III.Urinary Tract Obstruction (Obstructive Uropathy)

- Urinary tract obstruction increases susceptibility to

1. infection and
2. to stone formation,
3. and unrelieved obstruction almost always leads to permanent renal atrophy, termed hydronephrosis or obstructive uropathy.

- Fortunately, many causes of obstruction are surgically correctable or medically treatable.

- . Obstruction may be

a. sudden or insidious,
b. partial or complete,
c. unilateral or bilateral;
d. it may occur at any level of the urinary tract from the urethra to the renal pelvis.
e. It can be caused by lesions that are *intrinsic* to the urinary tract or *extrinsic* lesions that compress the ureter.[96]

Causes

1. urethral strictures,

2. meatal stenosis,

3.. bladder neck obstruction;

4. ureteropelvic junction narrowing or obstruction;

5.Urinary calculi

6. Benign prostatic hypertrophy

7. Tumors: carcinoma of the prostate, bladder tumors,

8. sloughed papillae or blood clots

9. Pregnancy

10. Functional disorders: neurogenic (spinal cord damage or diabetic nephropathy)

Hydronephrosis

- *Is the term used to describe dilation of the renal pelvis and calyces associated with progressive atrophy of the kidney due to obstruction to the outflow of urine.*
- Even with complete obstruction, glomerular filtration persists for some time because the filtrate subsequently

diffuses back into the renal interstitium and perirenal spaces, where it ultimately returns to the lymphatic and venous systems.

- Because of this continued filtration, the affected calyces and pelvis become markedly dilated.
- The high pressure in the pelvis

a. is transmitted back through the collecting ducts into the cortex, causing renal atrophy

b. It also compresses the renal vasculature of the medulla, causing a diminution in inner medullary blood flow.

- The medullary vascular defects are initially reversible, but lead to medullary functional disturbances the initial functional alterations caused by obstruction are largely tubular, manifested primarily by impaired concentrating ability

- Only later does the GFR begin to fall.
- *Obstruction also triggers an interstitial inflammatory reaction, leading eventually to interstitial fibrosis*

Morphology

1.Sudden and complete obstruction

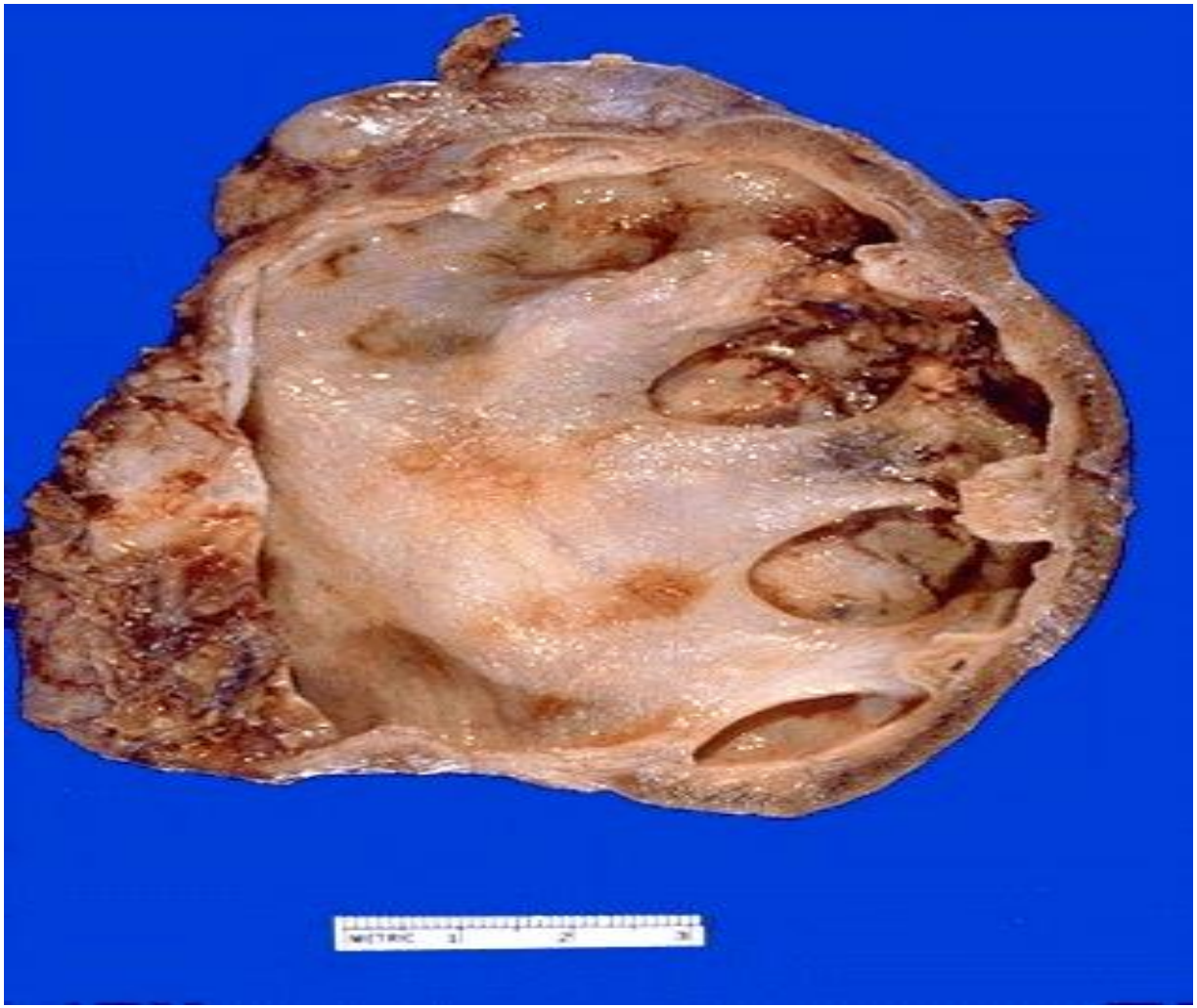
- The glomerular filtration is reduced.
- It leads to mild dilation of the pelvis and calyces and sometimes to atrophy of the renal parenchyma.

