

Hypertension

with focus on resistant hypertension

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Allina Cardiovascular Forum

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The patient

- Patient FDR: 63 year old caucasian male
- Long history of hypertension

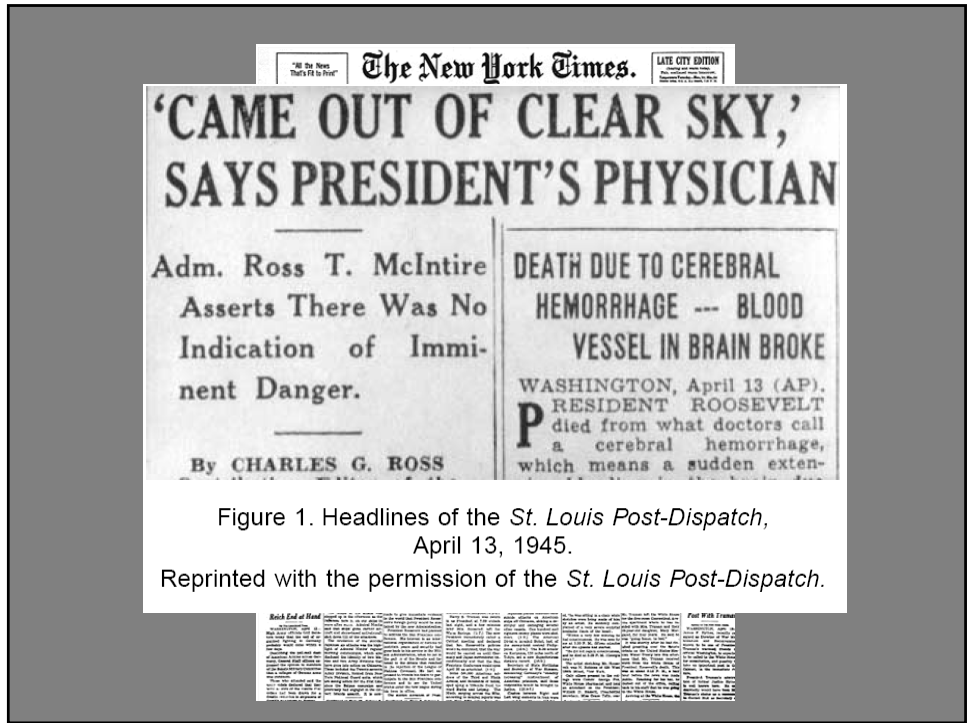
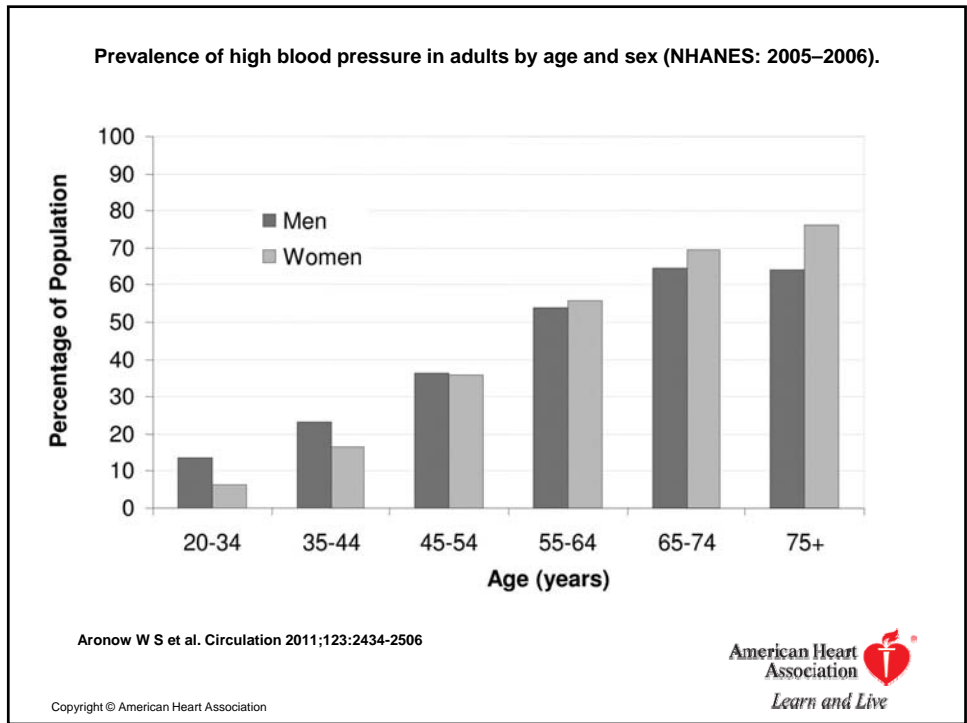
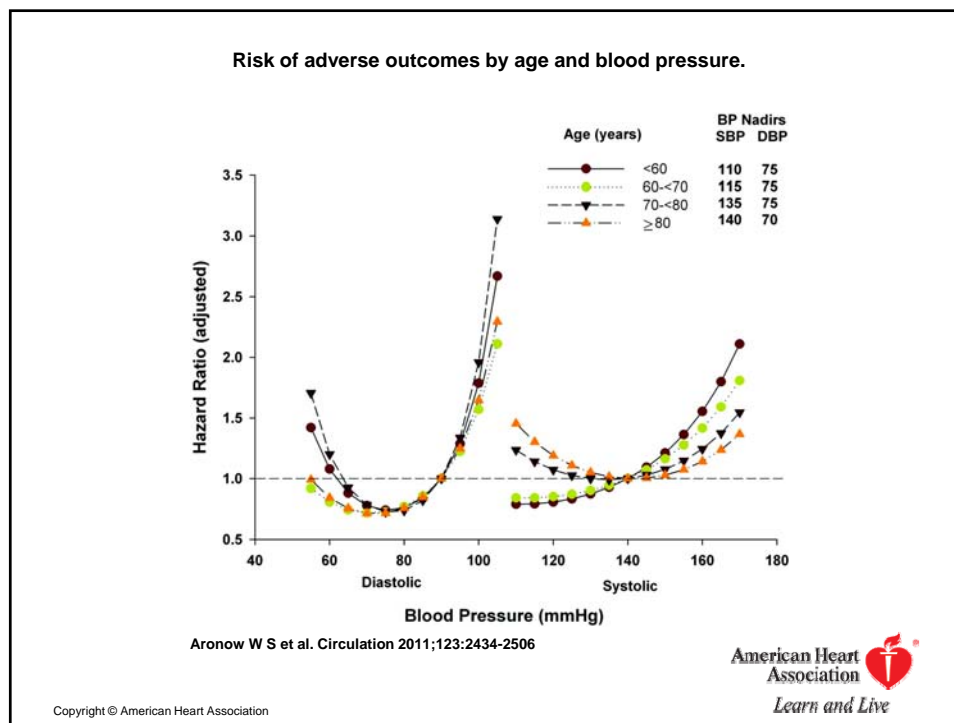


