

An Evidence-based Approach to Inpatient Hypertension

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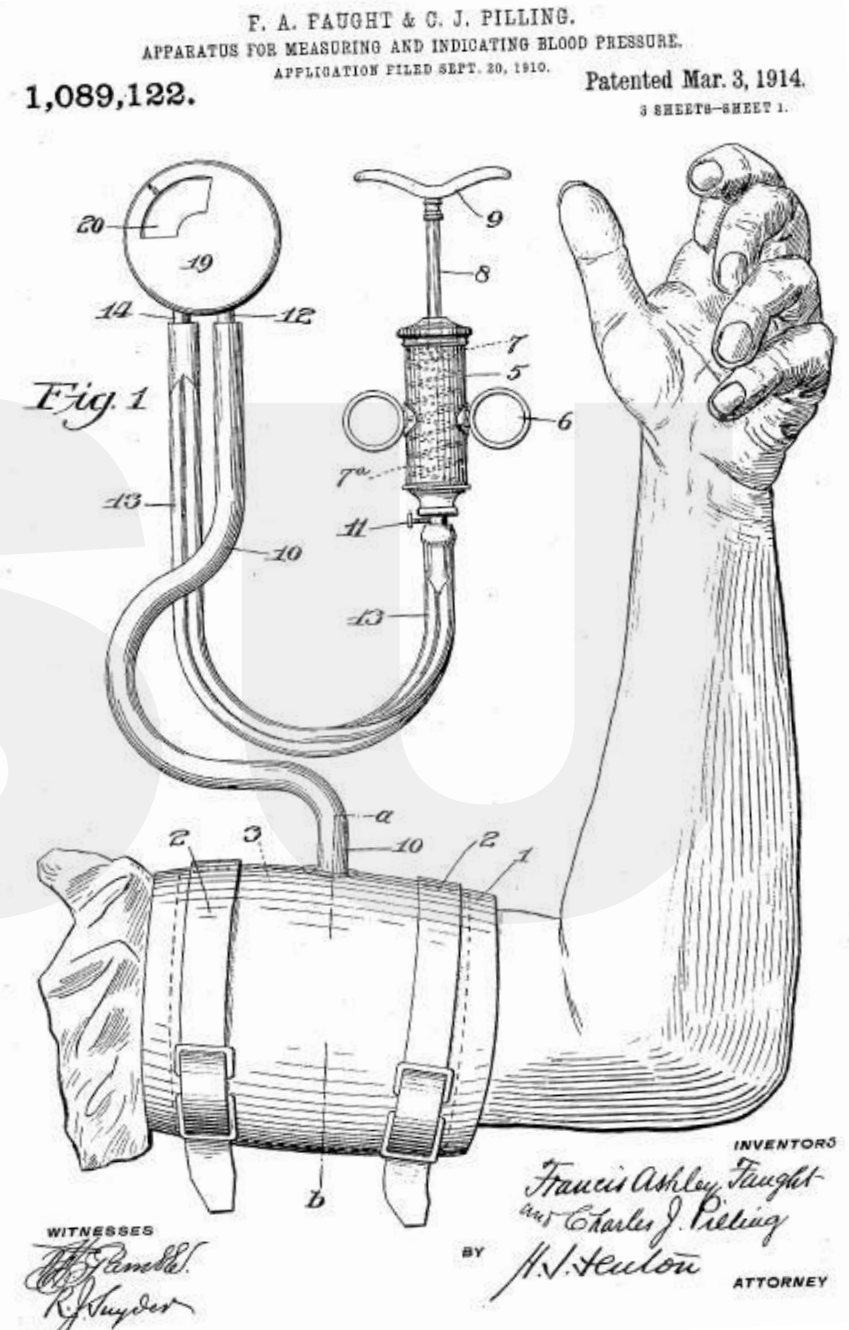


Image source: Google Patents



I have no disclosures or conflicts of interest to declare.

HHSU

Learning Objectives

Define	hypertensive emergency and “urgency”
Contrast	the treatment of hypertensive emergency and asymptomatic hypertension
Recognize	the risks of overtreatment of elevated blood pressure in the hospital
Describe	a stepwise approach for managing elevated BP in a stable hospitalized patient

Roadmap

1

Background

2

Hypertensive emergency

3

Hypertensive "urgency"

4

Stepwise approach

BACKGROUND

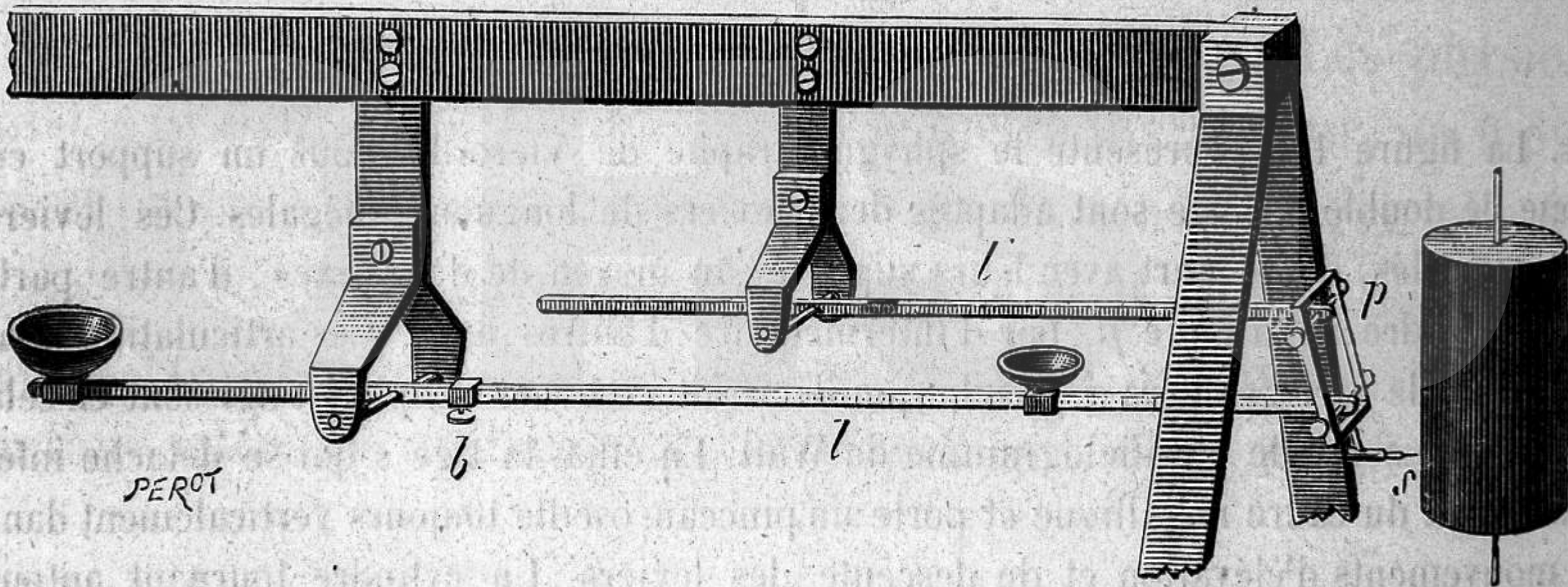
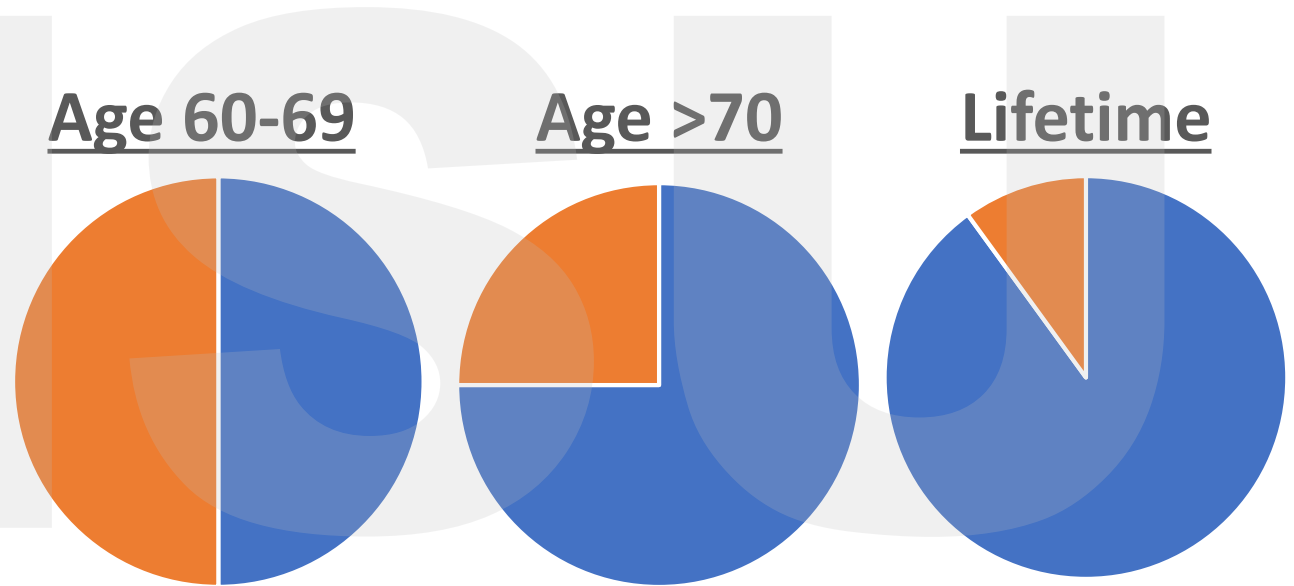
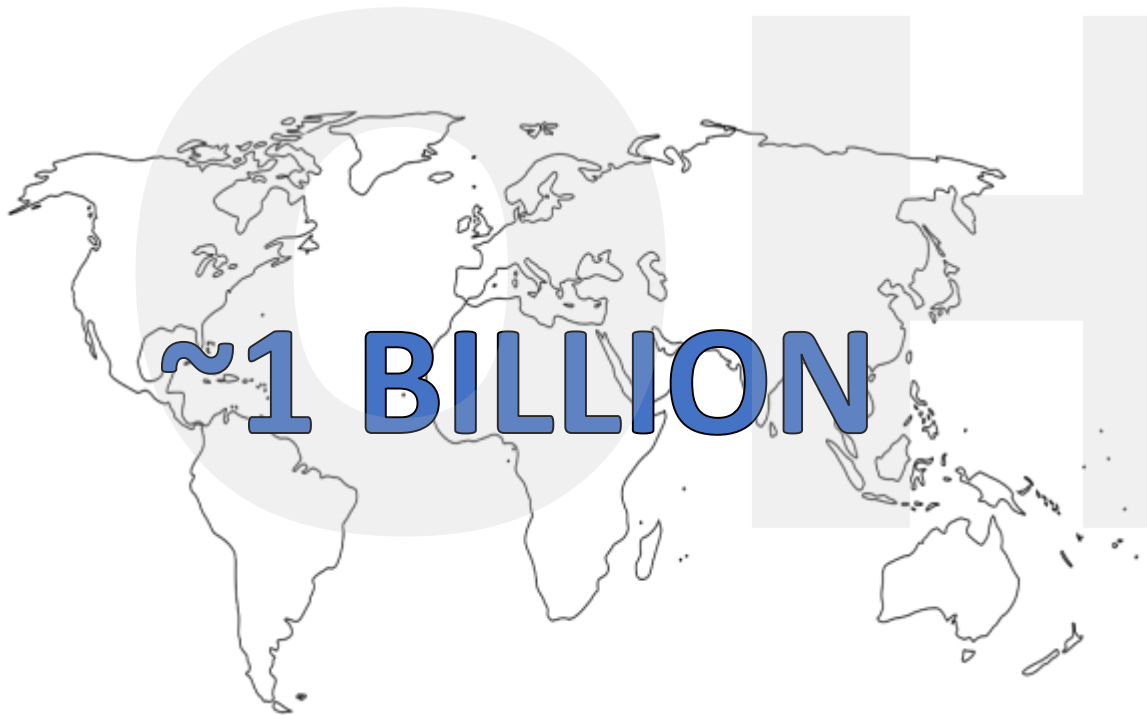


