tary selenium, as most selenium in food is bound to large molecules that must be digested before being absorbed. Further studies on the absorption of dietary selenium in psoriasis and atopic dermatitis are needed. Such studies may reveal a malabsorption of dietary selenium equivalent to the asymptomatic malabsorption of fat (5) found in these diseases.

ACKNOWLEDGEMENTS

We are grateful to the Psoriasis Association and to the Wessex Regional Health Authority for grants, to Mrs B. Lloyd for measuring the plasma selenium concentrations and to Drs D. M. Ackery, J. E. White, B. J. Leppard and P. G. Goodwin for allowing us access to their patients and facilities.

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Is the Effect of Phototherapy in Psoriasis Partly Due to an Impact on Vitamin D Metabolism?

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Staberg B, Oxholm A, Klemp P, Hartwell D. Is the effect of phototherapy in psoriasis partly due to an impact on vitamin D metabolism? Acta Derm Venereol (Stockh) 1988; 68: 436–439.

To elucidate the effect of phototherapy on vitamin D metabolism in psoriatics, the serum concentrations of the major vitamin D metabolites (25-hydroxy-vitamin D (25(OH)D), 1,25-dihydroxy-vitamin D (1,25$(OH)_2$D), and 24,25-dihydroxy-vitamin D (24,25$(OH)_2$D)) were studied in 10 patients with disseminated psoriasis, both before and after phototherapy. Some 3–4 weeks of Goeckerman therapy induced significantly increased serum levels of 25(OH)D (mean: 24.6 ng/ml versus 54.4 ng/ml; ($p<0.001$)) and 24,25$(OH)_2$D (mean: 2.01 ng/ml versus 3.49 ng/ml; ($p<0.001$)). After phototherapy the mean serum level of 1,25$(OH)_2$D increased nearly to the level found in healthy controls (mean: 23.8 vs. 32.2 pg/ml). However, this increase was not significant. It is shown that conventional phototherapy does have an impact on vitamin D metabolism in psoriatics. Since previous investigations have indicated an abnormal vitamin D metabolism in patients with psoriasis, it is possible that the beneficial effect of phototherapy in this disease might be due partly to an impact on vitamin D metabolism. (Received December 23, 1987.)

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The cutaneous synthesis of cholecalciferol in response to ultraviolet (UV) irradiation is considered to be the most important factor in maintaining vitamin D status in man (1, 2). Vitamin D is hydroxylated in the liver to 25-hydroxyvitamin D, followed by hydroxylation

in the kidney to 1.25-dihydroxyvitamin D or 24,25-dihydroxyvitamin D. $1,25(OH)_2D$ is the most active metabolite in regulating blood calcium level, while the effect of $24,25(OH)_2D$ is at present unknown. In normal skin $1,25(OH)_2D$ has an effect on cell division and differentiation of cultured dermal fibroblasts and keratinocytes (3, 4), while this mechanism seems to be defective in psoriatic skin (5). Recently, we have demonstrated a reduced serum concentration of $1,25(OH)_2D$ in patients with disseminated psoriasis (6). Furthermore, it has been shown that psoriasis may respond to local or systemic administration of active vitamin D metabolites (7, 8).

Since the beneficial effect of UV radiation in the treatment of psoriasis is already well established, we have in the present study examined the effect of conventional phototherapy on vitamin D metabolism in patients with disseminated psoriasis.

MATERIAL AND METHODS

Patients

A selected group of 10 informed patients with disseminated and active psoriasis, mean age 42 years (range 24–73 years) participated in the study. None of the patients had been exposed to UV-radiation on their body within 3 months of the investigation and none took vitamin pills. All patients had normal renal and hepatic function. 37 healthy sex and age matched individuals served as controls.

Light source

The patients were treated with Goeckerman therapy with 2% coal tar gel and medium-wave ultraviolet (UVB) irradiation, delivered in a walk-in triangle-shaped irradiation chamber with a medium-pressure Hg-lamp without UVC. All patients were whole-body irradiated three times a week for up to 4 weeks.

Assay procedures

Blood samples from the patients were obtained before and 3–4 weeks after initiation of phototherapy. Samples from the control subjects were obtained during the same period as the investigation was performed, during the months of November to March.

