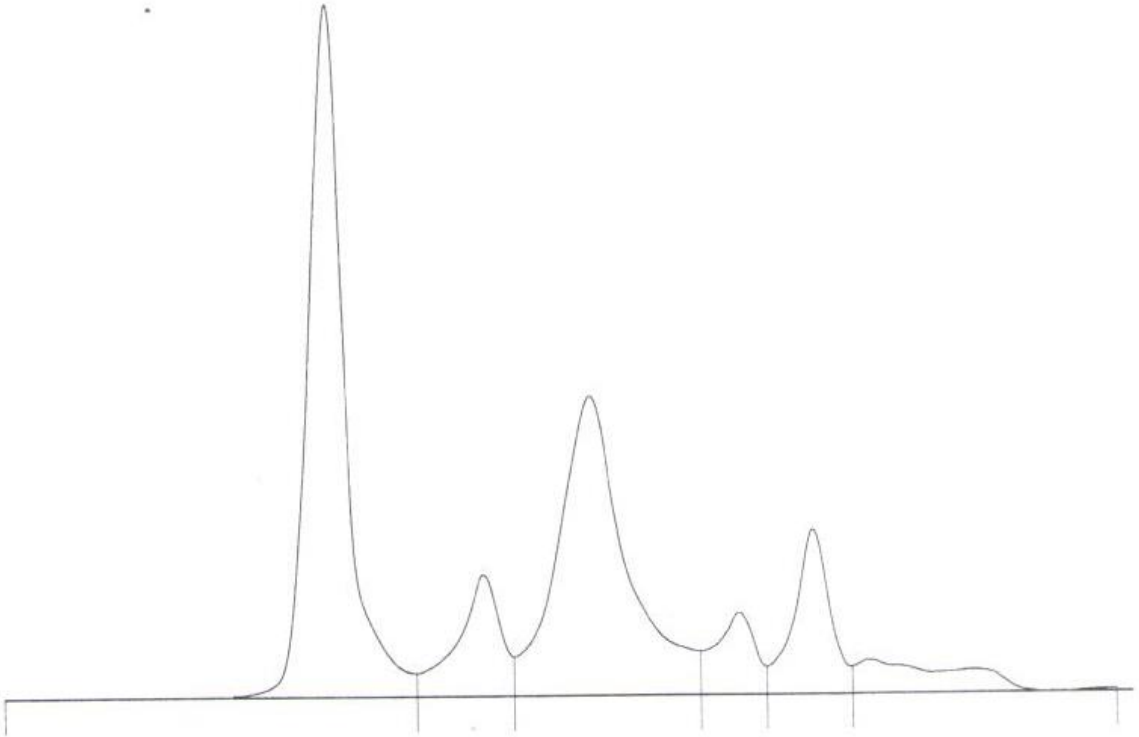
51-year-old man

- The patient came up with acute difficulties.
- He was examined in detail, including serum protein electrophoresis.

- Interpret the electrophoreogram of serum proteins in the following image.

- Which clinical symptoms could correspond to this finding?

Serum protein electrophoresis



Fractions	%		Ref. %	Conc.	Ref. Conc.
5941-Album	**39.7**	<	55.8 - 66.1	**13.86**	40.20 - 47.60
5942-Alp 1	**8.2**	>	2.9 - 4.9	**2.86**	2.10 - 3.50
5943-Alp 2	**32.4**	>	7.1 - 11.8	**11.31**	5.10 - 8.50
5944-Beta1	**5.1**		4.7 - 7.2	**1.78**	3.40 - 5.20
5945-Beta2	**9.3**	>	3.2 - 6.5	**3.25**	2.30 - 4.70
5946-Gamma	**5.3**	<	11.1 - 18.8	**1.85**	8.00 - 13.50

- In the electrophoreogram we see mainly **a low fraction of albumin, a high fraction of α2 and a low fraction of γ** (both in relative and absolute values).
- The α2 fraction contains **α2-macroglobulin**, which due to its very high molecular weight (Mr 720,000) does not pass even through the damaged glomerular membrane.
- The finding is typical for nephrotic syndrome, where the massive loss of protein is caused by increased permeability of the glomeruli. The synthesis of liver proteins is increased, most proteins pass through the damaged glomerular membrane (and are lost), with the exception of the mentioned α2-macroglobulin (it accumulates). Lipoproteins are also large enough to accumulate, and hyperlipidemia is typical of the nephrotic syndrome (but lipoproteins are not visible on conventional serum protein electrophoresis).

