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Morphological Assessment of Thyroid Gland at Native Men of the Republic Sakha (Yakutia) in different seasons

ABSTRACT

Morphological analysis of macro- and microstructures of thyroid gland at native male population of the Republic Sakha (Yakutia) in different seasons has been conducted. The males' thyroid gland appeared to be normoplastic mixed type of structure, indicators of outer and inner thyroid gland follicles diameter in winter were authentically bigger than in summer. The same tendency was observed when thyroid gland follicular - colloidal index was calculated. On a basis of the data obtained the assessment of impact of a season temperature factor on the thyroid gland structural indices was attempted, it being used as morphological equivalent of the body adaptation processes in northern regions.

Keywords: macromorphometry, micromorphometry, thyroid gland, seasons.

INTRODUCTION

The Republic of Sakha (Yakutia) is one of the biggest territories of the Russian Federation by its territory. By its natural and territorial conditions the republic is not comparable to any other regions of the world. More than 40% of the territory is situated beyond the north of the Arctic Circle.

Almost all continental territory of the Republic Sakha (Yakutia) is based on integral centuries-long permafrost [7]. Natural environmental and climatic conditions of Yakutia are mainly characterized as extreme one. Sharply continental climate is specified by long winter and short summer periods. One of the main exogenous factors of the northern latitudes which might cause ambrosia of regulatory and compensatory mechanisms, dyscrasia, and metabolic disturbance of the body as the integral whole is cold. In these conditions, health preservation of the population of the Sakha Republic, theoretically based preventive measures directed to optimize the adaptation process in cold regions of the world are still urgent questions to be considered and worked out.

Neuroendocrine system where thyroid body is one of the considerable components that fulfills specific functions in adaptation coping reactions of the body. The importance of the latest is proved by the fact that under hypothyroidism of endogenous iodinated thyroid hormone the intensity of metabolism decreases as well as the body temperature when the hyper function of thyroid body causes opposite effect [4,5]. In accordance to this the thyroid disease is to be

studied as the marker of ecological trouble. In available scientific references the data referring to the study of body's season adaptation on the basis of morphological indicators of native male subjects' thyroid gland has not been found.

Aim of the study:

To give season histomorphological characteristics of thyroid gland structural organization of native men in the Republic of Sakha (Yakutia).

MATERIALS AND METHODS:

In order to support objectives of the research thyroid glands of 45 dead male bodies, representatives of indigenous nationality on the territory of the Republic of Sakha (Yakutia) have been evaluated for the period January 2007 to August 2012. According to human ontogenesis age periodization adopted at the 7th All-Soviet Union Conference on Age Morphology Problems, Physiology and Biochemistry (1965) the second adulthood age has been assessed.

The died as a result of violent and sudden death with no injuries of neck have been the subjects of the research.

Material samplings were performed in summer (June, July, August) time and winter (December, January, February) time on the base of State Budget Establishment "Bureau of Forensic Medicine and Mortem Department of Republican Hospital №1- National Medical Center of the Republic Sakha (Yakutia).

The autopsy was conducted during the first 12-24 hours after death. Information about the samplings was obtained from protocols, personal data. According to reports on lifetime and postmortem pathology of thyroid gland was diagnosed.

Thus, all studied bodies were divided into 2 groups:

1st group – persons who died in summer time from mechanic injuries incompatible with life and who did not have any pathology of thyroid gland during their lifetime;

2nd group – persons who died in winter time from mechanic injuries incompatible with life and who did not have any pathology of thyroid gland during their lifetime.

Macromorphometrical method of research

During the postmortem examination of a corpse thyroid gland was properly separated, its topographic and anatomic characteristics were registered (perspective view and sectional). Thyroid gland was weighed on the scales VLKT-500 up to 0,01 gr. Further linear parameters of both lobes were measured (height, width, thickness). Absolute mass (AM) (gr) and relative

weight (RW) of thyroid gland were determined. The formula $RW(TB) = \text{Absolute mass (AM), gr/mass, kg} \times 100\%$ was used. For thyroid gland dynamics study we determined thyroid volume with the formula: $V = a \cdot b \cdot c \cdot 0,479$, where a – length, b – width, c – thickness of thyroid body shares, 0,479 – correction ellipsoid factor.

