

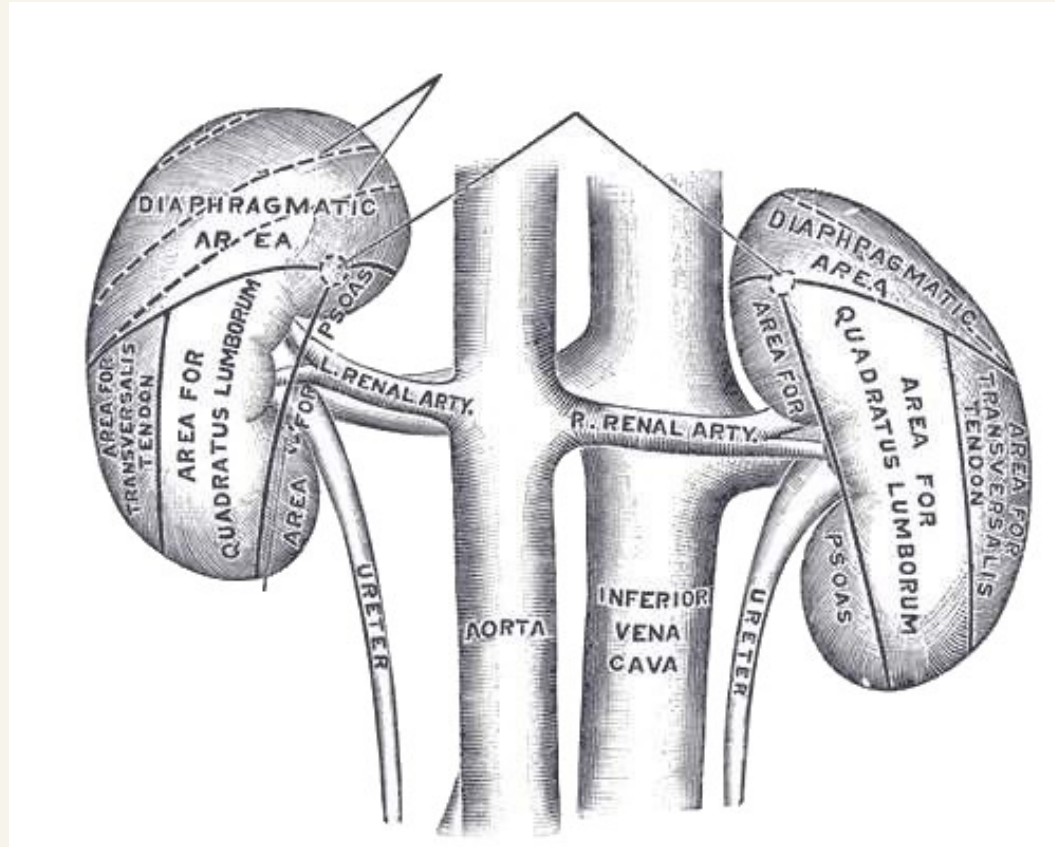
# Renal Artery Stenosis



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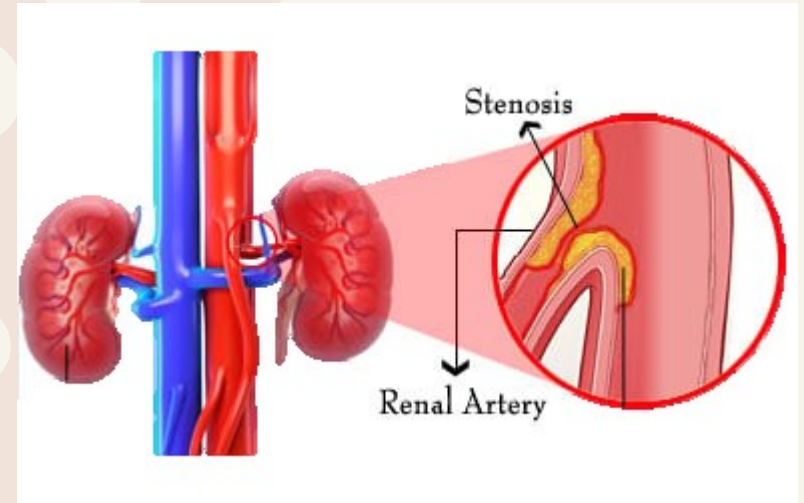
Yousef Al-nawaiesah  
Alaa Al-saraireh