Fig. 107. Sphygmographe de Vierordt.

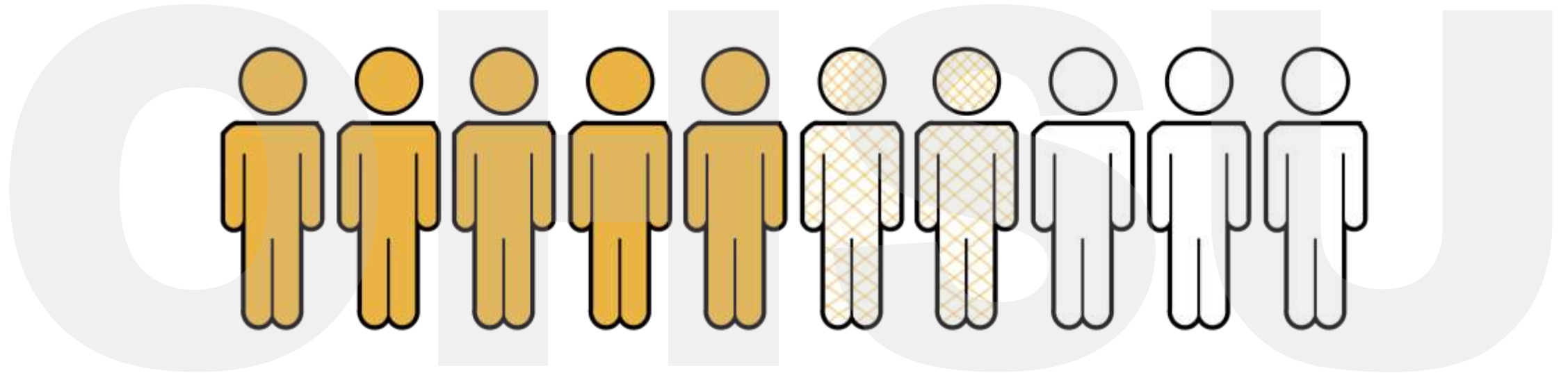
Karl Vierordt, 1855

Image source: Wellcome Library

Background | HTN is (nearly) ubiquitous



Background | Elevated BP is common in the hospital



50-70%

Background | Elevated BP is common in the hospital

NAUSEA



PAIN



ANXIETY



Background | Elevated BP is common in the hospital

NAUSEA



PAIN



ANXIETY



MEDS/DRUGS

Background | Elevated BP is common in the hospital



PAI



ETY



FOR _____

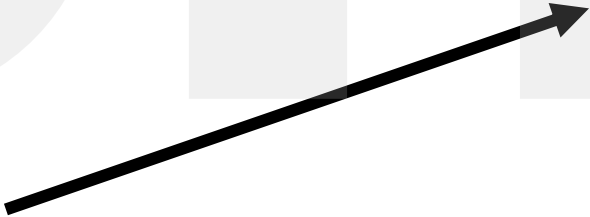
ADDRESS _____ DATE _____

Rx

- Corticosteroids
- NSAIDs
- Calcineurin inhibitors
- Erythropoietin
- OCPs
- Decongestants
- Stimulants



MEDS/DRUGS



Background | Elevated BP is common in the hospital

NAUSEA



PAIN



ANXIETY



MEDS/DRUGS



VOLUME



WITHDRAWAL

HYPERTENSIVE EMERGENCY

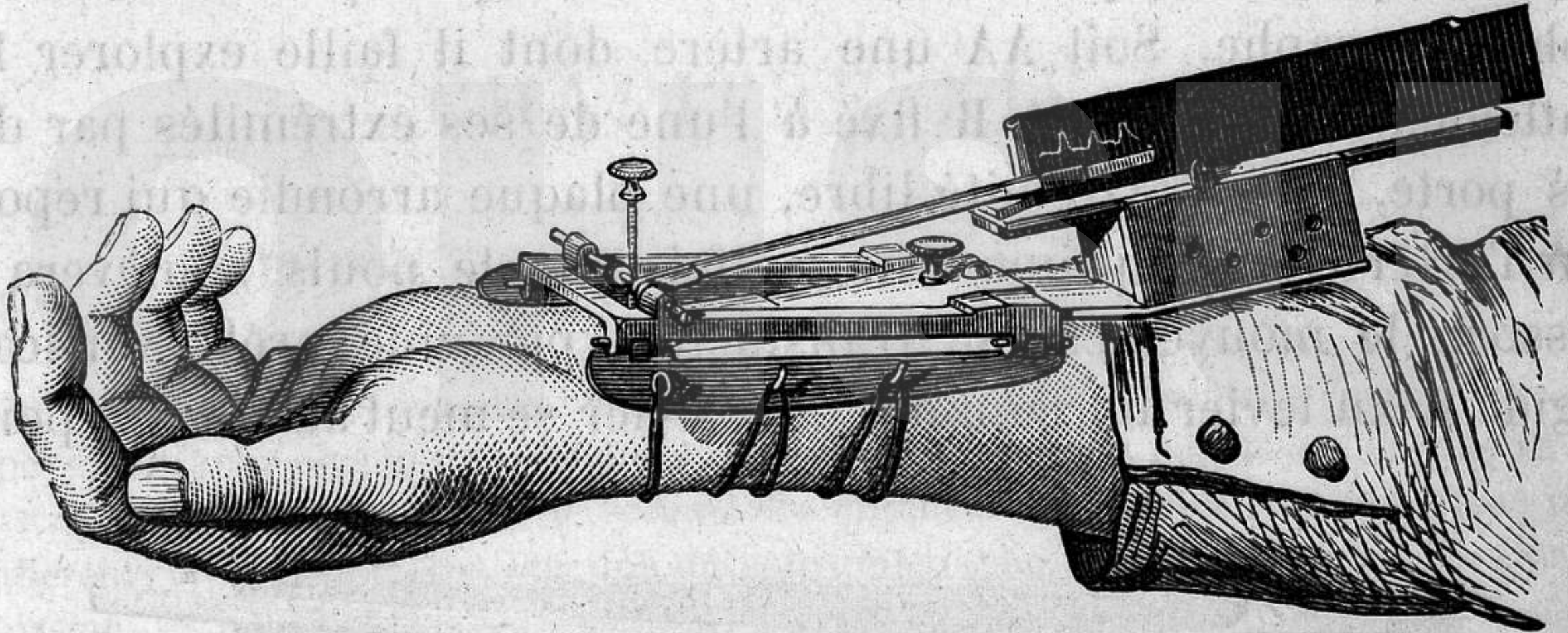


Fig. 109. Sphygmographe direct.
Étienne-Jules Marey, 1860

An 82-year-old woman is hospitalized for community-acquired pneumonia. Her blood pressure on hospital day two is 190/112 mmHg. She has no complaints and a comprehensive physical examination is normal.

In considering the appropriate goals of therapy and risk modification, which of the following is true?

- A. This patient has a significantly higher risk of myocardial infarction within the coming weeks, so rapid lowering of her blood pressure is indicated.
- B. This patient has an increased long-term risk of stroke, so gradual lowering of her blood pressure is appropriate.
- C. The patient is at immediate risk of cardiovascular or neurologic complications and her blood pressure should be lowered by 20-25% in the next hours to days.
- D. The patient should immediately have comprehensive testing to ensure there is no occult hypertensive complication with ensuing therapy given based on findings.

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Hypertensive crises

- First defined by Dr. Koch-Weser
- Operationalized in JNC 1984 report
 - Hypertensive emergency vs urgency

several weeks of ambulatory observation. Rapid normalization of blood pressure is unnecessary, often uncomfortable and sometimes hazardous.

Systematic, gradual institution of antihypertensive therapy is impossible in untreated or poorly treated hypertensive patients who present as hypertensive emer-

MEDICAL INTELLIGENCE



CURRENT CONCEPTS

Hypertensive Emergencies

JAN KOCH-WESER, M.D.

