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Urinary magnesium excretion during amiloride administration in saline-loaded rats

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Reduced urinary magnesium excretion was reported after triamterene administration to either normal human subjects (Hänze & Seyberth, 1967) or saline-loaded rats (Ryan & Phillips, 1977). Acute administration of amiloride to congestive heart failure patients receiving frusemide resulted in reduced urinary magnesium excretion and increased plasma and lymphocyte magnesium (Counihan, Dunne, Halley, Ryan & Ryan, 1978). Canrenoate potassium, an aldosterone antagonist, has been reported to exert magnesium-saving properties in patients with liver cirrhosis (Lim & Jacob, 1978). We have studied urinary magnesium excretion in saline-loaded rats during administration of amiloride either alone or in combination with frusemide.

Male Wistar rats (110–465 g) were fasted overnight with water allowed *ad lib.* All animals received an oral load of 2.5 ml of 0.9% NaCl per 100 g body weight. Diuretics were administered in the appropriate saline load. Rats were placed in individual metabolism cages and urine was collected for 6 hours.

Amiloride (2.5 mg/kg) resulted in a significant diuresis ($P < 0.001$) and natriuresis ($P < 0.001$). The amiloride group excreted an average of 148% of the administered sodium load compared to an average of 45% of the administered sodium load excreted by the control group. Both urinary potassium ($P < 0.001$) and magnesium ($P < 0.01$) excretion were significantly reduced in the amiloride group. Frusemide has been previously reported to enhance urinary output of sodium, potassium, magnesium and calcium in saline-loaded rats (Ryan & Phillips, 1977). In the present study, frusemide (40 mg/kg) induced a natriuresis amounting to an average of 235% of the administered sodium load. Combination of amiloride (2.5 mg/kg) with frusemide (40 mg/kg) produced no further increases in either urinary volume or sodium excretion. Administration of amiloride with frusemide did, however, result in significant reductions in urinary excretions of potassium ($P < 0.001$) and magnesium ($P < 0.01$). Urinary calcium excretion ($P < 0.01$) was significantly reduced during amiloride administration in the presence of frusemide. No reduction in urinary calcium was found during amiloride administration alone. This discrepancy may be related to the presence of calcium, as detected by analysis, in the pharmaceutical preparation of amiloride. Hypercalciuria has been reported after amiloride administration in man (Johny, Lawrence & O'Halloran, 1969).

These preliminary investigations indicate that acute amiloride administration either alone or in combination with frusemide can reduce urinary magnesium in saline-loaded rats. However, more detailed investigations are required to determine whether the reduced urinary magnesium excretion results from a direct action of amiloride on the renal handling of magnesium or is related to possible secondary effects of the diuretic such as extracellular volume contraction.

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