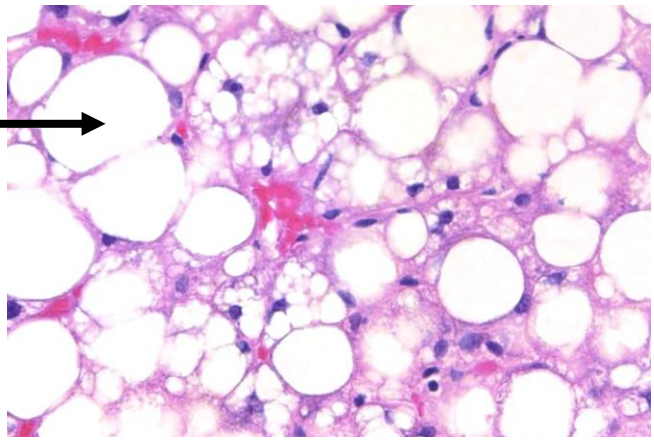
Last updated: 12/17/2020

Prepared by Kurt Schaberg

Donor Liver Frozen Section Evaluation

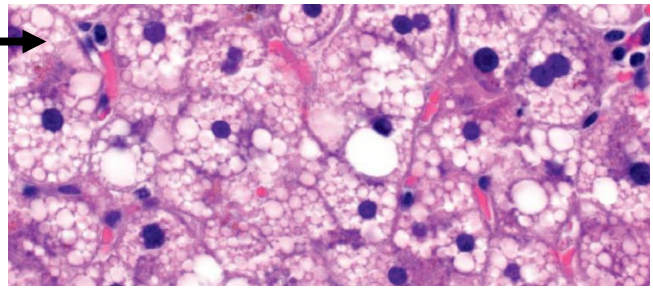
Based on a presentation by Dr. Neeraja Kambham, Stanford University Department of Pathology

Steatosis

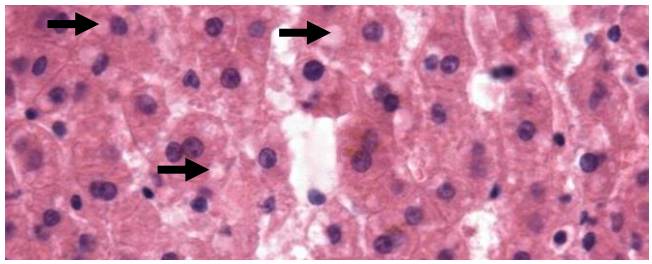


Macrovesicular steatosis *(Very important!!)*
Single Large fat droplet that push the nucleus to the side. Often scattered smaller droplets mixed in (still part of macrovesicular pattern).
Common causes: Alcohol, NASH/metabolic syndrome
Estimate % of total liver area involved.

>30%→ Relative contraindication (*may* not use organ)
>60%→ Absolute contraindication (will not use organ)
Associated with severe **reperfusion injury**



Microvesicular steatosis *(Not too important)*
Diffuse small fat droplets→ foamy appearance
Can occur following warm ischemia.
Does *not* seem to adversely impact transplant outcome.



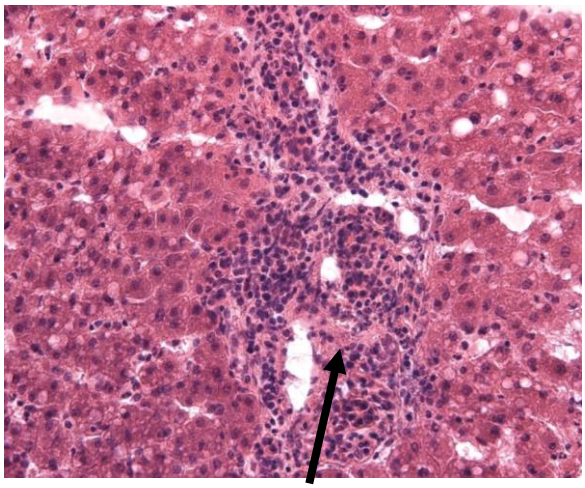
Often lumped in with microvesicular steatosis by some:
"Intermediate" droplet fat
Sometimes you'll see occasional fat droplets of intermediate size that do not displace the nucleus. This is of *no* clinical significance. Some people include this in the microvesicular count, others do not.