HYPERTENSION rarely constitutes a medical emergency. Ideally, the hypertensive patient is detected early, and his hypertensive mechanisms are characterized and corrected by appropriate, orally active drugs. Titration of dosage against blood-pressure response and drug effect should usually take several weeks of ambulatory observation. Rapid normalization of blood pressure is unnecessary, often uncomfortable and sometimes hazardous.

Systematic, gradual institution of antihypertensive therapy is impossible in untreated or poorly treated hypertensive patients who present as hypertensive emergencies. These crisis situations constitute failures of medical care and have become gratifyingly less common during recent years. They are life-threatening disorders usually characterized by severe elevation of arterial pressure, arteriolar spasm, necrotizing arteriolitis and secondary organ damage. Most prominent are encephalopathy, neuroretinitis, renal failure and left ventricular failure. Hypertensive emergencies rarely develop in previously normotensive persons during the course of acute glomerulonephritis, eclampsia, collagen vascular disease, head injury or drug ingestion. More commonly, they appear as complications of the accelerated phase of poorly controlled chronic hypertension of various causes. In patients with acute elevation of arterial pressure, the risk of complications is greater at any given level of blood pressure than in those with chronic hypertension.¹

Hypertensive emergencies (Table 1) require immediate and intensive treatment, and therapy takes precedence over time-consuming diagnostic procedures. The complications of hypertensive crises are largely reversible, but the degree of reversibility is a function of how soon effective treatment is instituted.

ACCELERATED HYPERTENSION

Patients with severe accelerated (malignant) hypertension must be considered medical emergencies.^{1,2} Each day without adequate reduction of arterial pressure leads to additional and potentially irreversible damage to vital organs, and ominous complications

From the Hypertension and Clinical Pharmacology Unit, Department of Medicine, Massachusetts General Hospital, Boston, Mass. 02114, where reprint requests should be addressed to Dr. Koch-Weser.
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such as hypertensive encephalopathy, intracranial hemorrhage, and acute left ventricular failure can appear at any time. Accelerated hypertension commonly manifests itself by markedly elevated diastolic pressure and by rapid progression of central-nervous-system manifestations ranging from headache to coma and convulsions, of retinopathy with cotton-wool exudates, striated hemorrhages, papilledema and blurring of vision, and of renal failure with proteinuria, hematuria, cylindruria and azotemia.

Patients with clinical manifestations of severe accelerated hypertension should be immediately hospitalized, preferably in an intensive-care unit. Treatment begins promptly and, depending on the clinical situation, aims at adequate blood-pressure reduction in a few hours to a few days. Diagnostic studies other than hemogram, urinalysis, serum creatinine and electrolytes, roentgenogram of chest and abdomen, and electrocardiogram can be deferred until the blood pressure is controlled.

HYPERTENSIVE ENCEPHALOPATHY

Hypertensive encephalopathy represents the most serious complication of accelerated hypertension¹ and requires control of arterial pressure within minutes to hours. The histopathology of the brain shows necrotizing arteriolitis, petechial hemorrhages and multiple small thrombi. Brain edema, increased intracranial pressure and papilledema are common. Elevated spinal-fluid protein and mild xanthochromia may be present. Cerebral blood flow in hypertensive encephalopathy has been thought to be decreased by cerebral arteriolar constriction,^{3,4} but recent evidence suggests that it may actually be increased because of "break-through" of cerebrovascular autoregulation.^{5,6}

The clinical picture of hypertensive encephalopathy is characterized by severe headache, nausea, vomiting, mental confusion and apprehension. Focal neurologic signs, including nystagmus, visual disturbances, Babinski's sign, reflex asymmetries and localized weakness, are common but usually wax and wane. All these manifestations can develop in less than a day. If untreated, they are likely to progress to stupor, coma and convulsions, and death can ensue within hours. Effective blood-pressure reduction can rapidly reverse the life-threatening aspects of hypertensive encephalopathy.^{1,4}

The differential diagnosis of hypertensive encephalopathy

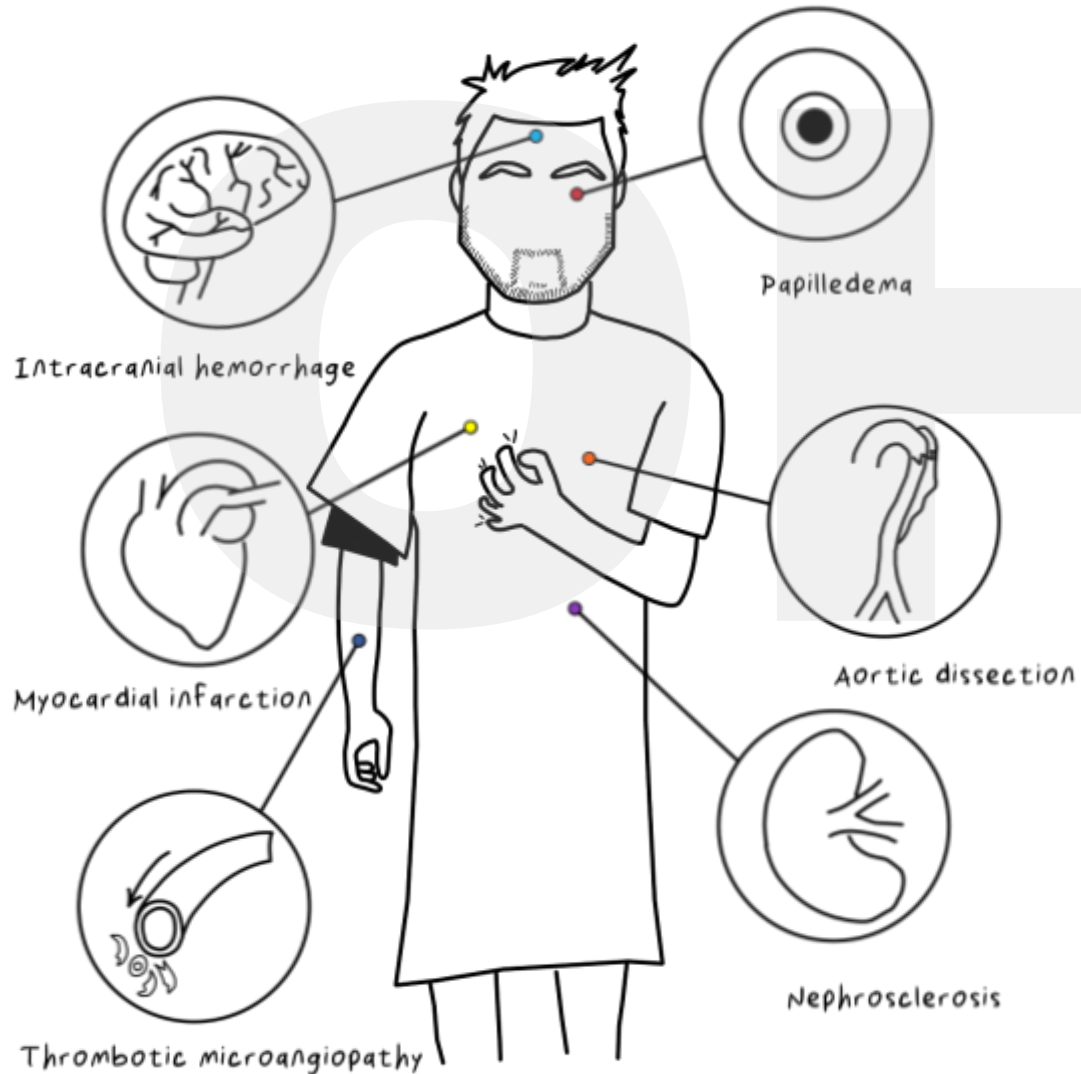
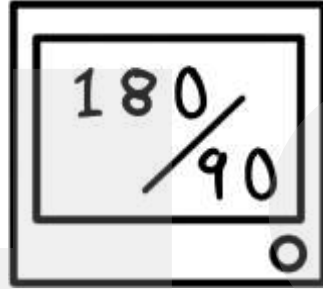
Table 1. Hypertensive Emergencies.

Severe accelerated (malignant) hypertension
Hypertensive encephalopathy
Hypertension complicated by:
Acute left ventricular failure
Intracranial hemorrhage
Aortic dissection
Postoperative bleeding
Hypertensive crisis of pheochromocytoma or during monoamine oxidase inhibitor therapy

Hypertensive Emergency

Vs.