- Clinical symptoms typical for advanced nephrotic syndrome and also occurring in our patient:
  - **Hyperhydration:** swelling of the lower limbs to anasarca, fluidothorax
  - Hyperhydration induced **heart failure**
  - **Atherosclerotic complications** caused by dyslipoproteinemia
  - **Common infections** due to hypogammaglobulinaemia (and thus secondary immunodeficiency, urinary Ig loss)

- The patient was later diagnosed with multiple myeloma with FLC lambda production and primary amyloidosis (heart and kidney infiltration).

- The relative increase in the β2 fraction in which β2-microglobulin is found corresponds to haematological malignancy.

Other laboratory findings:

					Ref. meze
81593	Sodný kation ISE - s ředěním	**140**	[*]	mmol/l	137-146
81393	Draselný kation ISE - s ředěním	**4,7**	[*]	mmol/l	3,8-5,0
81421	Alkalická fosfatáza IFCC metoda při 37°C (AMP)	**1,83**	[*]	ukat/l	0,66-2,20
81357	AST Modifikovaná IFCC metoda při 37°C	**0,74**	[ ]*	ukat/l	0,16-0,72
81337	ALT Modifikovaná IFCC metoda při 37°C	**0,76**	[*]	ukat/l	0,17-0,78
81435	GGT (GMT) IFCC metoda při 37°C	**0,94**	[ ]*	ukat/l	0,14-0,84
81361	Bilirubin celkový Vanadátová metoda	**6,9**	[*]	umol/l	2,0-17,0
81523	Kyselina močová Enzymová metoda s urikázou	**347**	[*]	umol/l	200-420
81621	Močovina Enzymová metoda s ureázou a GDH	**3,1**	[*]	mmol/l	2,8-8,0
	S-KREA				
81499	Kreatinin Enzymová kolorimetrická metoda	**79**	[*]	umol/l	55-96
	eGFR-krea-(CKD-EPI)	**1,65**		ml/s/1,73 m2	
81611	Triacylglyceroly GPO-PAP	**2,71**	[ ]*	mmol/l	0,70-1,70
81471	Cholesterol CHOD-PAP	**9,6**	[ ]*	mmol/l	3,4-5,0
81365	Celková bílkovina Biuretová metoda	**45,2**	*[ ]	g/l	65,0-85,0
	CZE-ELFO bílkovin				
81397	CZE-Albumin	**0,561**	[*]	rel.j.	0,558-0,661
	CZE-Alfa 1	**0,055**	[ ]*	rel.j.	0,029-0,049
	CZE-Alfa 2	**0,236**	[ ]*	rel.j.	0,071-0,118
	CZE-Beta 1	**0,054**	[*]	rel.j.	0,047-0,072
	CZE-Beta 2	**0,058**	[*]	rel.j.	0,032-0,065
	CZE-Gamma	**0,036**	*[ ]	rel.j.	0,110-0,188
91397	Paraprotein Elektroforéza proteinů s následnou imunofixací	**viz komentář, účtovat**			
91167	Free Kappa Imunonefelometrie	**7,7**	[*]	mg/l	3,3-19,4
91169	Free Lambda Imunonefelometrie	**417,5**	[ ]*	mg/l ředěno	5,7-26,3
	Kappa/Lambda	**0,02**	*[ ]		0,26-1,65
91153	CRP-HS Imunoturbidimetrie	**0,6**	[*]	mg/l	0,0-5,0
91139	Sérový amyloid A Imunonefelometrie	**1,73**	[*]	mg/l	<10,00
91147	Alfa-2-Makroglobulin Imunoturbidimetrie	**3,58**	[ ]*	g/l	1,31-2,93
97111	Separace séra	**1x**			

Komentář:
IF: prokázány pouze FLC Lambda.