Portal Inflammation/Fibrosis

Often reported using a scheme based on the "Batts and Ludwig" system.

What is usually "too much" for transplantation?
Inflammation grade ≥2 ("Mild")
Fibrosis stage ≥ 2 ("Portal tracts with fine, irregular fibrous extensions that mostly don't extend between portal tracts, but rare bridging is allowed").

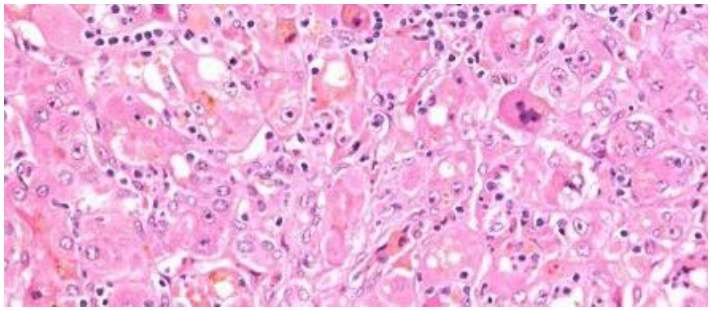
Common DDX: Viral hepatitis, Autoimmune hepatitis, Drug reaction



Portal inflammation grade 1 (Minimal), usually acceptable for transplantation

Good review article: Melin C, et al. Approach to intraoperative consultation for donor liver biopsies. Arch Pathol Lab Med. 2013.

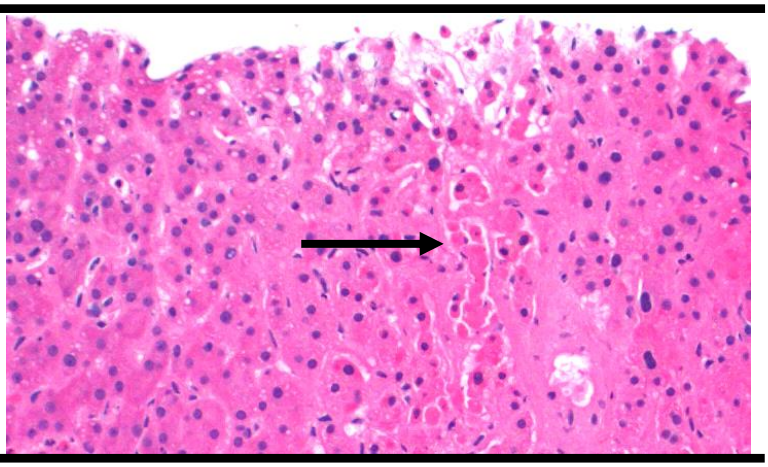
Lobular inflammation



Inflammation of the lobule (hepatocytes outside of the portal tracts), often with associated lobular disarray, ballooning, and/or acidophil bodies.

Common DDX: Acute viral hepatitis, Drug reaction,

Necrosis

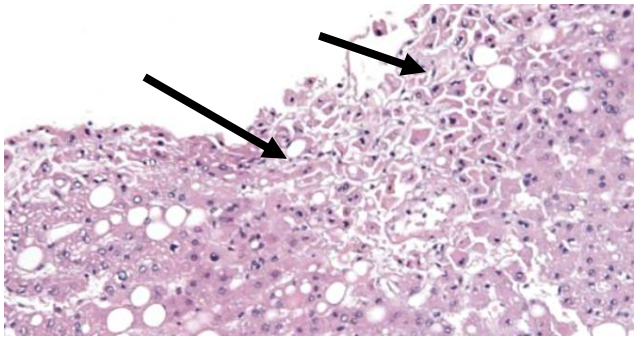


Coagulative necrosis with loss of cellular detail.
Minimal inflammation.
Often **<u>pericentral location</u>**.

