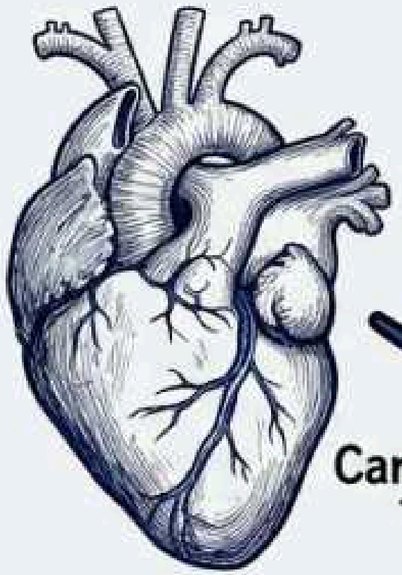
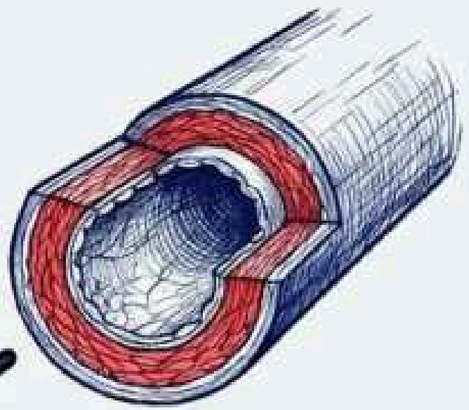
Hemodynamics & Blood Pressure Control

¶ 2.1



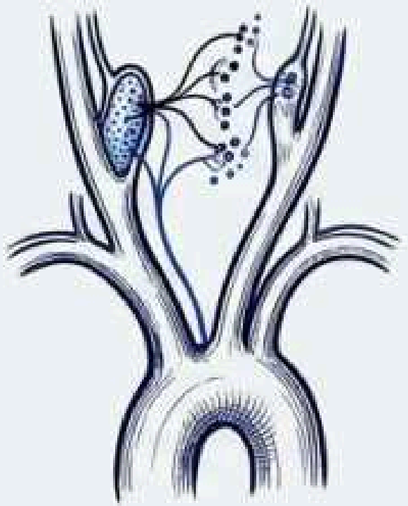
$BP = CO \times SVR$



Cardiac Output: The Pump

Systemic Vascular Resistance: The Arteries

Short-Term Control



Baroreceptor reflex provides immediate neural adjustments.