Histomorphometric method of the research

Pieces of thyroid gland tissue the size of 10 x 10 x 5,0mm were excised from middle part of both lobes (right and left at the same level). The material was fixed in 10% neutral formalin during 24 hours, then embedded in paraffin block with the unit «Leica EG 1150H». Four five micron thick sections were made from paraffin blocks with the luge microtome «LeicaSM 2010R». The sections were deployed in water bath and replaced to the micro slides. The sections for histologic research were colored with hematoxylin and eosin. When histologic specimen were studied the type of thyroid gland structure was determined, as well as its structural components which are morphological equivalents of thyroid gland functional state.

Thyroid gland morphometry was studied by its structural and functional components' quantitative assessment referring to recommendations given in scientific references [6]. Thyroid gland structural components' analysis (average outer and inner diameter of the follicle, the average height of follicular thyrocytes, follicular thyrocytes area, area of colloid, the core area of follicular thyrocytes) was conducted with licensed software, specialized for morphometric histologic research of specimen «Screen Meter». Secondary indicators were calculated basing on first indicators. Colloid accumulation index (CAI) indicator, follicular colloid-index (FCI) indicator, nuclear - cytoplasmic index (NCI) indicator were determined.

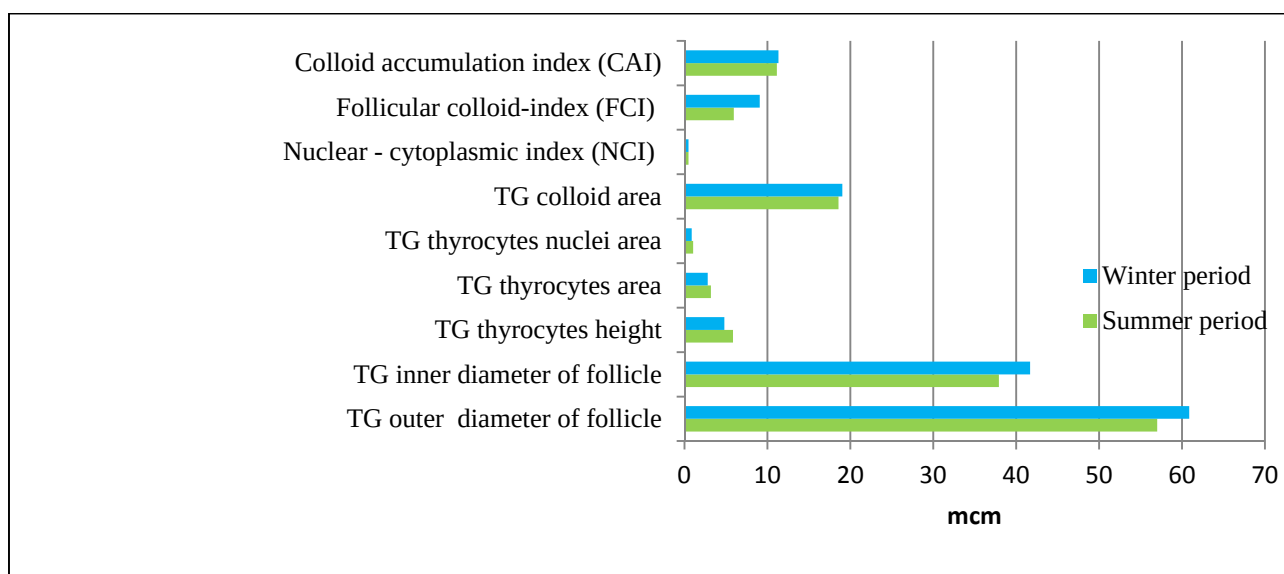
RESULTS AND DISCUSSIONS

Thyroid gland macro morphometric data of indigenous people in summer and winter periods: The thyroid gland is typically located on the front surface of the trachea and consisted of two lateral lobes connected by an isthmus. Sometimes pyramidal process was defined. The thyroid gland was surrounded by visceral fascia of the neck and enclosed in a dense fibrous capsule. The thyroid gland was smooth to the touch and had elastic consistence. The fabric on the cut was light chocolate brown. After linear dimensions of the thyroid gland were studied the average values were determined. As thyroid gland weight is one of its morphologic state indicators, we determined average thyroid gland (TG) absolute weight (AW) indicator. So for indigenous people in summer period it was $24,90 \pm 1,96$ gr and in winter period $22,48 \pm 0,61$ gr.

The calculation of the average value of relative weight (RW) was in summer period $39,00 \pm 2,73\%$, in winter period $39,09 \pm 1,58\%$ [3].

Thyroid gland micromorphometric data of indigenous people in summer and winter periods: Microscopic examination of thyroid gland tissues in study groups showed that their histologic structure belongs to normoplastic mixed, middle follicular type. According to the author Grigorieva V.A. (1970) [2], thyroid gland of normoplastic mixed type is not fully mature and corresponds to inverse growth where there is regular development in one parts and suppression with negative environmental impact in other parts.

