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Functional unit of kidney-P-4

Tissue Preparation A kidney biopsy is considered the gold standard for the diagnosis, prognosis, and management of multiple diseases. Since renal diseases may be secondary to evident causes and renal biopsy is an invasive test, its indications are limited.

Ultrasound-guided percutaneous renal biopsy (PRB) is the most accepted and commonly used technique to perform a renal biopsy. The ideal sample for microscopy should contain 20 glomeruli for a native kidney biopsy and at least ten glomeruli in a transplant kidney biopsy for diagnosis. The kidney cortex contains glomeruli, and medulla primarily has tubules. Hence it is important to obtain renal cortical tissue for analysis. However, in rare circumstances, medullary tissue is useful in diagnosis like BK virus nephropathy and antibody-mediated rejection in a transplanted kidney. After obtaining kidney tissue, it is fixed and processed with a microtome into thin sections and processed for light microscopy (LM), immunofluorescence (IF), and electron microscopy (EM). Microscopy Light As previously mentioned, multiple pathologic processes can affect distinct regions of the nephron to a varying extent. As such, knowledge of the diverse lesion patterns that are observable in renal tissue through various microscopic techniques is of great importance.

There are three primary microscopy modalities of clinical relevance are light microscopy (LM), immunofluorescence (IF) and electron microscopy (EM) Light microscopy: It is the essential modality used on all tissue samples and provides descriptive information regarding existing lesions in different segments of the renal parenchyma. This aids clinicians in determining differential diagnoses, particularly in pathologies affecting renal glomeruli. Histologic description of glomerular pathologies includes terms such as “proliferative” when there is an increase in the number of cells, “sclerosing” when there is scarring, and “necrotizing” when there are areas of cellular death. Lesions are further described as diffuse or focal if more or less than 50% of all glomeruli are involved, respectively. In an individual glomerulus, the process is considered global or segmental if more or less than 50% of the glomerular tuft is involved.

LM can be further characterized based on the stains used, below is a brief description of various LM stains. 1. Haematoxylin-eosin staining for general evaluation.

2. Periodic Acid-Schiff stain (PAS), widely used for the evaluation of glycogen storage disorders and after kidney transplant for the display of tissue rejection.
3. Masson's trichrome stain, for the determination of renal fibrosis.
4. Methenamine-silver stain (Jones), for better visualization of glomerular basement membranes.

Fluorescence microscopy (IF): as the development of fluorescent dye-associated antibodies expanded, IF has revolutionized clinical nephrology and is particularly useful in determining the main physiopathological mechanism generating a given renal lesion.

This modality has been useful to guide the diagnosis of immune mediated pathologies, as mentioned in further sections. Microscopy Electron Electron Microscopy (EM): though rarely available outside of academic/specialized centers, EM is essential for the diagnosis of many common and uncommon diseases (e.g., thin basement membrane nephropathy) in nephrology. This is one of the few medical disciplines in which EM has an active role in clinical practice. Pathophysiology Nephron pathologies are as complex as its structure. Each specific section of the nephron is susceptible to different mechanisms of damage, for instance, glomerular diseases are often immunologically mediated, whereas tubular and interstitial disorders are more likely to be caused by toxic or infectious agents.

However, more than one structure can be affected by a sole disease, as well as the interdependence of structures in the kidney makes other components be affected when only one part is damaged. As mentioned earlier, glomerular pathologies are mostly immune. Immune disorders can be either

1) mediated by antibodies against glomerular antigens
2) mediated by complement
3) pauci-immune.

The clinical manifestations, as well as the microscopic appearance of the glomerulus, will be dependant on the mechanism of damage. Clinical Significance Diseases affecting the glomerulus generally divide into two different entities according to the clinical presentation: Nephrotic syndrome: This syndrome presents with proteinuria >3.5g per 24 hours or protein-to-creatinine ratio >3000 mg/g, hypoalbuminemia