Long-Term Control

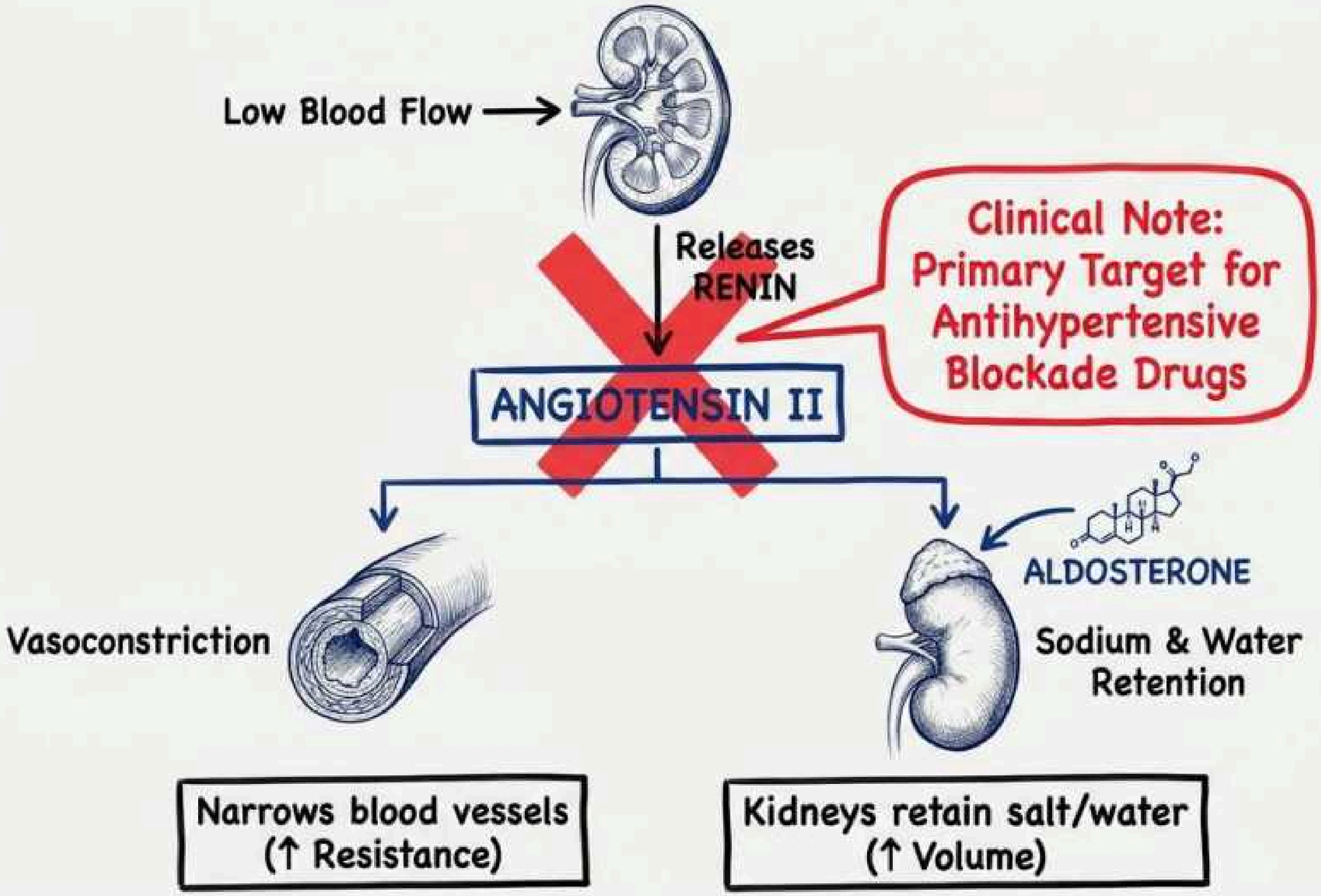


Na^+ H_2O

Kidneys dictate blood volume by adjusting salt and water retention.

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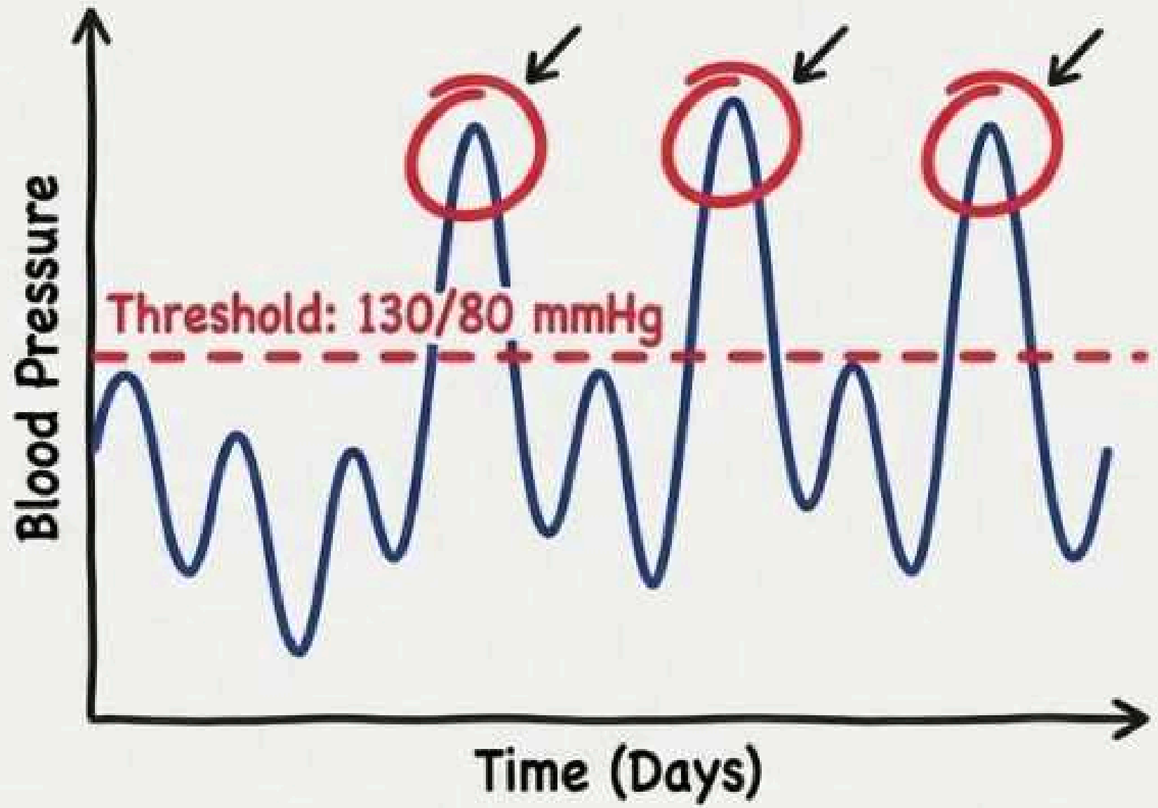
The Renin-Angiotensin-Aldosterone System (RAAS)