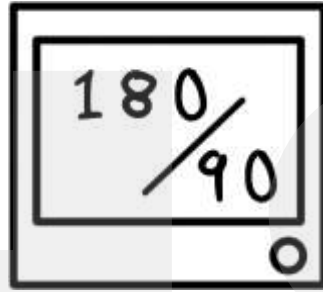
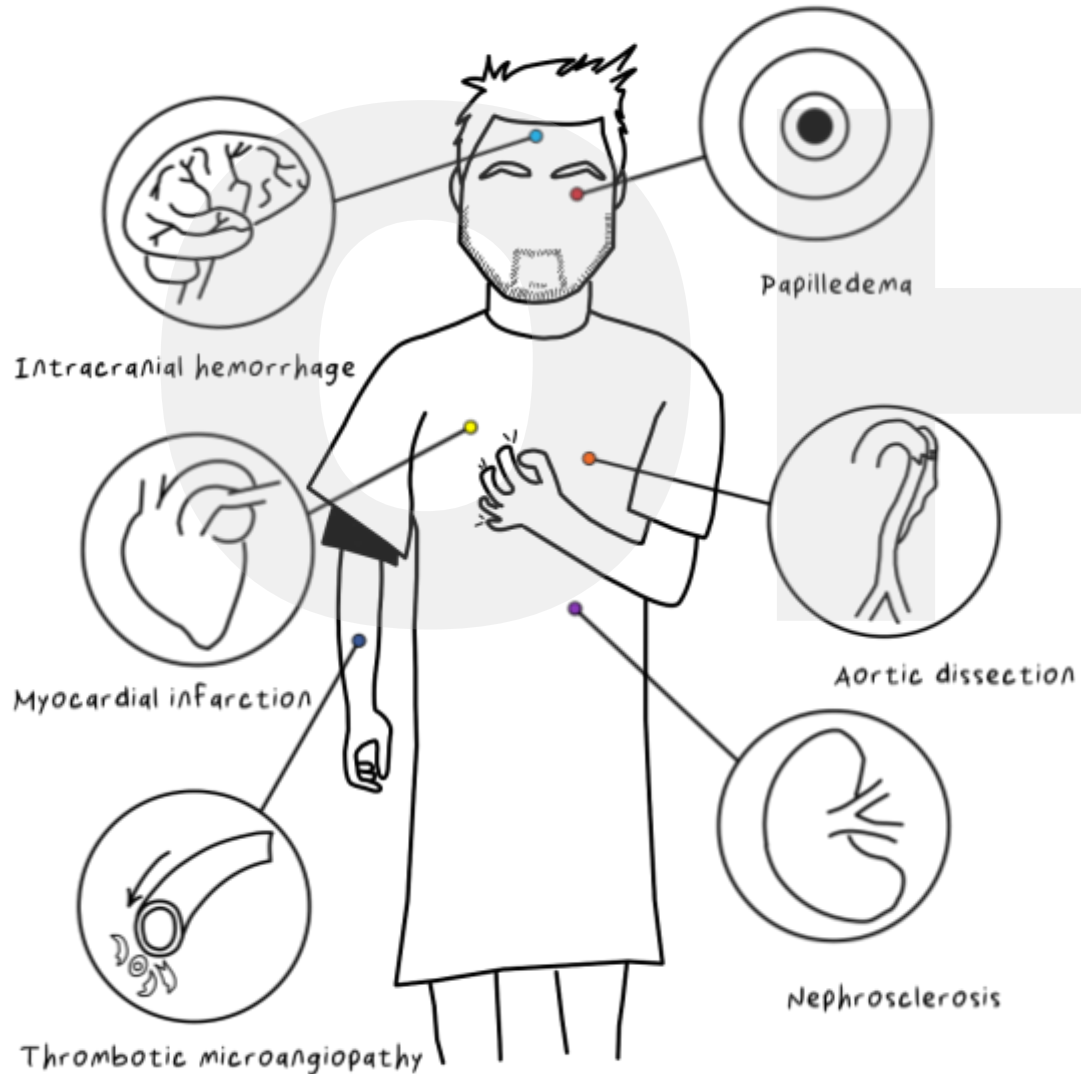
Hypertensive Urgency



Hypertensive Emergency

Vs.

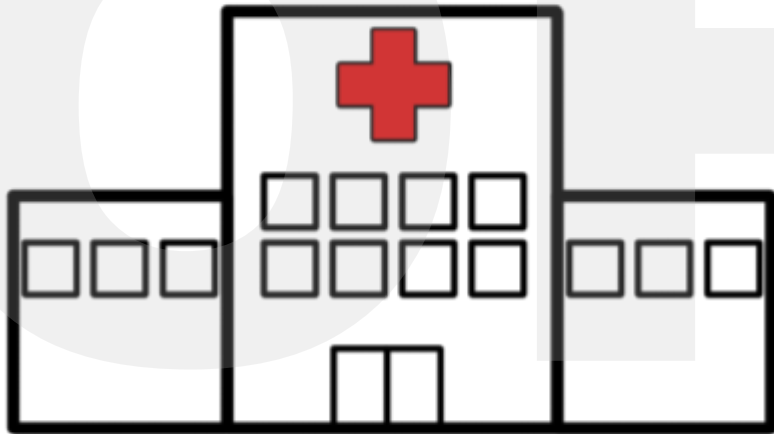
ASymptomatic Hypertensive ~~Urgency~~ ON



Hypertensive Emergencies | Epidemiology

“Hypertension rarely constitutes a medical emergency”

Dr. Koch-Weser, 1974



1-2 per million hospitalizations

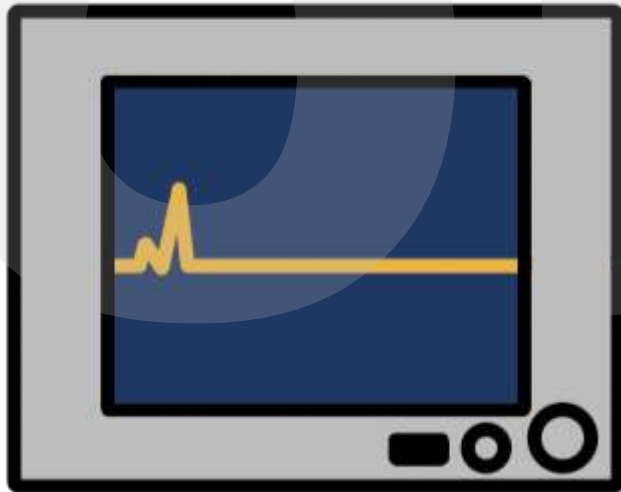


0.3% of all ED visits

Hypertensive Emergencies | Epidemiology

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13% in hospital mortality

39% one-year mortality

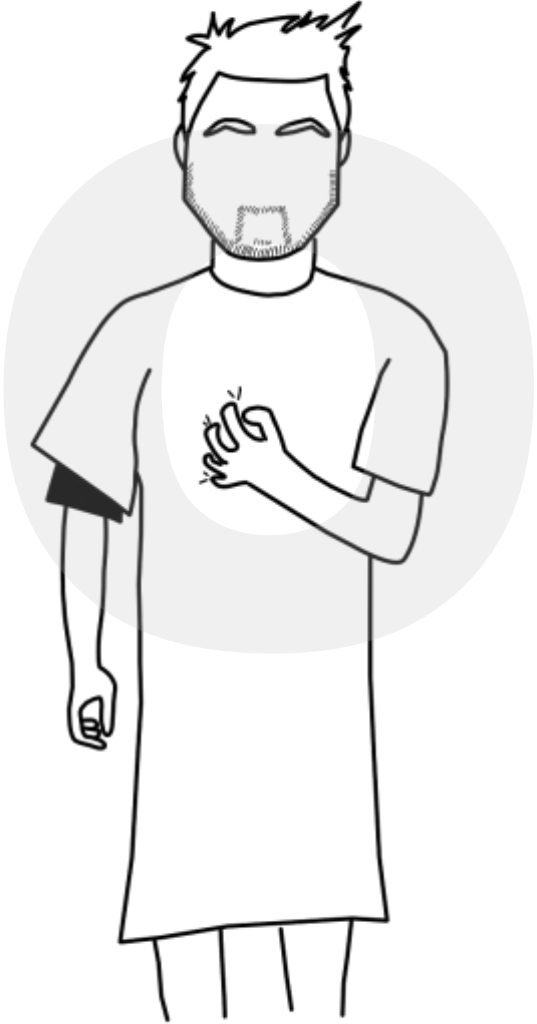
Hypertensive Emergencies | Epidemiology

Which of the following is the most common type of acute end organ damage among patients presenting with hypertensive emergency?

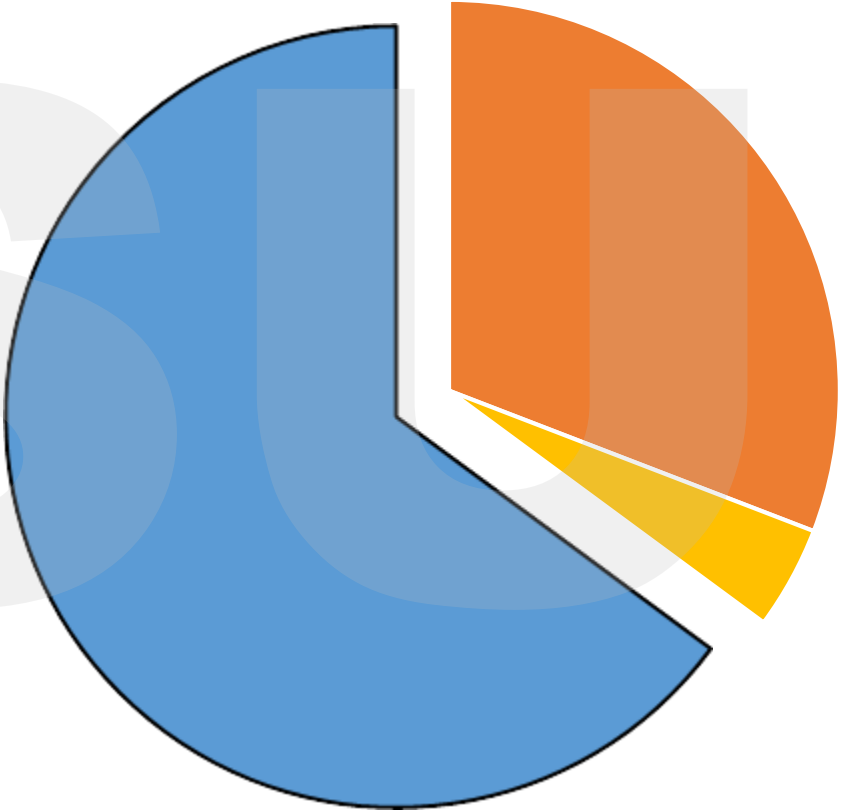
- A. Aortic dissection
- B. Hypertensive encephalopathy
- C. Intracranial hemorrhage
- D. Heart failure

