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From simple to complex reaction in hypertension emergency

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Disclosure

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Nothing to disclose

Different BP levels!

M/28 y – CVI, disection a. vert.
160/100 mmHg
Her usuall BP 138/85 mmHg

F/37 y – aortic dissection
270/130 mmHg
Her usuall BP 160/100 mmHg

M/52 y – kidney failure, TIA
190/110 mmHg
His usuall BP 150/90 mmHg

F/93 y – NSTEMI,
Pulomonray oedema
175/75 mmHg
His usuall BP 130/60 mmHg

Case 1: Outpatient clinic

- 28yrs old woman

With..

- In several ocasions at clinical visit with family doctor BP 142/86mmHg
- Shortness of breath on severe exertion for 2 months
- Diabetes for 1 year, on diet
- No other symptoms

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Čas sprejema:	25.05.2016 09:45:26 Nar
Čas zaključka:	25.05.2016 13:52:38 Zdr
Opombe:	na, k, ca, cl, p, b12, folna. feritin, tsh

Hematološke preiskave

Preiskava		Rezultat	Orient.ref.vred.za odr.	Enota
K-SR	H	24	do 15	mm/h
K-Levkociti		7.5	4.0 - 10.0	10^9/L
K-Eritrociti		4.3	4.2 - 6.3	10^{12}/L
K-Hemoglobin	L	101	120 - 180	g/L
K-Hematokrit	L	0.32	0.37 - 0.54	l
K-MCV	L	74	81 - 94	fl
K-MCH	L	23	26 - 32	pg
K-MCHC		317	310 - 350	g/L
K-RDW	H	0.149	do 0.145	%
K-Trombociti		340	140 - 340	10^9/L
K-DKS-aparat				
K-nevtrofilci		50	40 - 70	%
K-limfociti		38	20 - 50	%
K-monociti		10	3 - 9	%
K-eozinofilci		1	1 - 6	%
K-bazofilci		1	0 - 1	%
K-nevtrofilci-a		3.71	1.60 - 7.50	10^9/L
K-limfociti-a		2.83	0.80 - 5.00	10^9/L
K-monociti-a		0.78	0.08 - 1.00	10^9/L
K-eozinofilci-a		0.07	0.04 - 0.60	10^9/L
K-bazofilci-a		0.05	0.00 - 0.10	10^9/L

Patient history

- ***Family history:***
  - Father: hypertension, hyperlipidemia, CVI at the age of 54
  - Mother: myocarditis at the age of 32
  - Grandmother: diabetes mellitus type 2, carcinoma uteri

- ***Past history:***
  - Op. due to apendicitis 5y ago

- ***Allergies:*** amoxicillin with clavulanic acid

- ***Social history:*** not smoking, denies alcohol abuse

Evaluation of patient with hypertension:

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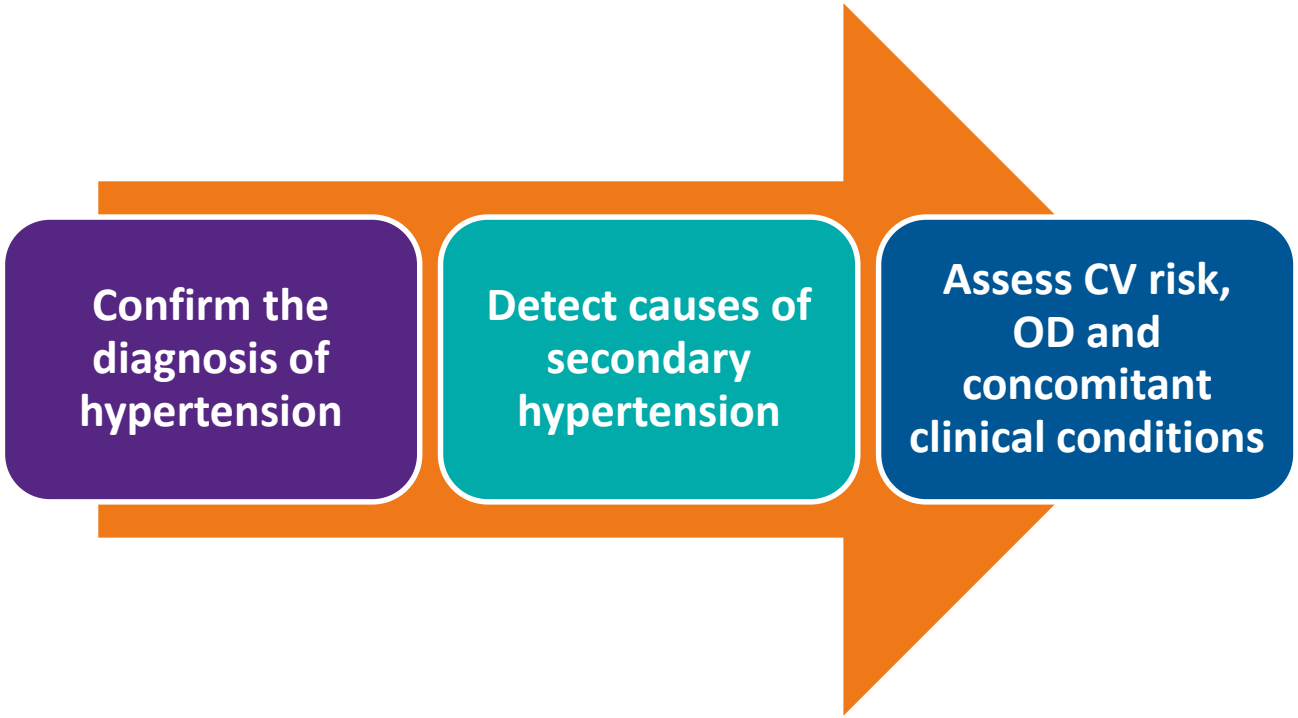


Physical examination Treatment??

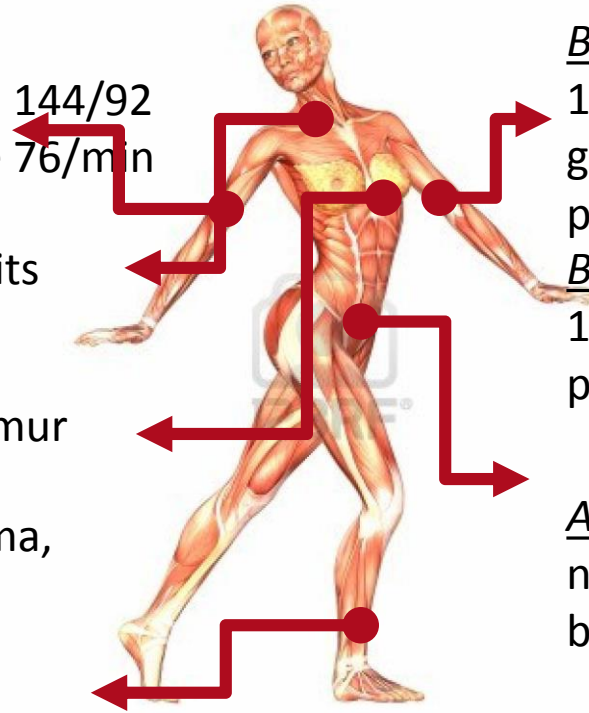
BMI=29 kg/m2

BP right arm: 144/92 mmHg, pulse 76/min

Neck: no bruits

Heart: no murmur

Extremities: no edema, normaly palpable peripheral pulses



BP left arm: 142/93mmHg, pulse 71 bpm

BP on standing: 144/90 mmHg, pulse 89/min

Abdomen: no abdominal bruit

Complex reaction in hypertension emergency

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- **Many** of patients who present to the Emergency Department (ED) may have elevated blood pressures recorded during their visit. This can be due to a **number of reasons** including pain, anxiety, missing their normal anti-hypertensive medications and "white coat hypertension".
- No current evidence based or guideline recommendations exist for a **blood pressure cut-off** at which point an asymptomatic patient must be acutely treated.
- So who can we **safely send home** and who needs more urgent treatment? The concern is not so much with the absolute numbers of the blood pressure readings but the effects of severe hypertension on the **rest of the body**. Patients with severe hypertension but no organ damage are often considered to be hypertensive urgencies rather than emergencies. They will require commencement of oral anti-hypertensive agents or alteration of existing regimen but can usually be discharged home with appropriate follow-up.
- Hypertensive emergencies will usually require **intravenous anti-hypertensive** therapy aiming for a 25% reduction in blood pressure over 1-4 hours.