Common cause: <u>Shock</u>
Histologically identical: Acetaminophen toxicity

What is usually "too much" for transplantation?
≥10% of liver area

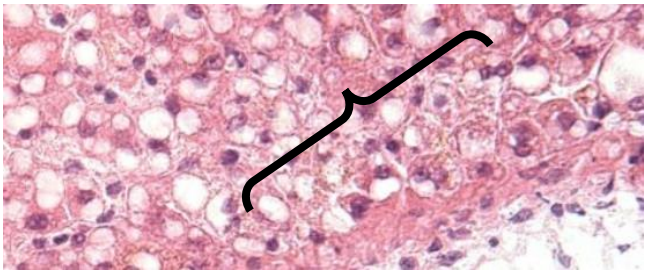
Saline Artifact



Saline can cause a variety of <u>artifacts</u> including:
Edge tissue degeneration (shriveled, pink hepatocytes)
→ easy to falsely interpret at necrosis, but edge ***<u>location</u>*** is a key clue!

Can also cause cellular swelling and edema centrally.

Lipofuscin

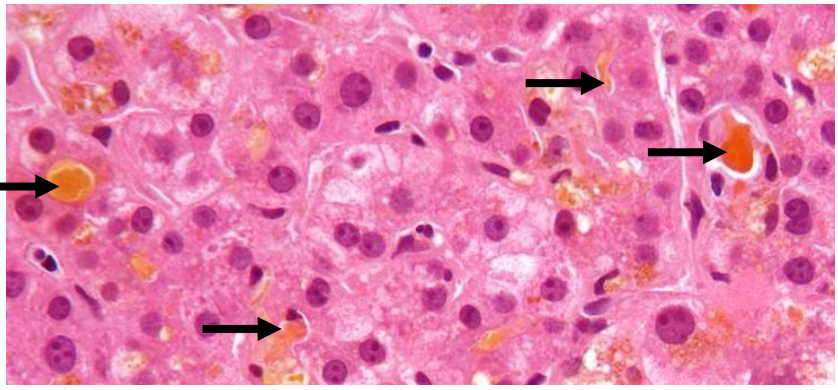


Fine yellow-brown pigment granules often incidentally seen near central veins.

Increased quantity seen with aging, but can see in kids ("Wear and tear pigment").

No clinical significance.

Cholestasis



Visible bile: Yellowish, brownish, green pigment.

Can be located in canaliculi (between hepatocytes) or within hepatocytes.

Always pathological. Can be seen with many conditions including bile duct obstruction, sepsis, drug reaction, etc…

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Donor Kidney Frozen Section Evaluation

Based on a presentation by Dr. Neeraja Kambham, Stanford University Department of Pathology.

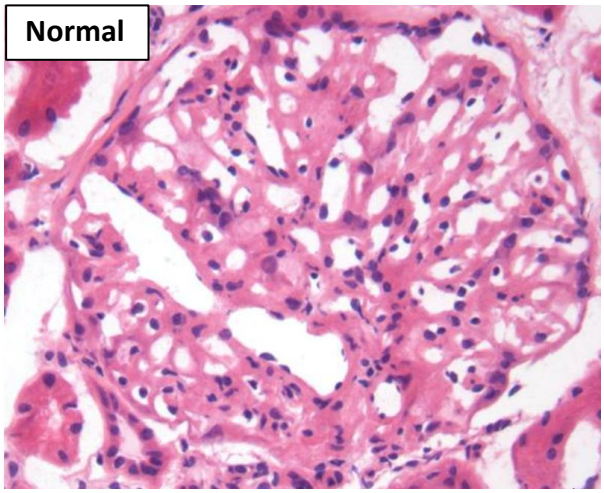
Main Purpose: to evaluate for "***unrecoverable***" loss of renal mass/function. This includes ***scarring*** such as glomerulosclerosis, interstitial fibrosis, tubular atrophy, and chronic vascular disease, and, rarely, infarction.

