

Hypertension: How High Is High?

(What We Know and Don't Know)

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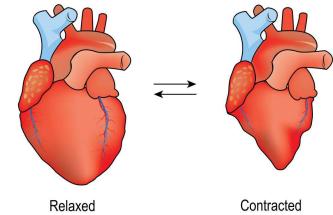


WHAT IS BLOOD PRESSURE?

- With each heartbeat, the heart contracts (and ejects blood), then relaxes.
- Systolic blood pressure (SBP) is the peak pressure during a heart contraction.
- Diastolic blood pressure (DBP) is the pressure on blood vessels between heartbeats.
- Consider that by age 80 years :

if your pulse was 60 times a minute, your heart will have beat
nearly 2.5 billion times

if your pulse was 90 times a minute, your heart will have beat
nearly 4 billion times



MEASURING BLOOD PRESSURE

- What actually is blood pressure?

Force per unit area exerted by blood on the walls of the artery

blood pressure of 130/80 means that when the heart contracts the pressure is strong enough to raise the level of mercury in a glass tube up to 130 mm and when it relaxes between beats, the mercury is raised to only 80 mm

Modern methods don't use mercury – they are based on pressure oscillations caused by pulsations in the artery.



Pressure depends on:

- * how much blood the heart pumps per minute (cardiac output)
- * how stiff the arteries are
- * how much blood there is in the body (blood volume)
- * how hard is it for the blood to flow through the smallest vessels in the body (peripheral resistance)

LET US START WITH THE PAST....

William Harvey
1628

105 years

Stephen Hales
1733

212 years

FDR died
1945

19 years

My father died
of heart failure
1964

Heart is a pump
Blood circulates
from heart through
arteries ,returns
to heart via veins



Blood pressure
was first
measured



Bed rest,
phenobarbital



Rice diet,
reserpine(side
effect:
depression)



Clinical notes on the illness and death of President Franklin D. Roosevelt. Bruenn HG. Ann Intern Med. 1970 Apr;72(4):579-91. doi: 10.7326/0003-4819-72-4-579. PMID: 4908628



Dr. Bruenn was consultant in cardiology to the National Naval Medical Center in Bethesda. He wrote:

“The President was brought to the Hospital on March 27, 1944, for a checkup; **a diagnosis was made of hypertension**, hypertensive heart disease, cardiac failure (left ventricular), and acute bronchitis. ”



HISTORY PROGRESSES..... OVER THE FOLLOWING YEAR

- **D-Day** Allied invasion into France June 6, 1944
- November 1944 - he gets re-elected. (Blood pressure ranged from 180/100 to 240/130mmHg.)
- February 1945 – attends **Yalta conference** with Churchill and Stalin – plan post-war Europe and divide up spheres of influence.
- March 1945 goes to Warm Springs, GA to recuperate.
- April 12, 1945 – **FDR dies of stroke**
- **Note that all 3 (Churchill, Roosevelt, and Stalin died of consequences of high blood pressure.**

WHEN FDR DIED THERE WERE NO DRUGS TO LOWER BLOOD PRESSURE; NOW, 80 YEARS LATER, THERE ARE MORE THAN 30

Stephen
Hales
1733

292 years from first measurement of BP to our arsenal of drugs

1945

1972

2025

212 yrs

80 yrs

Blood pressure
was first
measured



FDR
died

Bed
rest,

Diuretic
works

Rice diet,
reserpine

More
than 30
drugs to
treat
high BP



HYPERTENSION AND HISTORY

What if we had all these drugs in 1945?

“On joining the U. S. Naval Medical Corps in 1942 I had not the slightest inkling that I would be the attending physician to President Franklin D. Roosevelt from March 1944 to the day of his death....., I have often wondered ***what turn the subsequent course of history might have taken*** if the modern methods for the control of hypertension had been available. “

Dr. Bruenn



WE NOW HAVE DIFFERENT METHODS TO TREAT HYPERTENSION

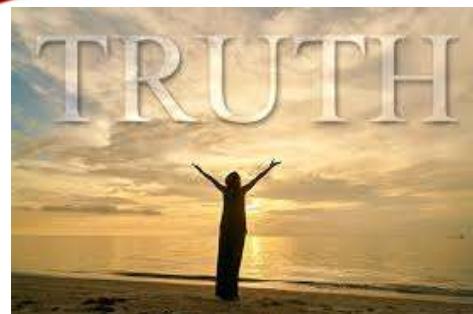
- Lifestyle interventions:
 - Weight loss
 - Lower salt in diet
 - Stress reduction
- Drugs that:
 - 1) *reduce blood volume*: Diuretics
 - 2) *reduce vascular resistance*: Vasodilators, Angiotensin converting enzyme inhibitors (ACE-I), Angiotensin II receptor blockers (ARBs),
 - 3) *reduce cardiac output by depressing heart rate and stroke volume*: Beta-blockers, calcium channel blockers (reduce cardiac output and vasodilation).



