Thyroid Hormone Status in Stroke and Transient Ischemic Attack Patients

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Summary. Background. Previous studies have shown increased risk of stroke in patients with hypothyroidism [1]. Additionally, it has been shown that low level of free thyroxin (T₄) is associated with worse neurological deficit in stroke [2]. The purpose of this research is to study the thyroid hormone status in patients with stroke and transient ischemic attack (TIA) to evaluate the sanogenetic mechanism in TIA.

Methods. We compared 107 patients and 46 healthy volunteers who were divided into two cohorts: “young” (45 years old and below) and “elderly” (above 45 years old). Each cohort was divided into the following groups: patients with total stroke (TS), lacunar stroke (LS), TIA, and control group. All subjects had laboratory blood test, which included measurement of three parameters: T₄, thyroid stimulation hormone (TSH), and serum antibodies to thyroid peroxidase (anti-TPO) on the first day.

Results. Among elderly patients, the T₄ level was found to be significantly higher for the TIA (p<0.05) group comparing to the control group: 17.10 pm/l and 12.70 pm/l respectively. Anti-TPO level in young patients was found to be significantly lower (p<0.05) in TS (0.50 mIU/L) and LS (1.03 mIU/L) groups comparing to the control group (3.35 mIU/L).

Conclusions. It was discovered that the thyroid status in patients with stroke and TIA depends on the size of stroke and on the age. Level of T₄ is in a greater degree caused by the volume of the brain damage in elderly cohort only. Level of anti-TPO ganged in both types of stroke groups in young cohort only.

Keywords: thyroid hormone status, transient ischemic attack, ischemic stroke, young and elderly patients.

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Stroke is the second leading cause of death for people in Europe [3] and the third leading cause in the United States [4]. TIA is a transient episode of neurological dysfunction, caused by focal brain, spinal cord, or retinal ischemia without acute infarction and lasting for 24 hours [5]. The 90-day risk of stroke after TIA is more than 17% [6].

According to previous epidemiological studies, thyroid hormone status has influence on the risk of stroke [1, 2]. Hypothyroidism is associated with stroke, especially ischemic stroke [7]. Patients with autoimmune disorder have an increased risk of ischemic stroke too [8]. It was shown that thyroid hormone status is connected to both the size of the stroke and the age of patients [9]. Level of T₄ was caused by the age, and anti-TPO by the weight of neurologic deficiency [9]. TSH indicator most likely shows activation of stress-regulating system on the ischemia of defeat in people of advanced age with minor stroke [9]. However, we still do not have any satisfactory explanation of these phenomena. We can assume that decrease of T₄ in the acute period of cerebral ischemia is caused by the syndrome of low thyroxin and T₄ is associated with worse neurological deficit [2]. To the best of our knowledge there is no report of a research devoted to comparative examination of the thyroid hormone status in TIA’s and stroke patients. Therefore identification of sanogenic reserves in the case of transient brain ischemia may be of a greatest importance.

MATERIALS AND METHODS

107 stroke and TIA patients admitted in the Stroke Unit of the Gomel Regional Veterans Hospital were examined. All stroke patients were divided into groups according to the size of stroke determined by computer tomography: TS (size of stroke > 15 mm), LS (size of stroke < 15 mm), TIA (damage is not visible on tomography). Subjects older than 45 years: 11 patients with TS (5 women and 6 men, mean age 61±11 years), 21 patients with LS (11 women and 10 men, mean age 63±11 years), 21 patients with TIA (18 women and 3 men, mean age 69±14 years), 20 healthy...
volunteers (8 women and 12 men, mean age 55±5 years) for an “elderly control group” were present. Patients younger than 45 years: 19 patients with TS (4 women and 15 men, mean age 39±6 years), 35 patients with LS (21 women and 14 men, mean age 39±7 years), 26 healthy volunteers (18 women and 8 men, mean age 31±5 years) for a “young control group”. TIA patients are absent in the young cohort.

The neurologic deficit in stroke patients was objectified using the American National Institute of Health Stroke Scale (NIHSS). On the 1st day the NIHSS score estimation was TS 13.40±6.19; LS 7.79±3.29 for elderly groups, and TS 12.64±5.65; LS 5.89±3.02 for young patients. Neurological deficit at admission in TIA patients has been presented as hemiparesis in 47.1%; asymmetry of nasolabial folds in 77.8%; instability in the Romberg position in 64.7%; asymmetry of tendon reflexes and Babinski symptom is was in 76.5%; hypoesthesia in 35.3% of patients. TIA subjects had the ABCD2 score of 4.64±1.67.