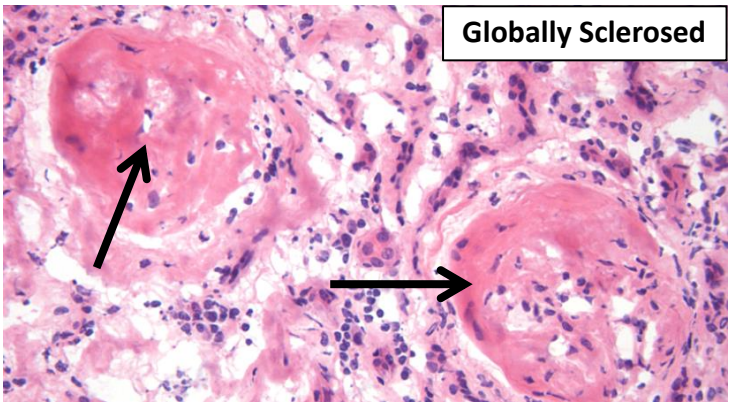
Glomeruli

Count the total number of glomeruli and the number that are globally sclerosed and then calculate the % global glomerulosclerosis

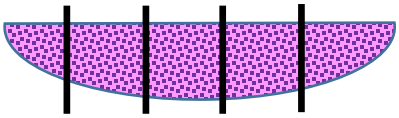
Global sclerosis (see below) is scarring/hyalinization of more than ½ of a glomerulus → seen with both normal aging and with chronic kidney disease

Also look at capillary loops → should be open & delicate





Pro Tip: When counting glomeruli, divide the wedge biopsy into several areas with a dotting pen and count each area and then add them together.

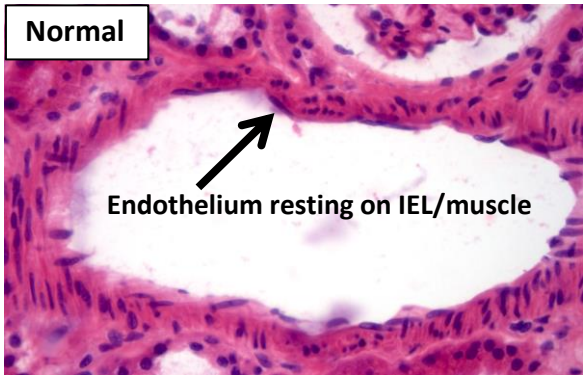


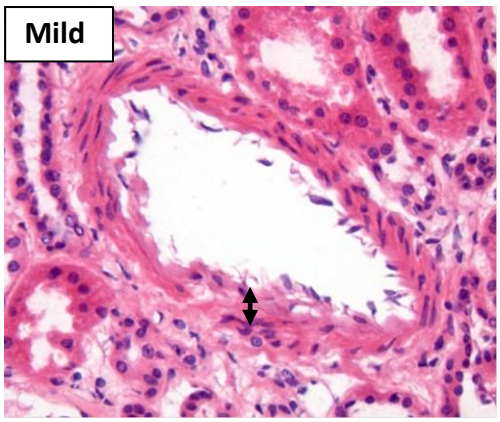
Arterial Sclerosis

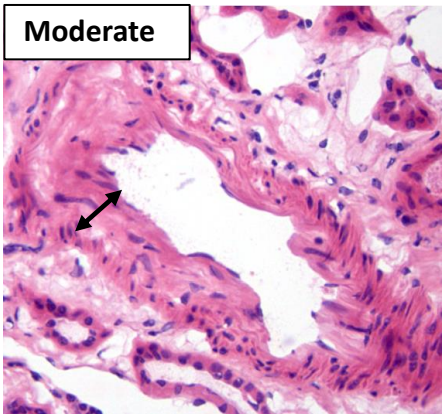
Normally, the **endothelium should essentially be on top of the internal elastic lamina** (IEL) and smooth muscle layers.

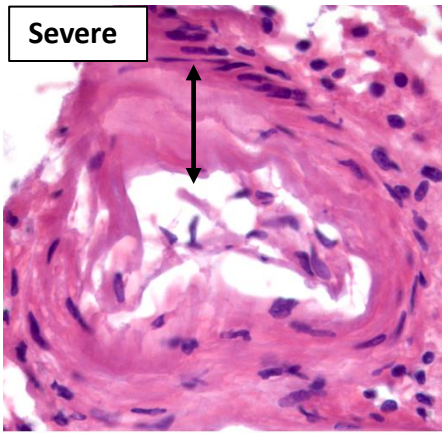
Hypertension & Aging → Deposition of collagenous extracellular matrix and vascular smooth muscle cell growth between endothelium and IEL → thickening of intima ("intimal fibroplasia") → narrowing of vessel lumen

See how the intimal thickness (↕) widens below.





