Title : EVALUATION OF RENAL DILUTING ABILITY AND OF HORMONAL RESPONSES IN INTENSIVE CARE UNIT PATIENTS

Authors : D. Dreyfuss, M.D., M. Sperandio, M.D., F. Leviel, M.D., M. Paillard, M.D., J. Marty, M.D., F. Coste, M.D.

Affiliation : Intensive Care Unit and Renal Physiology Department, Louis Mourier Hospital, 92701 Colombes, and Department of Anesthesia, Xavier Bichat Hospital, Paris VII University, France.

Introduction. A lowering of plasma sodium concentration is a common occurence in hospitalized patients, whether belonging to a medical or surgical population (1). This electrolyte disturbance appears due to the presence of nonosmotic secretion of arginine vasopressin (AVP) plus concomitant administration of hypotonic fluid (1, 2). It may sometimes be responsible for severe neurologic dysfunction in postoperative patients (3). The pathogenesis of nonosmotic AVP release in this setting is not fully understood, but the potential role of stress has been evoked, although not correctly documented (1). Moreover, renal diluting ability and hormonal responses to a water loading test have not been adequatly assessed in stressed intensive care unit (ICU) patients, devoid of other known stimulus for nonosmotic AVP release. Hence, the role of stress by itself remains mainly speculative. We therefore addressed this question by performing water loading studies in patients admitted in the ICU of Louis Mourier Hospital for a severe or potentially severe disease.

Methods. Nine patients (aged 21 to 59 years) were prospectively studied. All gave informed consent and institutional approval for the study was obtained. There were 2 pneumothoraces studied just before chest tube insertion, 1 hemopneumothorax studied after chest tube insertion, 1 acute myocardial infarction, 5 suspicion of unstable angina (1 associated with a newly discovered duodenal ulcer). No patient had circulatory, respiratory, renal or hepatic failure. The study consisted of a water loading test (15 ml/kg BW of D 2.5 % infused in one hour). During the 4 hours following the load, the following parameters were appreciated : minimum urine osmolality, percent excretion of the load, maximum free water clearance. Plasma AVP was determined before and at one-hour after water load in all the patients (radioimmunoassay). Plasma renin activity, plasma aldosterone (radioimmunoassays), plasma epinephrine and norepinephrine (HPLC) were determined in eight patients before and at one-hour after load. Plasma atrial natriuretic factor (radioimmunoassay) was determined in seven patients at the same times. Results are given as means ± SEM. The significance of the restults was assessed by paired t-test.

Results. * $p < 0.05$

	Plasma Na (mmol/l)	Plasma AVP (pg/ml)	Minimum Urine osmo.¶ (mOsm/kg)	% excreted load § (%)
Before water load	137.5 ± 0.5	4.5 ± 0.4		
After water load	132.3* ± 0.5	3.1* ± 0.5	95 ± 13	87± 9

(¶ =normal value ≤100 mOsm/kg; § normal value ≥ 80 %)

Renal diluting ability was strictly normal in 8 patients (figure). One patient had a moderate defect (minimum urine osmolality = 192 mOsm./kg). This patient (unstable angina plus duodenal ulcer) exteriorized a digestive hemorrhage just after completion of the study. This bleeding probably interfered, via hypovolemia, with renal diluting ability. Plasma AVP decreased in response to the water load in all the patients. Plasma renin activity and plasma aldosterone were not modified by the water loading test : 1.47 ± 0.64 vs 1.11 ± 0.33 ng/ml/h (normal values 0.5 to 3.5) and 74 ± 15.6 vs 79 ± 20.1 pg/ml (normal values 80 to 450), respectively. Plasma renin activity was high in the patient with duodenal ulcer (5.58 ng/ml/h), possibly attesting to the hypovolemia. Plasma atrial natriuretic factor did not change after water loading (38 ± 4.6 vs 37 ± 5.8 pg/ml; normal values 37 ± 14). Plasma epinephrine remained normal before and after load (87 ± 36 vs 88 ± 30 ng/l; normal values < 100 ng/l). By contrast, plasma norepinephrine was found evelated both before and after water load (750 ± 218 vs 669 ± 152 ng/l; normal values < 250 ng/l). Morover in two patients who had a strictly normal renal diluting ability, plasma norepinephrine levels were very high (> 1000 ng/l).

Discussion. This study shows that, in the absence of hemodynamic instability, renal diluting ability was not altered in our ICU patients. Morover, AVP secretion remained responsive to its osmotic stimulus, and did not seem to be influenced by the high levels of norepinephrine that can be encountered during stress. This latter finding seems to be in opposition with what has been previously suggested by others (4). We can conclude that stress due to severe or potentially severe illness and to hospitalization in the ICU does not interfere by itself with osmotic regulation of AVP and with renal water excretion. Thus, the occurence of hyponatremia in ICU patients cannot be attributed to stress alone and must always prompt the search of an other explanation.

This study was supported in part by a grant from the Conseil Scientifique de la Faculté Xavier Bichat.

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