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ESC European Society of Cardiology
European Heart Journal - Cardiovascular Pharmacotherapy
doi:10.1093/ehjcvp/pvy032

POSITION PAPER

ESC Council on hypertension position document on the management of hypertensive emergencies

Bert-Jan H. van den Born (chair)[1]*, Gregory Y.H. Lip (co-chair)[2,3], Jana Brguljan-Hitij[4], Antoine Cremer[5], Julian Segura[6], Enrique Morales[6], Felix Mahfoud[7], Fouad Amraoui[1], Alexandre Persu[8], Thomas Kahan[9], Enrico Agabiti Rosei[10], Giovanni de Simone[11], Philippe Gosse[5], and Bryan Williams[12]

doi:10.1093/ehjcvp/pvy032

Definition of Hypertensive Emergencies

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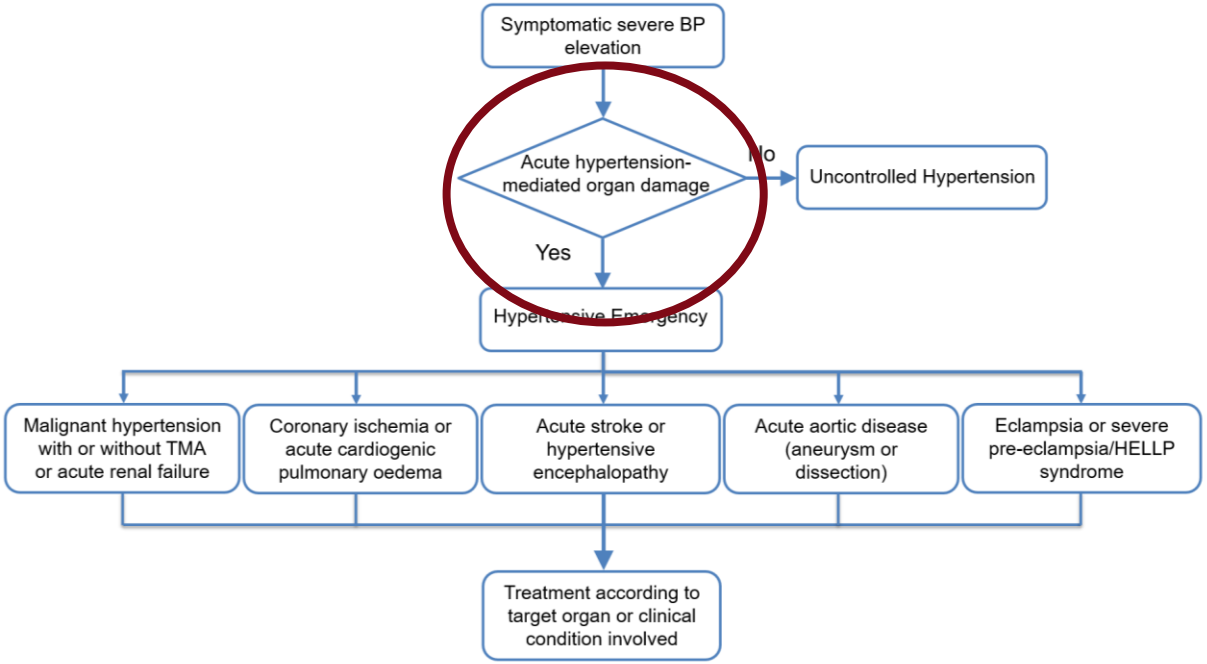
- Very high BP values associated with acute hypertension-mediated organ damage
- Key target organs: heart, retina, brain, kidneys, and large arteries
- Immediate BP reduction required to limit extension or promote regression of target organ damage
- The type of target organ damage is the principal determinant of the choice of treatment, target BP, and timeframe by which BP should be lowered

Stratification of hypertensive emergencies according to the condition or target organ involved



P van den Born ,G Lip, J Brguljan-Hitij, et al. Management of hypertensive emergencies European Heart Journal - Cardiovascular Pharmacotherapy 2018

Important !

- Patients with a hypertensive emergency should be admitted for close monitoring and, in most cases, treated with intravenous BP-lowering agents to reach the recommended BP target in the designated time-frame.

- Patients that have no hypertensive emergency can usually be treated with oral BP-lowering agents and usually discharged after a brief period of observation.

Epidemiology

- Coding differences among institutions
- One in every 200 patients presents at the emergency department with a suspected hypertensive emergency
- Despite improved treatment for hypertension in the past decades, the incidence of hypertensive emergencies has not declined
- Acute pulmonary oedema, stroke, myocardial infarction, heart failure, acute aortic dissection, acute renal failure and hypertensive encephalopathy.

Pathophysiology

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- Many pathophysiological mechanisms are involved in the development of hypertension emergencies, but the initiating events for the sudden escalation in BP are not completely understood.
- Among patients presenting at the Emergency Dept. with malignant hypertension, secondary causes can be found in 20-40% and most often consist of **renal parenchymal disease** and **renal artery stenosis**, whereas endocrine causes appear to be rare.
- The majority of patients with malignant hypertension have **unrecognized or uncontrolled** essential hypertension.

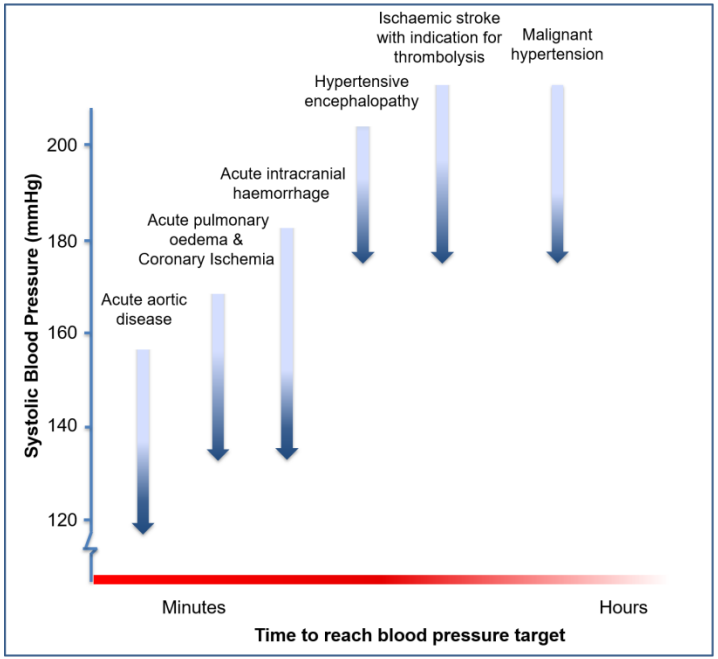
Acute HT mediated organ damage

Aorta – dissection, aneurysm

Heart – MACE, acute pulmonary oedema

Brain – stroke, hypertensive encephalopathy

Retina & Kidneys – malignant hypertension



Case 2

- 39 y old lady admitted to the emergency department due to chest pain which started in late afternoon and escalated till evening so relatives called an ambulance.
- At the admission she described her pain as sharp abrupt onset in her chest, tearing character radiating towards back
- Few days before her blood pressure was not well controlled and she measured SBP around 200mmHg

Examination list:

- History
- Physical examination
- Haemoglobin, platelet count
- Creatinine, GFR, sodium, potassium, lactic dehydrogenase (LDH), haptoglobin
- Quantitative urinalysis for protein, urine sediment for erythrocytes, leukocytes, cylinders and casts
- ECG
- Chest X Ray