Other laboratory findings:

Doba sběru: 24:00 hod Množství materiálu: 1300 ml

						Ref. meze
	Sodný kation					
81593	U-Na	**157**		mmol/l		
	ISE - s ředěním dU-Na	**204**	[*]	mmol		120-220
	Draselný kation					
81393	U-K	**47**		mmol/l		
	ISE - s ředěním dU-K	**61,1**	[*]	mmol		35,0-80,0
81395	ELFO proteinů Elektroforéza na SDS-agaróze	**> povolená frekvence**				
	Močovina					
81621	U-UREA	**207,5**		mmol/l		
	Enzymová metoda s ureázou a GDH dU-UREA	**269,8**	[*]	mmol		167,0-583,0
	Kreatinin					
81499	U-KREA	**14,8**	[ ]*	mmol/l		5,7-14,7
	Enzymová kolorimetrická metoda dU-KREA Enzymová kolorimetrická metoda	**19,24**	[ ]*	mmol		7,10-17,70
	Celková bílkovina sbíraná moč					
81369	U-CB	**12970**		mg/l	ředěno	
	Turbidimetrie - benzetonium chlorid dU-CB	**16861**	[ ]*	mg		20-150
	dU-CB/m2	**7900**	[ ]*	mg/m2		0-96
	U-CB/U-Krea	**876,35**	[ ]*	mg/mmol Krea		0,00-22,70

- **<u>Medication was adjusted</u>** in the patient:
  - deployed **bisphosphonates** *(suppress osteoclast activity, reduce new bone damage, enable healing of already damaged bones)*
  - potentiated therapy with **loop diuretics** with simultaneous monitoring of the internal environment and ionogram
  - initiated **anticoagulant therapy with low molecular weight heparin** *(due to secondary thrombophilia in nephrotic syndrome)*
  - initiated **antimicrobial prophylaxis** due to immunodeficiency
  - deployed pantoprazole due to extensive medication and planned chemotherapy

- **<u>Chemotherapy</u>** started according to the protocol

- In the following course, the following biochemical parameters were monitored:
  - Basic biochemical examination
  - Lactate dehydrogenase, β2-microglobulin, ferritin
  - Electrophoresis of serum and urine proteins
  - FLC kappa and lambda
  - Serum immunoglobulins
  - Proteinuria and waste other substances in the urine
  - Renal function
  - (NT-proBNP and others)

Patient 7

57-year-old man

- Chief complaint: a patient with a history of recurrent deep vein thrombosis and pulmonary embolism (HT, DLP) was recently hospitalized for recurrent pulmonary embolism, now on emergency admission due to chest pain
- At night he woke up with a burning sensation on his chest and shoulder pain, fell asleep, in the morning the burning continued, perhaps a slight relief while sitting and standing, fluctuating in intensity, without accompanying symptoms.
- He has reflux, he attributes the chest pain to this problem, but it has been going on for a long time, so he arrived for an examination (mainly due to a recent pulmonary embolism).
- The patient was given Controloc (pantoprazole), followed by virtually complete relief from the discomfort.