Vitamin D measurement

Vitamin D metabolites were determined by methods which involve specific extraction procedures, followed by chromatography on Sephadex LH 20 and high-pressure liquid chromatography (9). The serum concentrations of $1,25(OH)_2D$ were measured by competitive protein binding assay based on intestinal receptor from rachitic chickens (9). The serum concentrations of $25(OH)D_3$ and $24,25(OH)_2D_3$ were measured by radio-immunoassays (10, 11). The intra- and inter-assay variations were 9/14%, 5/10% and 8/13%, respectively.

Statistics

For statistical evaluation, Student's *t*-tests for paired and unpaired data were used. Level of significance was 5%.

RESULTS

In the patients with psoriasis the mean pretreatment values of $1,25(OH)_2D$ and $24,25(OH)_2D$ were decreased and increased, respectively, as compared with the mean values found in healthy controls. However, these differences were not significant ($0.1<p<0.2$) (Table I).

Some 3–4 weeks of phototherapy induced a significant increase in the serum concentrations of 25(OH)D and $24,25(OH)_2D$ ($p<0.001$). After phototherapy the mean serum concentrations of $1.25(OH)_2D$ increased about 40% and almost to the level of the healthy controls. However, compared with the pretreatment values of $1,25(OH)_2D$ the difference was not significant ($0.1<p<0.2$) (Table I).

DISCUSSION

$1,25(OH)_2D$ is involved in the regulation of differentiation and proliferation of epidermal cells (3, 4), but a defect in this mechanism have been demonstrated in psoriatic skin (5). Therefore a possible role for $1,25(OH)_2D$ in the pathogenesis of psoriasis has been suggested (5). Recently, we have shown a reduced serum concentration of $1,25(OH)_2D$ in patients with disseminated psoriasis (6). In the present study a 30% decrease was found in the serum concentration of this metabolite, compared with the controls. However, this difference was not significant (Table I).

UVB therapy of psoriatic patients has previously been shown to result in a marked rise in the serum concentration of 25(OH)D (12), a finding that was confirmed in the present study (Table I). Since the increase in 25(OH)D corresponded to the clinical improvement in the study by Sommer-Tsilenis et al. (12), a connection between vitamin D metabolism and psoriasis is suggested. In patients with chronic plaque psoriasis, Shuster et al. have demonstrated elevated serum concentrations of 25(OH)D one day after initiation of PUVA therapy (13). In contrast, no change in serum concentration of 25(OH)D was observed after two PUVA treatments of healthy individuals, indicating that vitamin D metabolism might be altered in patients with psoriasis (14).

Our demonstration of a significant rise in the serum concentration of $24,25(OH)_2D$ after phototherapy (Table I) accords with previous investigations showing a seasonal variation of the serum concentration of this metabolite, with maximum values in the summer (14, 15).

Despite a seasonal fluctuation in 25(OH)D and $24,25(OH)_2D$, the serum concentration of $1,25(OH)_2D$ remains virtually unchanged throughout the year (15, 16). In healthy individuals a single dose of UVB had no effect on the concentration of $1,25(OH)_2D$ although a 3–4-fold increase was found in vitamin D deficient patients (17). In our study a 40% increase toward normal level was found in the serum concentration of $1,25(OH)_2D$ after phototherapy. However, this increase was not significant, and it can therefore not be concluded that an increased concentration of $1,25(OH)_2D$ might be of importance for the beneficial effect of phototherapy in patients with psoriasis. In the present investigation the psoriatics were treated with Goeckerman therapy. Since this is not pure phototherapy, the possibility that the tar applications could influence the results cannot at present be ruled out, as no previous studies have focused on this subject.

In conclusion, in patients with disseminated psoriasis we have demonstrated a signifi-

Table I. *Mean serum concentrations of three vitamin D metabolites in 10 patients with psoriasis before (I) and after (II) phototherapy*

Vitamin D metabolites		Controls (n=37)	Patients I	Patients II
25(OH)D	Mean	27.8	24.6	54.4
(ng/ml)	±SD	12.8	25.2	26.0
	p	NS	<0.001	
$1,25(OH)_2D$	Mean	35.0	23.8	32.2
(pg/ml)	±SD	11.3	12.7	15.0
	p	NS	NS	
$24,25(OH)_2D$	Mean	1.28	2.01	3.49
(ng/ml)	±SD	1.05	2.45	2.51
	p	NS	<0.001	