- ***Family history:*** **Grandfather died because of CVI, father survived CVI and is treated for AH, grandmother is treated for DM and AH**
- ***Past history:*** **DM for few years on diet, chronic kidney disease stg 4 for 3 y, extreme obesity, hypertensive retinopathy**
- ***Present history:*** **Treated for hypertension for 4 years, she delivered 3 times, 2 times normal pregnancy, 1 spontaneous abortion and 1 on hypertensive therapy**
- **She was obese since her childhood, BMI in y2017 was 50.1 (163cm, 133kg)**
- **She was tested for secondary hypertension but was not discovered. Was hospitalised many times and often her SBP was measured even 280mmHg**
- **On medications: bisoprolol 10mg in the evening, furosemide 40mg , amlodipine 5mg, perindopril 4mg, moxonidine 0.3mg**
- **Smoker 10y 30 cig/day, now 10 cig/day**

Physical examination

- Extreme obesity, BMI 43
- On admission, her oxygen saturation was 92%
- BP 250/130mmHg D arm, 220/112mmHg L arm, HR 74/min
- Jugular venous pressure was normal
- Lungs: some inspiratory crackles were heard at pulmonary basis
- Heart: rhythmic action fr 74/min, no murmurs
- No abnormalities in abdomen
- No peripheral oedema

variable	result	variable	result
RBC	4.2 (10^{12}/L)		
WBC	9.7 (10^{9}/L)	pH	7.39
Hb	120 g/L	pO2	11.1 kPa
Creatinine	**308 µmol/L (3.5 mg/dL)**	pCO2	5.2 kPa
GFR	**16 (CKD-EPI)/1.73m²**	HbO2	0.94
K	3.6 mmol/L		
Na	141 mmol/L	**urine**	Proteinuria 2
LDH	**4.68 µkat/L**		
CRP	**109 mg/L**		
Trop I ultra	0.02 µg/L		
NT-pro BNP	**2878.5 ng/L**		

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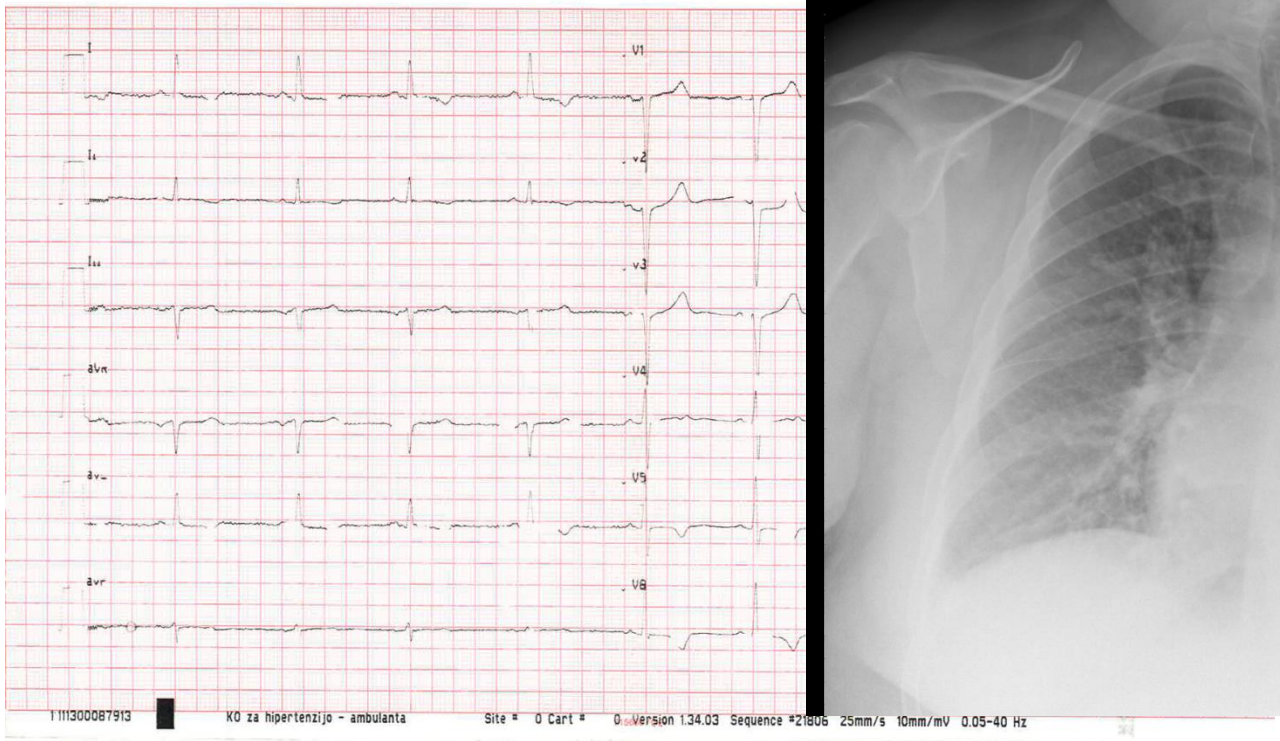
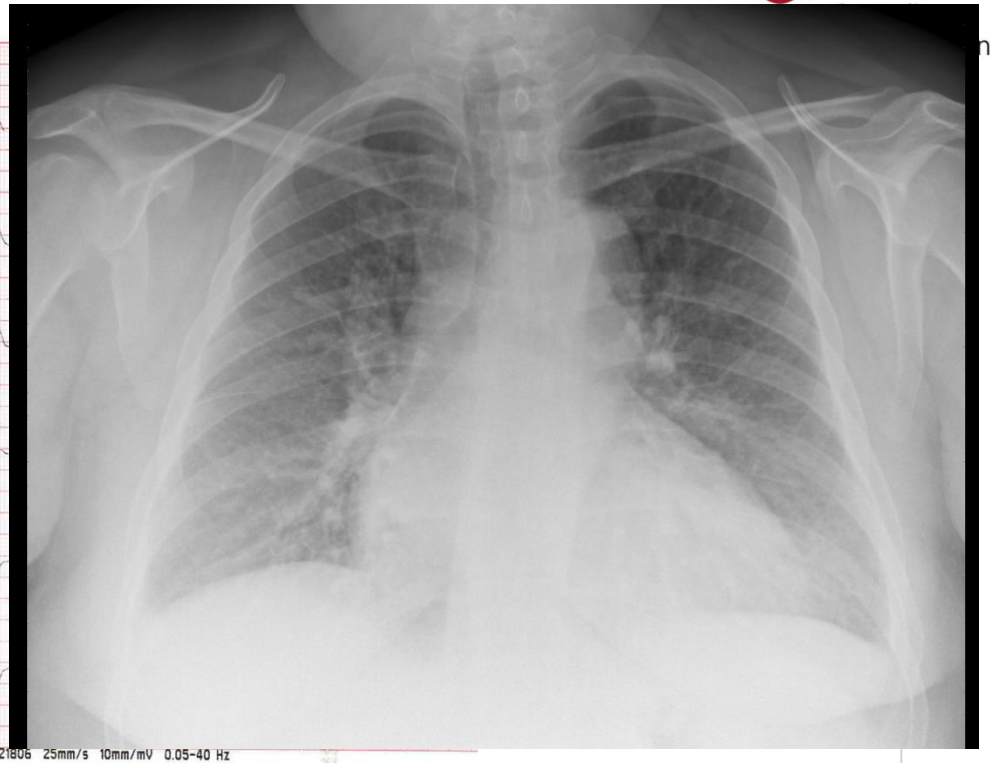