2. Subtotal obstruction

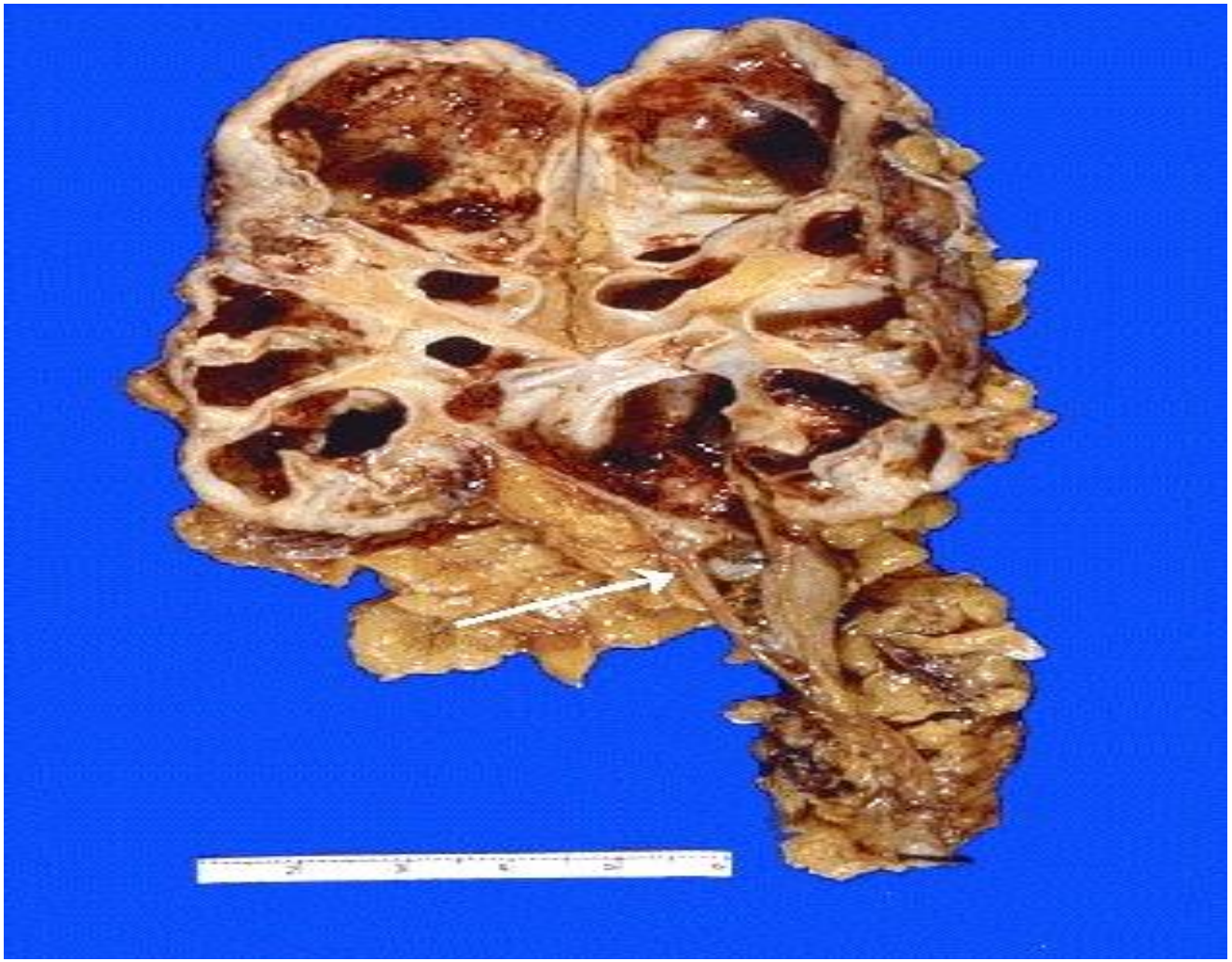
- The glomerular filtration is not suppressed,
- and progressive dilation ensues.