Examination 1, 10:22

					Ref. meze
81139 Ca celkový Fotometrie s arsenazo III	2,18	[*]	mmol/l		2,05-2,54
81141 Ca++ - norm. ISE	1,28	[*]	mmol/l		1,13-1,32
81465 Hořčík Kolorimetrická metoda s xylidilovou modří	0,83	[*]	mmol/l		0,66-0,91
81111 ALT Modifikovaná IFCC metoda při 37°C	0,17	[*]	ukat/l delta check: nevýznamný		0,17-0,78
81153 GGT (GMT) IFCC metoda při 37°C	0,26	[*]	ukat/l delta check: nevýznamný		0,14-0,84
81121 Bilirubin celkový Vanadátová metoda	11,0	[*]	umol/l delta check: nevýznamný		5,0-21,0
81137 Močovina Enzymová metoda s ureázou a GDH	3,7	[*]	mmol/l delta check: nevýznamný		2,8-8,0
S-KREA					
81169 Kreatinin Enzymová kolorimetrická metoda	84	[*]	umol/l delta check: nevýznamný		55-96
eGFR-krea-(CKD-EPI)	1,48		ml/s/1,73 m2		
hs TnI + delta					
81237 hs Troponin I CMIA Architect	88,2	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
Absolutní delta hs TnI počítaná hodnota	-13,3		ng/l		
Relativní delta hs TnI počítaná hodnota	-13,10		%		
81125 Celková bílkovina Biuretová metoda	61,3	*[ ]	g/l delta check: nevýznamný		65,0-85,0
97111 Separace séra	1x				

Lp (a): 1071 mg/L

Concentration **exceeding 300 mg/L** indicates high genetic risk for coronary heart disease!

Evaluation of results according to the difference of two consecutive values of hs TnI concentrations with the recommended interval between examinations of 3 hours, the so-called "delta" principle

- **"Absolute delta":** the difference between currently measured and previous value of hsTnI **≥ 20 ng /L** ⟶ clinically significant result

- **"Relative delta":** the difference between currently measured and previous value of hs TnI **≥ 50 %** (for input hsTnI below 50 ng /L)
  ≥ 20 % (for input hsTnI over 50 ng/L)
  ⟶ clinically significant result

Three-hour interval: as recommended by the European Society of Cardiology in 2011

- If faster diagnostics are needed, the second collection can be performed as early as 1 to 2 hours after the initial examination.

- However, the delta principle in a shorter interval than three hours does not yet have the force of recommendation.

- *In the case of our patient, the hsTnI value in sample 1 was above the reference interval, but did not reach the cut-off value for AMI.*
- *Absolute and relative delta values have even decreased since the last examination (on discharge from the last hospitalization for pulmonary embolism).*
- *This slightly increased value of hsTnI is therefore insignificant at this time for these reasons.*

Examination 2, 13:15

					Ref. meze
	hs TnI + delta				
81237	hs Troponin I CMIA Architect	**1584,5**	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
	Absolutní delta hs TnI počítaná hodnota	**1496,3**		ng/l	
	Relativní delta hs TnI počítaná hodnota	**1696,49**		%	
97111	Separace séra	**1x**			

On the ECG, a new negative T in the thoracic ducts (NSTEMI), after agreement, the patient is transferred to the coronary unit.

Examination 3, 17:57

					Ref. meze
	hs TnI + delta				
81237	hs Troponin I CMIA Architect	**6886,9**	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
	Absolutní delta hs TnI počítaná hodnota	**5302,4**		ng/l	
	Relativní delta hs TnI počítaná hodnota	**334,64**		%	
97111	Separace séra	**1x**			

- *In sample 2 (approximately after 3 hours according to the recommended algorithm) the values of hsTnI have already exceeded the cut-off value for AMI several times, the values of absolute and relative deltas were also significant.*

- *The patient was transferred to the coronary unit for **urgent intervention**. Before it, hsTnI concentrations were further increased (sample 3).*

Patient sent for coronary intervention:

Conclusion: tight 90-95% RIA stenosis treated with PCI (percutaneous coronary intervention) + DES (drug-eluting stent) within NSTEMI.

Examination Day 2, 5:20

					Ref. meze
81135 Sodný kation ISE - s ředěním	137	[*]	mmol/l delta check: změna -3% od 19.11.2019 ()		137-146
81145 Draselný kation ISE - s ředěním	4,2	[*]	mmol/l delta check: nevýznamný		3,8-5,0
81157 Chloridy ISE - s ředěním	108	[*]	mmol/l delta check: nevýznamný		97-108
81137 Močovina Enzymová metoda s ureázou a GDH	4,0	[*]	mmol/l delta check: nevýznamný		2,8-8,0
S-KREA					
81169 Kreatinin Enzymová kolorimetrická metoda	81	[*]	umol/l delta check: nevýznamný		55-96
eGFR-krea-(CKD-EPI)	1,54		ml/s/1,73 m2		
hs TnI + delta					
81237 hs Troponin I CMIA Architect	6619,5	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
Absolutní delta hs TnI počítaná hodnota	-267,4		ng/l		
Relativní delta hs TnI počítaná hodnota	-3,88		%		
91153 CRP-HS imunoturbidimetrie	2,1		mg/l delta check: nevýznamný		0,0-5,0
97111 Separace séra	1x				