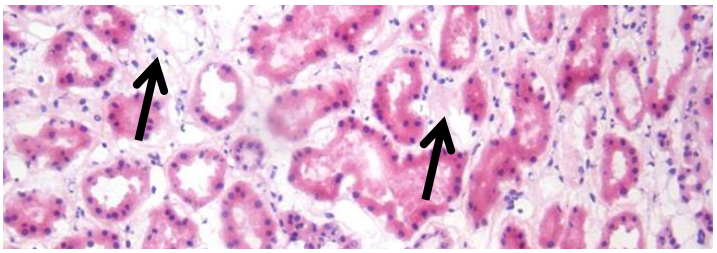


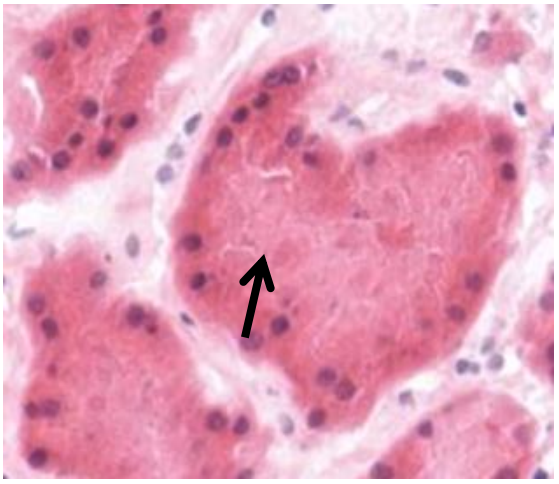


Normal Tubules

Proximal convoluted tubules should have abundant fluffy granular eosinophilic cytoplasm and be close to one another.

With freezing and saline transport, may have lots of ***artifactual*** space between tubules (see below, vs fibrosis)





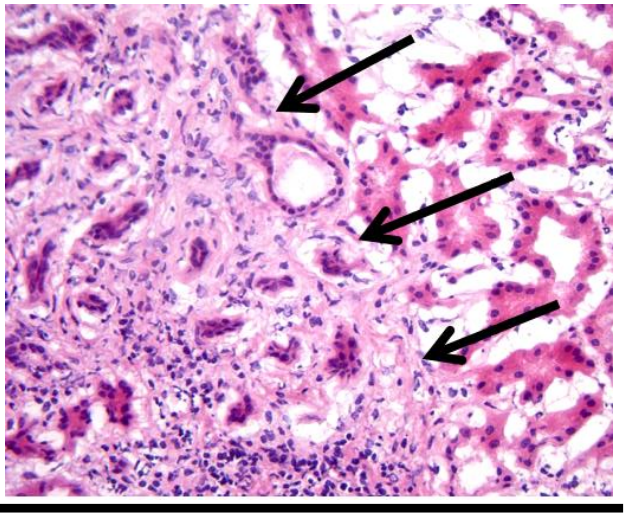
Interstitial Fibrosis and Inflammation

Intimal fibrosis, inflammation, and tubular atrophy are seen **together** as part of nephrosclerosis (along with global glomerulosclerosis). Fibrosis appears pink.

This contrasts with the artifactual interstitial fluid between tubules (see above), with no tubular atrophy or inflammation. Artifactual clearing appears clear.

Interstitial inflammation is usually primarily lymphocytic.

Grade using provided cut-offs.