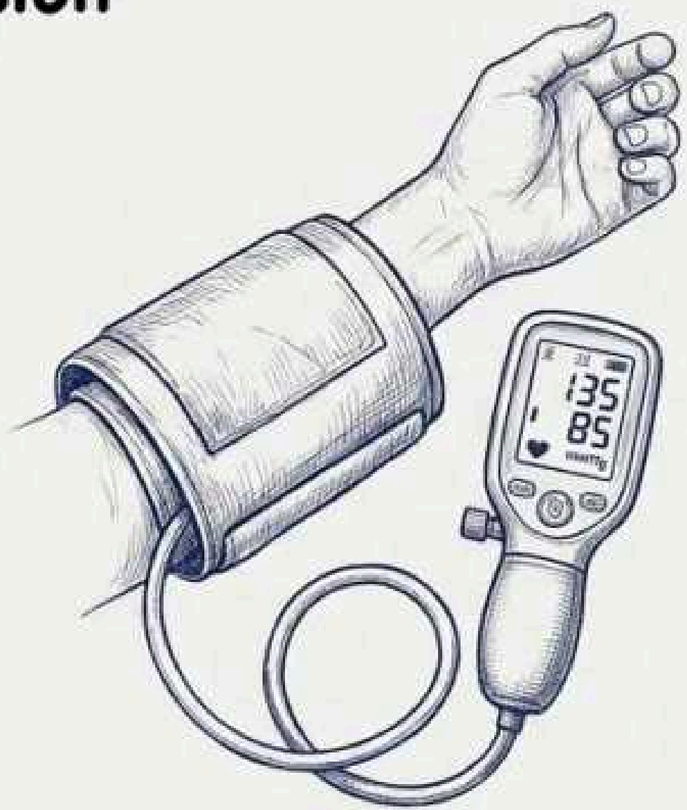


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¶ 2.3

Defining Hypertension





Definition:
Persistently elevated blood pressure above normal thresholds.

Diagnostic Criteria:
Consistently ≥ 130-140 Systolic
OR
≥ 80-90 Diastolic.

