

1. Introduction

At a new step in evolution of medical science and modern improving technologies, to perform interest is again increasing to the diseases of the thymus gland (TG). This is due to the fact that the TG is the beneficial organ of the immune system of the body, as well as the internal gland of secretion. A great number of pathological processes which occurs in our body deal with that dysfunction. Thymus cells are a significant part of the immune system and it can become the ground for the progress oncological process [1, 2]. High organization thymus tumors are a series of histological structure tumors that demonstrate options at the molecular range of thymomas are the most common feature of neoplasms of the high vein, which occurs in 87.5 %. To designate them in 1900 H. Grandhomme and R. Scminke proposed the definition "thymoma" [3].

Mediastinal neoplasms are difficult to identify and treat, because it often has a long asymptomatic evolution period and clinical manifestations in the form of compression of the mediastinal organs. It should be noted, that thymoma is the one of the general primary neoplasm of the front mediastinum but case for malignancies less than 2 % of all adult patients. Moreover, the histogenesis of tumors, more than a hundred of their morphological variants can arise [4, 5]. Currently, tumors are referred to as thymomas, developing from cells whose histogenesis is associated with the epithelium of the thymic parenchyma. However, thymic tumors are one of the most common formations of the anterior mediastinum and are detected in 10–40 % of patients whereas among all oncological diseases, thymomas are quite rarely (0.2–1.5 %). In men and women, this disease is noted in almost the same ratio, with frequency of 0.15 cases per 100,000 population. Thymomas are detected in patients of completely different ages. Cases of findings of a tumor of the thymus are described in an 8 month old child and a 90 year old patient [6]. Most thymomas are usually located in the mediastinum in front of it, in a typical place of localization of the TG, but probability of detecting a tumor is not limited the anatomical location of this gland. In 1.1–2.2 % of cases, multicentric thymomas may occur, which is characterized by the presence in different parts of one gland of 2 neoplasms [7, 8]. Thymoma is an indication for elective surgery, and the most radical the method of treatment is thymomectomy, which consists of the complete removal of the thymoma with veins, surrounding fat tissue and lymph nodes of the anterior mediastinum. For many years, full, and then a partial median sternotomy or thoracotomy. The evolution of video endoscopic systems, the advent

PECULIARITIES OF SURGICAL TACTICS OF PATIENTS WITH THYMUS TUMORS

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Abstract: The aim of the study: to study retrospective analysis results of the surgical treatment of thymus tumours for predicting long-time results.

Methods. Study included 35 patients who were treated at the Department of Thoraco-abdominal Surgery from September 2019 to May 2021. The control group included 20 patients with SVCS were treated with conventional techniques, while the experimental group included 15 patients who underwent a novel bypass surgery developed by us.

Results. The venous bypass was mandatorily complemented with cytoreduction. Complications in the post-operative period were reported from the experimental group and included auriculo-subclavian bypass thrombosis, post-operative complications were reported in the control group including haemorrhage from the sternotomy wound in 1 (3.3 %) case, superior vena cava thrombosis in 2 (6.6 %) cases, pneumonia in 2 (6.6 %). The relative risk of complications and lethal outcome was calculated for patients from both groups. It was found that the risk of complications was twice as high in the control group as in the experimental group (standard error of relative risk equals 0.64).

Conclusion. The first mandatory step of the radical surgery in patients with thymomas with SVC invasion should be the auriculo-jugular and auriculo-subclavian bypasses, which can reduce the relative risk of post-operative complications by a factor of the risk of lethal by a factor of 3.5.

Keywords: thymoma, surgical treatment, postoperation complication, radical surgery, bypass, vena cava superior syndrome, classification of thymomas, diagnostics, Myasthenia gravis.

of fiber-optic light guides and investigation have changed the methodological approaches to the surgical treatment of patients with thymomas. Have appeared scientific research publications on the removal of thymic tumors using mini-invasive technologies, such as videothoroscopic operations [9, 10]. The using of videothoroscopic technologies compared with open access, undoubtedly reduces surgical traumas, risks of bleeding, the risk of respiratory and cardiovascular complications after surgical interventions due to less traumatic approach. Positive factors also include acceleration of rehabilitation and reduction of the length of stay of patients in the surgical department [11].

