PARTICULAR ULTRASTRUCTURAL FEATURES OF HUMAN RENAL CAPSULE AND RELATED BENIGN TUMORS

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Objectives:

Our purpose was to investigate the cellular structure of the human renal capsule on kidney diagnostic biopsies and the possible connections with adjacent tumors.

Methods:

Over 1400 percutaneous renal biopsies have been examined for diagnostic using light microscopy, immunofluorescence and electron microscopy in all cases. About a third of the biopsy samples intercepted the renal capsule. Depending on the section incidence, either perpendicular or oblique, this capsule appeared thin or thicker, but the cellular structure was the same.

Results:

In the renal capsule we found a layer of immature smooth muscle cells (SMC) (**Figure 2**). These cells presented actin myofilaments mostly gathered in the periphery, some focal densities, peripheral dense plaques and caveole, rough endoplasmic reticulum, vacuoles and few mitochondria. The interstitial aspect of their plasma membranes was covered by a thin lamina of basement membrane material (**Figure 3**). A second cellular layer, covering the first, was composed of regular fibroblasts, a particular type of slender fibroblasts and many strips of collagen fibers (**Figure 4**). These slender fibroblasts were very flat cells, with a flat nucleus and extended cytoplasmic processes with dichotomous branching. An outstanding feature was the interrelation of these slender fibroblasts with the collagen fibers. The long cytoplasmic processes were placed between the collagen strips and sometime surrounded them (**Figures 5-6**). These cells were similar to the so-called telocytes recently described in the interstitial area of several organs, mainly in the heart. These telocytes made up a meshwork, interlacing clusters of collagen fibers, and thus strengthening the entire renal capsule. In two cases of our series of renal biopsies we found in light microscopy small tumoral proliferations of SMC (**Figure 1**). The ultrastructure of these benign tumors was that of leiomyoma.

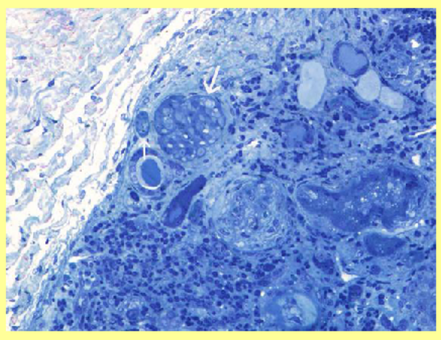

Figure 1. Kidney biopsy from a patient with focal segmental glomerulosclerosis. On the left one can see the renal capsule, and just beneath the smooth muscle cells two small tumors (arrows) diagnosed as leiomyomas. The kidney parenchyma contains also a damaged glomerulus, renal tubules, some atrophic and interstitial inflammation. Toluidine blue staining

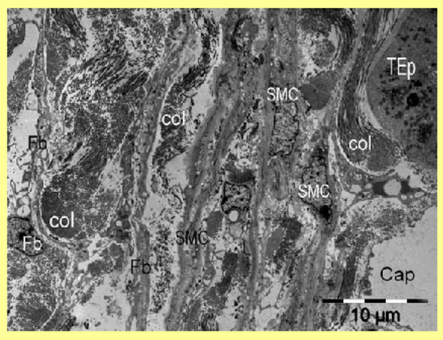

Figure 2. Human renal capsule showing the fibro-cellular two layers. Close to the renal parenchyma (TEp - tubular epithelium) one can see distinct smooth muscle cells (SMC) separated by collagen fibers (col). Capillary vessels (Cap) are present and also seldom lipocytes. Next to the smooth muscle cells layer one can see several fibroblasts (Fb) and much of collagen fibers sunken in extracellular matrix. The fibroblast placed on the left shows a slightly different pattern; slender cytoplasm with dichotomous processes

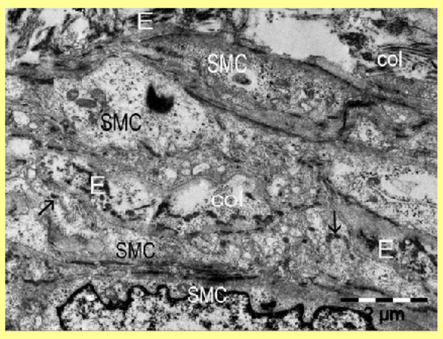

Figure 3. Smooth muscle cells (SMC) of the inner capsular layer admixed with collagen fibers (col) and elastic bands (E). Several junctional areas with desmosomes (black arrows) can be seen