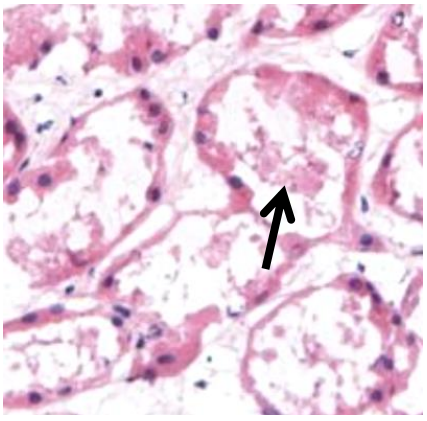


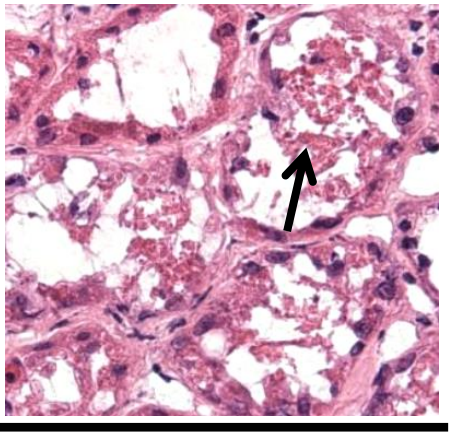
Acute Tubular Injury

Proximal tubules appear **dilated and are lined by a flattened epithelium**.

The **necrotic cell contents are shed into the tubule lumen** and appear as fluffy pink granular casts (→).

Often "recoverable" (can still use organ).



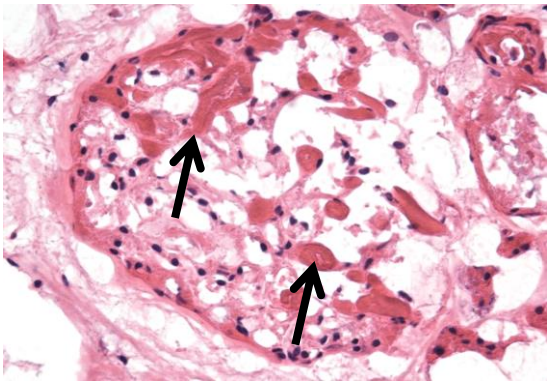


Fibrin Thrombi

Thrombotic microangiopathy (TMA) with platelet thrombi and fibrinoid necrosis in capillaries and arterioles throughout the body. Associated with donor head trauma and DIC.

Often "recoverable."

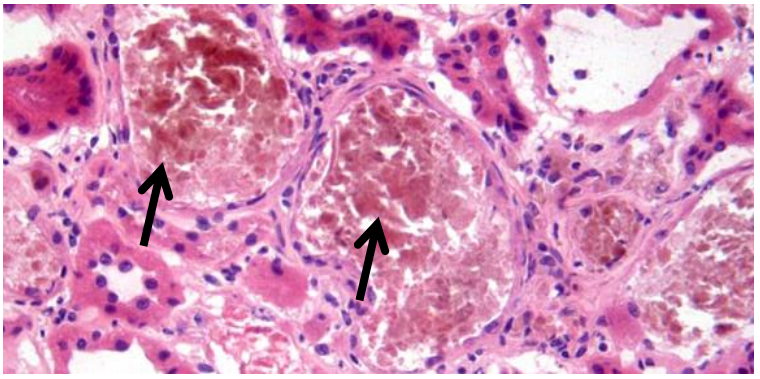
Visible as homogeneous eosinophilic to red material completely filling blood vessels.



Granular Casts

"Muddy brown" granular casts are seen with acute tubular injury → cellular debris and desquamated tubule epithelium

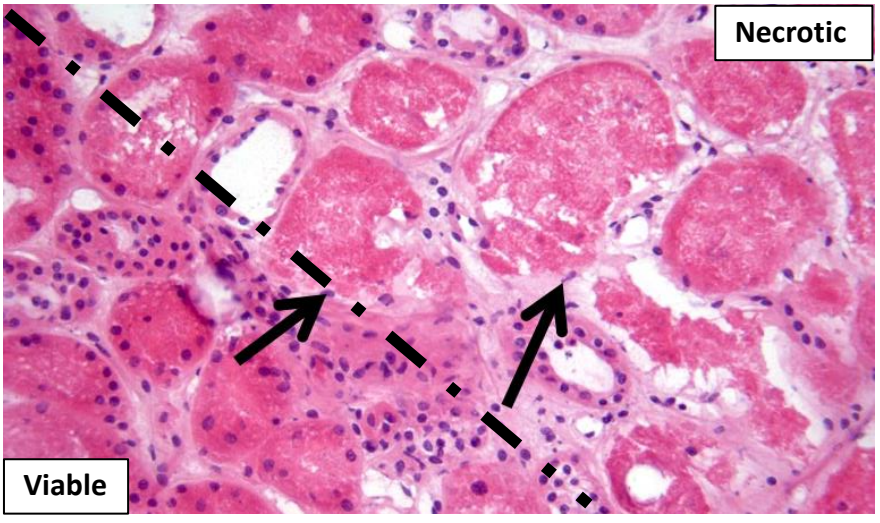
Granular casts can also be seen with other disorders.



