Oral Calcium load test in recurrent stone-formers

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INTRODUCTION

Hypercalciuria is the main risk factor in recurrent calcium stone-formers. The oral calcium load test (or Pak test) is a dynamic test that determines the origin of hypercalciuria in order to optimize the treatment. However, there is little literature about it, and it seems to have lost popularity in daily practice. In this study, we evaluated a population of stone-formers who underwent the test.

PARTICIPANTS & MEASUREMENTS

Between 2013 and 2016, we prospectively recruited 117 recurrent calcium stone-formers. After 2 days of calcium restricted-diet, patients had urinary and blood sampling at baseline and 120 min after the intake of 1g of calcium *per os*. Blood and urinary parameters were assessed during the dynamical test, including stone risk factors, calcium metabolism and bone evaluation. According to these results, patients were classified in three groups: resorptive (primary hyperparathyroidism), renal (renal calcium leak) or absorptive hypercalciuria.

RESULTS

- First, 19 patients were diagnosed with **normocalcemic primary hyperparathyroidism**, assessed by **inappropriate parathormone decrease** in regard to calcemia. The measurement of ionized calcemia was mandatory in order to detect the induced hypercalcemia after calcium intake. These patients also had higher bone turn-over. The treatment of this first group of patient is the parathyroidectomy.
- **Fasting hypercalciuria** was present in 39 patients with urinary calcium/creatinine >0.37mmol/mmol, and without hyperparathyroidism, classified thus as **renal hypercalciuria**. The treatment of these patients should include adapted calcium intake and thiazides.
- The third group included 34 patients with **absorptive hypercalciuria** defined by the increase of urinary calcium/creatinine >0.6mmol/mmol between 0 and 120 min, and **without any other significant abnormality**. They require adapted calcium and vitamin D intake too.
- Finally, the test results were not reliable for 33 cases because of the absence of sufficient calcemia increase or when the cause of lithogenesis could not be clearly identified.

Parameters (norms and units)	Primary Hyperparathyroidism (n=19)		Renal Calcium Leak (n=31)		Absorptive Hypercalciuria (n=34)	
Serum analyses						
Ca^{2+} (1.15-1.30mmol/l) 0min	1.28 (±0.03)	c	1.24 (±0.03)		1.24 (±0.03)	
Ca^{2+} (1.15-1.30mmol/l) 120min	1.37 (±0.05)	b,*	1.32 (±0.04)	*	1.33 (±0.04)	*
PTH (15-65pg/ml) 0min	75.38 (±22.66)	d	42.92 (±14.51)		39.39 (±13.00)	
PTH (15-65pg/ml) 120min	43.71 (±13.9)	d,*	20.05 (±8.18)	*	16.69 (±5.45)	*
PTH decrease (%)	41.41 (±12.82)	b	52.99 (±11.67)		55.03 (±15.7)	
PTH decrease (Δpg/ml)	31.7 (±14.5)	a	22.9 (±10.5)		22.7 (±11.7)	
TmPi/GFR (0.76-1.62mmol/l)	0.64 (±0.18)		0.80 (±0.11)	b	0.66 (±0.18)	
Urine analyses						
Ca/Creatinine (<0.37mmol/mmol) 0min	0.45 (±0.22)		0.53 (±0.21)		0.28 (±0.11)	c
Ca/Creatinine (<0.37mmol/mmol) 120min	1.08 (±0.67)	*	1.16 (±0.33)	*	1.03 (±0.34)	*
Ca/Creatinine increase (Δmmol/mmol)	0.63 (±0.52)		0.63 (±0.35)		0.75 (±0.34)	
Bone parameters	(n=10)		(n=23)		(n=18)	
BMD: Radius 33% Ts	-1.43 (±0.91)	b	-0.82 (±1.58)		-0.58 (±1.12)	b
BMD: Radius 33% Zs	-1.08 (±0.89)		-0.41 (±1.29)		-0.56 (±1.23)	
β-C-terminal telopeptide (ng/ml)	0.684 (±0.259)	a	0.554 (±0.204)		0.538 (±0.171)	
Osteocalcin (10.7-34.1ng/ml)	28.5 (±9.7)	b	23.8 (±9.0)		22.8 (±7.0)	b

Data are presented as mean (± SD). TmPi/GFR, phosphate tubular maximal reabsorption
a, $P<0.05$; *b*, $P<0.01$; *c*, $P<0.001$ vs. each of the two other groups;*, $P<0.0001$ vs. baseline.

DISCUSSION & CONCLUSIONS

The oral calcium load test was successful for the identification of hypercalciuria origin in stone-formers, allowing to optimize treatment of these patients. In addition, ionized calcemia was mandatory for the diagnosis of normocalcemic primary hyperparathyroidism, while the % or Δ of PTH decreases were useless to identify these patients with higher bone turnover.