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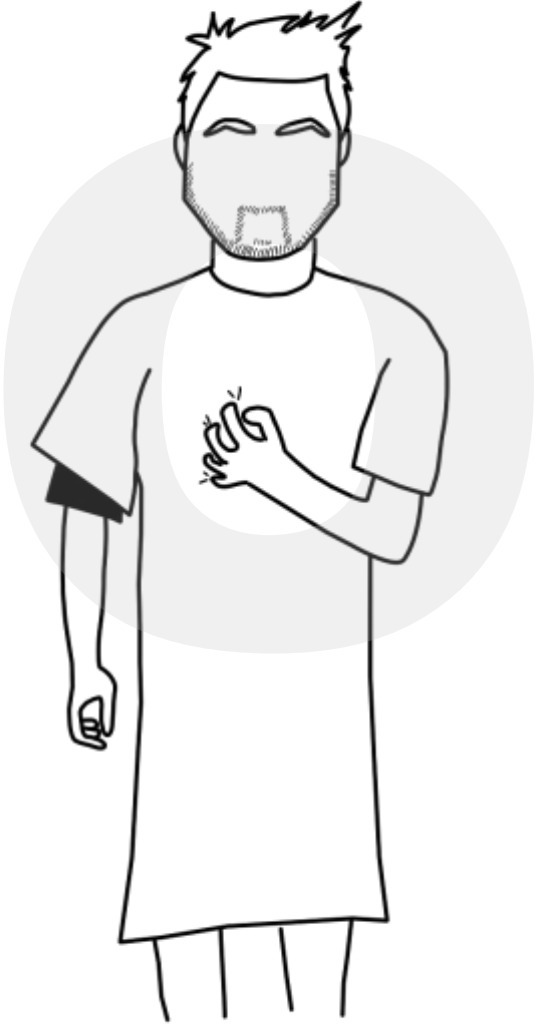
Hypertensive Emergencies | Epidemiology



32% Heart failure/Pulmonary edema
29% Ischemic stroke

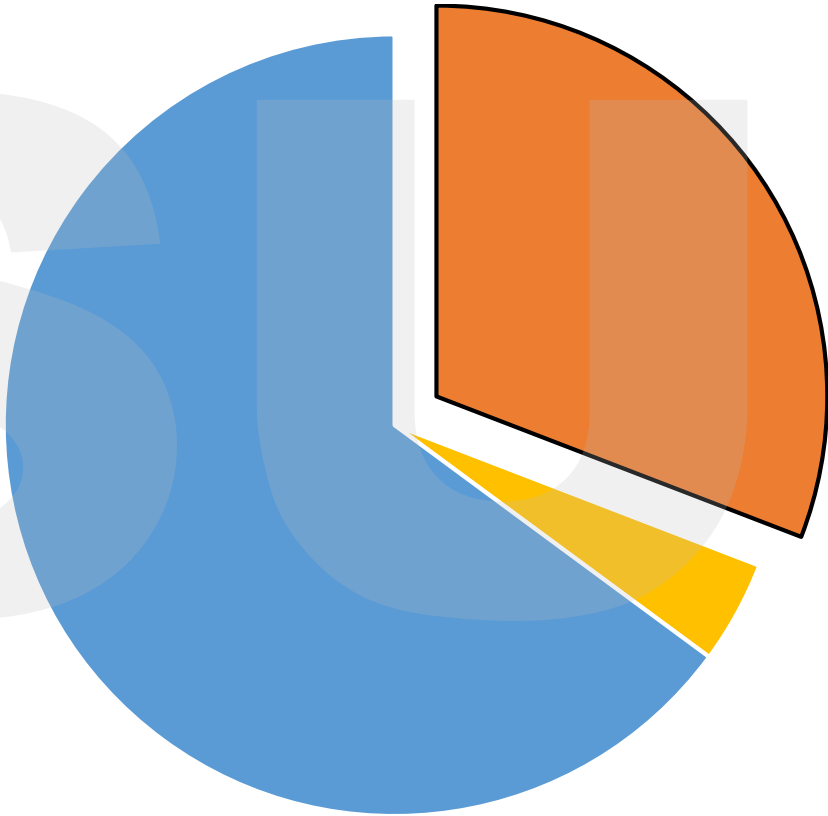


Hypertensive Emergencies | Epidemiology



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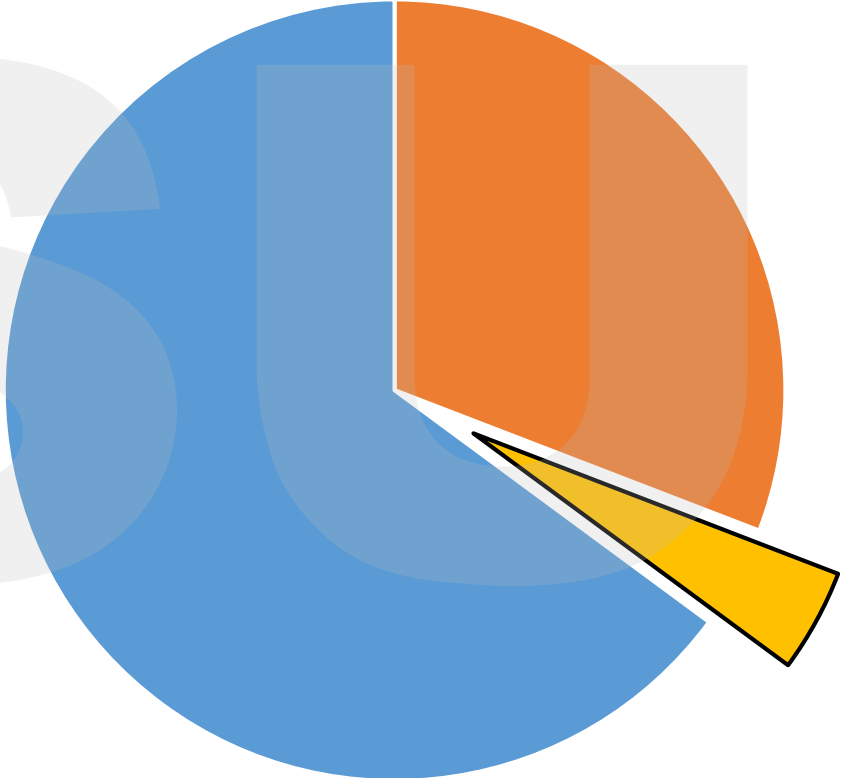
18% Acute coronary syndrome
11% Intracranial hemorrhage



Hypertensive Emergencies | Epidemiology



32% Heart failure/Pulmonary edema 29% Ischemic stroke
18% Acute coronary syndrome 11% Intracranial hemorrhage
2% Aortic dissection 2% Encephalopathy

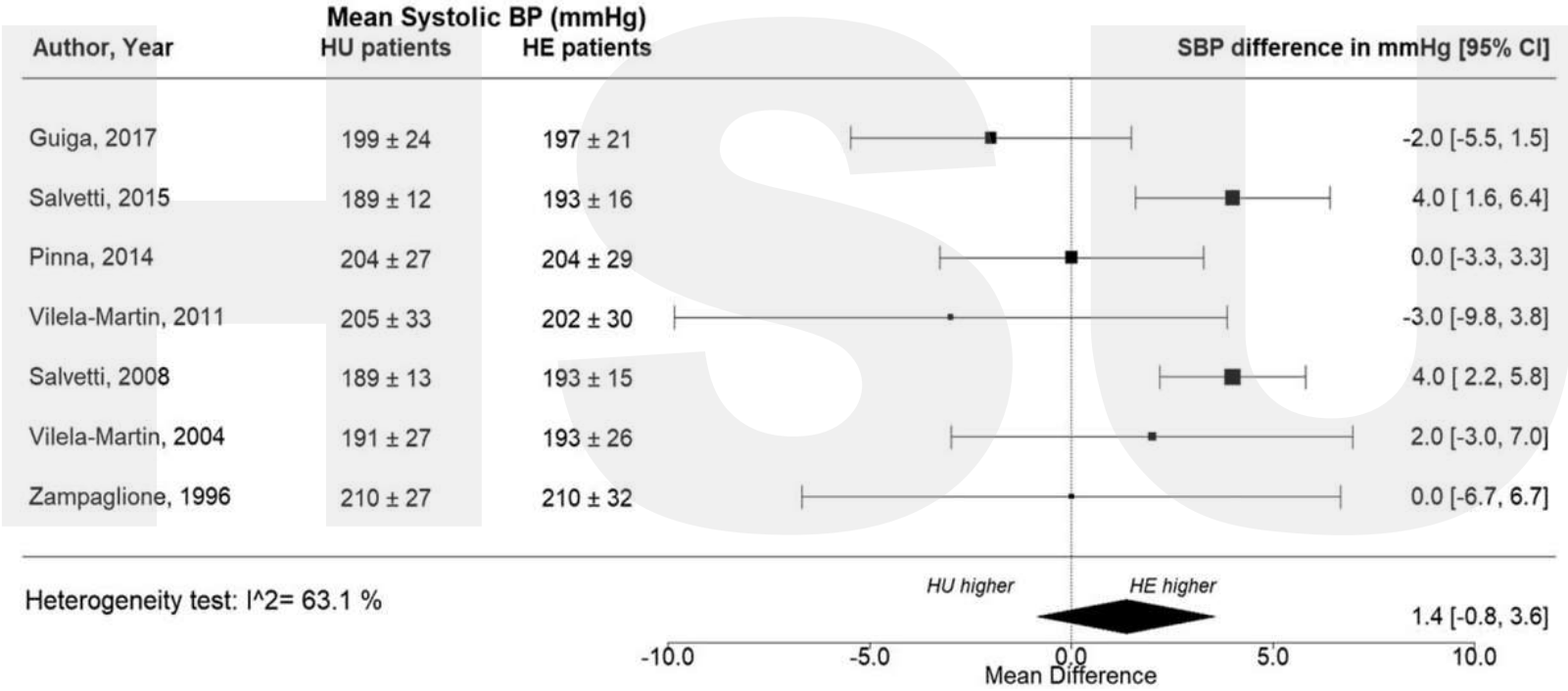


Hypertensive Emergencies | Epidemiology

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Hypertensive Emergencies | Epidemiology



Hypertensive Emergencies | Epidemiology

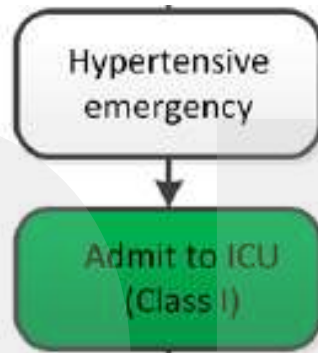


- ~~Chest pain~~
- ~~Dyspnea~~
- ~~Neurologic changes~~
- ~~Headache~~
- ~~Visual impairment~~