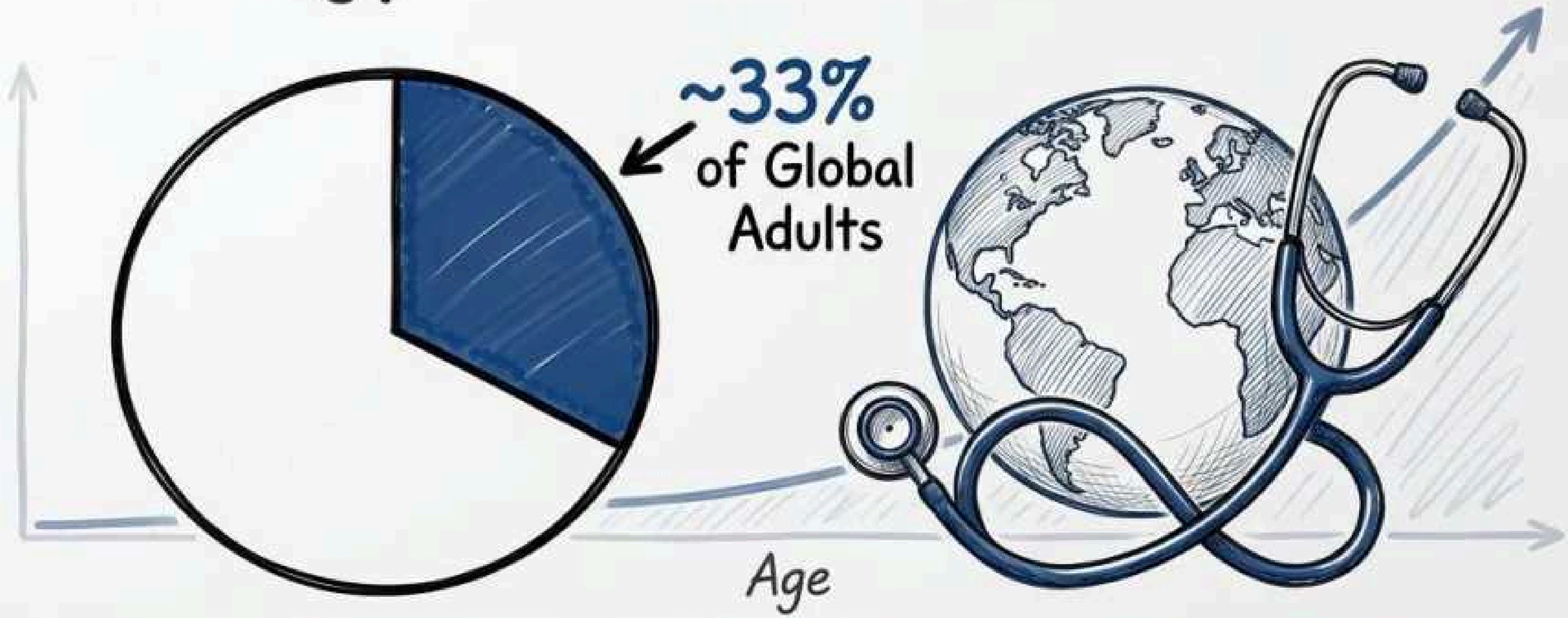
Protocol:
Requires repeated measurements over time due to natural diurnal fluctuations.

Best Practice:
Includes at-home monitored readings for maximum accuracy.

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Epidemiology: The Silent Killer

¶ 2.4



Prevalence

Affects roughly 1 in 3 adults worldwide.

Demographic Shift

Incidence rises significantly with advancing age.

The Silent Killer

Most patients are completely asymptomatic and feel entirely well.

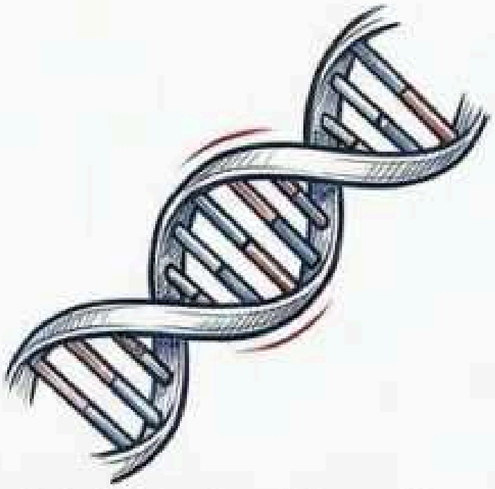
Clinical Imperative

Routine BP measurement is one of the most critical preventative checks in medicine.

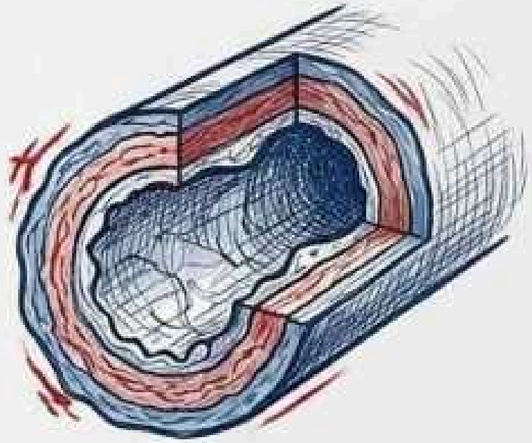
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¶ 2.5

Primary (Essential) Hypertension



Intrinsic: Genetic Predispositions



Intrinsic: Age-Related Arterial Stiffening

90%

Etiology: No single identifiable cause.



