Atrial Natriuretic Factor and Adrenal Steroid Production in Uremia

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Dear Sir,

Six years ago, natriuretic granules were detected in the atria of the heart [1], and thus a new chapter in physiology (cardiac, renal and endocrine) has begun to be written. Head-out water immersion or expansion of the blood volume in man leads to diuresis, natriuresis and to a decrease in plasma aldosterone (PA) levels and plasma renin activity (PRA) [2]. A decrement in cortisol hypersecretion induced by hemorrhage has also been reported following distension of the right atrium [3]. There is evidence from biological assays that the atria respond to distension with the release of material which has both a hormonal and a diuretic action [4]. Taken together, these data may suggest a role of atrial natriuretic factor (ANF) in mediating renal and humoral responses during low-pressure receptor stimulation by water immersion in man. In a recent work [5] we have demonstrated that central hypervolemia by water immersion stimulates low-pressure receptors and suppresses both the renin-aldo-sterone system and the ACTH-cortisol axis in normal man. In hemodialyzed patients, in whom autonomic neuropathy has been frequently found, PRA and ACTH were not suppressed during water immersion while plasma cortisol and aldosterone were significantly reduced. On the other hand, the dissociation between PRA and PA as well as between ACTH and cortisol seems to demonstrate further that adrenal gland function may be modulated by mechanisms other than those well known to be effective under physiological conditions. Other modulators, like dopamine, were supposed to be involved in regulating cortisol and aldosterone levels in hemodialyzed patients. Recent data suggest that both plasma and urinary dopamine levels rise in response to either isotonic-isooncotic expansion by water immersion or by isotonic saline infusion [6]; furthermore, high levels of dopamine are known to be able to directly modulate adrenal gland secretion [7]. More recently, the presence of receptors for atrial peptide has been demonstrated in the adrenal gland [8].

The direct effect of ANF on mineralocorticoid and glucocorticoid production was investigated in vitro in primary culture of bovine zona glomerulosa and fasciculata cells. The results have indicated that ANF potently inhibits steroid production from both types of cells stimulated by a variety of hormones and factors [9]. The depression of cortisol and aldosterone plasma concentrations and secretion in vitro by ANF fills a gap in our knowledge which the action of dopamine did not explain [10]. The mechanism(s) whereby stimulation of volume receptors mediates a suppression of cortisol and aldosterone remains speculative. Several possibilities have been entertained, including an immersion-induced suppression of the renin-angiotensin system [11, 12], ACTH secretion [3] or a direct effect on the adrenal cortex [2]. Previous studies, in concert with
the demonstration of a suppression of plasma aldosterone and plasma cortisol in normal subjects with a functional renin-angiotensin and ACTH system [5], lend strong support to the concept that the renin-angiotensin and ACTH axis constitutes a major regulator of volume-mediated changes in aldosterone and cortisol plasma levels. In the absence of a functional renin-angiotensin and ACTH system, ANF, stimulated by volume expansion, could mainly regulate adrenal steroidogenesis and consequently extracellular fluid volume in a number of disease states with deranged water and sodium homeostasis [13].

References

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