- The kidney may be slightly to massively enlarged, depending on the degree and the duration of the obstruction.
- In far-advanced cases the kidney may become transformed into a thin-walled cystic structure having a diameter of up to 15 to 20 cm with striking parenchymal atrophyand thinning of the cortex.

Hydronephrosis



hydronephrosis



Clinical Features.

1. Unilateral complete or partial hydronephrosis

- May remain silent for long periods, since the unaffected kidney can maintain adequate renal function.
- It is regrettable that this disease tends to remain asymptomatic, because in its early stages, perhaps the first few weeks, relief of obstruction leads to reversion to normal function.

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2. In bilateral partial obstruction

- The earliest manifestation is inability to concentrate the urine, reflected by polyuria and nocturia.
- Some patients have acquired distal tubular acidosis, renal salt wasting, secondary renal calculi,
- and a typical picture of chronic tubulointerstitial nephritis with scarring and atrophy of the papilla and medulla.

3.Complete bilateral obstruction

- Results in oliguria or anuria
- Is incompatible with survival unless the obstruction is relieved.
- Curiously, after relief of complete urinary tract obstruction, postobstructive diuresis occurs..

IV. Vascular diseases of the kidney

- The majority of vascular diseases of the kidney are secondary to systemic diseases such as vasculitis and hypertension

1. Hypertensive vascular diseases

A- Benign Nephrosclerosis

- Is the renal pathology associated with sclerosis of renal arterioles and small arteries.
- The resultant effect is focal ischemia of parenchyma supplied by sclerotic vesseles and associated with

a. Increasing age,

b. More frequent in blacks than whites

c. May be seen in the absence of hypertension

Note: Hypertension and diabetes mellitus increase the incidence and severity of the lesions.

- The vascular lesions are caused by extravasation of plasma proteins through injured endothelium and by increased deposition of basement membrane matrix

Morphology.