The aim of the study: to learn retrospective analysis results of the surgical treatment of thymus tumours.

2. Materials and research methods

The research is a retrospective analysis of observation data involving 36 patients with thymomas who were treated at the Department of Thoraco-abdominal Surgery of the State Institution "Zaycev V. T. Institute of General and Urgent Surgery of the National Academy of Medical Sciences of Ukraine" from September 2019 to May 2021. The

control group included 20 patients with SVCS treated with conventional techniques, while the experimental group included 16 patients who underwent a novel bypass surgery developed by us.

The authors declare that all procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008 (5), as well as the national law. Informed consent to participate in the study was discussed and signed by all study participants. Meeting of the Bioethics Commission (protocol No. 4 11.10.2021) of the State Institution "Zaycev V. T. Institute of General and Urgent Surgery of the National Academy of Medical Sciences of Ukraine".

At the preoperative stage, all patients underwent standard diagnostic tests to assess the advancement of the tumour process in the mediastinum and functional reserves: multislice computed tomography (MSCT) of thoracic and abdominal organs, comprehensive ultrasound test (including mediastinum ultrasound), electrocardiography, echocardiography, spirometry. Fiber-optic bronchoscopy was performed in case of lung lesion. The most reliable method of diagnosing SVC invasion at the preoperative stage and assessing tumour advancement is considered to be MSCT with intravenous contrast enhancement with iso-osmolar contrast, which does not cause a sharp blood pressure drop that is likely to cause a vascular collapse at the backdrop of reduced heart flow. SVC invasion is most precisely visualized in the early

venous phase. Echocardiography is required to identify a tumour thrombus in the mediastinum. Besides, patients obligatorily underwent doppler ultrasound test of upper limb and neck vessels.

There was not found a significant difference in the number of patients, average age, gender composition, or body mass index (BMI) found between OA groups ($p>0.05$).

The distribution of patients according to the TNM classification proposed by the World Health Organization in 2017 is shown in (Tables 1, 2).

Table 1
Grouping stages by TNM

Stage I	Stage II	Stage IIIa	Stage IIIb	Stage IVa	Stage IVb
T1N0M0	T2N0M0	T3N0M0	T4N0M0	T(any) N1M0;	T (any) N2M (0.1a);
				T (any) N (0.1), M1a	T (any) N (any) M1b
6 (21.1± ±0.3 %)	5 (17.2± ±0.1 %)	5 (17.2± ±0.2 %)	3 (15.7± ±0.2 %)	4 (16.5± ±0.1 %)	3 (12.3± ±0.1 %)

The differences between the main and control groups are statistically significant ($p<0.05$) in Table 1.

Table 2
Grouping patients depend on stages by TNM:

Stage I	Stage II	Stage IIIa	Stage IIIb	Stage IVa	Stage IVb
T1N0M0	T2N0M0	T3N0M0	T4N0M0	T (any) N1M0	T (any) N2M (0.1a); T (any) N (any) M1b;
5 (14.2± ±0.3 %)	5 (14.2± ±0.2 %)	7 (20.0± ±0.1 %)	8 (17.2± ±0.2 %)	10 (28.6± ±0.1 %)	5 (20.0± ±0.1 %)

Depending on from the predominance of a clinical symptom, we single out the following options for compression syndrome (classification by V. V. Boyko et al., 2009), I stage – syndrome of the superior vena cava, II stage – syndrome of compression of the trachea and bronchi, III stage – syndrome of compression of the pulmonary veins, IV stage – compression syndrome of the aortic arch and its branches, V stage – syndrome of the inferior vena cava, VI stage – syndrome of compression of the heart, VII stage – syndrome of nerve plexus compression, VIII stage – combined compression syndrome rum of the mediastinum (damage to 2 anatomical zones and more).

Ethics review. All patients signed a voluntary informed consent for the examination and treatment, as well as publication of anonymized personal medical information for academic purposes.

Statistical analysis. Findings concerning the effectiveness of different surgical interventions were analysed using non-parametric statistical techniques (analysis of two-dimensional frequency distributions based on the chi-squared criterion and relative risk). The differences between the main and control groups are statistically significant ($p<0.05$).