Day 3, 5:40

					Ref. meze
81135 Sodný kation ISE - s ředěním	138	[*]	mmol/l delta check: nový=namný		137-146
81145 Draselný kation ISE - s ředěním	4,1	[*]	mmol/l delta check: nový=namný		3,8-5,0
81157 Chloridy ISE - s ředěním	110	[ ]*	mmol/l delta check: nový=namný		97-108
81137 Močovina Enzymová metoda s urеázou a GDH	4,2	[*]	mmol/l delta check: nový=namný		2,8-8,0
S-KREA					
81169 Kreatinin Enzymová kolorimetrická metoda	89	[*]	umol/l delta check: nový=namný		55-96
eGFR-krea-(CKD-EPI)	1,38		ml/s/1,73 m2		
hs TnI + delta					
81237 hs Troponin I CMIA Architect	3044,9	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
Absolutní delta hs TnI počítaná hodnota	-3574,6		ng/l		
Relativní delta hs TnI počítaná hodnota	-54,00		%		
97111 Separace séra	1x				

Day 4, 5:50

					Ref. meze
81135 Sodný kation ISE - s ředěním	137	[*]	mmol/l delta check: nový=namný		137-146
81145 Draselný kation ISE - s ředěním	3,9	[*]	mmol/l delta check: nový=namný		3,8-5,0
81157 Chloridy ISE - s ředěním	108	[*]	mmol/l delta check: nový=namný		97-108
81137 Močovina Enzymová metoda s urеázou a GDH	4,2	[*]	mmol/l delta check: nový=namný		2,8-8,0
S-KREA					
81169 Kreatinin Enzymová kolorimetrická metoda	81	[*]	umol/l delta check: nový=namný		55-96
eGFR-krea-(CKD-EPI)	1,54		ml/s/1,73 m2		
hs TnI + delta					
81237 hs Troponin I CMIA Architect	1489,4	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-34,2
Absolutní delta hs TnI počítaná hodnota	-1555,5		ng/l		
Relativní delta hs TnI	-51,09		%		
91153 CRP-HS imunoturbidimetrie	5,9	[ ]*	mg/l delta check: změna +181% od 02.12.2019 ()		0,0-5,0
97111 Separace séra	1x				

- *From the day after the coronary intervention, hsTnI values gradually decreased (sampling on days 2, 3, 4).*

- Echocardiography revealed good left ventricular systolic function without significant valve defect.
- In good condition, the patient is discharged to home and outpatient treatment.

Patient 8

84-year-old woman

- **Chief complaint:** About a month of progression of swelling of the lower limbs above the knees, the patient cannot sleep lying down, she feels short of breath during any load, she is not short of breath at rest, angina pectoris negates, a month ago she had an episode of palpitations.
- The patient negates the cough, temperature or other signs of a respiratory infection or difficulty urinating.
- **Medical history:** hypertension, dyslipoproteinemia, AMI 2005 2x, chronic atrial fibrillation
- **Medication:** Furon 40 mg 1-0-1, Omeprazol, Lusopress, Amprilan, Betaloc, Torvacard

- **Objectively:** BP 100/62 mmHg, pulse 114 / min, SpO2 95%, temperature 37.2 ˚C

- **ECG: atrial fibrillation,** ventricles 122 / min, intermediate axis, QRS 108 ms, ST depression V5-6, Q and VL, V1-3

