

ELECTRODERMAL RESPONDING IN HYPERTHYROID PATIENTS

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(Received on June 26, 1998)

Abstract : The effects of hyperthyroidism on electrodermal habituation and responsiveness were examined in 43 hyperthyroid patients who were divided in two groups (medicated and unmedicated). In a comparison of 43 hyperthyroid and 43 normal controls; among patients with hyperthyroidism a great number of nonresponders were found. The distributions of SCR in habituation series in both group were almost the same but hyperthyroid patients were in slower habituation status than controls. These findings suggest that electrodermal nonresponsiveness or slow habituation in hyperthyroid patients might be considered as a function due to changes in the metabolism of biogenic amines in the central nervous system.

Key words : electrodermal responsiveness habituation
hyperthyroidism

INTRODUCTION

Electrodermal activity (EDA) recorded as a change in skin potential or resistance controlled by the sympathetic nervous system is a sweat gland reaction (1). EDA is a component of the orientated response (OR) as such it is assumed to reflect central information processing and attentional mechanism (2, 3). Conventional test procedures for the measurement of the because of their unstructured nature (4). These workers suggest that conventional instructions, to relax and adopt a passive frame and mind, to ignore the stimuli, or to listen but remain is required of them. Drawing an analogy with a reaction time experiment, they propose a more structured situation with instructions as follows "Try

to ignore the tones do not pay any attention to them. I will be measuring your body responses to see how fast you can stop responding to a meaningless tone very quickly (5). Instructions to count the stimuli should speed up the habituation process (6). In addition, habituation to specific stimuli is apparently slowed in anxiety patients (7).

It has been reported that both nonresponding and nonhabituating states were reproduced by intraventricular administration of 6-hydroxydopamine (6-OHDA), a neurotoxin selective to catecholamine neurons, in rats and cats (8, 9, 10, 11). These experimental results suggested that elevation of the central norepinephrine (NE) activity facilitates electrodermal responsivity while its

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diminution lowers them (8). Suer et al. found that the changes of EDA immobilisation stress in rats are mediated by NE system (12).

Excessive thyroid secretion is associated with the symptoms of sympathetic autonomic dysfunction, including hyperexcitability, irritability, restlessness, exaggerated responses to environmental stimuli and emotional instability (13). Hyperthyroidism if untreated ultimately lead to psychosis (14, 15, 16).

The purpose of the present study was to examine the incidence of electrodermal nonresponsiveness and the habituation in patients with hyperthyroidism.

METHODS

The forty three patients with clinical signs of hyperthyroidism (12 male and 31 female, mean age 39.6 years, age range: 15–62 years) and 43 healthy subjects (19 male and 22 female, mean 32.0, age range: 17–60 years) were included in this study. Informed consent were obtained from each subject. At the time of study, 14 patients (32.6%) received propylthiourasil at the standard doses. The mean diagnosed as clinically definite hyperthyroid by Department of Endocrinology, Erciyes University and as shown by thyroid function tests including free T_3 (fT_3), free T_4 (fT_4) and TSH, thyroid ultrasonography and thyroid scintigraphy. None of the subjects both in the experimental and control group, had a history of psychiatric disorder.

Stimuli: To evoke SCRs a series of tones was used. There were 1 Khz, 90 dB tone

and were produced by sound chip of computer. Auditory stimuli occurred 30–65 sec intervals and applied 15 times. Sampling at a rate of 5 Hz started at stimulus onset and lasted 22 sec.

Data analysis was carried out with the aid of a basic programme (ACPEOM), which is written in our laboratory. All SC change occurring from 0.5–3.0 sec after stimulus onset of amplitude change 1% were counted as SCR. Habituation number (HN) was the number of trials until a criterion of three consecutive nonresponses were reached. Nonresponding was defined as the failure to respond to any of the first stimulus presentations, and consequently responding was defined as a response to both of the first two tones. Fast habituators were those who gave only one or two responses before habituation. A subject with a $HN > 15$ was considered a nonhabituator. Other subjects were considered habituator.