Parenchymal Necrosis

Coagulative necrosis with loss of nuclear basophilia.

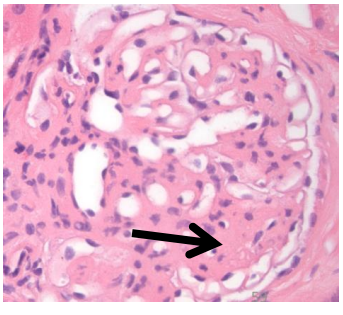
May not be "recoverable."

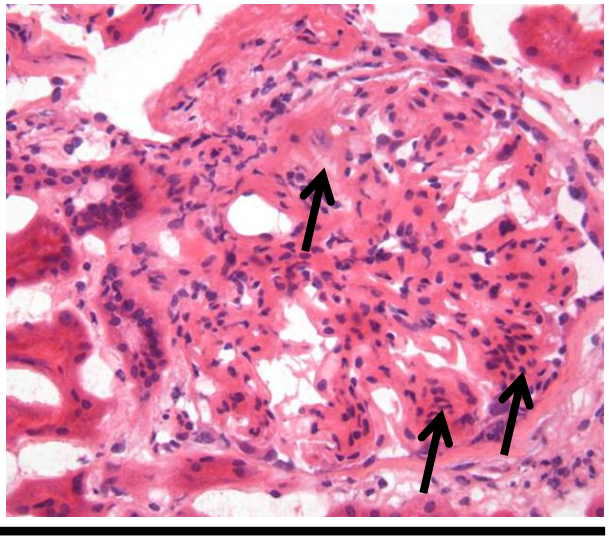


Diabetic Nephropathy

Characteristic finding: **<u>Nodular glomerulosclerosis</u>** (*Kimmelstiel–Wilson Nodule*) → large acellular nodules located in the intercapillary regions

Often also see diffuse glomeruloscerosis





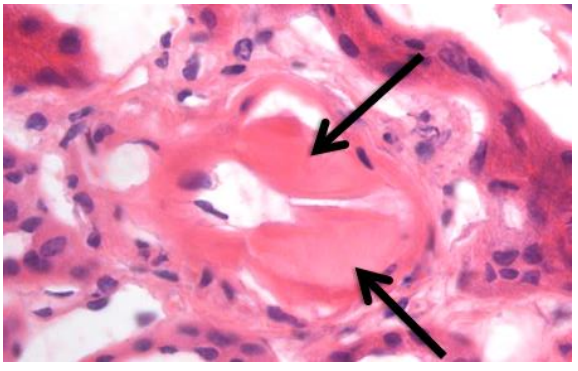
Arteriolar hyalinization

Vessel wall **is thickened by deposition of a homogeneous, eosinophilic, material** (PAS-positive on permanents).

Often hard to see on frozen!!

Seen with hypertension and diabetes.

Narrows lumen→ renal ischemia → atrophy



Donor Kidney Evaluation Criteria

From: Banff Histopathological Consensus Criteria for Preimplantation Kidney Biopsies. American Journal of Transplantation 2017; 17: 140–150

Donor Biopsy Scoring Sheet:

Type of specimen: Wedge biopsy Core biopsy

Specimen ID: _____

Number of glomeruli:	
Number of globally sclerosed* glomeruli:	
Percentage of global glomerulosclerosis:	
Number of arteries (not-arterioles)**:	

*Periglomerular sclerosis and FSGS should be recorded under other findings.
**Vessel with internal elastic lamina OR diameter greater than one third the diameter of a typical glomerulus cut in the median plane OR a vessel with 3 or more layers of smooth muscle.