The shapes of the follicles were mostly round, ovoid and irregularly rounded shape. The average thyroid gland outer diameter of the follicle of indigenous people in summer period was $57,01 \pm 2,33$ mcm, that is 1,05 times less than in winter period $60,87 \pm 1,42$ mcm. The average thyroid gland inner diameter of the follicle in summer period was proved to be less $37,92 \pm 1,89$ mcm, than in winter season of the year $41,68 \pm 1,38$ mcm. Thyroid gland follicular epithelium had cubic form. Average height of the latest in summer period was $5,84 \pm 0,19$ mcm, and in winter period $4,80 \pm 0,21$ mcm ($p < 0,05$). The study of medium-sized areas of follicular thyrocytes of indigenous people in summer period was $3,19 \pm 0,10\%$, that is 1,14 times bigger than in winter season of the year. Thyroid gland cell nuclei thyrocytes were predominantly round, oval, monochrome, located centrally in summer period $1,04 \pm 0,04\%$, in winter period $0,86 \pm 0,05\%$ ($p < 0,05$). The calculation of average indicator of nuclear - cytoplasmic index (NCI) showed equal values in summer and winter seasons of the year. Follicles were filled with homogeneous eosinophilic colloid. When the average indicator of colloid area was calculated, the result in summer period was 1,05 times less than in winter period. Average indicator of thyroid gland follicular colloid index (FCI) that determines functional activity of thyroid gland among indigenous people in summer season was $5,94 \pm 0,52$, that is significantly lower than in winter season ($9,07 \pm 0,65$) ($p < 0,05$). When colloid accumulation index (Brown's index) of indigenous people was assessed, it was defined that this indicator does not change and constitutes $11,13 \pm 0,51$ (pic.1).



Pic.1. Diagram of indigenous people micromorphometric parameters of thyroid gland in summer and winter seasons.

CONCLUSION

The data obtained proves the statement that thyroid gland possesses specific plasticity when human body adapts to the environmental conditions [6]. When thyroid gland histomorphologic analysis of indigenous people of the Republic Sakha (Yakutia) was conducted we detected that thyroid gland microstructure reacts to the seasonal temperature. It was proved by increase of such indicators as height, thyrocytes nuclei area, thyrocytes inner and outer diameter follicles, follicular colloid index in winter time in comparison with summer time. Where in the increase of the follicular colloid index indicator can be explained as functional tension of thyroid gland which is necessary for maintenance of proper activity level in this season of the year [1, 7, 8].

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