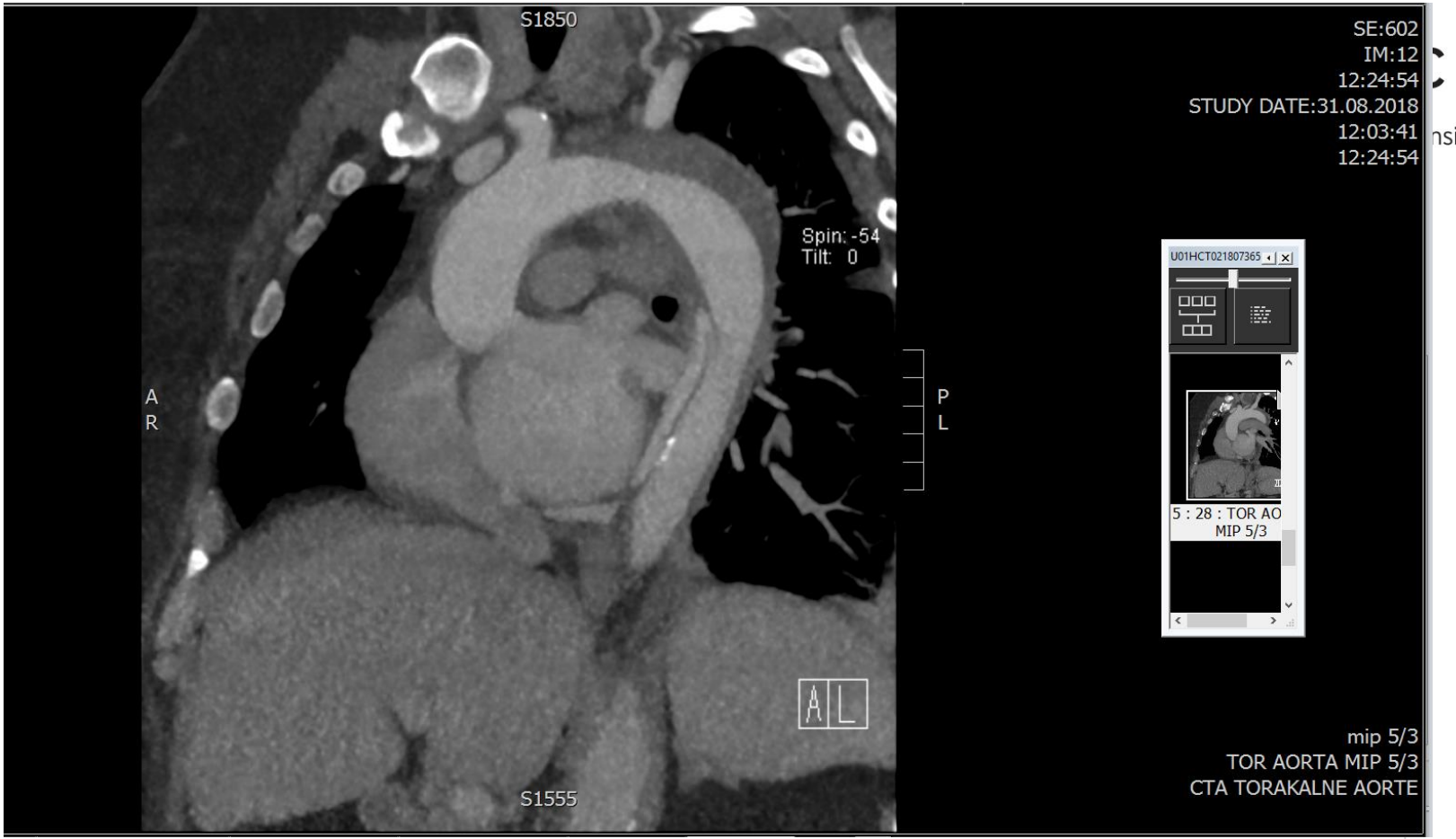


Enlarged heart, mild interstitial oedema

Differential diagnosis of acute chest pain

- **Nonvascular pathology:** pulmonary embolus, spontaneous pneumothorax, aortic regurgitation without dissection, esophageal rupture, pericarditis and pleuritis

- **Vascular pathology:** acute coronary syndrome, acute aortic dissection, other acute aortic pathologies as intramural hematoma without dissection, aortic aneurysm, aortic injury without dissection, peripheral artery dieses, chronic aortic dissection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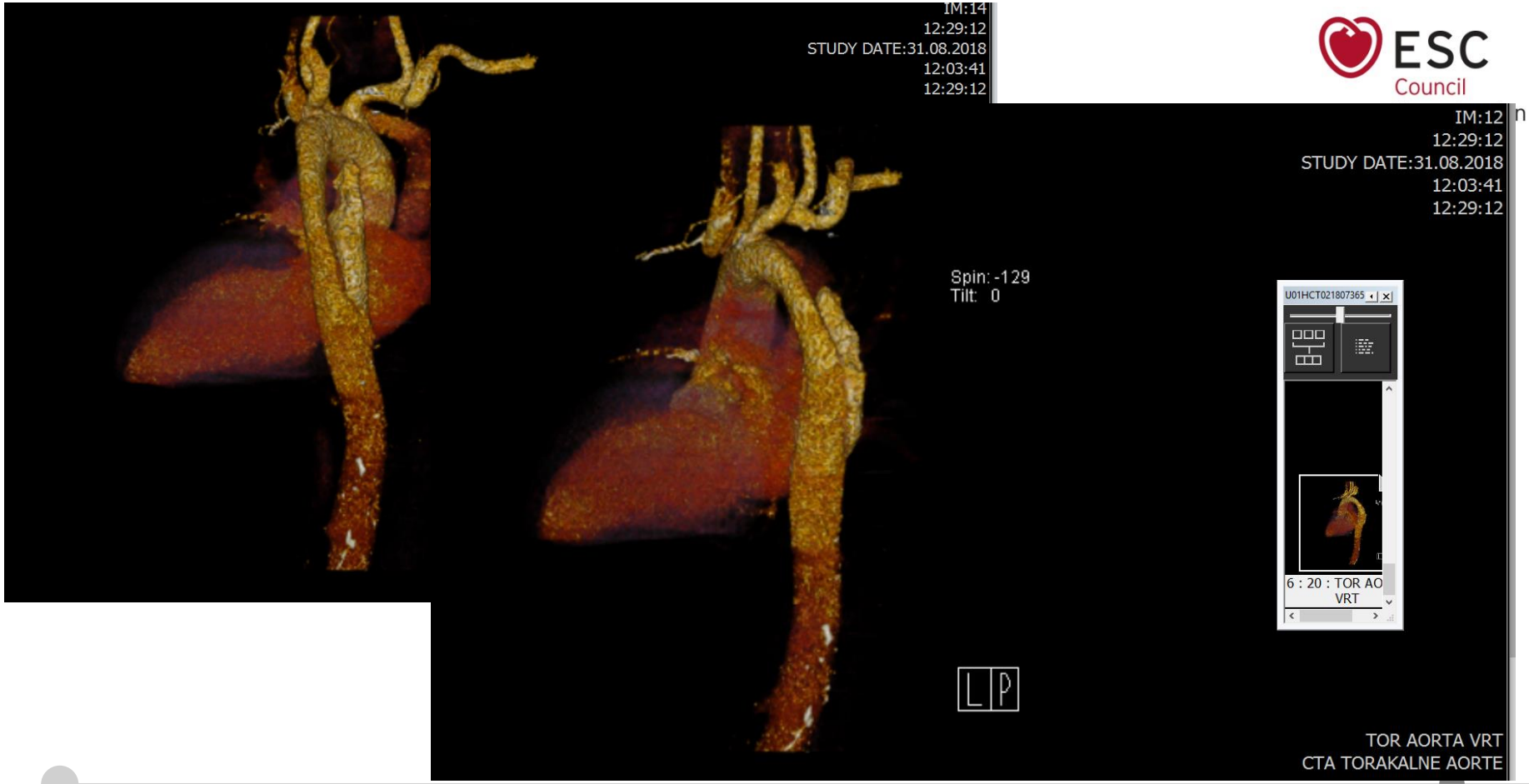
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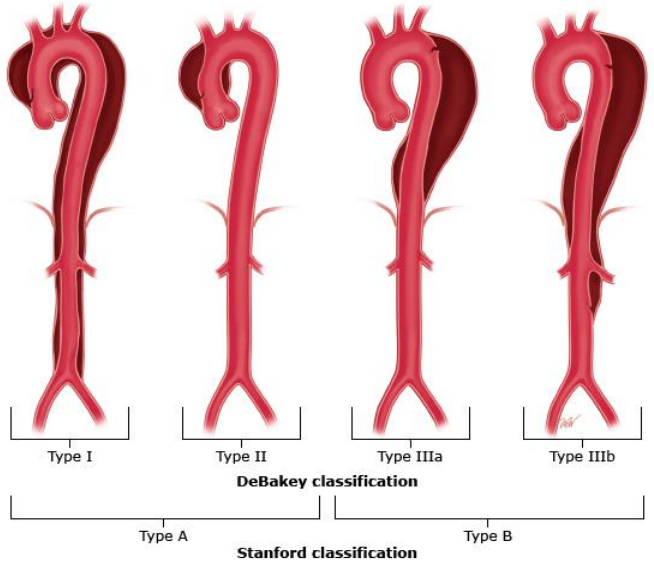
Classification of aortic dissection



In the DeBakey classification of aortic dissection:

- Type I involves the ascending aorta, arch, and descending thoracic aorta and may progress to involve the abdominal aorta.
- Type II is confined to the ascending aorta.
- Type IIIa involves the descending thoracic aorta distal to the left subclavian artery and proximal to the celiac artery.
- Type IIIb dissection involves the thoracic and abdominal aorta distal to the left subclavian artery.