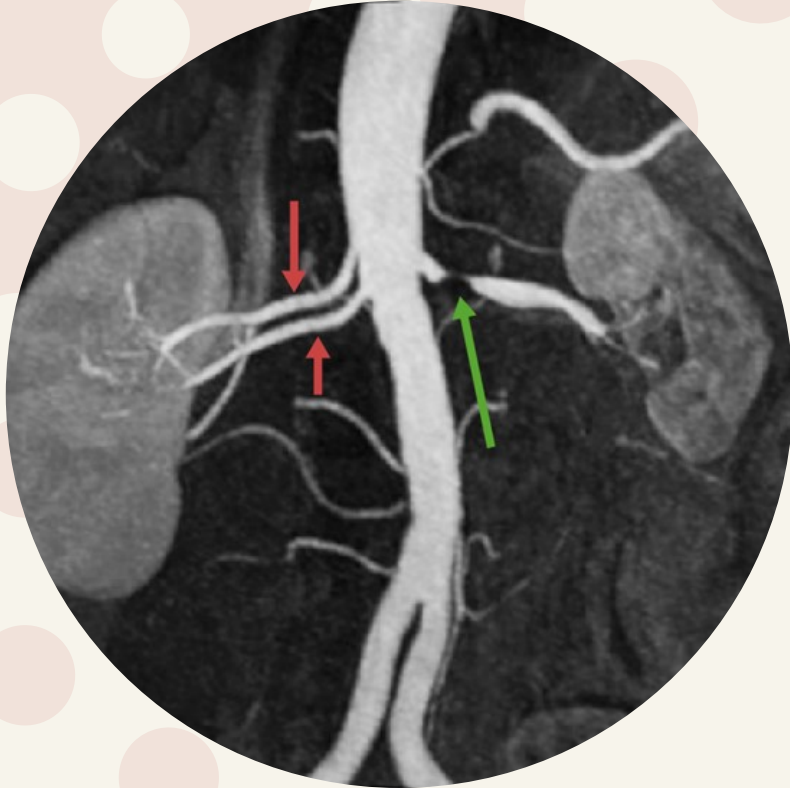
# Renal artery anatomy



# Definition

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## Definition

- narrowing of one or both renal arteries, preventing adequate blood flow to the kidneys.
- It is most commonly caused by **atherosclerosis** in old men , **fibromuscular dysplasia** in young women.

# Epidemiology



Accounts for **1-10%** of all hypertension cases.

3-10% of pediatric cases of secondary hypertension have a renovascular etiology



Age and sex preponderance depend on the underlying cause.

# Etiology



## Atherosclerosis

Occurs more often in men **> 50** years of age, increased risk in smokers.



## Fibromuscular dysplasia

stenosis of the small and medium-sized arteries due to proliferation of connective tissue and muscle fibers within the arterial vessel walls. mostly affects women **< 50** years of age.