Modifiable: High Sodium Intake & Excess Body Weight



Lifestyle: Heavy Alcohol Consumption & Physical Inactivity

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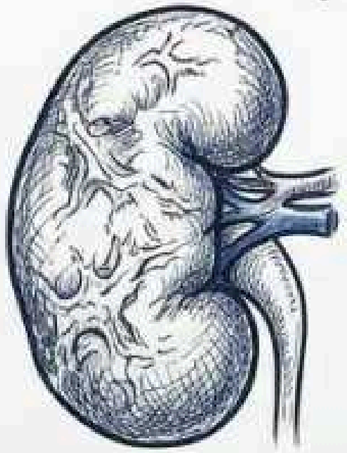
Secondary Hypertension

¶ 2.6

10% of Cases

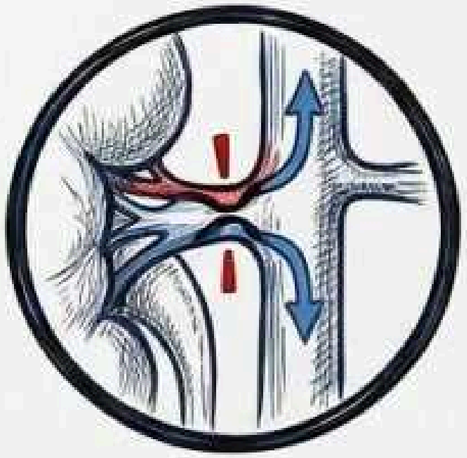
(Driven by specific, identifiable, and treatable underlying causes)

Renal Parenchymal



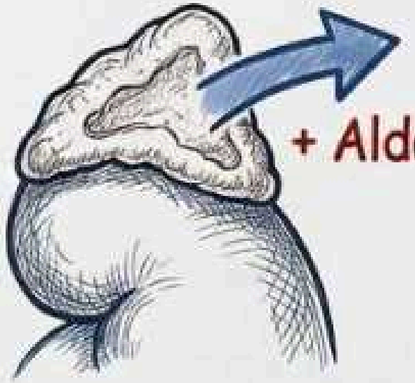
Chronic Kidney Disease

Vascular



Renal Artery Stenosis

Endocrine



Hormonal Conditions
(Adrenal Adenomas)

Index of Suspicion

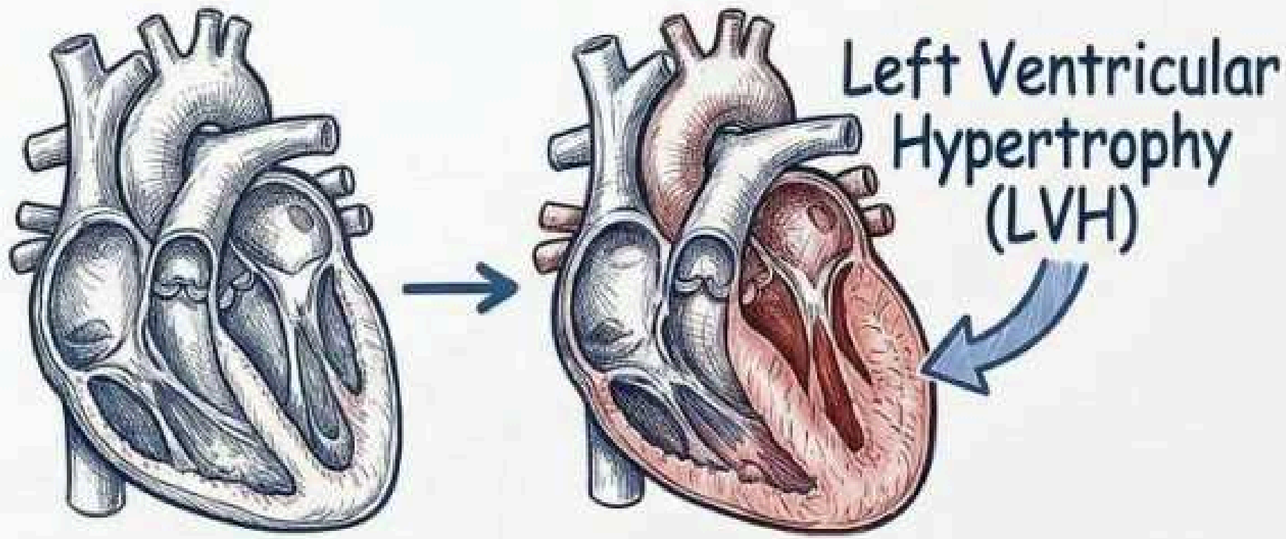
Maintain high clinical suspicion in unusually young patients, those with exceptionally high or treatment-resistant blood pressure, or when systemic clinical clues are present.