99% NPV

Hypertensive Emergencies | Management

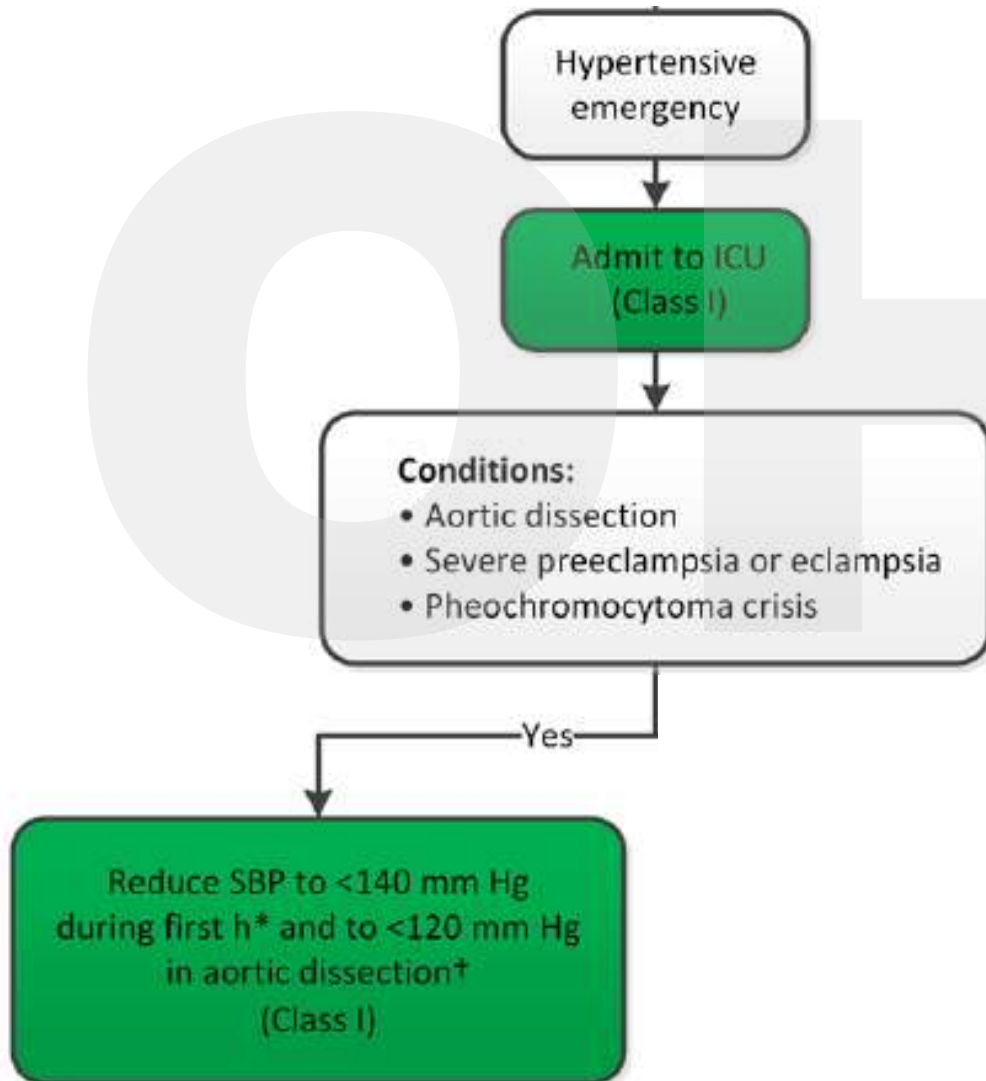
AHA/ACC 2017 Guidelines



COR	LOE	Recommendations
I	B-NR	1. In adults with a hypertensive emergency, admission to an intensive care unit is recommended for continuous monitoring of BP and target organ damage and for parenteral administration of an appropriate agent (Tables 19 and 20). ^{S11.2-1,S11.2-2}

Hypertensive Emergencies | Management

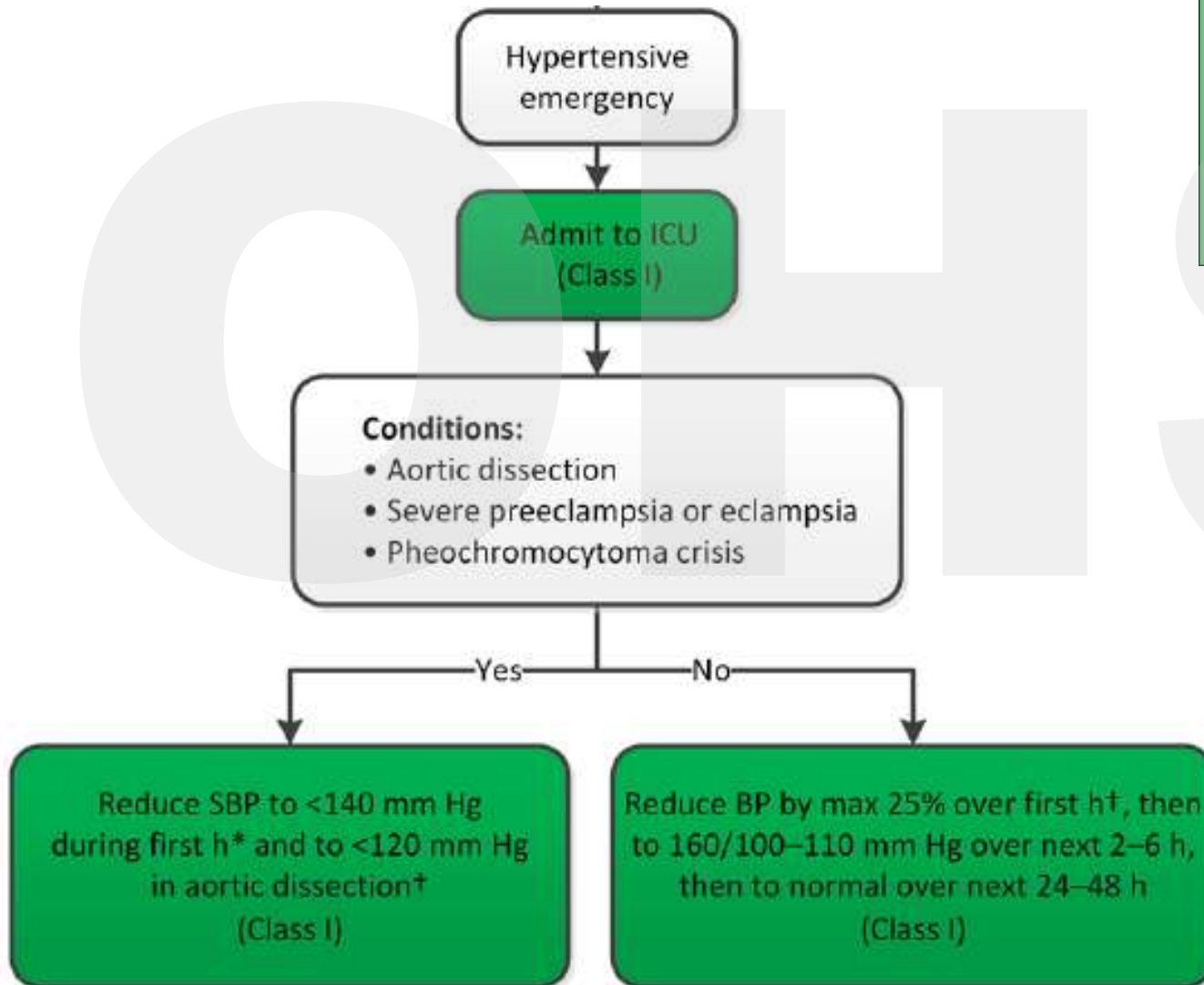
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Hypertensive Emergencies | Management

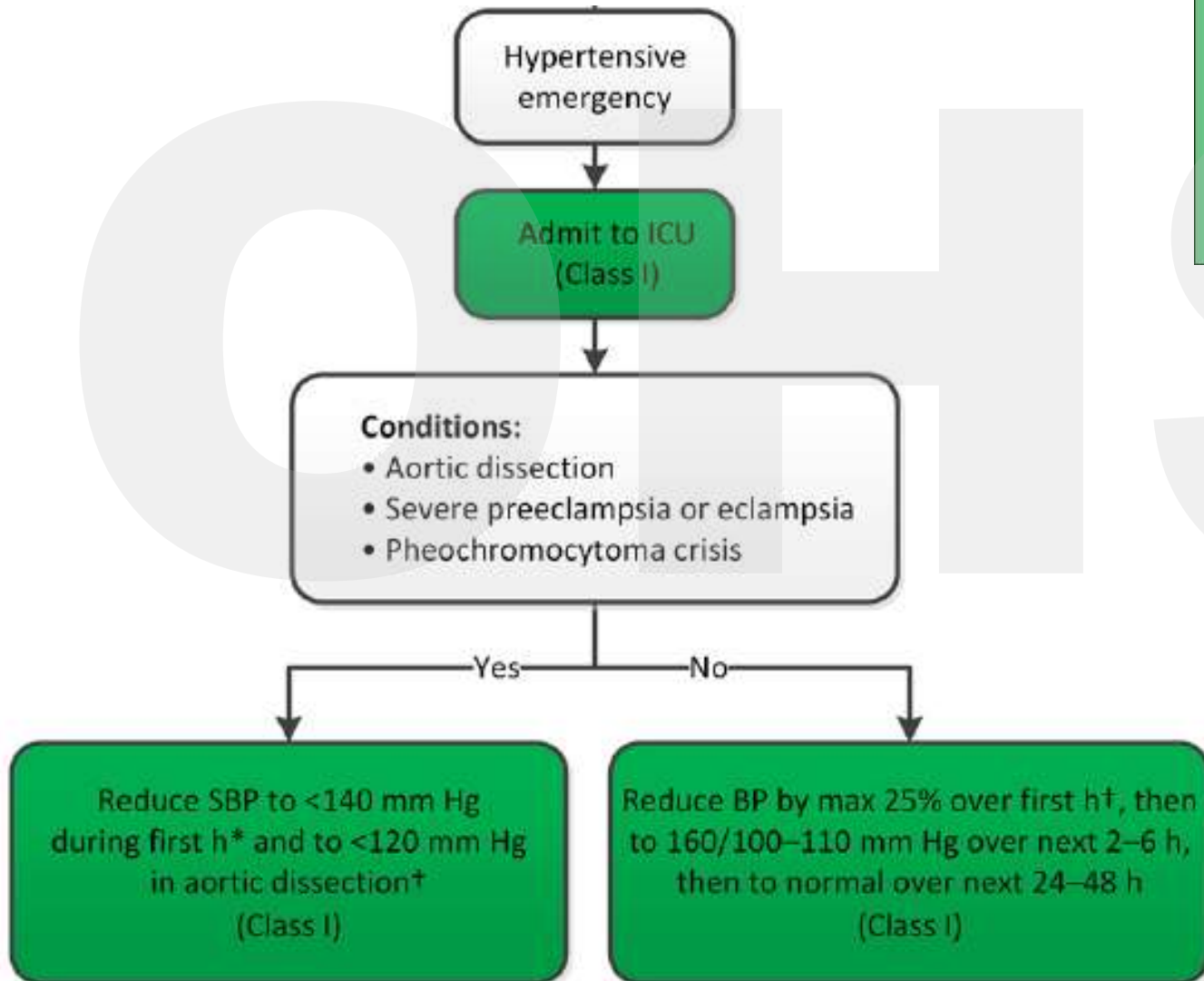
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Hypertensive Emergencies | Management