- On histologic examination there is:

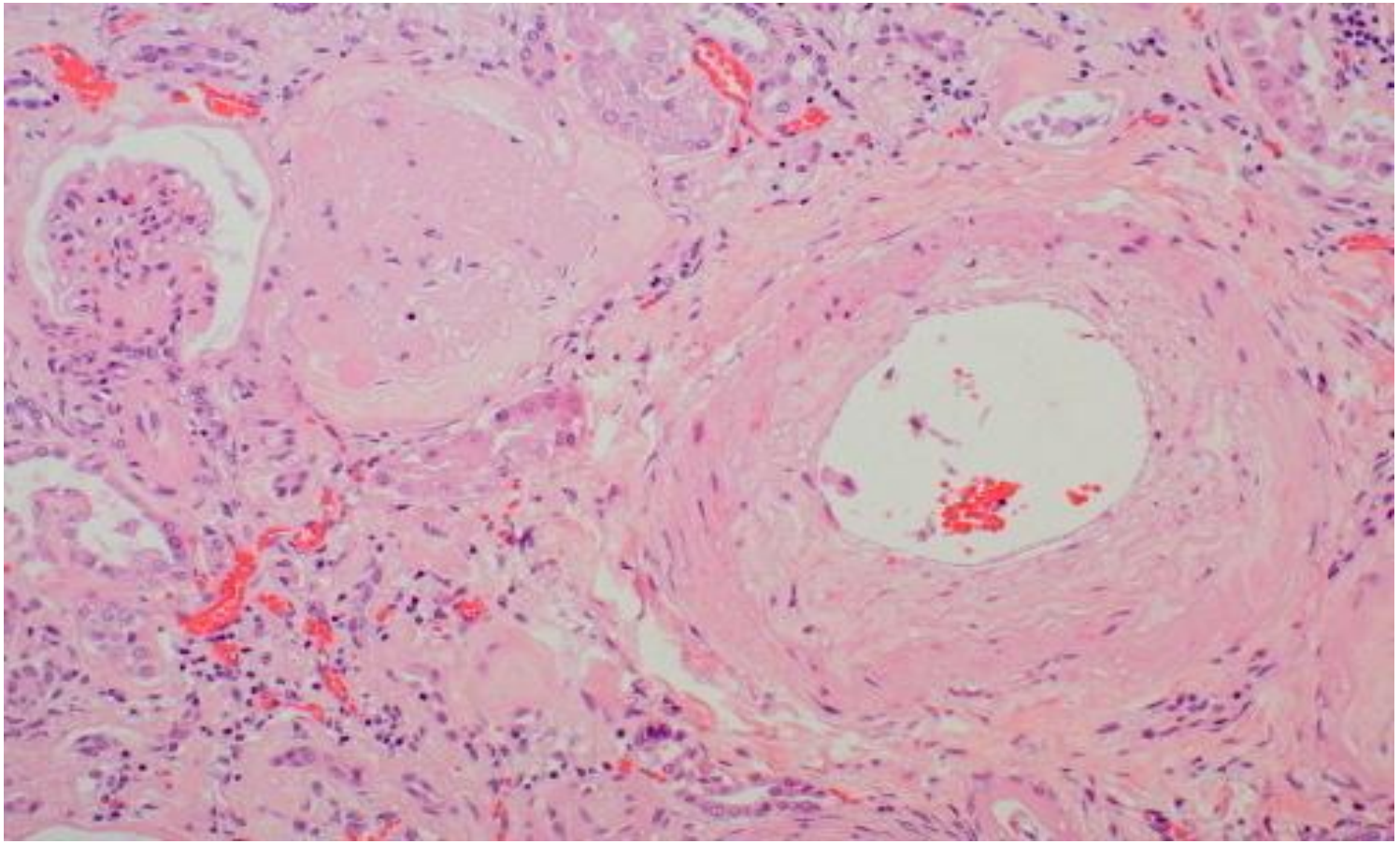
a. Narrowing of the lumens of arterioles and small arteries, caused by thickening and hyalinization of the walls called **(hyaline arteriolosclerosis)**

b. The kidney parenchyma showspatchy ischemic atrophy, which consists of

(1) foci of tubular atrophy and interstitial fibrosis

(2) sclerosis of some glomeruli

Hyaline arteriosclerosis



Clinical Features.

- It is unusual for uncomplicated benign nephrosclerosis to cause renal insufficiency or uremia.
- There are usually moderate reductions in renal blood flow, but the GFR is normal or only slightly reduced.