Figure 1. Headlines of the *St. Louis Post-Dispatch*, April 13, 1945.
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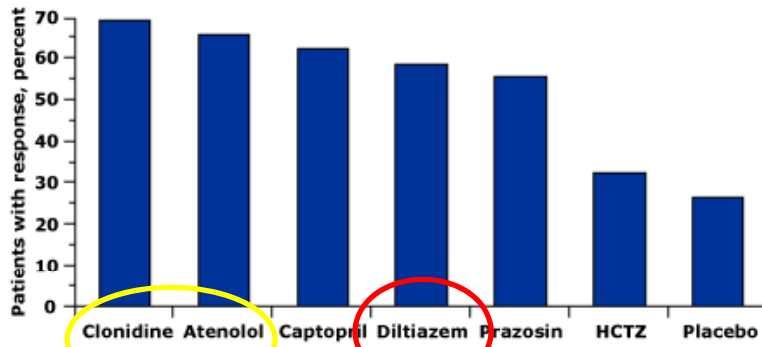


Where did 140/90 come from anyway?

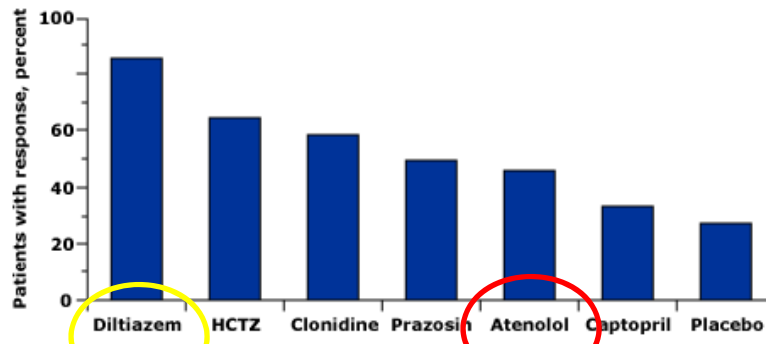
- Blood pressure studies by insurance companies in 1939 and 1959
- More \$\$\$ paid out for patients above 140 systolic or 90 diastolic



Antihypertensive response to different drugs in whites



Antihypertensive response to different drugs in blacks



Pharmacologic therapy

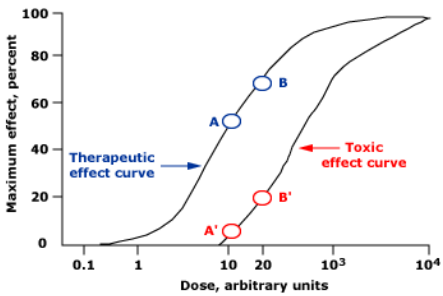
- 25-40% of patients controlled with monotherapy

Resistant Hypertension

- Blood pressure which remains above goal (140/90) despite 3 antihypertensive agents (one of which should be a diuretic)
- Patients requiring 4 agents for blood pressure control have resistant hypertension



Dose relation between therapeutic effect and toxicity with antihypertensive drugs



The theoretical therapeutic and toxic effect curves of antihypertensive agents vary based upon the administered dose. The theoretical effects of a single drug given at two different doses (10 and 20 units) are shown. At a dose of 10 units, the antihypertensive agent has a minimal toxic effect (A') and a moderate therapeutic effect (A). Doubling the dose, however, is associated with substantial toxic effects (B') but little increase in therapeutic efficacy (B).

Redrawn from Epstein, M, Bakris, G, Arch Intern Med 1996; 156:1969.



Diuretic Drugs

- Chlorthalidone (Hygroton) 12.5-25mg daily is probably more effective than hydrochlorothiazide as an antihypertensive
- When GFR falls below 30 ml/m² (creatinine \sim 2).....thiazide diuretics are less effective. Loop diuretics (furosemide or torsemide) are preferred

Aldosterone Antagonists

- Spironolactone: 25-50mg daily
- Elperenone (Inspra): 50 mg once/twice daily
- Amiloride: 5-10 mg daily
- Triamterene: 37.5-75 mg daily

- 20mm Hg drop in systolic BP

Renal Action Drugs*

- ACE inhibitors: Lisinopril
- ARB blockers: Losartan
- Renin inhibitor: Aliskiren (Tekturna)

* combining an ACE inhibitor with an angiotensin-receptor blocker (ARB) more than doubles the risk of both renal failure and hyperkalemia compared with receiving only one of the agents

Beta Blockers

- Carvedilol
- Labetalol
- Nebivolol

Calcium Channel Blockers

- verapamil, diltiazem
- amlodipine

Centrally Acting Agents

- Clonidine 0.1 bid (0.2-0.8mg daily) also patch
- Guanfacine (Tenex) norepinephrine receptor agonist alpha 2a agonist of receptor antagonist: 1mg bedtime

