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EFFECT OF $CaCO_3$ SUPPLEMENTS ON SERUM OXALATE IN PATIENTS ON REGULAR HAEMODIALYSIS TREATMENT

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Summary

The effect of changes in the dose of $CaCO_3$ supplements on serum oxalate was investigated in patients on regular haemodialysis treatment, in whom the dialysate calcium was contemporarily reduced. $CaCO_3$ increase or decrease was directly correlated with the percentage decrease or increase of serum oxalate. Because of the postulated binding action of calcium on oxalate in the gut and the behaviour of serum calcium and calcium-oxalate product, it seems advisable to increase oral calcium intake and decrease dialysate calcium in order to obtain an optimal calcium balance, to avoid hypercalcaemia after dialysis, to reduce serum oxalate and serum calcium-oxalate, and, consequently, to prevent calcium-oxalate deposits in haemodialysis patients.

Introduction

In patients on regular haemodialysis, hyperoxalaemia may be severe enough to induce calcium-oxalate deposits in many tissues [1–8]. Since previous studies [9] showed an increase in urinary oxalate excretion due to increased intestinal oxalate absorption in stone formers on a low calcium diet, it can be postulated that a high calcium intake might have an opposite effect by binding oxalate in the intestine and reducing its absorption.

We have investigated the effect of changes in oral calcium supplementation on serum oxalate in haemodialysis patients, in whom the dialysate calcium was contemporarily reduced to avoid a significant increase of serum calcium, especially at the end of each dialysis session.

Patients and methods

Nineteen adult patients on haemodialysis for at least one year, not affected by primary oxalosis or intestinal disorders, were selected for this investigation because of their steady state and their reliability in following therapeutic prescriptions. All were dialysed three times weekly for a total of 12–13.30 hours

with a cuprophan membrane and a dialysate containing 2mmol/L of Ca^{++}. They were on a free diet and received multivitamins, including pyridoxine; none were taking vitamin D derivates and most were given $CaCO_3$ supplements on interdialytic days to avoid dangerous hypercalcaemia in the immediate post-dialysis period. Both the serum total protein and albumin concentrations were normal in all the patients studied.

After basal pre- and post-dialysis determination of serum oxalate and serum calcium (basal period), oral $CaCO_3$ supplementation was kept unchanged in six patients, stopped in three patients and increased in the remaining 10 patients in various amounts ranging from two to 10g/day (in the interdialytic days only); furthermore, in all patients dialysate calcium was reduced from 2 to 1.75mmol/L. After a four month period on the new drug schedule (final period), the above parameters were evaluated as in the basal period. Serum oxalate and serum calcium were also determined in 20 normal subjects.

Serum oxalate was measured by specific enzymatic method [10] and its mean normal value was 21.9±4.9μmol/L, serum calcium by atomic absorption spectrophotometry and its mean normal value was 2.49±0.15mmol/L. All values were expressed as a mean ± standard deviation (SD) and were compared using the Student's 't' test for paired data.

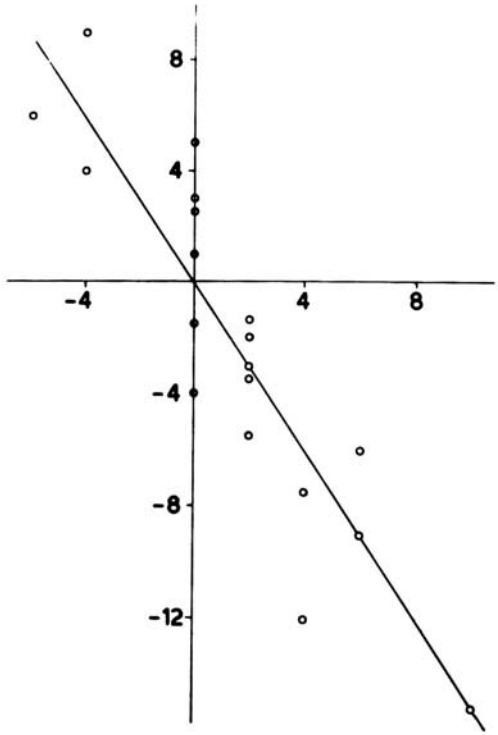

Figure 1. Inverse relationship between $CaCO_3$ dose changes (g/interdialytic day) – horizontal line, and percentage pre-dialytic serum oxalate variations – vertical line. ($r=0.89$, $p<0.001$, $y=-1.5x$)

