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The Relationship Between Urine Volume and Urinary Adrenaline and Noradrenaline Excretion in a Group of Psychotic Patients

By J. DAWSON and A. BONE

Various authors have reported that alterations in urine volume are associated with alterations in urinary adrenaline and noradrenaline output. (Perman 1961 and Leroy and de Schaepdryver 1961. Weil-Malherbe and Ström-Olsen (1958) reported alterations in urinary adrenaline and noradrenaline excretion associated with mood changes in a group of patients with manic-depressive psychosis. In three of the patients studied, there was also during the manic phase an increased urine volume.

Thus it is a possibility that the alterations in urinary adrenaline and noradrenaline excretion found by Weil-Malherbe and Ström-Olsen in the group of manic-depressive patients were consequent on alterations in urine volume, however produced, and not dependent on alterations in adrenal medullary secretion.

We have studied this by investigating the correlation between urine volume and noradrenaline and adrenaline excretion in Weil-Malherbe and Ström-Olsen's group of patients, in additional patients who show variations in urine output without a well-defined mood change, in normal male subjects in whom changes in urine volume were obtained by water deprivation and water loading, and in a group of hypertensive patients.

Methods

In the psychotic subjects, serial 24 hour urine collections were made and the completeness of the collection assessed by creatinine estimations. In the normal male subjects, hourly urine collections were made for 4 hours. The first two collections were after 15 hours fluid deprivation and the other two collections after 500 ml. water ingestion. This was repeated on two other days for each subject. A group of 30 hypertensives was also studied. This was a cross-sectional study of 16 males and 14 females from whom one 24 hour urine collection was made and the urinary adrenaline and noradrenaline excretion determined, together with the urine volume. Catechol amines were estimated by the method of Weil-Malherbe and Bone (1957) with the modifications described by Weil-Malherbe and Ström-Olsen (1958).

Results

Table I demonstrates the correlation coefficients for adrenaline and noradrenaline with respect to urine volume in a group of patients. These results demonstrate that there is a highly significant association between urine volume and urinary adrenaline and noradrenaline excretion in the cases reported by Weil-Malherbe and Ström-Olsen. In 2 of the other 5 cases there is a significant relation between urine volume and adrenaline excretion, and in 2 there is a significant relation between urine volume and noradrenaline excretion.

Table I

Psychotic Subjects

Patient	No. of Observations	Correlation Coefficient between Urine Volume and Adrenaline Excretion	Correlation Coefficient between Urine Volume and Noradrenaline Excretion
1	8	+0·70 $p < 0·05$	+0·54 N.S.
2	13	+0·28 N.S.	+0·05 N.S.
3	14	+0·10 N.S.	+0·45 N.S.
4	12	+0·22 N.S.	+0·70 $p < 0·02$
5	11	+0·73 $p < 0·01$	+0·82 $p < 0·001$
6*	46	+0·44 $p < 0·01$	+0·88 $p < 0·001$
7*	11	+0·58 $p < 0·05$	+0·87 $p < 0·001$
8*	13	+0·84 $p < 0·001$	+0·70 $p < 0·01$

* Patients 6, 7 and 8 are described by Weil-Malherbe and Ström-Olsen (1958).

Table II demonstrates the results obtained in 3 normal males. There is no significant correlation between adrenaline excretion and urine volume. All three subjects showed a significant correlation between noradrenaline excretion and urine volume. In the hypertensive group a significant correlation $r = +0{\cdot}56$ ($p < 0{\cdot}01$) was found between urinary noradrenaline excretion and urine volume. There was no significant correlation between urinary adrenaline excretion and urinary volume, $r = +0{\cdot}36$.

TABLE II

Normal Subjects

	No. of Observations	Correlation Coefficient between Urine Volume and Adrenaline Excretion	Noradrenaline Excretion
A	12	−0·45 N.S.	+0·69 p < 0·01
B	12	−0·33 N.S.	+0·57 p < 0·05
C	12	−0·46 N.S.	+0·99 p < 0·001

Discussion

In the hypertensive group, variations in urine volume within the group are associated with variations in noradrenaline excretion.

In the normal individuals, alterations in urine volume produced by alterations in fluid intake are associated with alterations in urinary noradrenaline excretion. In 5 out of 8 psychotic patients studied, the same relationship can be seen. It must therefore be concluded that one of the factors influencing urinary noradrenaline excretion is the rate of urine flow. There will be considerable difficulties in relating urinary noradrenaline excretion to rate of noradrenaline secretion by the adrenal medulla.

The factors controlling urinary adrenaline excretion are more complex. In normal subjects and in the hypertensive group there is no relationship between urinary adrenaline excretion and urine volume. In 5 out of 8 patients there is a positive correlation between urinary adrenaline excretion and urine volume. This was not obtained in normals by a change in hydration. A change in hydration is, however, not the only way in which changes of urine volume could be produced and more fundamental changes in glomerular filtration rate or renal tubular function may be altering the urine volume in the patient group, and so determining the correlation between adrenaline excretion and urine volume. It is possible that increased adrenaline secretion by altering glomerular filtration rate and or tubular function could affect urine volume. Langston and Guyton (1958) found that adrenaline by increasing arterial pressure could increase urine flow. If, however, arterial pressure was held constant, then the direct effect of adrenaline on the kidney was to decrease urine flow.

In considering results of urinary noradrenaline excretion, alterations in urine volume dependent on fluid intake can affect the excretion of this compound. It will, therefore, be difficult to relate urinary excretion data to secretion rate.

Only in some psychotic subjects has a relation been established between urinary adrenaline excretion and urine volume. The factors determining this relation are at present unknown, but seem unlikely to be related simply to fluid intake.

Summary

In 3 normal males, a group of 30 hypertensives, and in 5 out of 8 psychotic patients, the urinary noradrenaline excretion is positively correlated with urine volume. In 5 out of 8 of the psychotic patients, but in neither the normal males nor the hypertensive group, urinary adrenaline excretion is positively correlated with urine volume. The interpretation of variations in urinary catecholamine excretion in patients with mental illness, should take account of the variations in urine volume however produced.

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J. Dawson, M.Sc., M.B., Ch.B., *Member of the External Scientific Staff of the Medical Research Council*

A. Bone, F.I.M.L.T., *Runwell Hospital, Nr. Wickford, Essex*