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COR	LOE	Recommendations
I	C-E0	2. For adults with a compelling condition (ie, aortic dissection, severe preeclampsia or eclampsia, or pheochromocytoma crisis), SBP should be reduced to less than 140 mm Hg during the first hour and to less than 120 mm Hg in aortic dissection.
I	C-E0	3. For adults without a compelling condition, SBP should be reduced by no more than 25% within the first hour; then, if stable, to 160/100 mm Hg within the next 2 to 6 hours; and then cautiously to normal during the following 24 to 48 hours.

Hypertensive Emergencies | Management

AHA/ACC 2017 Guidelines

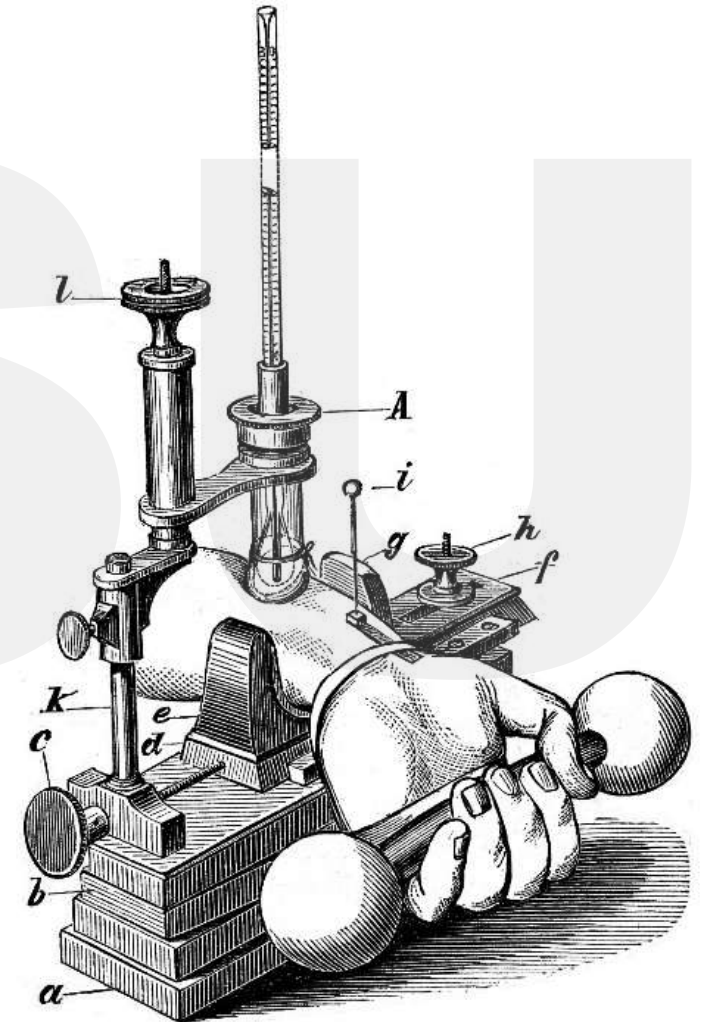
Table 19 (adapted)

Class	Preferred Drug(s)
CCB - dihydropyridines	Nicardipine Clevidipine
Vasodilators - NO dependent	Sodium nitroprusside Nitroglycerine
Vasodilators - direct	Hydralazine
Beta blockers	Esmolol
Beta/alpha blockers	Labetalol
Nonselective alpha blockers	Phenotamine
Dopamine agonists	Fenoldopam
ACE inhibitors	Enalaprilat

Table 20.

Comorbidity	Preferred Drug(s)*
Acute aortic dissection	Esmolol, labetalol
Acute pulmonary edema	Clevidipine, nitroglycerin, nitroprusside
Acute coronary syndromes	Esmolol, † labetalol, nicardipine, nitroglycerin ‡
Acute renal failure	Clevidipine, fenoldopam, nicardipine
Eclampsia or preeclampsia	Hydralazine, labetalol, nicardipine
Perioperative hypertension (BP \geq 160/90 mm Hg or SBP elevation \geq 20% of the preoperative value that persists for >15 min)	Clevidipine, esmolol, nicardipine, nitroglycerin
Acute sympathetic discharge or catecholamine excess states (eg, pheochromocytoma, post-carotid endarterectomy status)	Clevidipine, nicardipine, phentolamine
Acute ICH	Section 9.4.1
Acute ischemic stroke	Section 9.4.2

HYPERTENSIVE “URGENCY”



Sphygmomanometer

Samuel Siegfried Karl Ritter von Basch, 1881

Image source: Wellcome Library

“The greatest danger to [someone] with high blood pressure lies in its discovery, because then some fool is certain to try and reduce it.”

- J.H. Hay, M.D. (1931)



Hypertensive “Urgency” | Epidemiology

Inpatient prevalence not well defined

- 1 in 20 patients in clinic
- 1 in 7 patients in ED (pre-admit)

OHSU



Hypertensive “Urgency” | Management

Should BP be acutely lowered?

Assumptions:

1. Prompt BP reduction will improve outcomes
2. Treatment will result in better short-term BP control
3. Benefit of treatment outweighs risk



Hypertensive “Urgency” | Management

There is **no evidence** to support rapid reduction of BP in asymptomatic patients



Hypertensive “Urgency” | Management

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1. VA Cooperative Study Group on Antihypertensive Agents (1967)
 - 143 patients with clinic DBP 115-129 randomized to tx or placebo
 - Benefits accrued over months



Hypertensive “Urgency” | Management

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2. Patel et al (2016)
 - Of 60,000 patients w/ SBP>180 in clinic
 - 0.7% referred to the ED, 0.2% admitted
 - Those sent home had ↓ admission rates @ 7 and 30 days
 - MACE rare (<1%) and no diff. btwn groups at 7d, 30d, 180d



Hypertensive “Urgency” | Management

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 - Those sent home had ↓ admission rates @ 7 and 30 days
 - MACE rare (<1%) and no diff. btwn groups at 7d, 30d, 180d
3. No need for ED referral, hospitalization, or rapid reduction in BP
 - AHA/ACC, ACEP, JNC 7, BHS, ISH



Hypertensive “Urgency” | Management

- Common practice, even for SBP <180
- Often not getting home meds

O H S U

Hypertensive “Urgency” | Management

- Common practice, even for SBP <180
- Often not getting home meds
- Adverse events
 - **Unpredictable response**
 - Reflex tachycardia
 - Hypotension
 - Syncope/Falls
 - Conduction disturbances
 - Retinal ischemia
 - Coronary ischemia/infarct
 - Stroke



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Hypertensive “Urgency” | Management

Home antihypertensives are commonly intensified during hospitalization

- ~15k older adults (median age 75) hospitalized for non-cardiac reasons

1 in 7

Discharged with intensified antihypertensive regimen

>50%

Of whom had well-controlled outpatient BPs

- No difference in rates among those least/most likely to benefit
 - Limited life expectancy, dementia, metastatic malignancy
 - History of MI, CVD, renal disease

Hypertensive “Urgency” | Management

Follow up study of 4000 patients

	Intensified	Not intensified
30-day readmission	21.4% (NNH 27)	17.7%
Serious adverse event	4.5% (NNH 70)	3.1%
Mean systolic BP / Adv. cardiac events at 1 year	No diff.	No diff.