Results

An increase or decrease in oral $CaCO_3$ directly correlated with a percentage decrease or increase of pre-dialytic serum oxalate, respectively ($r=0.89$, $p<0.001$) (Figure 1).

TABLE I. Values (mean ± SD) of serum oxalate (sOx) (μmol/L), serum calcium (sCa) (mmol/L) and calcium oxalate product (sCaxOx), before and after dialysis (BD, AD), during a control period (basal period) and after the therapeutic changes (final period) in haemodialysis patients divided into four groups according to the $CaCO_3$ amount variations

Patients No	$CaCO_3$ changes g/interdialytic day	Parameters		Basal period	Final period	p
6	No change	sOx	BD	62.3±8.4	63.2±9.8	NS
			AD	36.2±7.2	31.8±5.7	0.1 (NS)
		sCa	BD	2.76±0.31	2.62±0.27	NS
			AD	3.28±0.19	3.04±0.1	0.05
		sCaxOx	BD	173±38	167±39	NS
			AD	119±24	97±15	0.01
5	Increase 2g	sOx	BD	69.3±6.8	66.2±4.7	NS
			AD	38.5±3.8	34.5±4	0.1 (NS)
		sCa	BD	2.69±0.22	2.44±0.18	0.01
			AD	3.17±0.34	3.04±0.29	NS
		sCaxOx	BD	186±18	161±8	0.01
			AD	122±12	104±11	0.1 (NS)
5	Increase from 4 to 10g	sOx	BD	85.8±9.1	77.4±10.1	0.005
			AD	44±4.2	41.3±4.9	NS
		sCa	BD	2.58±0.28	2.57±0.16	NS
			AD	3.12±0.19	3±0.2	NS
		sCaxOx	BD	222±43	199±30	0.1 (NS)
			AD	137±14	124±17	0.1 (NS)
3	Cessation	sOx	BD	52.1±4.5	56±4.1	
			AD	29.6±0.6	29.2±2.2	
		sCa	BD	2.54±0.1	2.36±0.03	
			AD	3.15±0.13	2.83±0.02	
		sCaxOx	BD	132±7	132±9	
			AD	93±2.5	82±6	
Normal subjects		sOx		21.9±4.9		
		sCa		2.49±0.15		
		sCaxOx		54±13		

In both periods, significant hyperoxalaemia was confirmed in all the groups of patients. However, the pre-dialysis serum oxalate decreased significantly only in patients in whom $CaCO_3$ was increased by large amounts, whereas significant reductions of serum calcium and serum calcium-oxalate product were observed in the other groups, as expected by the decrease of dialysate calcium not associated with a large increase of $CaCO_3$ intake (Table I).

Discussion

Even though haemodialysis removes oxalate and pyridoxine administration has been shown to lower serum oxalate [5], these procedures are not sufficient to reduce serum oxalate to prevent oxalosis induced by calcium-oxalate deposits which are expected to occur when an uncertain limit value of the calcium-oxalate product is exceeded. Therefore, it seems reasonable to suggest other therapeutic approaches to decrease serum oxalate and consequently the calcium-oxalate product in haemodialysis patients.

On the basis of the postulated binding action of calcium on oxalate in the gut, according to the relationship between oral calcium intake and serum oxalate changes, and the behaviour of serum calcium and the calcium-oxalate product, high oral $CaCO_3$ supplements are suggested and should be associated with a decrease in dialysate calcium in order to obtain the following objectives: to reduce serum oxalate, to keep optimal calcium balance, to avoid hypercalcaemia, especially at the end of dialysis, and, finally to reduce the calcium-oxalate product in haemodialysis patients.

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