IDENTIFICATION OF A POSSIBLE SITE FOR ACTIVE UREA TRANSPORT IN DISTAL NEPHRONS OF SQUALUS ACANTHIAS.

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Urea reabsorption by the kidney of the shark plays an important role in osmotic homeostasis. In previous studies we defined a diluting segment located in the peritubular sheath which may participate in a countercurrent urea reabsorptive process. While this mechanism may be responsible for much of the observed urea reabsorption, it does not account for the low urea concentrations in final urine (80-100 mM). Since it is likely that active urea reabsorption would occur at a site following the diluting segment, we measured tubular fluid:plasma (TF/P) urea concentrations in collected fluid samples of distal I tubules microdissected from the peritubular sheath. Tubules were perfused and bathed in shark Ringer's containing 350 mM urea at 14-16°C. Total urea content of perfused and collected fluid samples was determined with a commercial BUN assay kit (Sigma). Using 75-100 nL samples, the assay was linear over the range of 175-350 mM urea and the coefficient of variation for replicate samples was 3.8%. Two types of morphologically distinct distal segment from the sheath were examined. Ciliated distal I segments (DS_c) had inner and outer diameters (ID, OD) of 25.1 ± 1.9 and 44.9 ± 2.7 microns, and a transepithelial voltage (V_e, mV) of -0.2 ± 0.1 (n=7). Smooth, nonciliated distal I segments (DS_s) had an ID of 24.4 ± 2.0 and OD of 39.6 ± 4.1 microns; Ve averaged 0.6 ± 0.1 (n=6). At perfusion rates of 7.4 ± 0.9 nl/min, TF/P urea averaged 0.92 ± 0.02 in DS_c ($P<0.01$). In contrast TF/P urea at comparable perfusion rates was 1.00 ± 0.02 in DS_s. Serosal K removal tended to evoke a rise in TF/P urea in DS_c segments but this change was not significant in this limited series of observations. We conclude: 1) that two morphological distinct distal I segments are present in bundle zone nephrons; and 2) the DS_c segment may represent a site of active urea reabsorption; however, it is possible that an active volume secretion mechanism like that previously described for a sinus zone proximal tubule segment (Beyenbach and Fromter, Am. J. Physiol. 248: F282-F295, 1985) may be responsible for some or all of the reduction in TF/P urea. (These studies were supported grant DCB 87-02159 from the National Science Foundation).