In the Stanford classification of aortic dissection:

- Type A involves the ascending aorta and may progress to involve the arch and thoracoabdominal aorta.
- Type B involves the descending thoracic or thoracoabdominal aorta distal to the left subclavian artery without involvement of ascending aorta.

Up to Date 2019

Acute aortic dissection

- Relatively uncommon, estimated 2.6 to 3.5 per 100.000 person-years, 66% men
- Hypertension is the most important predisposing factor, more common in distal aortic dissection
- Important to define ascending vs descending aortic involvement (surgical vs medical management)

Drug choice according the cause and mechanism of the HTN Emergency

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Table 3 Hypertensive emergencies requiring immediate BP lowering

Clinical presentation	Time line and target BP	1st line treatment	Alternative
Malignant hypertension with or without TMA or acute renal failure	Several hours, MAP -20% to -25%	Labetalol Nicardipine	Nitroprusside Urapidil
Hypertensive encephalopathy	Immediate, MAP -20% to -25%	Labetalol Nicardipine	Nitroprusside
Acute ischaemic stroke and BP >220 mmHg systolic or >120 mmHg diastolic	1 h, MAP -15%	Labetalol Nicardipine	Nitroprusside
Acute ischaemic stroke with indication for thrombolytic therapy and BP >185 mmHg systolic or >110 mmHg diastolic	1 h, MAP -15%	Labetalol Nicardipine	Nitroprusside
Acute haemorrhagic stroke and systolic BP >180 mmHg	Immediate, systolic 130<BP <180 mmHg	Labetalol Nicardipine	Urapidil
Acute coronary event	Immediate, systolic BP <140 mmHg	Nitroglycerine Labetalol	Urapidil
Acute cardiogenic pulmonary oedema	Immediate, systolic BP <140 mmHg	Nitroprusside or Nitroglycerine (with loop diuretic)	Urapidil (with loop diuretic)
Acute aortic disease	Immediate, systolic BP <120 mmHg and heart rate <60 b.p.m.	Esmolol and Nitroprusside or Nitroglycerine or Nicardipine	Labetalol or Metoprolol
Eclampsia and severe pre-eclampsia/HELLP	Immediate, systolic BP < 160 mmHg and diastolic BP <105 mmHg	Labetalol or Nicardipine and Magnesium sulphate	

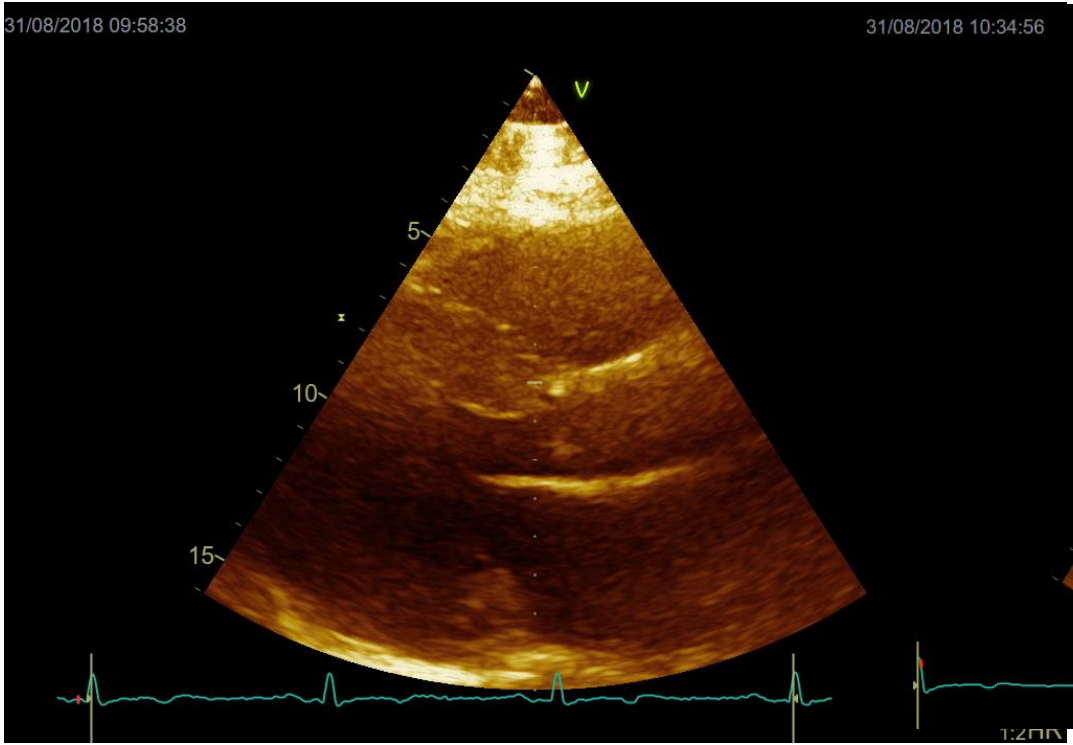
Case-Treatment

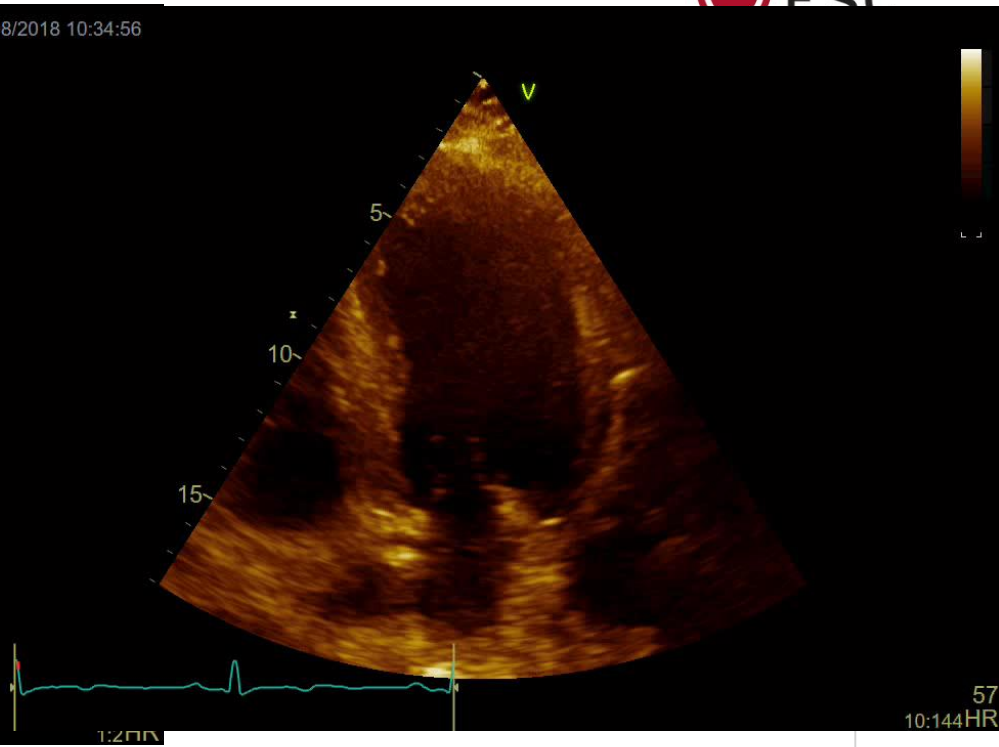
- Continuous perfusion of anti-hypertensive is mandatory, our case urapidil i.v. (25mg till 75mg i.v.) and gliceriltrinitrat infussion, furosemid 40mgi.v.

