NAIL CALCIUM, PHOSPHATE AND MAGNESIUM IN HYPERTHYROIDISM

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SYNOPSIS

In 18 hyperthyroid patients the mean nail calcium (50.1 MEq/Kg) is significantly higher ($p < 0.05$) than that in 18 euthyroid subjects (37.3 MEq/Kg). The mean nail phosphate and magnesium in the hyperthyroid patients are also higher than those in the euthyroid subjects, although the difference is not significant. The serum calcium, phosphate and magnesium in the hyperthyroid group closely resemble those in the euthyroid group. The present study substantiates the clinical observation that nail changes are frequently observed in hyperthyroidism.

INTRODUCTION

Changes in the fingernails are frequently observed in hyperthyroidism. The nail tends to leave the nail bed, giving a concave or wavy margin to the terminal portion in contact with the nail; the surface of the nail tends to lose its lustre and the longitudinal striations are exaggerated and the nail becomes brittle; these changes are sometimes referred to as "Plummer's nails" (1,2). These nail changes may reflect an alteration in its mineral composition; there is scanty literature on the mineral composition of nails in hyperthyroidism. This communication describes the calcium, phosphate and magnesium contents of the nails in hyperthyroid patients.

MATERIALS AND METHODS

Fingernail clippings were obtained from 18 hyperthyroid patients (8 males, 10 females; mean age: 35 years, age range: 19 to 67 years). The diagnosis of hyperthyroidism was made clinically and confirmed by thyroid function tests which included the resin uptake of triiodothyronine and the serum thyroxine level. All these patients had nail changes; 8 had mild to moderate changes while 10 had marked changes. After the nail clippings were obtained the serum calcium, phosphate and magnesium were also determined. Fingernail clippings were also obtained from 18 euthyroid subjects matched for sex and age; all these subjects had normal-looking fingernails. Similarly, after the nail clippings were obtained the serum calcium, phosphate and magnesium were determined.

The method used for determining the calcium, phosphate and magnesium contents of the nail is that described by Lim, Tay and Tan (3). The nails were weighed, placed in small porcelain crucibles and incinerated at 500° C overnight in a muffle-furnace. Two ml. of N HCl was added to dissolve the ash in each crucible. An aliquot of the resulting solution was diluted with 1% aqueous strontium chloride. The range of dilution varied from 2.5 to 10 times depending on the weight of the nails obtained which ranged from 50 mg to 130 mg. The determination of calcium and magnesium was then carried out on the diluted solution using the Atomic Absorption Spectrophotometer (Unicam SP 90). Phosphate was determined by the method of Kraml (4).

Table 1 — Calcium, phosphate and magnesium (mean ± SD) in serum and nail

	Hyperthyroid patients (18)	Euthyroid subjects (18)	Difference (p)
Serum Ca (mg/100ml)	9.7 ± 0.4	9.6 ± 0.4	NS*
Nail Ca (MEq/Kg)	50.1 ± 21.9	39.3 ± 9.0	< 0.05
Serum PO4 (mg/100ml)	2.5 ± 0.2	3.3 ± 0.5	NS
Nail PO4 (MEq/Kg)	19.9 ± 13.4	15.6 ± 5.6	NS
Serum Mg (mg/100ml)	1.9 ± 0.2	2.1 ± 0.1	NS
Nail Mg (MEq/Kg)	8.2 ± 3.5	7.2 ± 3.9	NS

*NS denotes not significant

RESULTS

These are shown in Table 1. The serum calcium, phosphate and magnesium in the hyperthyroid patients closely resemble those in the euthyroid subjects. The nail calcium in the hyperthyroid group is significantly higher than that in the euthyroid group ($p < 0.05$). The mean nail phosphate and magnesium in the hyperthyroid patients are also higher than that in the euthyroid subjects although the difference is not significant.

In the 8 hyperthyroid patients with marked nail changes, the mean nail calcium is 57.1 MEq/Kg while in the other 10 hyperthyroid patients with mild to moderate nail changes, the nail calcium is 44.7 MEq/Kg; the difference is not significant.

DISCUSSION

Chemical analysis of nails has mainly been performed in forensic medicine, in the diagnosis of mucoviscidosis and hepatolenticular degeneration (5). There is little information on the composition of the nails in hyperthyroidism in spite of the fact that changes in the nails are frequently observed in hyperthyroidism.

The present study shows that the nails calcium is significantly higher in the hyperthyroid patients when compared to euthyroid subjects. The nail phosphate and magnesium are also higher in the hyperthyroid patients than in the euthyroid subjects although the difference is not significant. This study supports the clinical observation of the nail changes in hyperthyroidism.

Increase in the nail calcium appears to be a surprising finding in view of the fact that there is a negative calcium balance in hypethyroidism (2). Nitrogen is the major component of the nail and this is compatible with the fact that keratin is the chief constituent of nails (5). In hyperthyroidism, there is increased protein catabolism (2) and this may deplete the keratin content of the nails leading to a relative increase in the mineral components. This can explain the increased nail calcium in hyperthyroidism observed in this study. In Kwashiorkor, there is negative protein and mineral balance and increased nail calcium has been reported in this disorder (6).

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