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EFFECT OF AN ACUTE SODIUM CHLORIDE LOAD ON THE URINARY EXCRETION OF PROSTAGLANDINS E_2 AND F_2 IN ANTIDIURETIC SUPPRESSED DOGS

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Summary

The urinary excretion of prostaglandins E_2 and $F_{2\alpha}$ was measured in six healthy anaesthetized antidiuretic suppressed dogs before and after an acute isotonic saline load. No significant changes in prostaglandin excretion were found even in the presence of a significant increase in urinary sodium excretion. The renal adaptation of dogs to an acute saline load occurs without changes in the renal PGE_2-$PGF_{2\alpha}$ system.

Introduction

Renal tissue may convert arachidonic acid to several prostaglandins [1]. Prostaglandins E_2 (PGE_2) and $F_{2\alpha}$ ($PGF_{2\alpha}$) are mainly synthetized in the renal medulla [2] and we have suggested that changes in sodium balance may influence the synthesis of renal PGE_2 and $PGF_{2\alpha}$, as measured by their urinary excretion [3,4]. The main problem concerning the interpretation of these findings relates to the possible effect of antidiuretic hormone (ADH) on the urinary excretion of prostaglandins [2]. The present study examines the urinary excretion of prostaglandins in anaesthetized dogs submitted to an acute intravenous sodium load after adequate suppression of ADH secretion.

Methods

Studies were performed in six healthy anaesthetized (nembutal 25mg/kg) male mongrel dogs, weighing between 12 and 20kg. After intubation (in order to maintain a controlled and free airway) the urinary bladder was catheterized by a suprapubic access, using a 16-French Foley catheter. Femoral artery and veins were cannulated for infusions and in order to obtain easily blood collections. The experiments were started when urinary osmolality was lower than 100mOsm/kg. This was obtained by infusing intravenous hypotonic saline solution (0.45g/dl)

at a rate of 28.8±2.6ml/min for a mean time of 162 (±29) minutes. The experimental protocol was performed as follows: during 30 minutes the intravenous hypotonic NaCl solution was continued at the rate of the urine excretion rate (period A); three 10 minute urine collections were obtained; blood samples were taken at the midpoint of each urine collection. Then an isotonic saline solution (0.9g/dl) was infused in parallel (period B), leading to an acute NaCl load (1 L/30 min); urine and blood samples were collected as in period A. During the third and last 30 minutes (period C) the same protocol as performed in period A, was repeated. In each urine collection excretion of sodium, potassium, PGE_2, $PGF_{2\alpha}$ were evaluated. Free water clearance (CH_2O) and $PGE_2/PGF_{2\alpha}$ ratio) were calculated. Sodium and potassium were measured by flame photometry and PGE_2 and $PGF_{2\alpha}$ by a radioimmunoassay previously described [3]. Results are expressed as mean±SD. Statistical analysis was performed by using the student's 't' test (paired values).

Results

In period A urine osmolality remained low (Table I). In period B urinary sodium increased significantly ($p<0.02$), urine flow rate increased ($p<0.05$) as did the free water clearance ($p<0.05$). Urinary PGE_2 and $PGF_{2\alpha}$ did not change. The $PGE_2/PGF_{2\alpha}$ ratio was higher but the difference was not significant. In period C, the results were similar to those found in period B (Table I).

TABLE I. Changes in urinary volume (UV), urinary Na (UNaV), free water clearance (CH_2O), urinary prostaglandins (PGE_2, $PGF_{2\alpha}$) and $PGE_2/PGF_{2\alpha}$ ratio (E/F) during the three periods of experience (see text)

	UV (ml/min)	UNaV (μmol/min)	CH_2O (ml/min)	PGE_2 (ng/min)	$PGF_{2\alpha}$ (ng/min)	E/F
period A	9.5±1.3	130±31	7±1.1	1.27±0.28	2.45±0.68	0.65±0.09
period B	13.8±1.26**	529±141*	9.4±1.1	1.55±0.36	2.81±0.78	0.87±0.15
period C	13.2±1.3**	504±104*	10.2±1.3	1.66±0.45	2.83±0.69	0.80±0.18

*$p<0.02$ (when compared to period A); **$p<0.05$ (when compared to period A)

Discussion

Measurements of the renal production of prostaglandins after changes in sodium balance have produced conflicting results. In man, increased urinary PGE_2 is found with sodium retention [3,5,6]. In rabbit, similar findings have been reported [7]. In rats urinary prostaglandins may be increased when a sodium load is given, but the results may be influenced by the effect of ADH [4]. Antidiuretic hormone affects the renal production of prostaglandins by stimulating phospholipase activity [2]. In this respect, the present report provides data concerning the urinary prostaglandin excretion in dogs with depressed ADH secretion, the experiments having been started when urinary osmolality

was less than 100mOsm/kg. During the experimental period of 90 minutes urine flow rate was high. Acute alterations of urine flow rate, in dogs, is a significant factor in determining the rate of urinary prostaglandin excretion [8]. It has been shown, in dogs, that the urinary excretion of PGE increases linearly when the urine flow increases. However, it seems that this is true until a flow of about 9ml/min, after which a plateau is reached [8]. In the present experiments urine flow rate was generally greater than that value. It seems therefore possible, in these conditions, to relate any changes of prostaglandin excretion to experimental manoeuvres in the absence of ADH. The urinary excretion of PGE_2 and $PGF_{2\alpha}$ was not significantly higher in period B and C. These slight changes may be, possibly, related to the increased urine flow rate. The urinary sodium excretion increased significantly during the period of sodium load. The absence of modifications in urinary prostaglandins and in the PGE_2/$PGF_{2\alpha}$ ratio during these experiments suggest that, in ADH suppressed dogs, an acute sodium load is not associated to changes in the production of renal PGE_2 and $PGF_{2\alpha}$. In the condition of our protocol the renal response to the acute salt load is adequate, but the renal PGE_2-$PGF_{2\alpha}$ system does not seem to be involved. This system has been found to be probably important in other species and in other conditions [2,3,6,7]. Further investigations will be necessary to determine if the renal prostaglandin system has a role in the adaptation of the dog kidney to chronic sodium changes or to other acute manipulations.

References

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