- Pain control - analgesia

Admission to the ward

- Intensive care unit, regulating BP, ACE inhibitor creat 455
- Doppler of renal arteries: bad visibility, no obvious stenosis, RK: 10.3cm, RI 0.78, LK 10.4cm, RI 0.8,
- Echocardiography

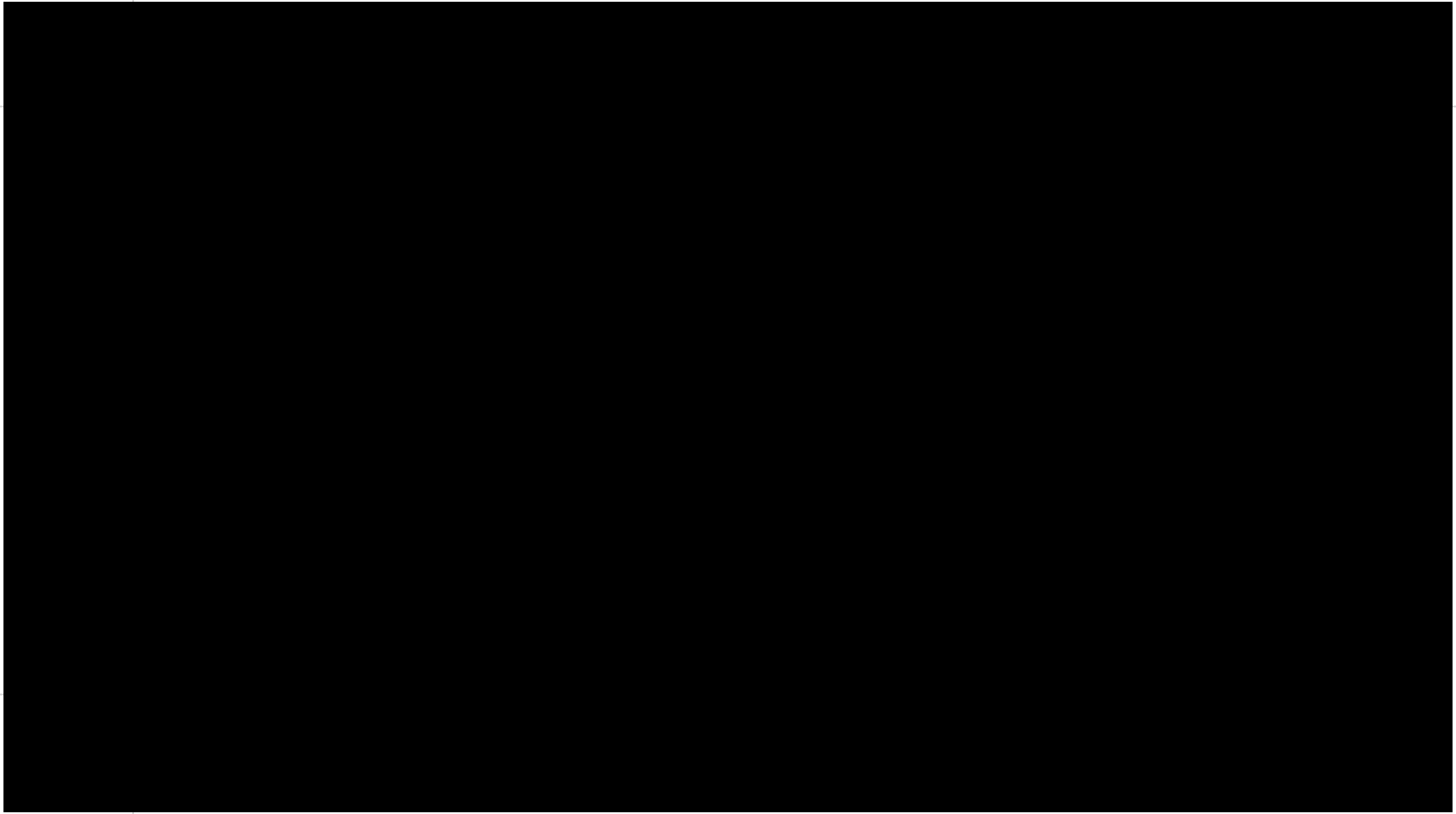




LV EDD 5.1cm, ESD 3.3cm, IVS 1.8cm, INF LAT 1.6cm, LVMI (ASE) 201g/m², LVMI (Ht) 115g/m, RWT 0.60, EDV 116ml, EDVI 53ml/m², SV 2D 77ml, EF 2D 66%. LVOT premer 2.5cm. LA premer (PLAX) 4.9cm,

Discharge from the ward

- Her th. on discharge was: amlodipine 10mg/24h, furosemide 40mg 2 times daily, minoxidil 2.5mg/12h, bisoprolol 10mg, doxazosin 4mg/12h, moxonidine 0.3mg/12h, rosuvastatin 10mg, aspirin 100mg, sodium bicarbonate 2x1g, CaCo3 3x 1g
- Advised to continue loosing weight



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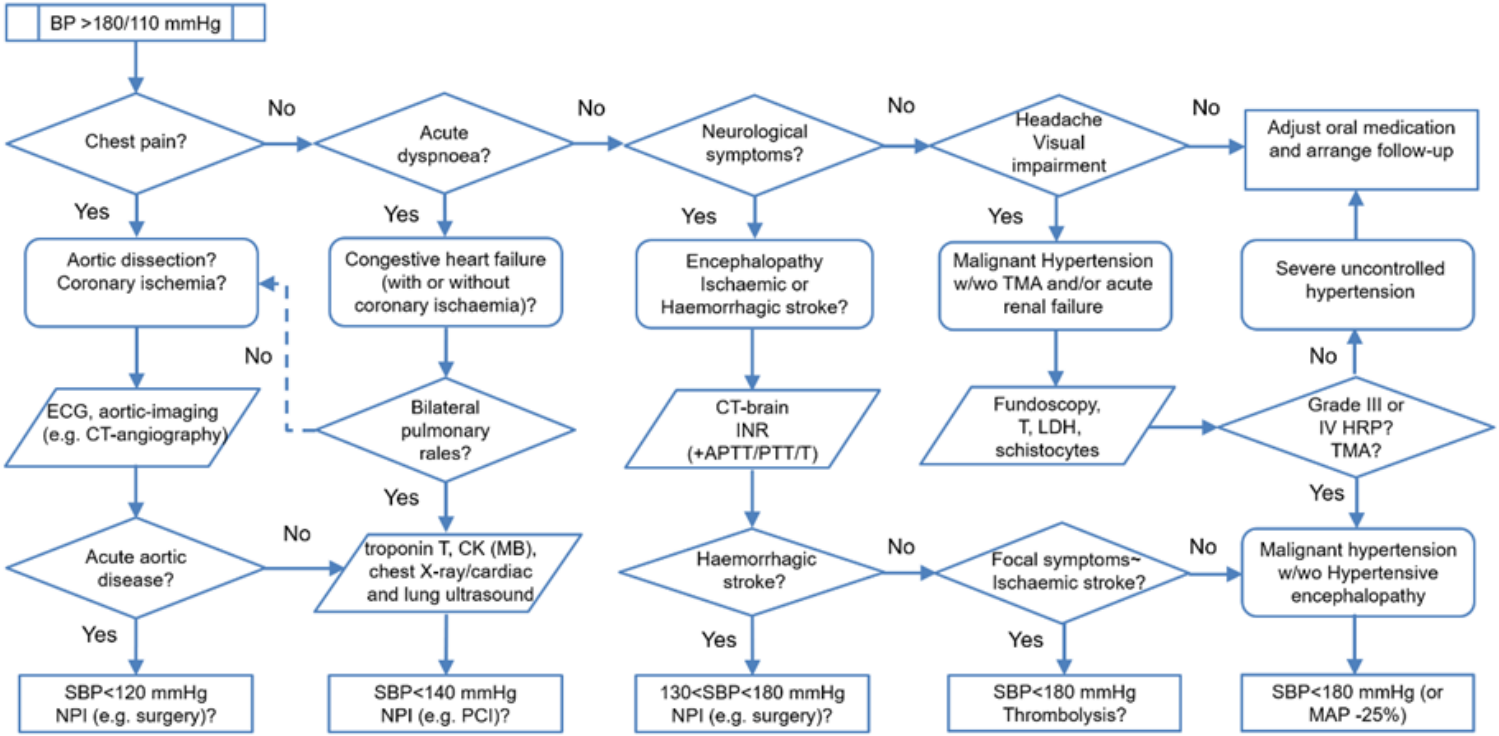

Case 3

- 59 y old lady admitted to the emergency department due to heavy breathing which started in late afternoon and escalated till late evening so relatives called an ambulance.
- Rescue team measured blood pressure 240/100mmHg oxygen saturation 70% and put her on OHIO mask where oxygen saturation elevated to 90%, administered furosemide 40mg i.v., Morphin 2mg plus 2mg i.v., metoclopramide i.v. and fenoterol and ipratropium bromide in inhalation.
- They transferred her to emergency department of our university hospital.