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End-Organ Damage: Cardiovascular System

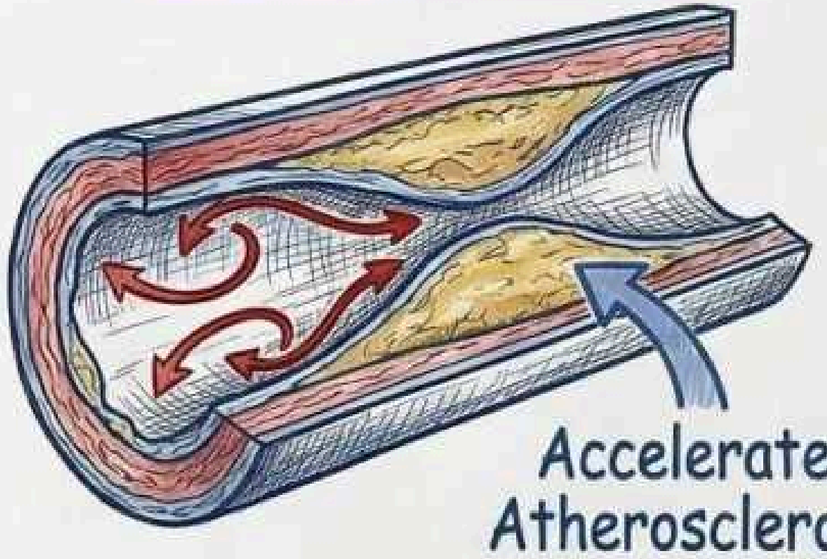
¶ 2.7

Cardiac Strain



Pumping against high resistance thickens heart muscle, eventually risking heart failure.

Vascular Trauma



High pressure physically damages arterial walls, accelerating plaque formation.

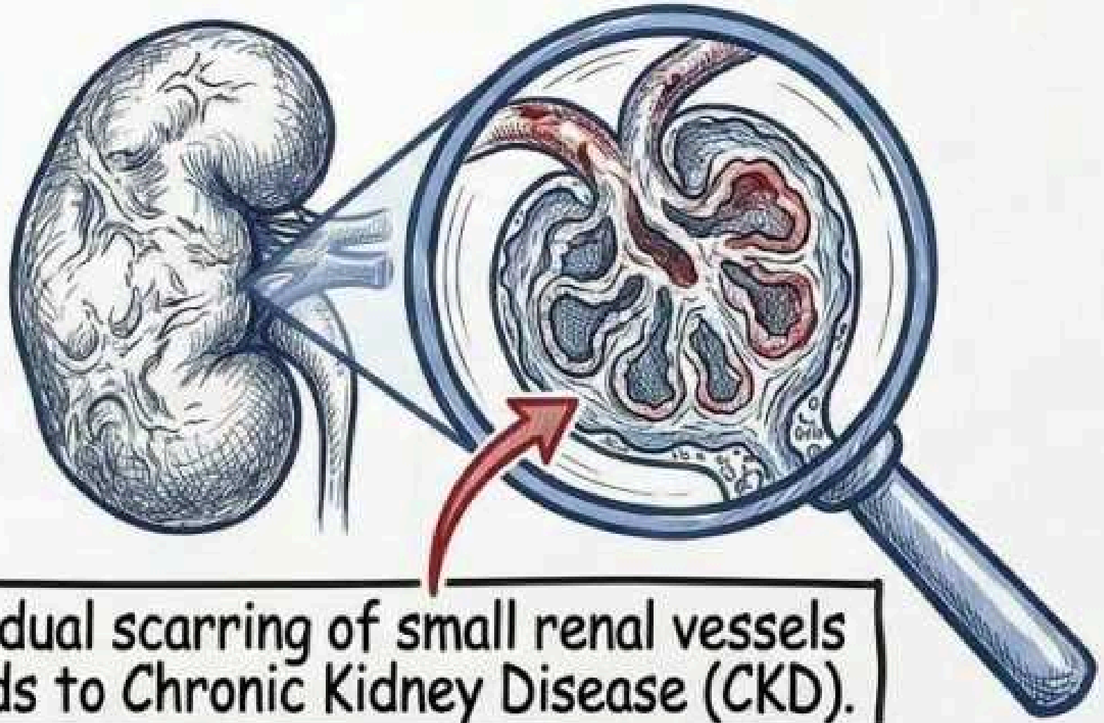
Clinical Outcomes: These combined structural effects make hypertension a primary driver of myocardial infarctions (heart attacks) and cerebrovascular strokes.

