Thyroid Hormone Status in Stroke and Transient Ischemic Attack Patients

N. V. Halinouskaya*
S. V. Samsonau**
N. N. Usava*
V. B. Smychek***

**Gomel State Medical University, Gomel, Belarus*

***College of Staten Island/CUNY, Engineering Department, NY, USA*

****National Science and Practice Centre of Medical Assessment and Rehabilitation, Gorodische, Belarus*

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 (T_4) 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: T_4, thyroid stimulation hormone (TSH), and serum antibodies to thyroid peroxidase (anti-TPO) on the first day.

Results. Among elderly patients, the T_4 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 T_4 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.

Neurologijos seminarai 2015; 19(65): 207–209

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 T_4 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 T_4 in the acute period of cerebral ischemia is caused by the syndrome of low thyroxin and T_4 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

Address:
Natallia V. Halinouskaya
Gomel State Medical University,
Lange 5, Gomel, Belarus 246000
Tel.:+375295037765, fax: +375232749831
E-mail: stroke.ynt@tut.by

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 $ABCD^2$ 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.

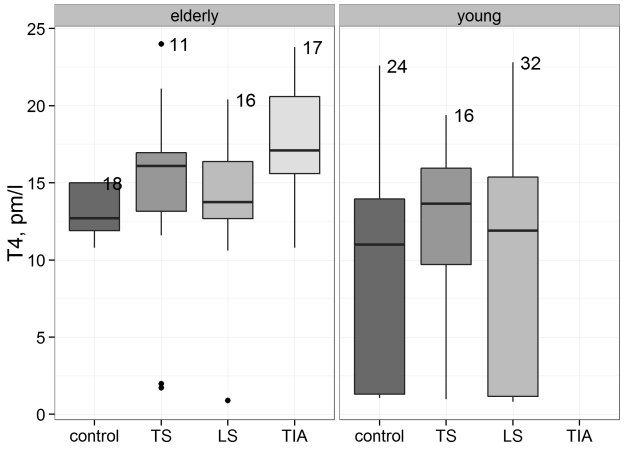

Fig. 1. **T_4 level by groups (control, TS, LS, TIA) for elderly (left) and young (right) cohorts.**

Data are plotted after removal of outliers. Number of observations is given to the right of a top whisker. Boxes show 1st, 2nd, and 3rd quartiles.

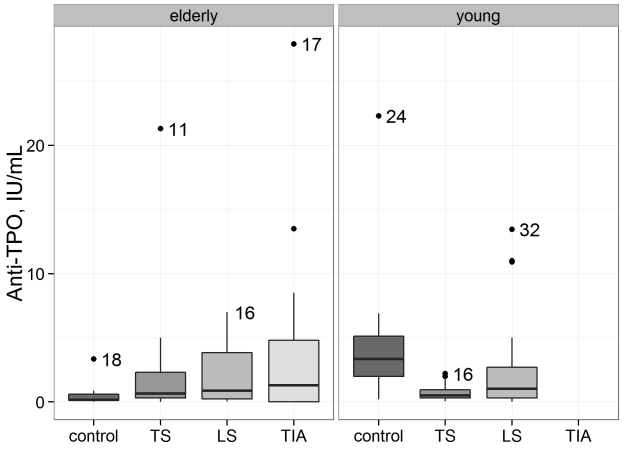

Fig. 2. **Anti-TPO level by groups (control, TS, LS, TIA) for elderly (left) and young (right) cohorts.**

Data are plotted after removal of outliers. Number of observations is given to the right of a top whisker. Boxes show 1st, 2nd, and 3rd quartiles.

On the opposite side the T_4 level was higher in the cohort of elderly patients, in which the representation of stroke was significantly higherthan 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 pathogenic process, and have an age and morphological conditionality.