Diagnostic examination:

- Detail history and physical examination with BP meassured on both arms
- ECG (ischemia, arrhythmias, left ventricular hypertrophy)

On indication:

- Troponin-T, CK, CK-MB
- Chest X-ray (fluid overload)
- Fundoscopy
- Transthoracic echocardiography (cardiac structure and function) or
- point of care cardiac and lung ultrasound (cardiac pulmonary oedema)
- CT (or MRI)-brain (intracranial haemorrhage)
- CT-angiography of thorax and abdomen (acute aortic disease)
- Renal ultrasound (postrenal obstruction, kidney size, left to right difference)

- *Family history:* Father CVI, mother operated on heart but no details known
- *Past history:* Hypothyreosis from 2001 on therapy,
- PTA AIC bilateral with stenting in year 2013,
- Known three vessel coronary disease. CABG on February 2018 (LIMA-LAD, SVG-OMV, RCA off pump)
- Aorto-bifemoral bypass and TEA AFC sin on May 2018
- *Present history:* Treated for hypertension for 15 years, two days before admission she had breathing problems which worsened the night of admission
- On medications: bisoprolol 2x5mg, Aspirin 100mg, perindopril/indapamide/amlodipine 10/2.5/10mg, rosuvastatin 40mg, levothyroxine 50microg
- Smoker 30y 15 cig/day, now 6 cig/day

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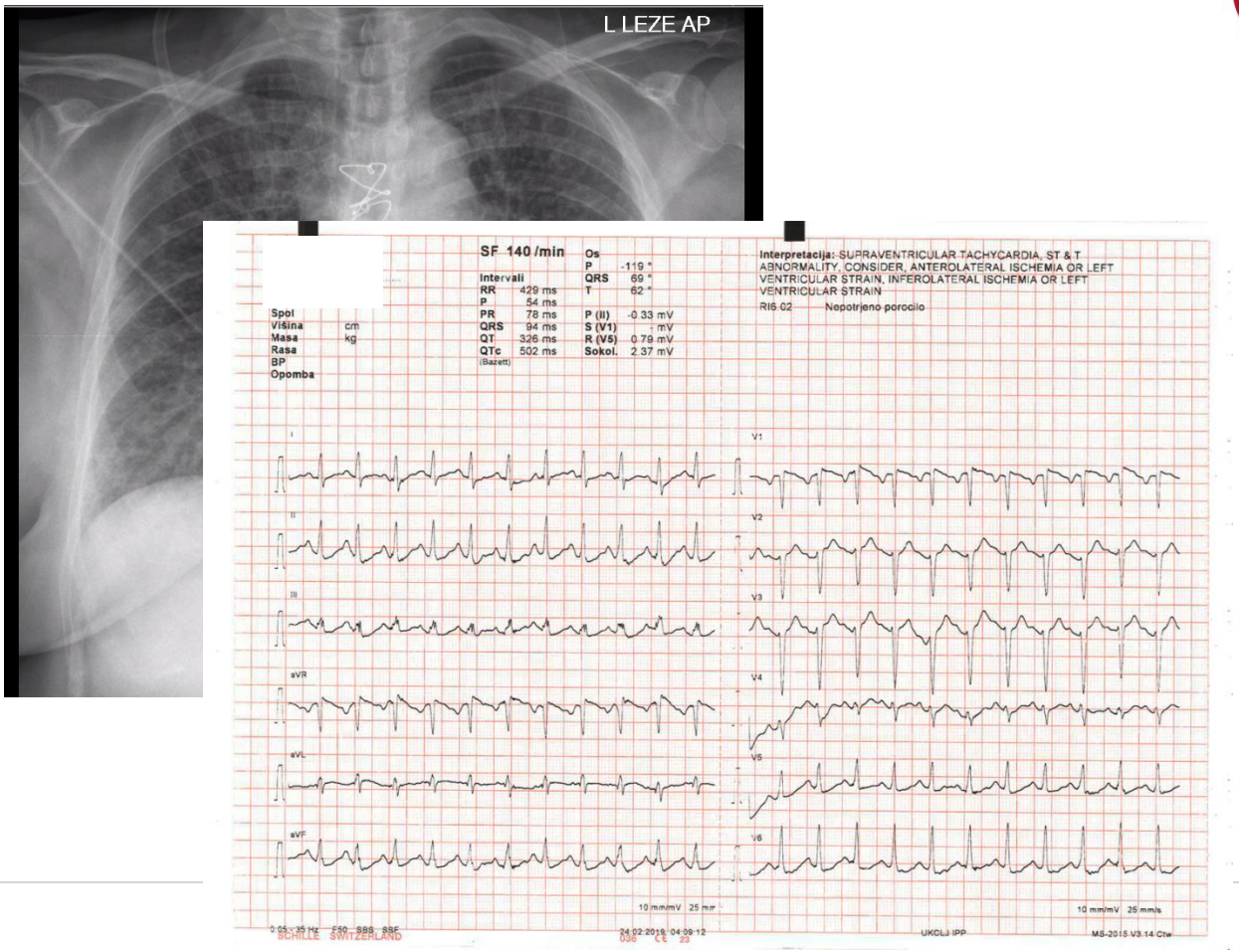
- On admission, her oxygen saturation on OHIO oxygen mask was 94%
- BP 233/125mmHg, HR 141/min
- Jugular venous pressure was measured as 20 cm
- Lungs: diffuse inspiratory crackles and expiratory wheezing were heard
- Heart: rhythmic action fr 130/min, no murmurs
- No abnormalities in abdomen
- Moderate peripheral oedema

Lab. test

variable	result	variable	result
RBC	5.22 (10^{12}/L)	OHIO mask	
WBC	**20.1** (10^{9}/L)	pH	**7.29**
Hb	143 g/L	pO2	**9.1** kPa
Creatinine	**120 µmol/L (1.36 mg/dL)**	pCO2	**6.0** kPa
GFR	**43 (CKD-EPI)/1.73m²**	HbO2	**0.91**
K	4.1 mmol/L		
Na	141 mmol/L		
LDH	**4.68 µkat/L**		
CRP	**117 mg/L**		
Trop I ultra	**0.289 µg/L**		
NT-pro BNP	**26926 ng/L**		