>50% had good outpatient control pre-hospitalization

Hypertensive “Urgency” | Management

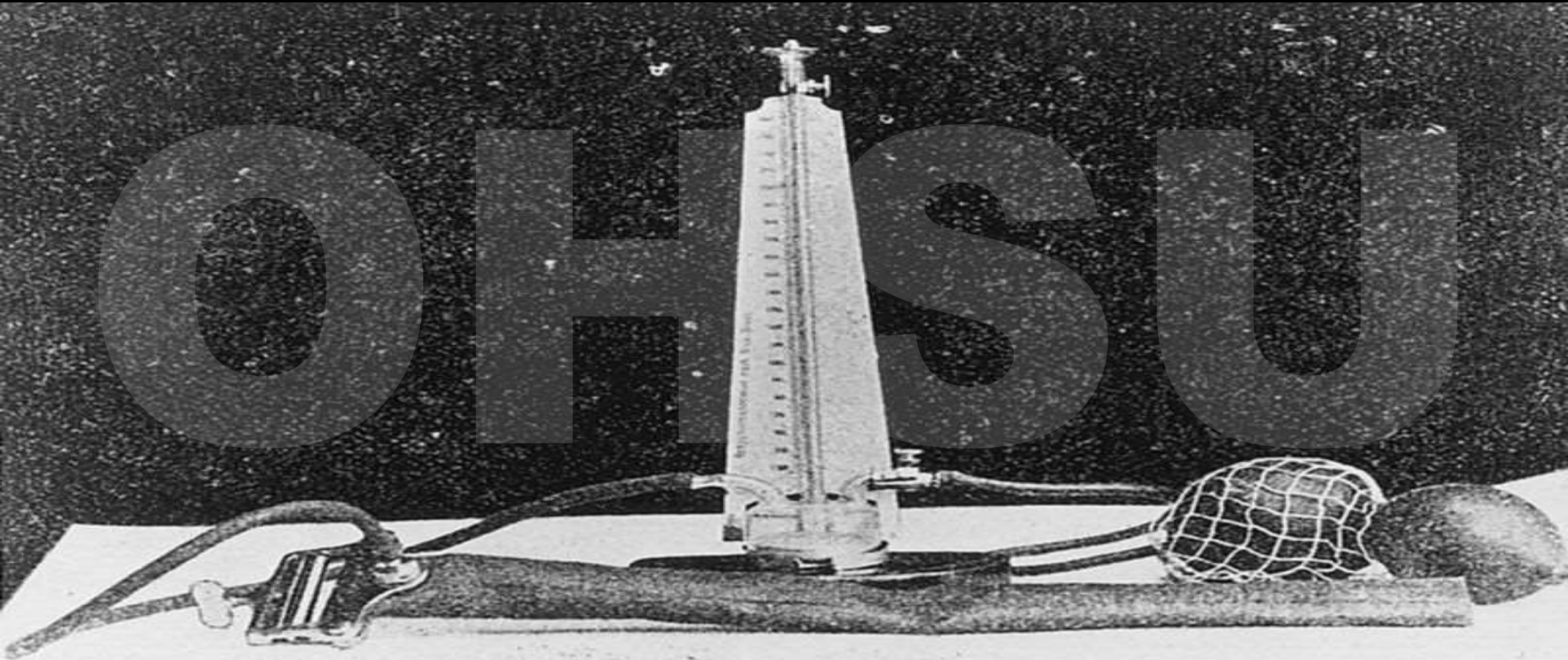
Should BP be acutely lowered? **NO!**

Assumptions:

- ~~1. Prompt BP reduction will improve outcomes~~
- +/-** 2. Treatment will result in better short-term BP control
- ~~3. Benefit of treatment outweighs risk~~



STEPWISE APPROACH

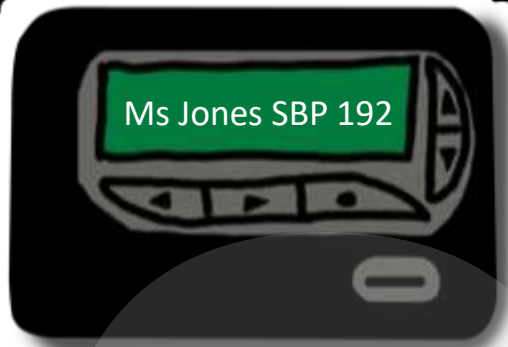


Sphygmomanometer

Nikolai Sergeevich Korotkov, 1910

Image source: Wikimedia

BEEP BEEP
BEEP



~~AEOD?~~



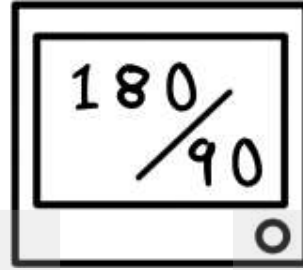
Admit to ICU for IV meds

OHSSU

BEEP BEEP
BEEP



Technique



Contributors



Rest/Reasses



Home meds



~~AEOD?~~

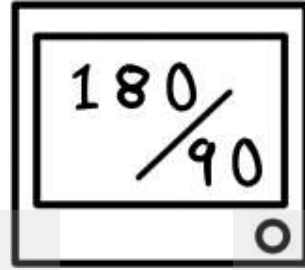


Admit to ICU for IV meds

Consider intensifying home medications or starting new ones orally
Goal: reducing blood pressure over days, not hours



Technique



Contributors



Rest/Reasses



Home meds



~~AEOD?~~



Admit to ICU for IV meds

Consider intensifying home medications or starting new ones orally
Goal: reducing blood pressure over days, not hours

Chronicity



Don't tx if Well-controlled

Comorbidities



CAD / CHF / DM, etc.

Context



Age Prognosis

Coordinate

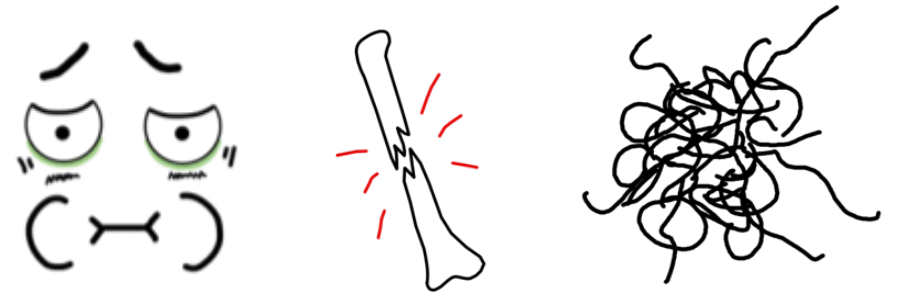


Follow up

Conclusions | Take home points

1. Elevated BP is common in the hospital

- Many causes/contributory factors



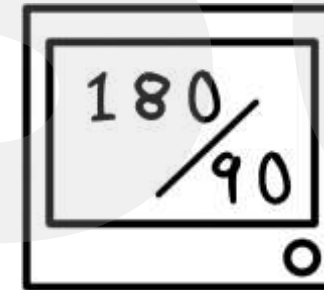
2. Hypertensive emergency (AEOD) has

- Low prevalence
- High mortality
- Clear guidelines (ICU/IV)



3. Hypertensive ~~Urgency~~ is a misnomer

- Instead, use *Asymptomatic Hypertension*



4. Caution with intensification of BP meds

- Can cause SAE, especially among the elderly



5. For asymptomatic patients, treat contributory factors first

- Then *consider* initiation/intensification of PO meds



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THANK YOU!

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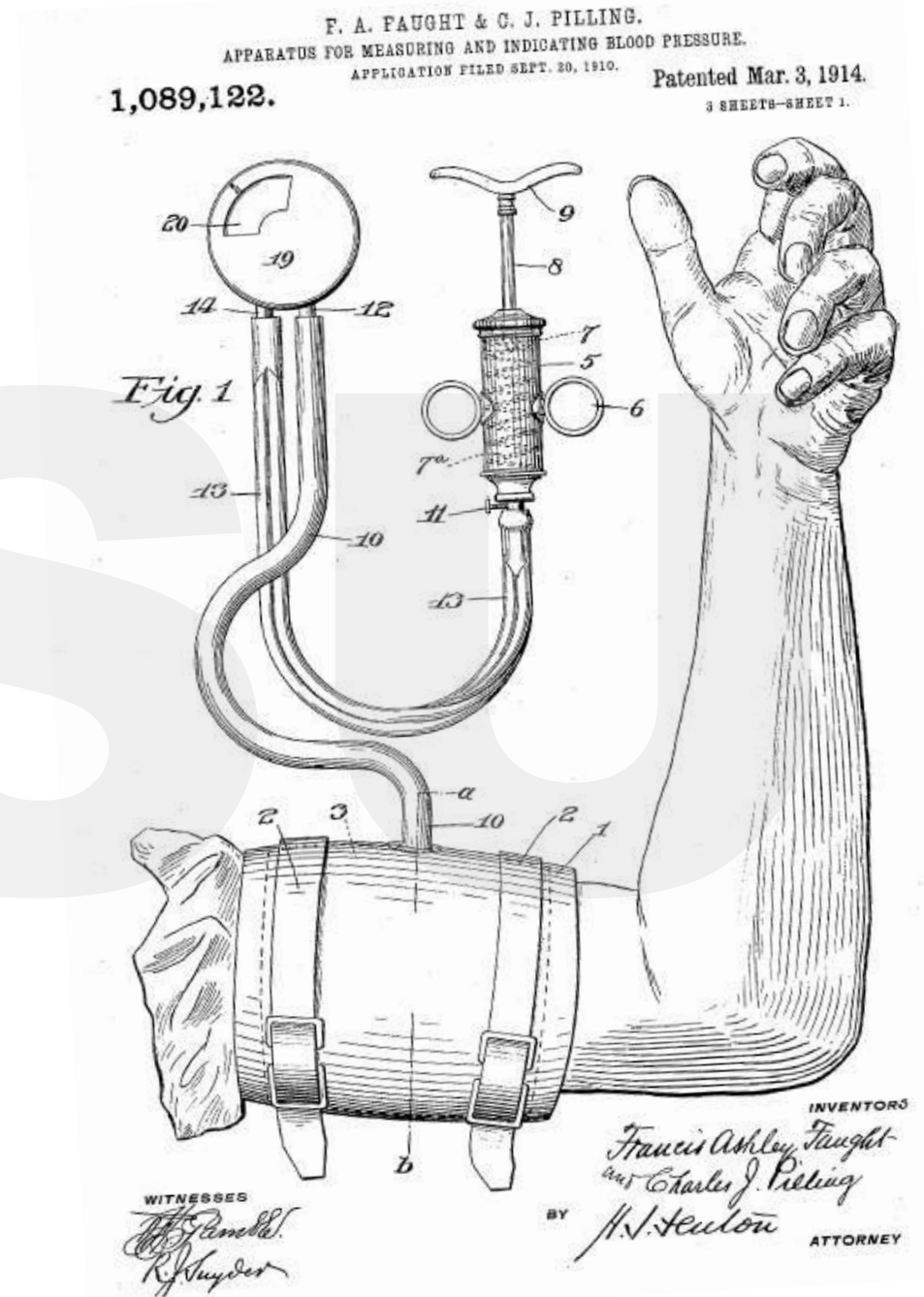


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