- The hypertensive patients with benign nephrosclerosis who are at increased risk of developing renal failure:

a. people of African descent,

b. people with more severe blood pressure elevations,

c. persons with diabetes

Malignant Hypertension and Accelerated Nephrosclerosis

- *Malignant nephrosclerosis is the form of renal disease associated with the malignant or accelerated phase of hypertension.*
- This dramatic pattern of hypertension may occasionally develop in previously normotensive individuals but often is superimposed on preexisting essential benign hypertension,

Or secondary forms of hypertension such as underying chronic kidney disease

-Malignant hypertension is relatively uncommon, occurring in 1% to 5% of all people with elevated blood pressure.

Pathogenesis.

- Malignant hypertension causes

1. Endothelial injury causes increased permeability of the small vessels to fibrinogen and other plasma proteins,
2. focal death of cells of the vascular wall, and platelet deposition (called) *fibrinoid necrosis* of arterioles and small arteries,with intravascular thrombosis

3. PDGF cause hyperplasia of intimal smooth muscle of vessels, resulting in the hyperplastic arteriolosclerosis

Effects on kidney

1- The kidneys become markedly ischemic.with severe involvement of the renal afferent arterioles,

2. The renin-angiotensin system receives a powerful stimulus, so patients with m*alignant hypertension have markedly elevated levels of plasma renin*.

3. Angiotensin II causes intrarenal vasoconstriction, and the attendant renal ischemia perpetuates renin secretion .

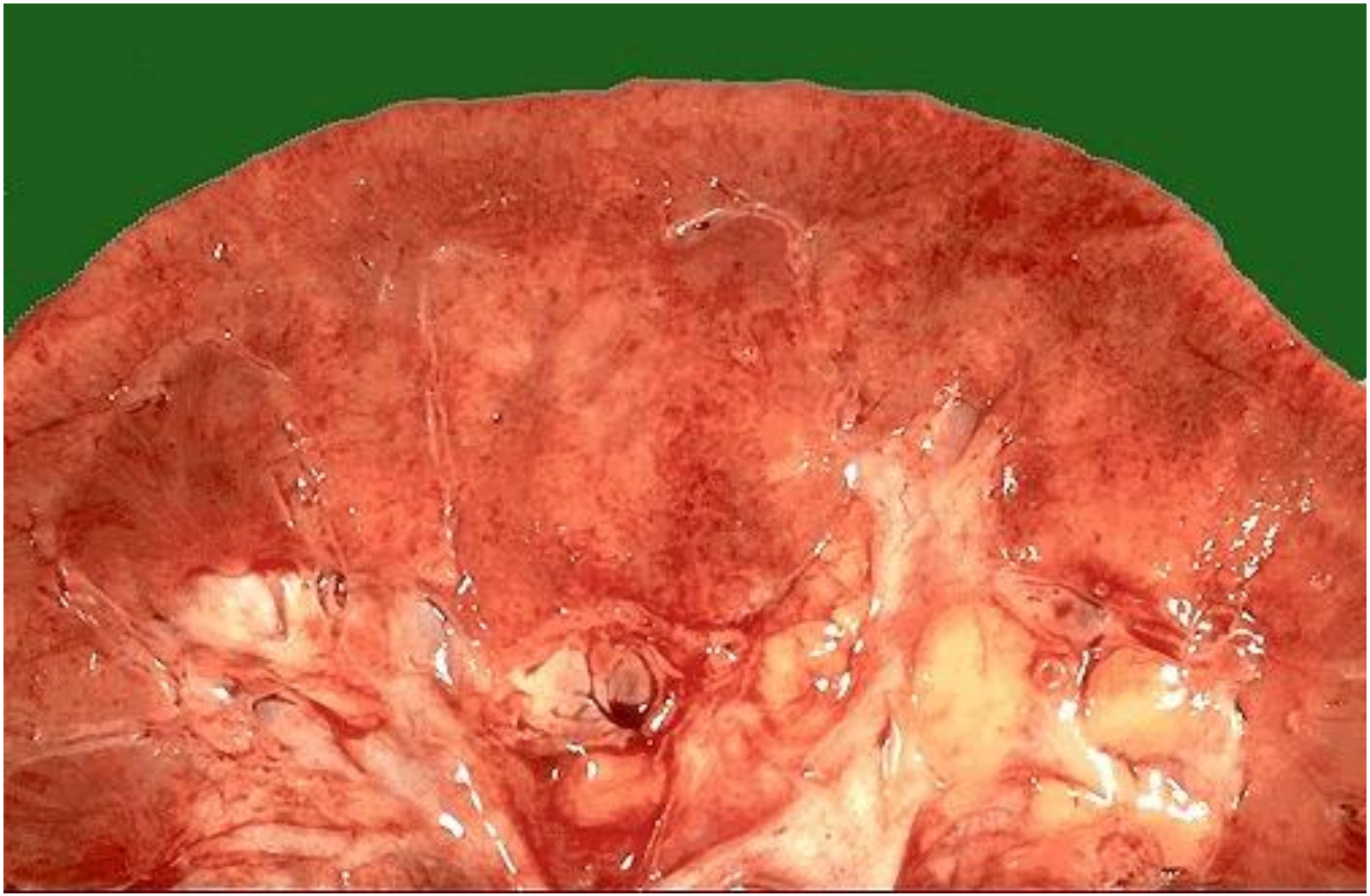
- Other vasoconstrictors (e.g., endothelin) and loss of vasodilators (nitric oxide) may also contribute to vasoconstriction.
- All these lead to decrease GFR