Case 1: admission



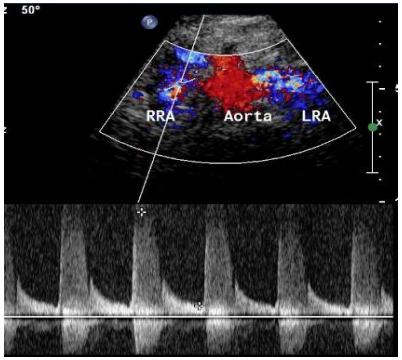
Case 3: treatment

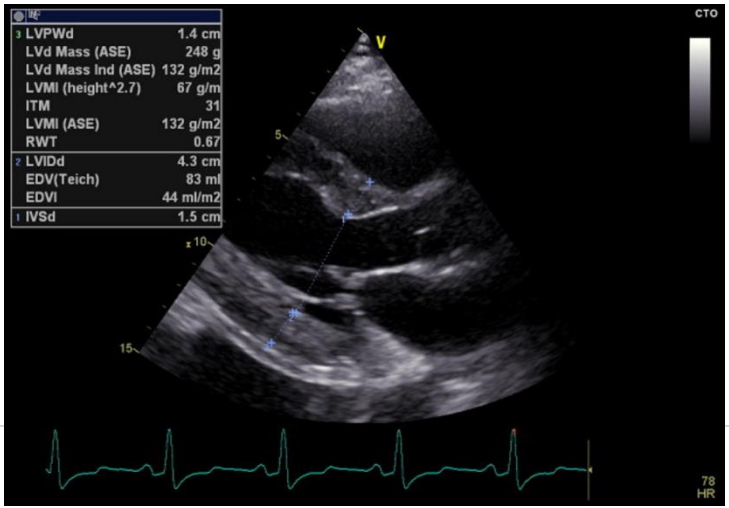
- OHIO oxygen mask
- NTG 2x subl, Nitroglycerine infusion, furosemide 40mg iv, MO 3mg,
- Beside cefotaxime, azithromycin were suggested from our infectologists

- BP dropped to 150/82, HR 120/min
- She was feeling better and admitted to our department
- During hospitalization we noticed, murmur in abodmen,transitional decline in renal function, SBP was 100-110 mmHg
- Abdomen US and renal doppler was performed

Case 3: hospitalization

- Sizes: right kidney 11.6 cm, left kidney 9 cm
- Resistence indexes: right 0.61 left 0.55
- Stenosis of left renal artery
- **ECHO:** normal EF, contractility abnormalities, elevated LVMI





Dg.:Pulmonary oedema
Acute respiratory infection
Renovascular hypertension
CABG 2018
Peripheral Arterial Disease
Hypothyreosis on th.

Hypertension

Therapy:
bisoprolol 2x5mg, Aspirin 100mg,
amlodipine 10mg,
rosuvastatin 40mg,
levothyroxine 50microg

Woman, 59 y	Succ. 95%
24-h average:	139 / 69 mmHg
SD (weighted):	17 / 9 mmHg
Awake:	133 / 69 mmHg
Sleeping:	148 / 69 mmHg
BP dipping:	+11 / 0 %
Max. (last hour):	169/81 mmHg
HR (24 h/awake/sleep):	85 / 84 / 87 min^{-1} (+4%)

ARV_d = 15/7 mmHg
ARV_{24} = 13/7 mmHg

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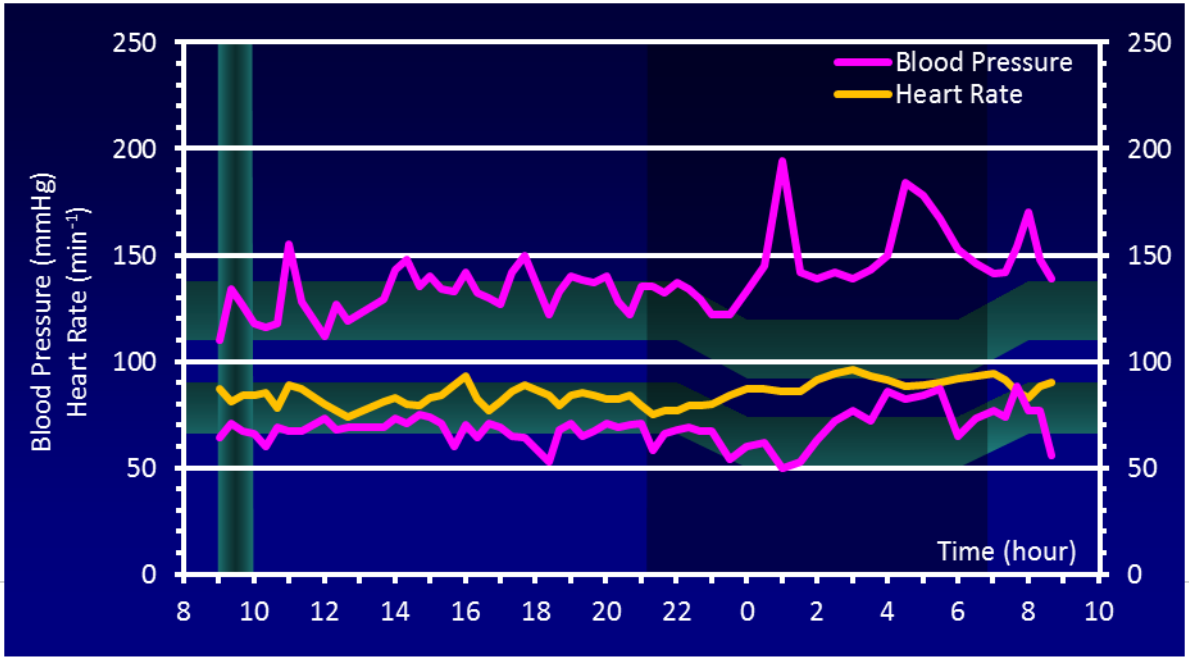
24-hour Ambulatory Blood Pressure Monitoring 2019-03-13

KOHip 2019



Drug choice according the cause and mechanism of the HTN Emergency

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Acute cardiogenic pulmonary oedema	Immediate, systolic BP <140 mmHg	Nitroprusside or Nitroglycerine (with loop diuretic)	Urapidil (with loop diuretic)
Acute aortic disease	Immediate, systolic BP <120 mmHg and heart rate <60 b.p.m.	Esmolol and Nitroprusside or Nitroglycerine or Nicardipine	Labetalol or Metoprolol
Eclampsia and severe pre-eclampsia/HELLP	Immediate, systolic BP < 160 mmHg and diastolic BP <105 mmHg	Labetalol or Nicardipine and Magnesium sulphate	

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Table 1. Hypertensive Emergency versus Asymptomatic Markedly Elevated Blood Pressure	
Term	**Criteria**
Hypertensive Emergency	SBP >180 or DBP > 120 mmHg **AND** End-Organ Dysfunction
Asymptomatic Markedly Elevated Blood Pressure (formerly hypertensive urgency)	SBP ≥ 160-180 mmHg or DBP ≥ 100-120 mmHg

https://epmonthly.com/article/dont-let-hyperten

Table 2. Symptoms Associated with Hypertension

Hypertensive Emergency	Blood Pressure Target	Treatment
Aortic Dissection	Reduce SBP to 100-120 mmHg Lower heart rate to <60 bpm	1. Labetalol or Esmolol 2. Nitroprusside or nicardipine after beta-blocker
Acute Myocardial Infarction	Reduce BP < 160 mmHg	Nitroglycerin Labetalol or metoprolol (if no heart failure)
Acute Pulmonary Edema	Reduce BP by 20%–30%	Nitroglycerin sublinqual/topical/IV or Nitroprusside IV or Nicardipine IV and Furosemide if volume overloaded
Acute Renal Failure	Acute reduction in BP by < 20%	Nicardipine IV or Clevidipine IV
Hypertensive Encephalopathy	Reduce BP 20-25% in first hour	Nicardipine IV or Clevidipine IV or Labetalol IV
Subarachnoid Hemorrhage	Reduce SBP to <160 mmHg	
Intracerebral hemorrhage	SBP goal 140-180 mmHg	
Acute Ischemic Stroke	Receiving tPA: Reduce <185 mmHg with goal 140-150 mmHg No tPA: Reduce to <220/120 mmHg	

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Final take home messages

Definition

- We should abandon the term ‘hypertensive crises’, which may not precisely characterize the clinical picture.
- We should use the terms:
- Hypertensive emergencies,

or

- Uncontrolled hypertension
- depending on the presence (emergencies) or absence of acute and rapidly progressing end-organ dysfunction/damage

Important points

- HT emergencies 1 in 200 pts at the emergency department
- A correct diagnosis and appropriate treatment are critical.
- Blood pressure should be reduced:
- within minutes to hours (target BP depending on the clinical diagnosis) in patients with hypertensive emergencies
- within 24 to 48 hours in patients with hypertensive urgencies.

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