3. Results

Traditional infusion in the SVC system veins significantly increases venous hypertension and oedema of the upper half of the body. To avoid this, femoral veins were catheterized and the medicines were administered intra-arterially (mostly in the

radial artery). In patients from the experimental group, where the tumour could not be resected for technical reasons, venous bypass was performed to correct SVCS.

In 5 (19.2 %) cases, the auriculo-jugular bypass was used as an auxiliary stage in radical resection of thymoma tumours. In our opinion, resecting a tumour with SVC invasion without a prior bypass is a mistake that may cause a lethal outcome. SVC transection or its acute thrombosis during the tumour resection causes a rapid increase in the central venous pressure with all the ensuing consequences. In certain cases, the near-tumoral thrombus or tumoral tissue may get detached and migrate to the right heart compartments, leading to the development of the pulmonary embolism.

Complications in the post-operative period were reported in 3 (11.5 %) patients from the experimental group and included auriculo-subclavian bypass thrombosis in 1 (3.8 %) case, pneumonia in 1 (3.8 %) case. Post-operative lethality in the study groups was reported for 4 (13.3 %) patients in the control group and 1 (3.8 %) patient in the experimental group. Total lethality rate was 8.9 % (5 patients).

The relative risk of complications and lethal outcome was calculated for patients from both groups. It was found that the risk of complications was twice as high in the control group as in the experimental group (standard error of relative risk equals 0.64), whereas the risk of lethal outcome increased by a factor of 3.5 in the control group (standard error of relative risk equals 1.09).

There was not found a significant difference in the number of patients, average age, gender composition, or body mass index (BMI) found between OA groups ($p>0.05$).

4. Discussion

In our research, which is a retrospective analysis of observation of the results of surgical treatment for 56 patients with locally advanced thymomas complicated by SVCS. The control group included 30 patients with SVCS treated with conventional techniques, while the experimental group included 26 patients who underwent a new bypass surgery developed by us [6, 11].

In patients with locally advanced thymomas, constantly increased pressure in the SVC system for several months leads to progressive dilatation and development of a network of collateral venous blood flow. Owing to this mechanism, the SVCS remains at the compensation or sub-compensation stage for a rather long time [5, 7].

It should be noted that in the structure of complications in the post-operative period in our study, the leading place is occupied by auriculo-subclavian bypass thrombosis in 3.8 % of patients [6, 11]. So, in our study, pneumonia was in 3.8 % of patients. Thromboembolism of small pulmonary arteries in 3.8 % of patients whereas in 23.4 % of patients' post-operative complications were reported in the control group including haemorrhage from the sternotomy wound in 3.3 % of patients. Also, superior vena cava thrombosis in 6.6 % of patients while pneumonia in 6.6 % of patients. However, thromboembolism of small pulmonary arteries in 6.6 % of patients [3, 11].

Study limitations. This study combines the results of a retrospective analysis of observation of the results of surgical treatment patients with thymomas complicated by SVCS. Since the use of the venous bypass to improve results in the postoperative period and realize the full effect of treatment in patients.

Prospects for the future research. Since the usage of bypass methods of surgical treatment and conservative treatment patients with thymomas complicated by SVCS can notice to improving of surgical results, we plan to develop an algorithm that will reduce the number of postoperative complications.

5. Conclusions

The superior vena cava syndrome in 56 patients (26 (46 %) in the experimental group and 30 (54 %) in the control group) with locally advanced thymoma is an emergency condition whose surgical correction must be personalised depending on the anatomic and topographic classification of SVC lesion types. An obligatory pre-condition of the perioperative period in this category of patients is an adequate vascular approach to the superior vena cava system.

The first mandatory step of the radical surgery in patients with locally advanced thymomas with SVC invasion should be the auriculo-jugular ASA II 37 (66.1 %), ($p < 0.05$).

Conflict of interests

The authors declare that they have no conflicts of interest.