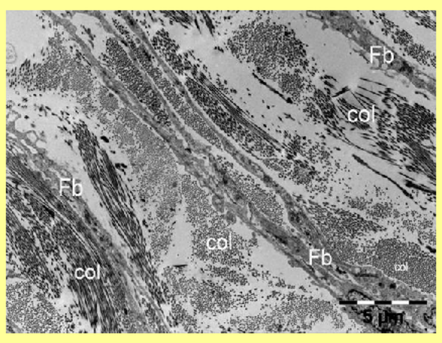

Figure 4. Renal capsular outer layer composed of fibroblasts (Fb), collagen fibers (col) and extracellular matrix. This particular type of fibroblasts shows characteristic features of the so-called telocytes. They are very flat cells with elongated dichotomous cytoplasmic processes and no lamina on the outer aspect of plasmalema. They are regularly arranged in a more or less parallel pattern in the mass of collagen fibers

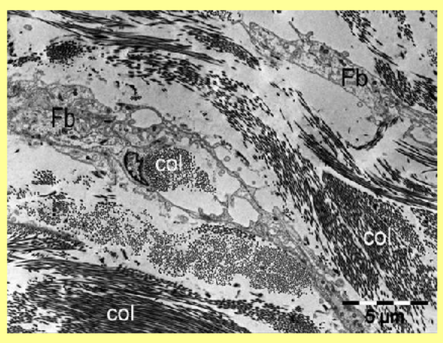

Figure 5. Connective tissue layer of renal capsule showing large masses of collagen III (col) arranged in clusters and several fibroblasts (Fb) with telocytic pattern. These cells devoid of basal lamina are surrounded by very short cytoplasmic small processes realizing a feature of hairy plasma membrane. A collagen cluster in the middle area is entirely surrounded by cytoplasmic processes

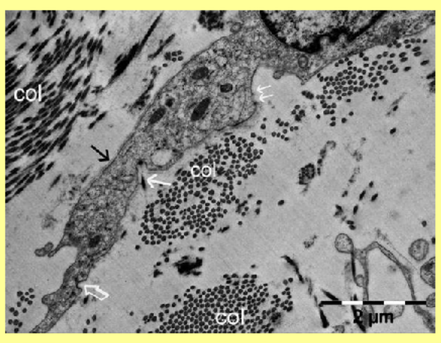

Figure 6. Two interstitial cells of the same area as Figure 5 showing telocyte-like pattern. One side of the main cell is covered by a basal lamina (black arrow). Also visible is a group of caveole (small white arrows). The cytoplasm contains mitochondria, rough endoplasmic reticulum, ribosomes and small vesicles. Also visible are a coated pit (hollow arrow) and another pit in contact with a collagen fiber (long white arrow). Several collagen clusters (col)

Conclusions:

Based on our ultrastructural results we try to demonstrate the presence of telocytes in the outer layer of the human renal capsule and propose distinct histogeneses for leiomyomas and myxomas as derived from the inner and outer capsular layers respectively.

References:

1. Park H-K, Yasuda K, Kuo MC, Ni J, Ratliff B, Chander P, Goligorsky MS. Renal capsule as a stem cell niche. *Am J Physiol Renal Physiol* 2010;**298**:F1254-F1262
2. Popescu LM, Faussone-Pellegrini MS. TELOCYTES - a case of serendipity: the winding way from Interstitial Cells of Cajal (ICC), via Interstitial Cajal-Like Cells (ICLC) to TELOCYTES. *J Cell Mol Med* 2010;**14**:729-740
3. Kobayashi K. Fine structure of the mammalian renal capsule: The atypical smooth muscle cell and its functional meaning. *Cell Tissue Res* 1978;**195**:381-394
4. Val-Bernal J.F, Aguilera C, Villagra NT, Correas MA. Myxoma of the renal capsule. *Pathol Res Pract* 2005;**200**:835-840
5. Mohler JL, Casale AJ. Renal capsular leiomyoma. *J Urol* 1987;**138**:853-854

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