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Developmental Expression of Hyaluronan in Rat Kidney

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Hyaluronan (Hyaluronic acid) (HA), a glycosaminglycan, is extremely abundant in the interstitium of the renal inner medulla in contrast to the low amounts seen in other regions of the kidney. HA in the inner medulla is believed to be produced by type 1 interstitial cells that form characteristic "bridges" between the thin limbs of Henle and vasa recta. Due to the pattern of intrarenal distribution and to the polyanionic nature and gel-like properties of HA, it is conceivable to suggest that HA is an important determinant of the interstitial hydrostatic pressure and water flux in the renal inner medulla and papilla, consequently that of the free water reabsorption and concentration processes. In addition, HA is particularly abundant during embryonic development and organogenesis when it is required for cell proliferation and migration. The present study was performed to identify the pattern of HA expression in the developing rat kidney, in which the urine concentration ability develops after birth, by immunohistochemistry. Kidneys from 15-, 16-, 18-, and 20-day-old fetuses, 1-, 4-, 7-, 14-, 21-day-old pups, and adult animals were studied.

In adult rat kidney, HA immunoreactvity was most strong in the interstitium of the renal papilla followed by decreasing intensity in the inner medulla, in the outer medulla and in the cortex, where it could only be hardly detected. In the prenatal kidney, however, strong HA immunoreactivity was observed in the interstitium of all kidney regions. After birth, HA immunoreactivity of interstitium in the cortex was gradually decreased except subcapsular area until 7 days old pups and entirely undetectable including subcapsular area after 14-day-old fetuses. In contrast, expression HA immunoreactivity in the inner medulla increased steadily through birth until postnatal day 21, when the adult pattern of expression is established coincidently with the full maturation of the renal medulla and urine-concentrating ability. In addition to the HA expression of interstitium, HA was expressed on the luminal membrane of the epithelial cells of the vesicle-, comma shaped-, and S-shaped-nephron stages, however no HA immunoreactivity was observed in the mature nephrons including stage III nephrons. These observations suggest that HA is contributed to the maturation of urine concentrating mechanism and also involved in nephrogenesis.