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End-Organ Damage: Microvasculature

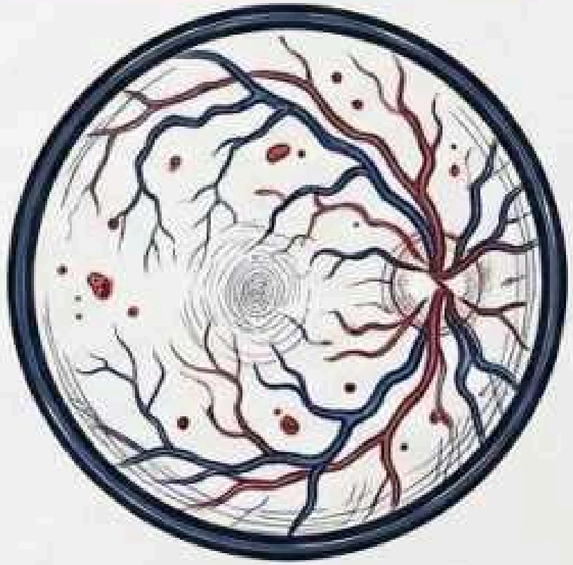
¶ 2.8

Renal Damage



Gradual scarring of small renal vessels leads to Chronic Kidney Disease (CKD).

Retinal Damage



Microvascular changes in the eyes are directly visible via ophthalmoscope.

Hypertensive Emergency: Very severe, rapidly rising blood pressure can inflict irreversible organ injury within hours to days, requiring emergency medical intervention.

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First-Line Treatment: Lifestyle Modifications

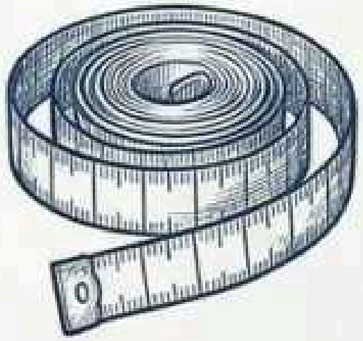
¶ 2.9

$\sum(\Delta \text{ Lifestyle}) \approx 1$ Pharmacological Agent

Each behavioral measure lowers BP by several points.
Combined, their efficacy matches a full-dose antihypertensive drug.



Dietary Adjustments: Reduce sodium intake.



Physical Adjustments: Lose excess body weight.



Physical Adjustments: Engage in regular exercise.



Substance Moderation: Strictly restrict alcohol intake.



Dietary Adjustments: Increase fruits, veg, and whole grains.

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Pharmacotherapy Classes

¶2.10

Drug Class	Target Organ/System	Mechanism of Action
RAAS Blockers	Systemic	Interrupts the Renin-Angiotensin biochemical cascade.
Calcium Channel Blockers (CCBs)	Arteries	Relaxes arterial smooth muscle to reduce resistance.
Thiazide Diuretics	Kidneys	Promotes renal excretion of Na^+ and H_2O to reduce fluid volume.