Vasodilators

- Minoxidil 5-80mg (give once or twice a day). Black box warning for pericardial effusion and sinus tachycardia
- Hydralazine 25-50mg twice a day. Caution for lupus like syndrome

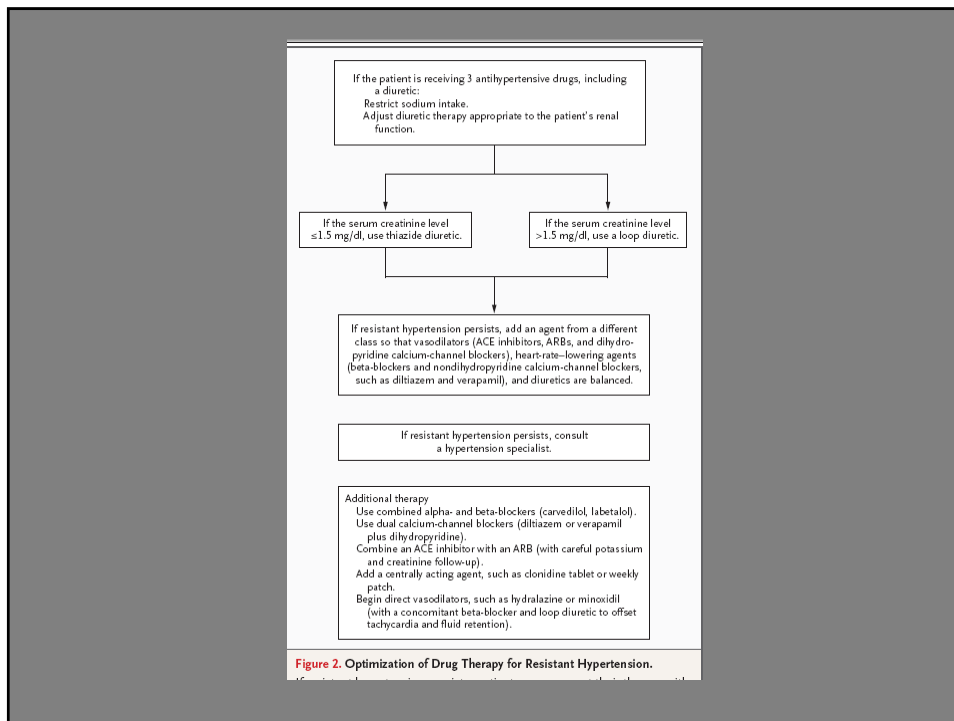
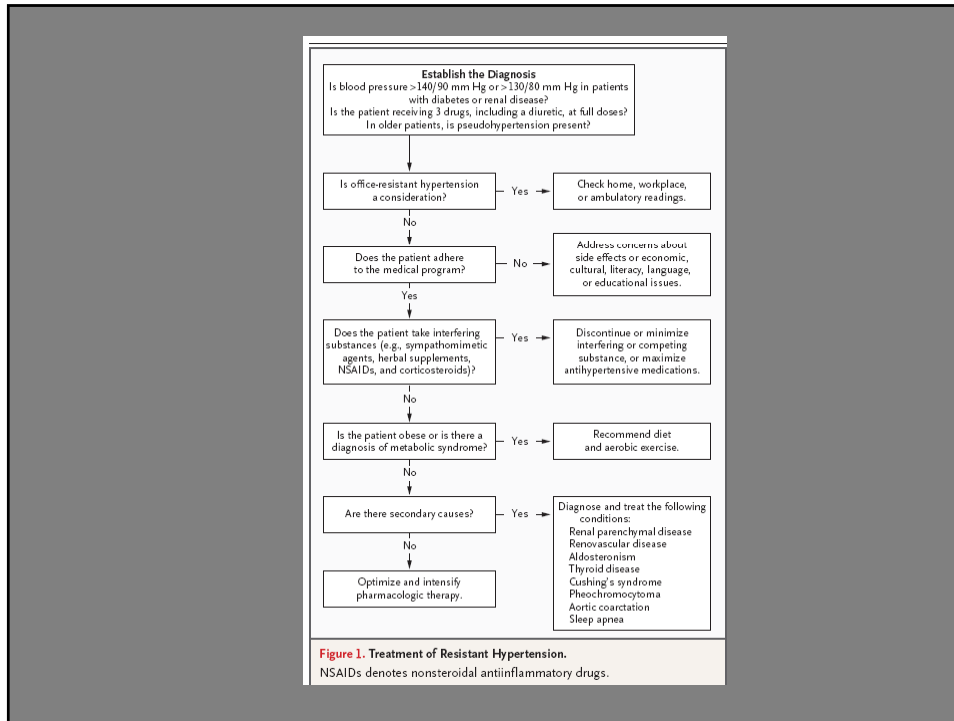
Pharmacologic Less Effective:
older patients and African Americans.