Thyroid hormones and Thyrotropic hormone (TSH) measurement: Free T_3 and free T_4 levels were quantified by RIA and TSH level by IRMA kits were from Diagnostic Products Corporation, Los Angeles.

RESULTS

Men in our study constituted 27.91% ($n=12$) of the patients with hyperthyroidism ($n=43$), 46.81% ($n=20$) of the normal controls ($n=43$) [$X^2(1)=3.413$, $P>0.05$]. The mean age (range) for each group was: patients =39.6 (21–62); normal controls=32.02 (17–60) years.

Rate of nonresponding: two (4.65%) of the 43 control subjects and 8 (18.61%) of

the 43 patients with hyperthyroidism failed to show a SCR to one of the first two tones and were, therefore, considered nonresponder (NR). This difference in prevalence of nonresponding was statistically significant [$X^2(1)=4.07$, $p>0.04$]. When the effects of both medication and gender on the rate of non responding were computed, no significant responses were found.

Distribution of SCR in habituation series: Figure shows the distribution of number of trials to habituation for the patients and control group during the OR series. As shown in Figure the distributions of HN in both groups were almost the same. Although the percentage of fast habituators, habituators and nonhabituators in the patient group were not statistically different from those in normal controls [$X^2(2)=3.73$, $p=0.16$], lesser number of patients ($n=4$) were classified as fast habituators than control ($n=11$).

DISCUSSION

Our data analysis indicated that the rate of NRs was higher in hyperthyroid patients (18.6%) than in controls (4.65%). Electrodermal NRs are observed in affective disorders and in normal people but appear in a startlingly high proportion of schizophrenic subjects (17). The ratio of NRs found in our control subjects is in line with 5% to 10% NRs typically found in normal (3). While the ratio of NRs observed in our hyperthyroid patient group is lower than those observed in schizophrenic subjects (18, 19, 20), the bulk of reports indicate that non responsivity correlates with reduced autonomic activity (21, 22, 23). Since thyroid

hormones enhance central symphatetic autonomic activity (24, 25), we have every reason to eliminate this possibility. A number of other intervening factors have been suggested to explain nonresponsiveness: the type of stimuli used, the composition of experimental group, responding criterion, the size and position of electrodes, electrolytic medium, the chronicity of the illness and medication. The majority of these factors are excluded in our experimental design (by the use of the same experimental method). Moreover, higher percentage of NRs in hyperthyroidism could not have been not a function of medication (5 NRs in unmedicated, 3 NRs in medicated patients). Since our patients had been placed on medication a short time before they were included in the study. Although whether the increased nonresponsiveness is due to the duration of hyperthyroidism requires further research, NR hyperthyroid patients had a longer period of the illness (42.8 ± 15.3 months i.e. 18.0 ± 3.8 months, $t=2.35$, $p<0.05$), depending on their anamnesis. Thus the relation between nonresponsiveness and hyperthyroidism remains unclear.

Hyperthyroid patients had a tendency to habituate more slowly than the controls. The poor habituation of the hyperthyroid patients could be interpreted in terms of theories presented by Sokolow (26) and Ohman (27) as reflecting a disturbance of cortical model formation due to dysfunction of preattentive mechanism of short term memory. On the other hand, habituation rate correlated with levels of general and overt anxiety suggesting the presence of anxiety is associated with slow habituation (7, 28). In agreement with previous report,

significant increases in habituation number were noted in hyperthyroid patients compared with controls (29).

It has been reported that thyroid hormone deficiency in rats leads to permanent changes in the development of the central catecholaminergic systems, as demonstrated by persistent reduction in whole brain tyrosine hydroxylase activity and NE content (30). Conversely hyperthyroidism leads to increase the synthesis and turnover of NE (24). But several authors reported a relationship

between central NE activity and electrodermal responsivity (8). In the light of these previous studies we did not explain relationships between NE and electrodermal nonresponsivity and slow habituation.

In conclusion, our findings indicate that hyperthyroidism may cause electrodermal alterations. However a more detailed and specific assessment of biogenic amines is necessary in order to explore thoroughly how electrodermal alteration are associated with thyroid status.

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