The normal ranges for $T_4$, TSH and anti-TPO were 10.0–25.0 pm/l, 0.35–4.94 mIU/L, and 0-50 IU/L, respectively. Venous blood samples were drawn at 8:00 AM on the 1st–2nd day of admission in study groups and in the controls. Serum level $T_4$, TSH and anti-TPO levels were measured using a solid-phase chemiluminescent immunometric assay (AxSYM, ABBOTT, USA). Patients with previous thyroid disease were excluded from the study.

Statistical analysis was performed using “STATISTICA 7.0” (descriptive statistics) and R [10] (detailed algorithm can be found in the supplemental information). After removal of outliers Kruskal-Wallis one way analysis of variance was used to determine whether there was any difference between groups (control, TS, LS, TIA) of individuals in every age cohort. Siegel and Castellan procedure was used for post-hoc analysis [12]. A p-value of less than 0.05 was considered statistically significant.

The study was approved by the Ethic Committee of the Gomel State Medical University.

RESULTS

Kruskal-Wallis one-way test performed for groups of elderly individuals revealed statistically significant difference of $T_4$ level (p=0.001) (Fig. 1), that particularly confirms data of our own previous studies [9]. No significant differences were found in TSH (p=0.21) and anti-TPO (p=0.12) levels between groups of elderly individuals.

Post-hoc analysis of $T_4$ level in elderly individuals revealed a significant increase of that in the TIA patients versus control group (17.10 pm/l and 12.70 pm/l respectively, p<0.05). There was no statistically significant difference for thyroid hormone status characteristics in the patients with various sizes of stroke (p>0.05).

Kruskal-Wallis one-way test performed for groups of young individuals revealed statistically significant difference of anti-TPO level (p=9.215e-05) (Fig. 2). No significant differences were found in $T_4$ (p=0.45) and TSH (p=0.56) levels between groups of young individuals.

Post-hoc analysis of anti-TPO level in young individuals revealed a significant decrease (p<0.05) of that in the TS patients (0.5 IU/L) versus control group (3.35 IU/L) and LS patients (1.03 IU/L) versus control group. No statistically significant difference was found between TS and LS patients.

DISCUSSION

Patients with TIA and stroke demonstrated different thyroid status in acute period of brain ischemia. The higher level of $T_4$ present in elderly patients with transient neurological deficit without brain morphological changes may be explained as a sanogenetic mechanism. We assume that high $T_4$ level may precede cerebral ischemia and provide a protective effect.
On the opposite side the T4 level was higher in the cohort of elderly patients, in which the representation of stroke was significantly higher than in the young population. We do not see T4 changes, in the cohort of younger patients in which the tone of the autonomic nervous system is initially biased towards the parasympathetic part [11]. In our opinion decrement of the anti-TPO in stroke groups younger than 45 years may indicate suppression of autoimmune reaction against the background of the autonomic nervous system tone activation.

CONCLUSION

The above differences between thyroid hormone status discovered in patients with acute brain ischemia indicate a special leading mechanism in each case of pathogenetic process, and have an age and morphological conditionality.

References


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Santrauka

Ivadas. Anksčiau atlikti tyrimai parodė, kad hipotiroidizmo ser- gantys pacientai turi padidėjusią insulto riziką. Taip pat buvo įrodyta, kad sumaižėjęs laisvo tiroksino (T4) kiekis yra susijęs su di- desniu neurologiniu deficitu sergančiu insultu. Šio tyrimo tikslas iš- tirti skydliauksės hormonų bûklę pacientams, sergantiems insultu ar praeinančiu smegenų išemijos priepuoliu (PSIP), siekiant įver- tinti sanogeninius mechanizmus sergančią PSIP.

Tiriameji ir tyrimo metodai. Įsystėme 107 pacientus ir 46 sveikus savanorius, kurie buvo suskirstyti į dvjų kategorijų: „jąinus“ (45 m. amžiaus ir jaunesnės 45 m. amžiaus), kiekvieno kategorijų 58 pacientų, serginčių insultu, sergantiems PSIP ir kontrolinę grupę. Vėsimiems tiriamiesiems pirmą dieną buvo atlikti laboratoriniai kraujo tyrimai siekiant nustatyti tris rodiklius: T4, tireostimuliuojantį hormoną (TSH) ir serumo antikūnus prieš skydliauksės peroksidą (anti-TPO).

Rezultatai. Tarp vyresnių pacientų T4 buvo reikšmingai padi- dėjęs PSIP grupėje (p < 0,05), lyginant su kontroline grupe: 17,10 pm/l ir 12,70 pm/l atitinkamai. Anti-TPO tarp jaunų pacien- tų buvo reikšmingai mažesnis (p < 0,05) SI (0,50 mIU/L) ir LI (1,03 mIU/L) grupėse, lyginant su kontrolinė grupė (3,35 mIU/L).


Raktąžodžiai: skydliaukšės hormonai, praeinant smegenų išemijos priepuolis, išeminis insultas, jaunesnis ir vyresnis pacien- tai, ūminiai insulto sindromai.