- ACE inhibitor
- ARB
- Renin Inhibitor (aliskrinen/Tekturna)

Rational Combination Therapy

- ACE Inhibitor or ARB blocker
- Long acting dihydropyridine calcium blocker
- Thiazide diuretic

Amiloride and hydrochlorothiazide - [Moduretic](#)
Amlodipine and benazepril - [Lotrel](#)
Atenolol and chlorthalidone - [Tenoretic](#)
Benazepril and hydrochlorothiazide - [Lotensin HCT](#)
Bisoprolol and hydrochlorothiazide - [Ziac](#)
Captopril and hydrochlorothiazide - [Capozide](#)
Enalapril and hydrochlorothiazide - [Vaseretic](#)
Felodipine and enalapril - [Lexxel](#)
Hydralazine and hydrochlorothiazide - [Apresazide](#)
Lisinopril and hydrochlorothiazide - [Prinzide](#), also sold as Zestoretic
Losartan and hydrochlorothiazide - [Hyzaar](#)
Methyldopa and hydrochlorothiazide - [Aldoril](#)
Metoprolol and hydrochlorothiazide - [Lopressor HCT](#)
Nadolol and bendroflumethiazide - [Corzide](#)
Propranolol and hydrochlorothiazide - [Inderide](#)
Spironolactone and hydrochlorothiazide - [Aldactazide](#)
Triamterene and hydrochlorothiazide - [Dyazide](#), also sold as Maxide
Verapamil extended release) and trandolapril - [Tarka](#)

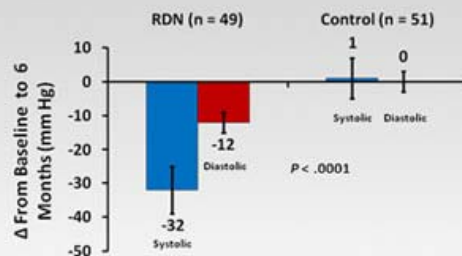


Radiofrequency Ablation Renal Sympathetic Nerves



Radiofrequency Ablation Renal Sympathetic Nerves

Symplicity HTN-2: Change in 6-Month BP Measured in Clinician's Office



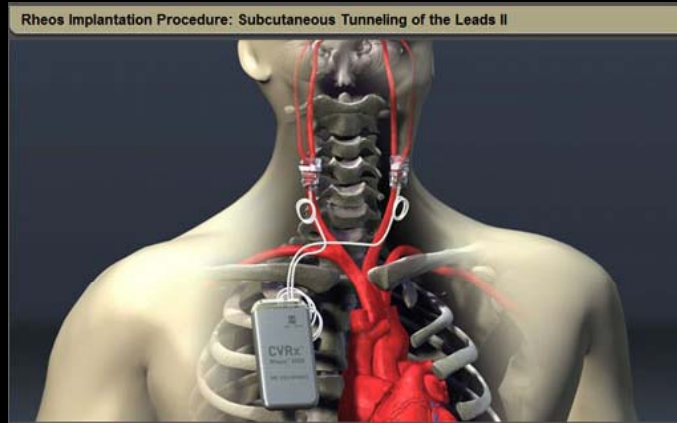
RDN = renal denervation



Reprinted from Symplicity HTN-2 Investigators, et al. *Lancet*. 2010;376:1903-1909. With permission from Elsevier.