Strategy
Classes are frequently used in combination for synergistic effects to reach BP targets.

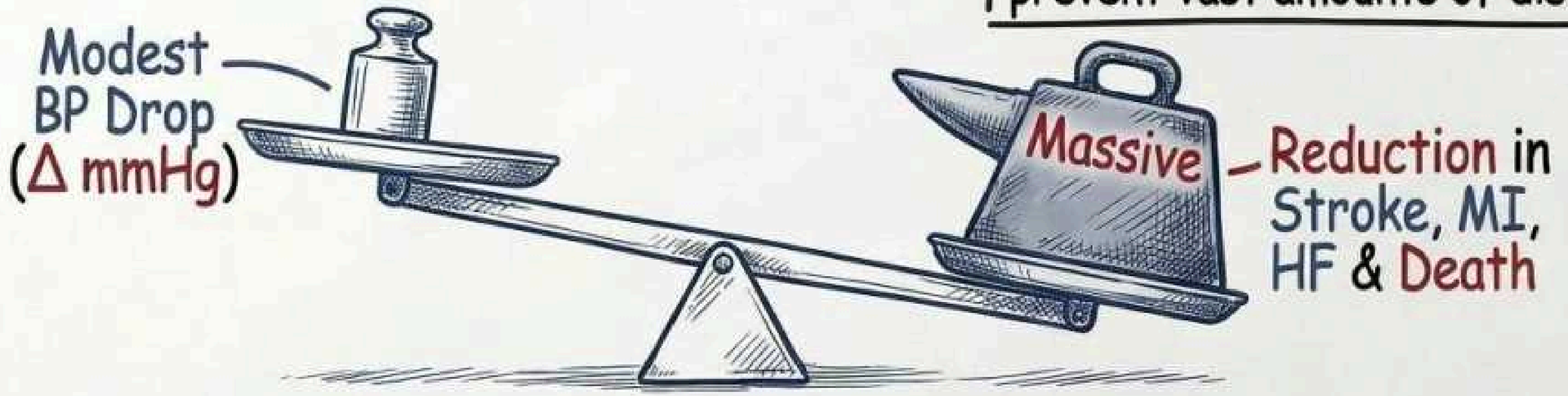
Selection Criteria
Drug choice is tailored to patient comorbidities. Driven by large-scale evidence base proving efficacy in preventing MI and stroke.

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The Population-Level Impact of Treatment ¶2.11

Individual Benefit
Substantially lowers the personal risk of stroke, heart attack, heart failure, and mortality.

Population Benefit
Because prevalence is so high (~33%), even tiny average BP reductions across a population prevent vast amounts of disease.



Consensus
The clinical and epidemiological benefits of pharmacological and lifestyle interventions are definitively established.

[Ref: MED 515 B]

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Summary & Next Steps

¶2.12

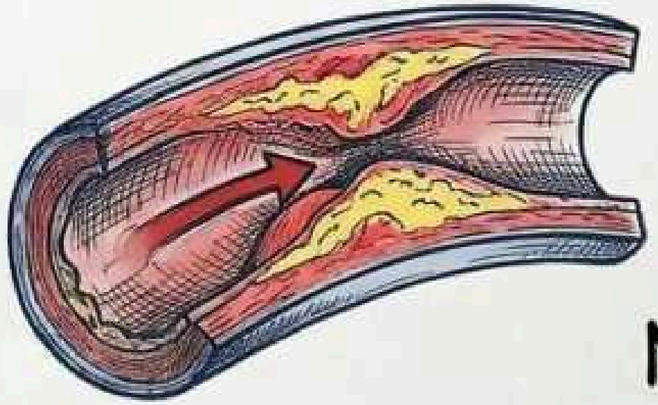
Heart
Vessels
Kidneys
Hormones

HYPERTENSION

Heart
Brain
Kidneys
Eyes

BP is dictated by cardiac output, vascular resistance, renal volume, and hormonal cascades.

Decades of silent elevation systematically damages end-organs.



Looking Ahead: Hypertension is a primary accelerator of arterial disease, leading directly into our next topic.

Next Module: Atherosclerosis

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