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Olfactometry in Patients with Certain Endocrine Diseases

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Abstract

The endocrine system affects the function of many organs and systems. Some endocrine disorders damage the nervous system and the sensory systems. The aim of this study was to identify changes in the sense of smell in some endocrine diseases: prolactinoma, acromegaly, hypothyroidism and hyperthyroidism. The sense of smell in four groups of patients with these diseases was examined and compared with that of a group of healthy controls. For testing and evaluating the sense of smell, the olfactometer of Dimov-Raykov was used. In the four groups, we observed reduced sense of smell compared to the control group. We have found significant deviations in patients with acromegaly and prolactinoma. In other two groups of patients with hyperthyroidism and hypothyroidism, we established also weak pathological deviations; however they have no statistical significance.

Keywords: Olfactometry; prolactinoma; acromegaly; hypothyroidism; hyperthyroidism.

1. Introduction

The endocrine system affects many organs and systems, for example, the nervous system and the sensory system. Caruso *et al*. described that the menopause leads to a reduced sense of smell [1]. They explained this situation with the reduction of the concentrations of the hormones estrogens, progesterone, and androgen. Savović and his colleagues [2] have described that besides menopause, pregnancy also leads to a reduced sense of smell. They have found that this effect was due to the reduction of the concentrations of estrogen hormones, progesterone, and androgen hormones [2]. Other effects of hormonal disorders of the nervous system are established. In acromegaly, which is characterized by overproduction of growth hormone, symptoms such as headache, acroparesthesia, and visual disturbances are described [3].

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In pituitary adenoma, the pituitary presses the optic nerve causing visual disturbances, even full loss of eye sight [4]. When the thyroid gland is overactive, due to the increase in the thyroid hormones secretion, confusion, anxiety, tremor, and emotional lability are described [5]. When the thyroid gland is underactive, due to the decrease in the thyroid hormones secretion, symptoms such as fatigue, drowsiness, impaired memory, and loss of concentration arise [5].

In the scientific literature there is no evidence that disease such as: prolactinoma, acromegaly, hypothyroidism and hyperthyroidism affect the olfactory system. Because of this, the aim of this study was to identify changes in the sense of smell at these endocrine diseases.

2. Methods

The sense of smell was examined with the olfactometer of Dimov-Raykov, validated for Bulgaria [6]. With this device, a simultaneous study of the two main functions of the olfactory analyzer can be tested: a quantitative and qualitative assessment of same flavoring substances. These examinations were applied on four groups of patients: with prolactinoma, acromegaly, hypothyroidism and hyperthyroidism and on a control group of healthy subjects (Table 1).

Table 1: Composition of the person groups by age and gender.

Group	***Sex***	***Number***	***Age (years)***
			Average age (± SD)
Healthy controls	Men	12	48 (±3,2)
	Ladies	12	52 (±3,5)
Prolactinoma	Men	10	48,3 (±3,1)
	Ladies	14	52,7 (3.8)
Acromegaly	Men	12	46,7 (±2,5)
	Ladies	12	50,6 (±2,9)
Hypothyroidism	Men	12	48,7 (±3,2)
	Ladies	12	53,8 (±3,9)
Hyperthyroidism	Men	12	52,3 (±1,7)
	Ladies	12	54,9 (±2,1)

3. Results

The average deviation of the detection threshold in the control group was 5.5 cm^3, and the average determination threshold was 15.4 cm^3.

In the patient group with prolactinoma, the average detection threshold was 9.5 cm^3, and the average

determination threshold was 22.6 cm^3. Compared with the healthy persons, the deviation is significantly greater, both in the detection and in the determination threshold ($p < 0.05$).

In the patient group with acromegaly, the average detection threshold was 9.1 cm^3, and the average determination threshold was 21.5 cm^3. Compared with the healthy persons, the deviation is significantly greater, both in the detection and the determination threshold ($p < 0.05$).

In the patient group with hypothyroidism, the average detection threshold was 7.0 cm^3, and the average determination threshold was 18.5 cm^3. Compared with the healthy persons, the deviation of detection and determination is greater, but has no statistical significance ($p > 0.05$).

In the patient group with hyperthyroidism, the average detection threshold was 7.3 cm^3, and the average determination threshold was 17.5 cm^3. Compared with the healthy persons, the deviation of the detection and the determination is greater, but has no statistical significance ($p > 0.05$).

The summarized data concerning the detection and discrimination of the sense of smell in the healthy controls and in the patients with the four endocrine diseases are presented on Figure 1.

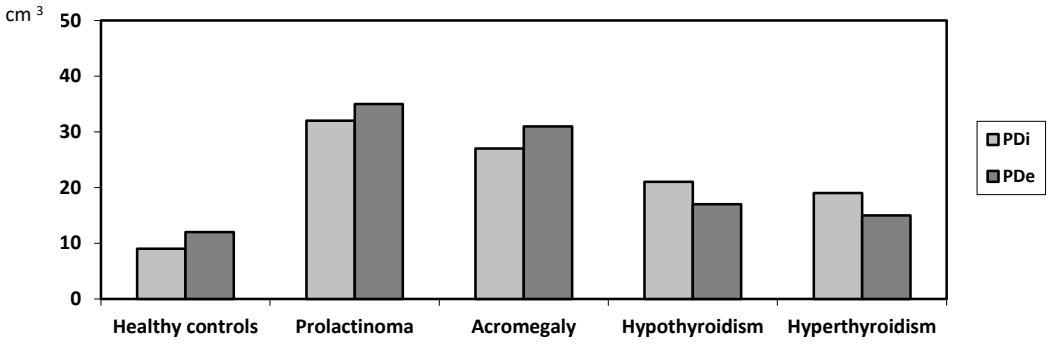

Figure 1: Comparison of the sense of smell between the healthy controls and the patients with prolactinoma, acromegaly, hypothyroidism, and hyperthyroidism. PDi – threshold of detection; PDe – threshold of discrimination.

4. Discussion

This study shows that the patients in the four endocrine groups studied have disorders in their sense of smell. We propose that the ophthalmic symptoms are due to mechanical influences on the brain function. This mechanism is observed in the pituitary adenoma. Another mechanism that may explain the olfactory disorders is the hormonal dysfunction. The pathogenic effect of the hormones on the sense of smell in the studied endocrine diseases is not fully established. In hyperthyroidism, the brain blood circulation and oxygen consumption increase. Additionally, the glutamate dehydrogenase and pyruvate dehydrogenase activity in the brain decreases. Except this, the number of the opioid receptors is increased. Thyroid hormones affect the synthesis of myelin and because of this also oxidative damages in the myelin membrane and oligodendroglial cells are present [7, 8].

This study shows that the sense of smell reduces in the examined four groups of endocrine disorders. It shows also that the reduction of the sense of smell is manifested differently in the tested groups [9, 10]. According to our hypothesis, these endocrine diseases cause proliferation of some tissues which leads to mechanical influence on the brain. Another mechanism that may explain these olfactory disorders is the hormonal dysfunction [11].

5. Conclusion

In conclusion, this study shows that the examination of the sense of smell in patients with acromegaly, prolactinoma, hypothyroidism, and hyperthyroidism may help in various degrees in the diagnostic of some nervous diseases. We suppose future examinations are needed to obtain a necessary algorithm for diagnostics of patients with the mentioned endocrine diseases

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