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The topic of GDR surgery of the thoracic cavity of the State Institution "Zaycev V. T. Institute of General and Urgent Surgery of the National Academy of Medical Sciences of Ukraine", P.01.14, Development of surgical tactics with thymomas complicated by the superior vena cava syndrome, No. UA 0119U002466. This research became a fragment of this research work.

References

1. Michels, G., Drebber, U., Pfister, R., Michels, G. (2012). Thymoma – an important differential diagnosis of mediastinal tumours. *Acta Clinical*, 67 (4), 304–305.
2. Girard, N., Ruffini, E., Marx, A., Faivre-Finn, C., Peters, S. (2015). Thymic epithelial tumours: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Annals of Oncology*, 26, v40–v55. doi: <http://doi.org/10.1093/annonc/mdv277>
3. Klimova, E. M., Drozdova, L. A., Lavinskaya, E. V., Minukhin, D. V., Kudrevich, A. N. (2020). Advisability of thymectomy in young patients with thymus-independent myasthenia gravis in the presence of biomarkers specific for patients with thymoma. *Kharkiv Surgical School*, 3, 62–67. doi: <http://doi.org/10.37699/2308-7005.3.2020.13>
4. Boyko, V. V., Klimova, O. M., Lavinskaya, O. V., Drozdova, L. A., Minukhin, D. V., Yevtushenko, D. O. (2019). The Choice of Treatment in Various Ages Patients with Myasthenia Against to Immunoresistance Parameters. *International Journal of Education and Science*, 2 (3), 43–52. doi: <http://doi.org/10.26697/ijes.2019.3.4>
5. Barbolina, T. D., Bychkov, M. B., Allakhverdiev, A. K., Borisova, T. N., Vladimirova, L. Iu., Gerasimov, S. S. et. al. (2021). Prakticheskie rekomendatsii po lekarstvennomu lecheniiu opukholei vilochkovoï zhelezy (timomy i raka timusa). *Malignant Tumours*, 10 (3s2-1), 603–614. doi: <http://doi.org/10.18027/2224-5057-2020-10-3s2-35>
6. Rouquette, I., Taranchon-Clermont, E., Gilhodes, J., Bluthgen, M.-V., Perallon, R., Chalabreysse, L. et. al. (2019). Immune biomarkers in thymic epithelial tumors: expression patterns, prognostic value and comparison of diagnostic tests for PD-L1. *Biomarker Research*, 7 (1). doi: <http://doi.org/10.1186/s40364-019-0177-8>
7. Alexandrov, O. A., Ryabov, A. B., Pikin, O. V. (2017). Thymoma (review of the literature). *Siberian Journal of Oncology*, 16 (4), 76–83. doi: <http://doi.org/10.21294/1814-4861-2017-16-4-76-83>
8. Boyko, V., Krasnoyarskiy, A., Minukhin, D., Dubovyk, D., Ponomarova, K., Sochnieva, A., Kritsak, V. (2021). Outcomes of surgical reconstruction of the superior vena cava syndrome in patients with locally advanced thymomas. *EUREKA: Health Sciences*, 3, 37–44. doi: <http://doi.org/10.21303/2504-5679.2021.001852>
9. Tovazhnyanska, O. L., Klimova, O. M., Samoilova, H. P., Minukhin, D. V., Ponomarova, K. V., Yevtushenko, D. O., Hroma, V. G. (2021). Rehabilitation of the patients with myasthenia gravis as an Integral part of the patient's Treatment Algorithm in the postoperative period. *Acta Balneologica*, 64 (3), 155–159. doi: <http://doi.org/10.36740/abal202103104>
10. Kritsak, V., Ponomarova, K., Minukhin, D. (2020). Preoperative endobronchial sanitation as preparation for thoracic interventions. *EUREKA: Health Sciences*, 2, 46–52. doi: <http://doi.org/10.21303/2504-5679.2020.001188>
11. Nam, J. G., Goo, J. M., Park, C. M., Lee, H., Lee, C. H., Yoon, S. H. (2019). Age- and gender-specific disease distribution and the diagnostic accuracy of CT for resected anterior mediastinal lesions. *Thoracic Cancer*, 10 (6), 1378–1387. doi: <http://doi.org/10.1111/1759-7714.13081>

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