# Etiology



## Other causes

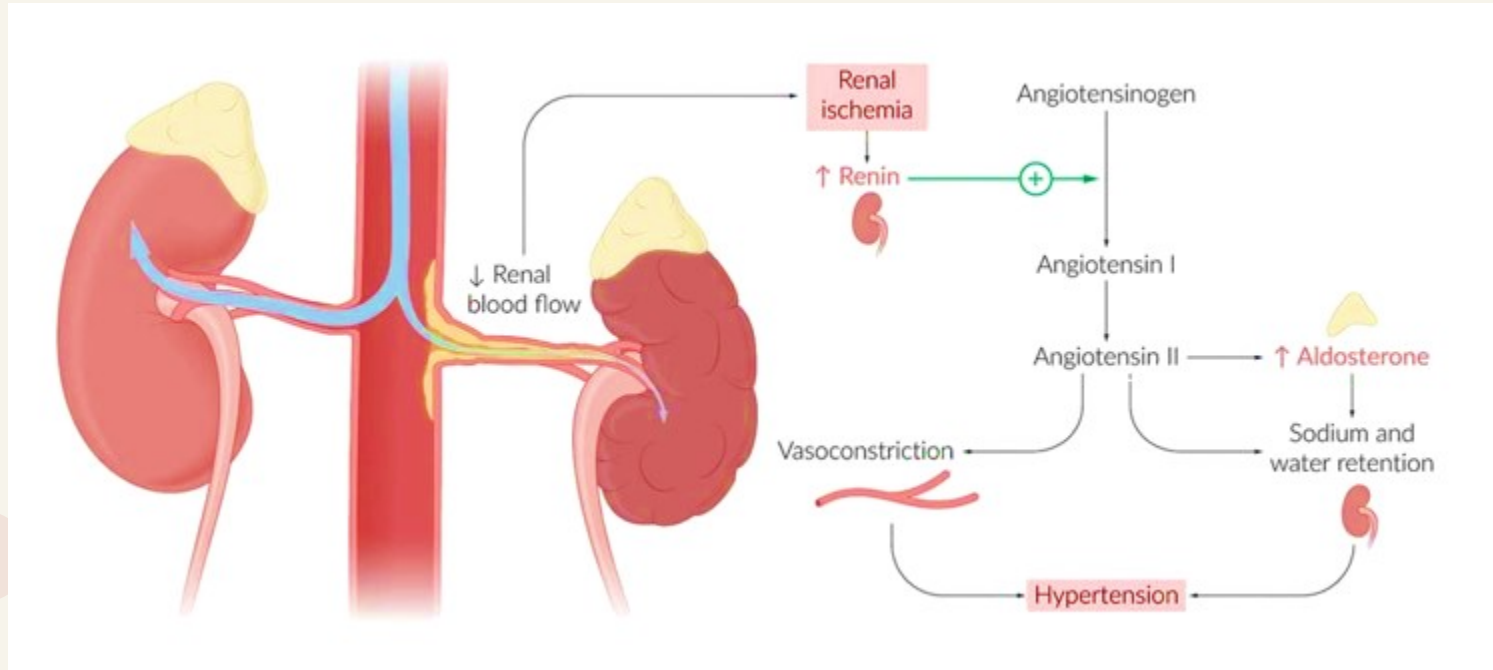
- Improper surgical anastomosis after renal transplantation.
- Vasculitis (e.g., Takayasu arteritis, polyarteritis nodosa, Kawasaki disease).
- Hereditary conditions (e.g., neurofibromatosis type 1).
- Extrinsic compression (e.g., abdominal aortic aneurysm, retroperitoneal tumors).
- Abdominal radiation therapy.

# Pathophysiology

- **Narrowing** of one or both renal arteries → **Obstruction** of renal blood flow  
→ **Ischemia** → Renin release and activation of the renin-angiotensin-aldosterone system  
→ Hyper-reninemic hyper-aldosteronism (increased renin leads to increased angiotensin then increased aldosterone) → Increased sodium retention and peripheral vascular resistance → Renovascular hypertension (**secondary hypertension**).
- Prolonged renal hypoperfusion → **Chronic** stimulation of the juxtaglomerular apparatus to secrete renin → Hyperplasia of the juxtaglomerular apparatus.
- No improvement in renal blood flow → **Ischemic renal injury** → Renal insufficiency and progressive renal atrophy (unilateral or bilateral depending on laterality of **RAS**).



# Pathophysiology



# Clinical Features

**Hypertension:** Severe (i.e., resistant to therapy) and/or early-onset (i.e., hypertension in individuals < 30 years of age).

**Abdominal bruit** heard over the flank or epigastrium: Present during both systole and diastole.

**Features of renal insufficiency** (e.g., nausea, edema).

## **Flash pulmonary edema :**

A type of sudden-onset cardiogenic pulmonary edema triggered by an acute physiological stressor (e.g., ischemia, drugs, acute valvular dysfunction, tachyarrhythmia), most commonly occurs in patients with hypertension and in such cases is considered a type of hypertensive emergency. The resulting sympathetic activation increases **afterload** and **preload**, thereby creating a vicious cycle of worsening forward flow and pulmonary edema.