Morphology.

- **On gross inspection**

- Small, pinpoint petechial hemorrhages may appear on the cortical surface from rupture of arterioles, giving the kidney a peculiar “flea-bitten” appearance.

Flea bitten appearance in malignant nephrosclerosis



- Microscopic Examination: :

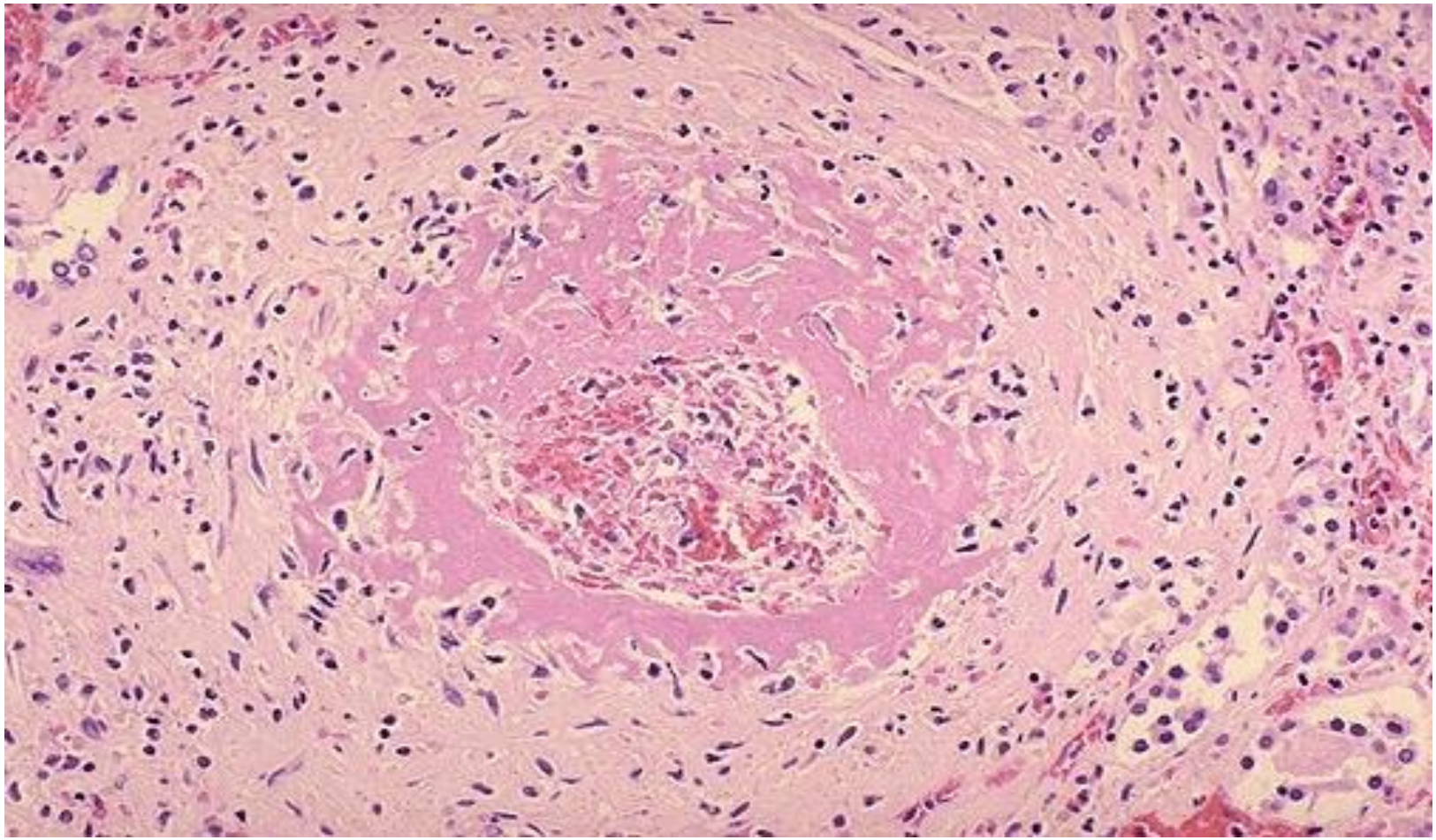
1. **Fibrinoid necrosis of arterioles.**

