The Intrarenal Distribution of $^{125}$I-Albumin in the Syrian Hamster

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Summary. The intrarenal distribution of radioiodinated human serum albumin ($^{125}$I-HSA) after intravenous injection was studied in Syrian hamsters by scintillation counting and frozen section autoradiography.

After 15, 30, and 60 min the virtual plasma albumin space in the renal cortex of the hamster represented 6.49, 7.13, and 8.06% respectively of the kidney tissue volume. From the cortex to the renal papilla the albumin space increased to about 30% of the tissue volume. In comparison to this the albumin space in the renal cortex of the rat was about 20% and in the renal papilla about 33% (11).

Frozen section autoradiography indicated that the distribution of radioalbumin in the renal cortex of the Syrian hamster is limited mainly to the kidney vessels, being especially noticeable in the glomerular capillaries. Toward the papilla increasingly greater (mainly extratubular) activity could be observed not only intravascularly but also interstitially. In the cortex of the rat kidney, on the other hand, radioactive albumin was accumulated (probably by filtration and reabsorption) predominantly in the proximal tubular epithelium.

Within 30 min the kidneys of the rat excreted more than 10 times as much $^{125}$I than the hamster kidneys. These results (substantially less cortical accumulation and urinary excretion of radioalbumin in the Syrian hamster) indicate that, in contrast to the rat, obviously much less albumin is filtered (and then accumulated by proximal reabsorption) by the Syrian hamster glomeruli. This suggests that the Syrian hamster kidney is more suitable than the rat kidney for determining the interstitial, cortical, albumin space.

Key words: $^{125}$Iodine-human Albumin — Albumin Filtration — Protein Accumulation — Interstitial, Cortical Albumin Space — Syrian Hamster.

During a frozen section autoradiographic comparison of $^{125}$I-albumin distribution in the renal medulla of rats and Syrian hamsters differences, especially in the cortex of both species, were observed. While in the rat darkening due to accumulation of radioalbumin could be observed above all in the proximal tubular epithelium, the renal cortex of the hamsters had an overall lighter appearance, only the glomeruli and larger vessels being conspicuous because of their high radioalbumin content. This observation suggested that albumin turnover in the cortex
is quite different in the Syrian hamster and in the rat. With respect to the discussion about the intrarenal haematocrit (Gibson et al. [8], Lilienfield et al. [13], Law [12], Carone et al. [4], Pappenheimer and Kinter [14], Ulfendahl [21], Wolgast [24], Rassmussen [15,16]), the interstitial albumin pool (Bethge [1], Carone [4], Brenner [3], Slotkoff [17], Gärtner [6,7], Källskog [10], Vogel [22], Wilde [23], Wolgast [24], Wunderlich [26]), and protein accumulation and turnover (Blöhmer [2], Cortney [5], Katz [9]), this point was examined more closely from the aspect of possible differences in albumin filtration and/or reabsorption in both species.

Method

Male Syrian hamsters having an average weight of 102 ± 2 g and free access to water and grain feed were anaesthetized intraperitoneally with 100 mg of Nembutal/kg. The animals were placed on a heating pad and then a tracheal, jugular, and carotid cannula was inserted. At the beginning of the experiment urine was collected by bladder compression and examined for pathological components. In some cases blood pressure was taken during the experiment.

The injections of 125I-Iodine-human albumin (125I-RISA from Amersham) were given in the jugular vein as follows:

1. 2.66 mg of 125I-RISA, 10 μCi, in 0.3 ml of 0.9% NaCl solution, within 30 sec (for the scintillation counting experiments); and
2. 40 mg of 125I-RISA, 180–200 μCi, in 2.0 ml of 0.9% NaCl solution, within 2 min (for autoradiography).

In the counting experiments groups of 5 animals were examined 15 min, 30 min, and 60 min after injection of 125I-RISA; the abdomen was opened, the bladder clamped at the trigonum vesicae, approximately 0.5 ml of carotid blood taken, and then first the left, subsequently the right kidney removed and decapsulated. The left kidney was then divided under magnification into portions of cortex, outer stripe of outer medulla, inner stripe of outer medulla, and inner medulla (papilla). These specimens were then counted in a NaI gamma counter (gamma guard 150, ICN Tracer Lab). The right kidney was counted as a whole. The total amount of urine produced during each experiment, collected by puncturing the bladder, was determined and 0.1 ml, as well as 0.01 ml of the plasma obtained by centrifugation, likewise counted. By TCA-precipitation of plasma it was shown that the share of free 125I-Iodine never exceeded 3% of the total activity.

Of same experiment duration, the procedure with the animals used for a second series of experiments, mainly for autoradiography, was similar except for the following: Immediately after the left, the right kidney was removed, decapsulated, and divided into several slices. These slices were frozen in liquid N₂ and cut into 2–10 μm-thick frozen sections for autoradiography (cryostat temperature —17°C; knife angle 2°, section stretching with Frigen and liquid paraffin, Ilford G 5 and K 2 plates; exposure time 6—9 or else 20–40 days at 20°C; compare Taugner and Wagenmann [19], Taugner et al. [18]).

Results and Discussion

The size of the virtual albumin space \( \left( \frac{\text{organ activity} \cdot 100}{\text{plasma activity}} \right) \) in each of the kidney regions and in the whole kidney 15, 30, and 60 min after