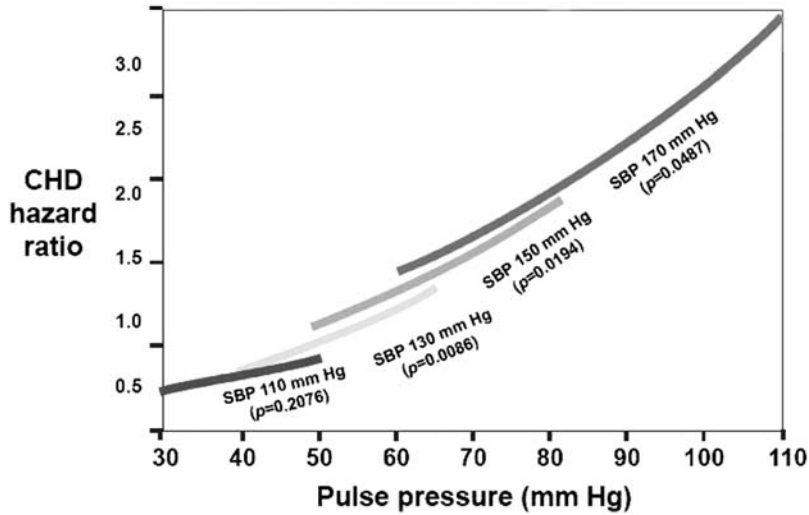


Carotid Sinus Baroreceptor Stimulation



Elderly and Hypertension

Joint influences of systolic blood pressure and pulse pressure on coronary heart disease.

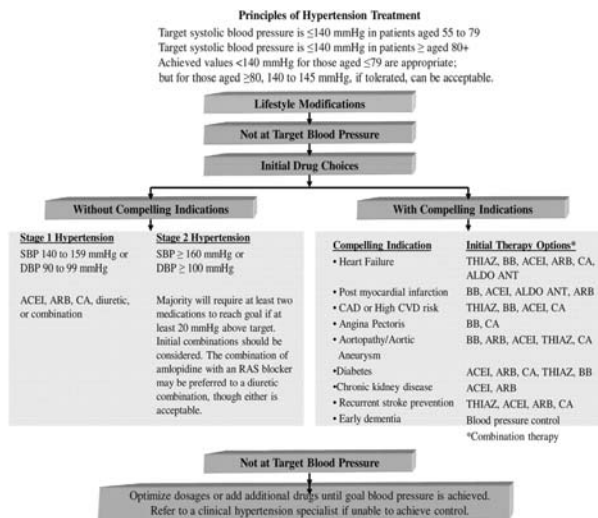


Aronow W S et al. Circulation 2011;123:2434-2506



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Algorithm for treatment of hypertension in the elderly.

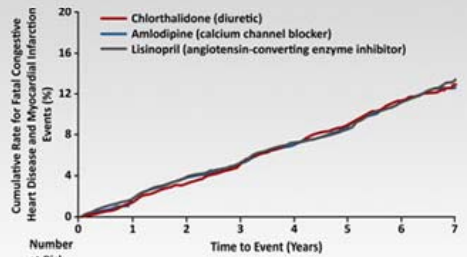


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ALLHAT: Medication Comparison Shows Diuretics as Effective in Reducing Coronary Events



HYPERTENSION

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heart.org Medscape EDUCATION

the 2007 update of the European Society of Hypertension/European Society of Cardiology guidelines)

recommends that beta blockers NOT be used as first line therapy, particularly in patients over age 60

An alpha blocker is not recommended for initial monotherapy, with the possible exception of older men with symptoms of prostatism, particularly if they are not at high cardiovascular risk.