- This appears as an eosinophilic granular change in the blood vessel wall with limited inflammatory infiltrate within the wall,

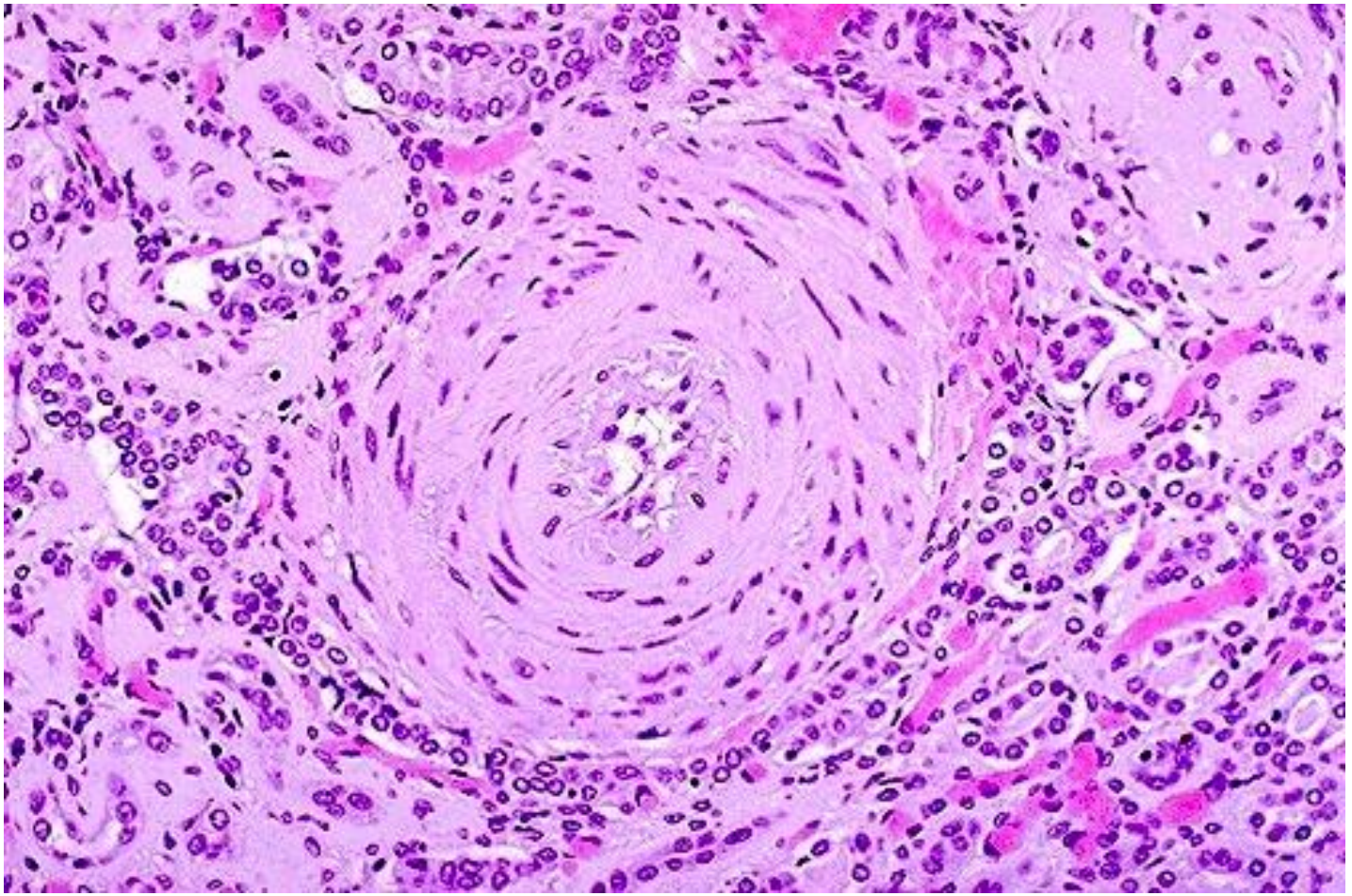
2. Hyperplastic arteriolitis,

- *In the interlobular arteries and arterioles*
- *is intimal thickening caused by a proliferation*

Fibrinoid necrosis



Hyperplastic arteriolitis



of elongated, concentrically arranged smooth muscle cells, together with fine concentric layering of collagen called ***onion-skinning*** *appearance*

Note: The lesion,correlates well with renal failure in malignant hypertension

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Clinical Features.

- The full-blown syndrome of malignant hypertension is characterized by

a. systolic pressures greater than 200 mm Hg and

b. diastolic pressures greater than 120 mm Hg

c. papilledema, encephalopathy,

d. and renal failure

e. retinal hemorrhages

-Initiallly there marked proteinuria and microscopic or sometimes macroscopic hematuria but no significant alteration in renal function.followed soon by renal failure

- The syndrome is a true medical emergency

2.Renal Artery Stenosis

- Unilateral renal artery stenosis is a relatively uncommon cause of hypertension, responsible for 2% to 5% of cases,
- ***It is important because it represents a potentially curable form of hypertension with surgical treatment..***

Pathogenesis.

- The hypertensive effect, at least initially, is due to stimulation of renin secretion by cells of the juxtaglomerular apparatus and the subsequent production of the vasoconstrictor angiotensin II.

Note:

- *Large proportion of individuals with renovascular hypertension have elevated plasma or renal vein renin levels*