- **Everyone has blood pressure** – but when is it “high” blood pressure?
- **When** should we start treatment with drugs?
- Does it differ for older vs younger people?
- How do we know?
- What kind of studies give us our guidelines?



SCIENCE IS A CLIMB TOWARD “THE TRUTH”



Each step on the
ladder represents
more solid evidence

EVIDENCE

NOT GOOD EVIDENCE:

- My great-uncle smoked every day most of his life, and he died at 102 without ever having lung cancer.
- My grandfather never smoked and he died of lung cancer



BETTER EVIDENCE:

group of smokers
and group of non-smokers

→ Are followed
over time

→ To determine
who develops
lung cancer

BEST EVIDENCE:

An experiment

EVIDENCE

NOT GOOD EVIDENCE:

- My grandfather had low blood pressure and he died of a heart attack at age 50
- My great-uncle had elevated blood pressure, and he died at 102 (he was hit by a bus)



BETTER EVIDENCE:

group of hypertensives
and group of
normotensives

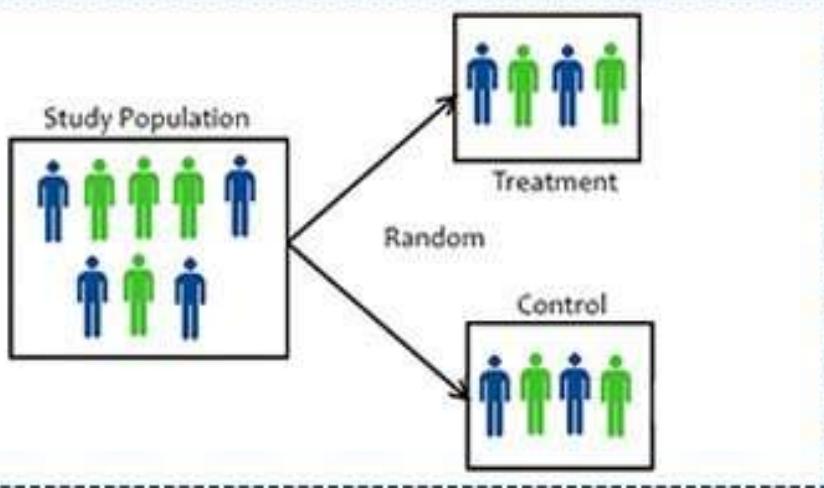
→ Are followed
over time →

To determine which
group has a higher
death rate

BEST EVIDENCE:

An experiment!

THE EQUIVALENT OF AN EXPERIMENT IN HEALTH RESEARCH IS THE RANDOMIZED CLINICAL TRIAL (RCT)



- Hypertensives randomly assigned to **Treatment** or **Control** group.
- Balance of characteristics in each group.
- Any difference in result is only due to treatment.
- Double-blind trial – neither participant nor doctor know which group .

An RCT is “gold standard” of evidence



Does lowering blood pressure reduce CVD events and mortality?

EVIDENCE FOR HYPERTENSION TREATMENT – **MAJOR RANDOMIZED CLINICAL TRIALS THAT INFORMED GUIDELINES**

• V.A.	1967	DBP, mean age = 51	Note that the early clinical trials focused on diastolic blood pressure and on younger people.
• HDPP	1979	DBP, ages 30-69	
• SHEP	1991	SBP, ages 60+	
• HYVET	2010	SBP, ages 80+	More recent trials focused on systolic blood pressure and somewhat older people.
• SPRINT	2015	SBP, ages 50+	

But there are still not many trials that include people over 80 yrs old.

AGES OF WHI WOMEN AS OF 2024

Age group	number	percent
75-79	3,487	7.5
80-84	14,892	31.9
85-89	15,243	32.7
90-94	9,110	19.5
95-107	3,892	8.3

27.8% of WHI women are 90 or older

Dr. Haring will discuss the connection between blood pressure and getting to live to at least age 90





A FIRST EXPERIMENT: BY SIR RONALD FISHER IN 1935

Can you tell the difference when tea is poured first and then milk, or milk is poured first and then tea?

- **Muriel Bristol** said she could tell, Fisher said she couldn't.
- **Experiment:** she was presented with 8 cups, in random order.
- **Result:** She identified all 8 correctly!
- **How likely?:** very unlikely that she could get them all right by chance alone,
- **Conclusion:** She was **not** just guessing and really could taste the difference.