# Diagnosis

- **Imaging** is required to confirm a clinical suspicion of renal artery stenosis.
- Laboratory findings may provide supportive evidence but are not diagnostic

## **Laboratory studies :**

- BMP.
- Evidence of renal insufficiency.
- Hypokalemia (uncommon).
- Urinalysis: Proteinuria may be present.
- Tests to identify the underlying cause.

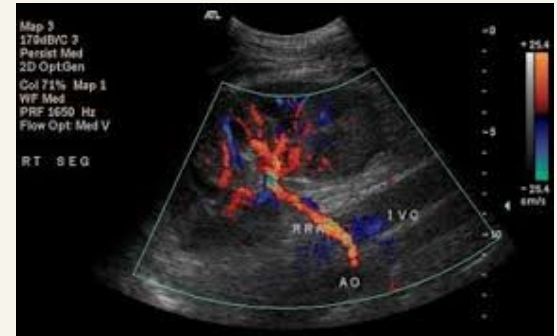
# Indications for Imaging

- Onset of hypertension **before** the age of **30** years.
- **Severe** hypertension after the age of **55** years.
- Hypertension resistant to a 3-drug antihypertensive regimen (**resistant HTN**).
- New-onset or worsening of **renal dysfunction** (↑ serum creatinine) after initiating ACE inhibitors or ARBs
- Acute worsening of previously controlled hypertension.
- Hypertension with acute end-organ damage (**hypertensive emergency**).
- Unexplained **renal atrophy** or asymmetry of **> 1.5 cm** between the kidneys.
- Unexplained acute pulmonary edema
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# Modalities:

## First-line (screening) tests:

- Renal dysfunction present: Duplex ultrasonography (US) or MR angiography without contrast.
- Normal or near-normal renal function: Duplex US, CT angiography, or MR angiography with gadolinium contrast.



renal Duplex ultrasonography

# Modalities:

**Second-line test: Catheter angiography** (Diagnostic gold standard):

- Consider if the index of suspicion for renal artery stenosis is high despite inconclusive noninvasive imaging.

- **Disadvantage:** Invasive modality associated with procedural complications, including radiation exposure and risk of contrast-induced nephropathy.



# Findings

- **Increased systolic flow velocity in the renal artery** (on duplex US).
- **Segmental narrowing of one or both renal arteries:**
  - ❑ Stenotic segment(s) can be complete or partial and solitary or multiple.
  - ❑ **Hemodynamically significant renal artery stenosis:**
    - $\geq 70\%$  narrowing of the renal artery diameter on imaging.
    - Or a **50–69%** narrowing of the renal artery diameter with evidence of increased renal arterial pressures
- **Ipsilateral renal atrophy** (decrease in kidney size).

# Findings

- **The site of renal artery stenosis differs according to the underlying etiology.**

**Proximal 1/3rd:** Typically, due to atherosclerotic disease



**Distal 2/3rds:** with stenotic segments alternating with aneurysms

**“string of beads”** appearance





# Treatment

## Medical therapy

- All patients with symptomatic or asymptomatic renal artery stenosis should be initiated on medical therapy to **control HTN** and **treat the underlying disease**.
- Multiple agents may be required to achieve blood pressure control.
- Regimens including a **RAAS inhibitor** are preferable.
- Options include:
  - **ACE inhibitors** (e.g., lisinopril).
  - **Angiotensin receptor blockers** (e.g., losartan).
  - **Calcium channel blockers** (e.g., amlodipine).
  - **Beta blockers** (e.g., metoprolol).

# Treatment

## Revascularization procedures

- Endovascular revascularization: Percutaneous transluminal renal angioplasty (PTRA).
- 
- Atherosclerotic disease: Balloon angioplasty **with** stenting of the stenotic segment(s).
- Fibromuscular dysplasia: Balloon angioplasty typically **without** stenting.
- Surgical revascularization: Aortorenal bypass surgery.



# Thanks

Do you have any questions?