References

1. Karch A, Thomas MSc, Thomas SL. Autoimmune thyroiditis as a risk factor for stroke. Neurology 2014; 82(18): 1643–52.
2. Zhang Y, Meyer MA. Clinical analysis on alteration of thyroid hormones in the serum of patients with acute ischemic stroke. Stroke Res Treat 2010; 10.4061:290678.
3. Jauch EC, Saver JL, Adams HP, Bruno JA, Connors JJ, Demaerschalk BM, et al. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2013; 44: 870–947.
4. Kernan WN, Ovbiagele B, Black HR, Bravata DM, Marc IC, Michael DE, et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2014; 45: 2160–236.
5. Yachno NN, Shtulnam DR. Diseases of the nervous system: a guide for physicians. Moskou: Medicine, 2001; 253–6.
6. Kjartansson O, Valdimarsson EM. Cerebral ischemia/infarction – epidemiology, causes and symptoms. Laeknabladid 2014; 100(5): 271–9.
7. Adnan I, Qureshi AE, Fareed MK, Suri CD, Abu Nasar BC, Jawad F, Kirmani F, et al. Free Thyroxine Index and risk of stroke: results from the National Health And Nutrition Examination Survey follow-up study. Giles Med Sci Monit 2006; 12(12): 501–6.
8. Roifman I, Beck PL, Anderson TJ, Eisenberg MJ, Genest J. Chronic inflammatory diseases and cardiovascular risk: a systematic review. Can J Cardiol 2011; 27: 174–82.
9. Usova NN, Halinouskaya NV, Prokopovich AS, Latysheva VY. Comparative characteristic of the thyroid status patients with the stroke of young and advanced age. Med Panorama 2010; 10: 14–8.
10. R Core Team. A language and environment for statistical computing. Vienna, Austria: Foundation for Statistical Computing, 2014. URL: www.R-project.org
11. Halinouskaya NV, Usava NN. The comparative analysis of the vegetative status in patients with passing and proof forms of the ischemic brain damage. Neurol and Neurosurg for East Europe 2012; 1(13): 43–51.
12. Siegel S, Castellan NJ. Nonparametric statistics for the behavioral sciences. McGraw-Hill Publishing Co., 1988.

N. V. Halinouskaya, S. V. Samsonau, N. N. Usava, V. B. Smychek

SKYDLIAUKĖS HORMONAI SERGANT INSULTU IR PRAEINANČIU SMEGENŲ IŠEMIJOS PRIEPUOLIU

Santrauka

Įvadas. Anksčiau atlikti tyrimai parodė, kad hipotiroidizmu sergantys pacientai turi padidėjusią insulto riziką. Taip pat buvo įrodyta, kad sumažėjęs laisvo tiroksino (T_4) kiekis yra susijęs su didesniu neurologiniu deficitu sergant insultu. Šio tyrimo tikslas ištirti skydliaukės hormonų būklę pacientams, sergantiems insultu ar praeinančiu smegenų išemijos priepuoliu (PSIP), siekiant įvertinti sanogeninius mechanizmus sergant PSIP.

Tiriamieji ir tyrimo metodai. Ištyrėme 107 pacientus ir 46 sveikus savanorius, kurie buvo suskirstyti į dvi kohortas: „jauni“ (45 m. amžiaus ir jaunesni) ir „vyresni“ (daugiau nei 45 m. amžiaus). Kiekviena kohorta buvo padalinta į šias grupes: pacientai su stambiu insultu (SI), lakūniniu insultu (LI), PSIP ir kontrolinė grupė. Visiems tiriamiesiems pirmą dieną buvo atlikti laboratoriniai kraujo tyrimai siekiant nustatyti tris rodiklius: T_4, tireostimuliuojantį hormoną (TSH) ir serumo antikūnus prieš skydliaukės peroksidazę (anti-TPO).

Rezultatai. Tarp vyresnių pacientų T_4 buvo reikšmingai padidėjęs PSIP grupėje ($p < 0,05$), lyginant su kontroline grupe: 17,10 pm/l ir 12,70 pm/l atitinkamai. Anti-TPO tarp jaunų pacientų buvo reikšmingai mažesnis ($p < 0,05$) SI (0,50 mIU/L) ir LI (1,03 mIU/L) grupėse, lyginant su kontroline grupe (3,35 mIU/L).

Išvados. Buvo nustatyta, kad skydliaukės hormonų kiekiai, sergant insultu ir PSIP, yra susiję su insulto dydžiu ir paciento amžiumi. T_4 lygis labiau susijęs su smegenų pažeidimo tūriu tik vyresnių tiriamųjų kohortoje. Anti-TPO kiekis buvo mažesnis abiejose insulto grupėse tik jaunesnių pacientų kohortoje.

Raktažodžiai: skydliaukės hormonai, praeinantis smegenų išemijos priepuolis, išeminis insultas, jaunesni ir vyresni pacientai, ūminiai insulto sindromai.

Gauta: 2015 05 05

Priimta spaudai: 2015 06 18