Samples Day 1, 9:15

					Ref. meze
81111 ALT Modifikovaná IFCC metoda při 37°C	0,33	[*]	ukat/l		0,10-0,63
81153 GGT (GMT) IFCC metoda při 37°C	0,98	[ ]*	ukat/l		0,15-0,92
81121 Bilirubin celkový Vanadátová metoda	26,0	[ ]*	umol/l		3,0-19,0
S-KREA					
81169 Kreatinin Enzymová kolorimetrická metoda	133	[ ]*	umol/l		42-80
eGFR-krea-(CKD-EPI)	0,52		ml/s/1,73 m2		
hs TnI + delta					
81237 hs Troponin I CMIA Architect	72,9	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-15,6
Absolutní delta hs TnI počítaná hodnota	**nelze spočítat**				
Relativní delta hs TnI počítaná hodnota	**nelze spočítat**				
81125 Celková bílkovina Biuretová metoda	61,6	*[ ]	g/l		62,0-77,0
97111 Separace séra	1x				

9:25

					Ref. meze
Hb Vodivost/Fotometrie Nova SP CCX	126,0	[*]	g/l		117,0-155,0
Hct Konduktometrie Nova SP CCX	39	[*]	%		35-45
81135 Sodný kation Potenciometrie Nova SP CCX	136	*[ ]	mmol/l		137-144
81145 Draselný kation Potenciometrie Nova SP CCX	3,6	*[ ]	mmol/l		3,9-5,3
81157 Chloridy Potenciometrie Nova SP CCX	104	[*]	mmol/l		98-107
81141 Ca++ - norm. Potenciometrie Nova SP CCX	1,23	[*]	mmol/l		1,16-1,29
81155 Glukóza Amperometrie Nova SP CCX	5,90	[*]	mmol/l		4,60-6,40
81137 Močovina Potenciometrie Nova SP CCX	5,6	[*]	mmol/l		2,9-8,2
FIO2	20,90		%		

18:26

					Ref. meze
hs TnI + delta					
81237 hs Troponin I CMIA Architect	149,5	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-15,6
Absolutní delta hs TnI počítaná hodnota	76,6		ng/l		
Relativní delta hs TnI počítaná hodnota	105,08		%		
97111 Separace séra	1x				

- *In the patient, the hsTnI value was already above the reference range at baseline, but the cut-off value for AMI was not exceeded.*
- *On the same evening, the hsTnI value was already approaching the cut-off value for AMI and the absolute and relative delta values were exceeded.*
- *Increased hsTnI also occurs in **cardiac failure** (in our patient there were significant clinical manifestations, **NT-proBNP** examination was planned for the next day).*
- *The patient would be indicated for intervention (especially due to the dynamics of changes – i.e.delta values), but due to comorbidities she would be very at risk.*
- *Proceeded (at least until day 2) conservatively - administered i.v. diuretics.*