Circle appropriate findings:

Interstitial fibrosis	None <5%;	Mild 6-25%	Moderate 26-50%	Severe >50% of cortex involved
Tubular atrophy	None 0%;	Mild <25%	Moderate 26-50%	Severe >50% of cortical tubules involved
Interstitial inflammation	None <10%;	Mild 10-25%	Moderate 26-50%	Severe >50% of cortex involved
Arterial intimal fibrosis	None 0%;	Mild <25%	Moderate 26-50%	Severe >50% vascular narrowing
Arteriolar hyalinosis hyalin restricted to subendothelial layer	None	Mild *	Moderate *	Severe *

*Mild: at least one arteriole
Moderate: more than one arteriole
Severe: multiple arterioles affected, circumferential

Glomerular thrombi	None	Mild *	Moderate*	Severe*

*mild <10% of capillaries occluded; moderate: 10-25% occlusion; severe: >25% occlusion
evaluate in the most severely affected glomerulus

Acute tubular injury/necrosis	None†	Mild†	Moderate †	Severe†

†Mild: ATI – epithelial flattening, tubule dilation, nuclear dropout, loss of brush border; Moderate – focal COAGULATIVE TYPE necrosis; Severe – infarction.

Other findings: (FSGS, nodular glomerulosclerosis, tumor, etc.)

UC Davis After-hours Transplant (Deceased Donor) Kidney and Liver Biopsy Form

UNOS ID: _____ **Patient Name:** _____

MRN: _____ **DOB:** _____

Biopsy Date: _____ **Time:** _____

Reason for kidney biopsy:_____

Right Kidney Information □ **Needle** □ **Wedge** □ **Other**		**Left Kidney Information** □ **Needle** □ **Wedge** □ **Other**	
Number of Glomeruli:_____ Number of Glomeruli Sclerosed: _____ Percentage Sclerosed: _____		Number of Glomeruli:_____ Number of Glomeruli Sclerosed: _____ Percentage Sclerosed: _____	
Interstitial Fibrosis	**Inflammation**	**Interstitial Fibrosis**	**Inflammation**
□ Absent □ Minimal (1-10%) □ Mild (11-25%) □ Mild-Moderate 26-50% □ Severe (>50%)	□ Absent □ Minimal (1-10%) □ Mild (11-25%) □ Mild-Moderate 26-50% □ Severe (>50%)	□ Absent □ Minimal (1-10%) □ Mild (11-25%) □ Mild-Moderate 26-50% □ Severe (>50%)	□ Absent □ Minimal (1-10%) □ Mild (11-25%) □ Mild-Moderate 26-50% □ Severe (>50%)
Kidney Arterial Sclerosis		**Kidney Arterial Sclerosis**	
□ Absent □ Minimal (1-10%) □ Mild (11-25%) □ Mild-Moderate 26-50% □ Severe (>50%)		□ Absent □ Minimal (1-10%) □ Mild (11-25%) □ Mild-Moderate 26-50% □ Severe (>50%)	
Additional findings: _____ _____ _____		Additional findings: _____ _____ _____	

Reason for liver biopsy:_____

Liver Biopsy □ **Needle** □ **Wedge** □ **Other**	
(Large droplet fat only) % Macro vesicular fat: _____	(Small and medium droplet fat only) % Micro vesicular fat: _____
Fibrosis	**Portal Infiltrates**
□ None □ Fibrosis of some portal areas, with/without short fibrosis septa □ Fibrosis of most portal areas, with/without short fibrosis septa □ Fibrosis of most postal areas, with occasional portal to portal bridging □ Fibrosis of portal areas, with marked bridging □ Marked bridging with occasional nodules □ Cirrhosis	□ None □ Mild, some or all portal areas □ Moderate, some or all portal areas □ Moderate/Marked □ Marked, all portal areas
Evidence of: (Mark all that apply)	
□ Centrilobular necrosis □ Cholestasis	□ Lipofuscin □ Active lobular inflammation
Other Pathology: □ **None** □ **Present. Please describe:** _____ _____	

Pathologist: _____ Phone: (____) _____

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