-, and almost all show a reduction of blood pressure when given drugs that block the activity of angiotensin II.

- Furthermore, unilateral renal renin hypersecretion can be normalized after renal revascularization, usually resulting in a decrease in blood pressure

Morphology.of causes of renal artery stenosis

1. **Atheromatous occlusion of the origin of the renal artery**

- Is the most common cause of renal artery stenosis (70% of cases)

2. **Fibromuscular dysplasia of the renal artery.**

- These lesions are subclassified into

a. intimal,

b. medial, by far the most common

c.adventitial hyperplasia, the medial type being

- This lesion is:

1. More common in women
2. and tend to occur in younger age groups (i.e., in the third and fourth decades

Note

- The lesions may consist of a single well-defined constriction or a series of narrowings, usually in the middle or distal portion of the renal artery.
- May be bilateral.

Morphology

1. Ischemic kidney
2. The arterioles in the ischemic kidney are usually protected from the effects of high pressure, thus showing only mild arteriolosclerosis.
3. The contralateral nonischemic kidney may show more severe arteriolosclerosis, depending on the severity of the hypertension

Clinical Course.

- Few distinctive features suggest the presence of renal artery stenosis,

1. On occasion, a bruit can be heard on auscultation of the affected kidneys.
2. Elevated plasma or renal vein renin
3. Response to angiotensin-converting enzyme inhibitor

- Arteriography is required to localize the stenotic lesion.
- The cure rate after surgery is 70% to 80% in well-selected cases.