Day 2
6:20

	Ikterický vzorek	+				
81593	Sodný kation ISE - s ředěním	138	[*]	mmol/l		137-144
81393	Draselný kation ISE - s ředěním	5,0	[*]	mmol/l		3,9-5,3
81469	Chloridy ISE - s ředěním	97	*[ ]	mmol/l		98-107
81641	Železo Metoda s ferrozinem	5,6		umol/l		
81421	Alkalická fosfatáza IFCC metoda při 37°C (AMP)	1,52	[*]	ukat/l		0,88-2,35
81357	AST Modifikovaná IFCC metoda při 37°C	0,80	[ ]*	ukat/l		0,16-0,63
81337	ALT Modifikovaná IFCC metoda při 37°C	0,51	[*]	ukat/l		0,10-0,63
81435	GGT (GMT) IFCC metoda při 37°C	1,13	[ ]*	ukat/l		0,15-0,92
81621	Močovina Enzymová metoda s ureázou a GDH	8,3	[ ]*	mmol/l		2,9-8,2
	S-KREA					
81499	Kreatinin Enzymová kolorimetrická metoda	151	[ ]*	umol/l		42-80
	eGFR-krea-(CKD-EPI)	0,45		ml/s/1,73 m2		
81611	Triacylglyceroly GPO-PAP	1,01	[*]	mmol/l		0,40-1,98
81471	Cholesterol CHOD-PAP	4,2	[*]	mmol/l		3,8-7,0
	HDL-CHOL					
81473	HDL cholesterol Přímá metoda	1,01	[*]	mmol/l		0,72-2,69
	non-HDL cholesterol Vypočítaná hodnota	3,19	[*]	mmol/l		3,80
81527	LDL cholesterol Přímá metoda	2,58	[*]	mmol/l		1,50-5,40
	hs TnI + delta					
81237	hs Troponin I CMIA Architect	168,8	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-15,6
	Absolutní delta hs TnI počítaná hodnota	19,3		ng/l		
	Relativní delta hs TnI počítaná hodnota	12,91		%		
81731	NT - proBNP ECLIA, Cobas 6000 (e601)	19114,0	[ ]*	ng/l		20,0-450,0
81365	Celková bílkovina Biuretová metoda	63,0	[*]	g/l		62,0-77,0
91153	CRP-HS Imunoturbidimetrie	11,0	[ ]*	mg/l		0,0-5,0
	Transferin					
91137	Transferin Imunoturbidimetrie	3,76	[*]	g/l		1,90-3,80
	Saturace transferinu	5,9	*[ ]	%		20,0-40,0
	Celk.vaz.kapacita pro železo	94,9	[ ]*	umol/l		44,8-80,6
93195	TSH CMIA Centaur	3,348	[*]	mIU/l		0,350-4,800

- *On day 2, significant heart failure was confirmed by NT-pro BNP examination.*

- *hsTnI values did not increase significantly (delta values were not exceeded either), so the doctors continued conservatively (i.v. diuretics - CAUTION: with careful monitoring of renal function and ionogram).*

Examination after 14 days

					Ref. meze
81135 Sodný kation ISE - s ředěním	141	[*]	mmol/l		137-144
81145 Draselný kation ISE - s ředěním	5,2	[*]	mmol/l		3,9-5,3
81157 Chloridy ISE - s ředěním	104	[*]	mmol/l		98-107
81563 Osmolalita Kryoskopie	305	[ ]*	mmol/kg		280-301
81111 ALT Modifikovaná IFCC metoda při 37°C	0,56	[*]	ukat/l		0,10-0,63
81153 GGT (GMT) IFCC metoda při 37°C	1,40	[ ]*	ukat/l		0,15-0,92
81121 Bilirubin celkový Vanadátová metoda	23,7	[ ]*	umol/l		3,0-19,0
81137 Močovina Enzymová metoda s urеázou a GDH	11,2	[ ]*	mmol/l		2,9-8,2
S-KREA					
81169 Kreatinin Enzymová kolorimetrická metoda	172	[ ]*	umol/l		42-80
eGFR-krea-(CKD-EPI)	0,38		ml/s/1,73 m2		
hs TnI + delta					
81237 hs Troponin I CMIA Architect	89,6	[ ]*	ng/l	cut-off AIM: M: 342; Ž: 156	0,0-15,6
Absolutní delta hs TnI počítaná hodnota	-79,2		ng/l		
Relativní delta hs TnI počítaná hodnota	-46,92		%		
81125 Celková bílkovina Biuretová metoda	57,3	*[ ]	g/l		62,0-77,0
91153 CRP-HS Imunoturbidimetrie	20,0	[ ]*	mg/l		0,0-5,0
91481 Prokalcitonin ECLIA Cobas 6000 (e601)	0,37	[*]	ug/l		0,00-0,50
97111 Separace séra	1x				

- *The values of hsTnI in 14 days indicate its significant decrease (decrease also in delta values), so there was a significant improvement*

- *Corresponding to this was the decline in the manifestations of heart failure.*

- *Note: there was a further (minor) deterioration in renal function (where renal insufficiency was already present), but life-saving treatment was a solution to the patient's heart failure (even with the knowledge that renal function would deteriorate on diuretic therapy).*

Thank you for your attention