OUR EXPERIENCE OF THE THORACOSCOPIC SYMPATHECTOMY IN CASE OF THE PERIFERAL ARTERIES DISEASES

Investigated the results of thoracoscopic sympathectomy at 107 patients with peripheral arteries diseases. The best results in post operation period observed in patients with Raynaud’s disease and syndrome, which efficacy reached up to 100%. In the long follow up period efficacy of operation observed 100% and 90% accordingly. At obliterating endarteritis and an atherosclerosis we fought followed preservation of the basic functions of the extremities. In conclusion in post operative period this parameter was 73.2% and 62.5% accordingly and in the long follow up period extremities could be saved 62% and 25% accordingly.

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Introduction

For today, there are more than one hundred methods of operative and non-operative treatment of patients with obliterating diseases of peripheral arteries, which, as it is well known, take a major place in the structure of cardio-vascular system’s pathology. In case of such diseases the artery reconstruction surgery is widely applied, which improves blood circulation and eliminates hemodynamic disorders at various levels of main blood flow (Saveliyev et al., 1997; Pokrovsky, 2004).

At the same time, in case of the symmetric morbid affection of vessels, which is observed during the Raynaud’s disease and syndrome, obliterating endarteritis (OE) and obliterating arteriosclerosis (OA) with symmetric gangrene, application of such surgery is either impossible in many cases, or its effect is of short-term nature (Kohan et al., 1997; Gayibov et al., 2001; Pokrovsky, 2004).

Under such circumstances, in opinion of a number of clinicians (Bonjer et al., 1996; Gayibov et. al., 2001) the only efficient method, and in certain cases the only one, is surgery of the sympathetic nervous system. While the necessity of appliance of the lumbar sympathectomy is undisputed, an attitude towards the thoracic sympathectomy (TSE) for a long time was more reserved. One of the main reasons of such perception of the thoracic sympathectomy is traumatic character of surgical intervention and associated complications (Malish, 1982; Kohan et al., 1997).

Rapid development of endoscopic surgery in recent years has contributed to elaboration and introduction of the thoracoscopic sympathectomy (TSSE) into clinical practice (Kux, 1978; Drott et al., 1993; Kurganskiy, 2006). According to Kux and Kohan, such intervention allows reduction of the in-patient treatment period, decreases need in medicines, reduces complications, and provides good cosmetic effect due to the low invasiveness of operation. By its hemodynamic effect this operation as well is not less efficient than open thoracic sympathectomy, which, naturally, will contribute to increase the number of indications for TSSE.
**Material and methods**

Starting from 1996 in the Vascular Surgery Department of the Clinic 2 of Tashkent Medical Academy, TSSE had been introduced into the treatment course for the patients with obliterating diseases of peripheral arteries of upper and lower extremities.

TSE performed in the past by open cut method on the patients, who suffered from this deficiency, has proved the documented data about traumatic nature of such intervention. Therefore, the postoperative hospitalization period used to be long and made in average 12.2±1.5 in-patient days, while the complications associated with thoracotomy used to be observed in 26.7% of cases. Besides, the thoracotomy performed to this category of patients, who in many cases were at the critical stage of the limb ischemia and had serious coexistent diseases, challenged a surgeon with uncertainty of TSE results and validation of surgical risk.

All that had created the grounds for restrictions in indications for open TSE. At the same time, refusal to perform surgical intervention on thoracic sympathetic trunk facilitated a rapid progress of disease and loss of the upper and lower limbs. In other words, decisions to apply the open TSE used to be taken only in case of progressing ischemia or under the risk of limb loss. It is confirmed by a number of performed surgical operations. If in the course of 12 years only 30 thoracic sympathectomies had been operated by thoracotomy method, later on, within a similar period of time, already 129 TSSE had been performed in 107 patients (in 22 cases TSE have been performed from both sides). Meanwhile, in case of the Raynaud’s disease (RD) TSSE had been applied in 27 cases, in case of the Raynaud’s syndrome (RS) - 53 times, under OE - 41 times, under OA - in 8 cases.

Age of the patients, who were operated with TSSE ranged from 16 to 58 years (average age made 31.2±4.2 years). It should be noted that increase of the average age of operated patients, as the Table 1 shows, is determined by wide application of TSSE to the patients with OA and OE. Normally, the analyzed patients were of the most active labor age, which proves the social significance of the issue of our study.

<table>
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<th>TABLE 1. PATIENTS AGE DISTRIBUTION</th>
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<td></td>
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<tr>
<td>up to 20 yrs</td>
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<tr>
<td>----------------</td>
</tr>
<tr>
<td>RS (n=40)</td>
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<tr>
<td>RD (n=21)</td>
</tr>
<tr>
<td>OE (n=38)</td>
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<tr>
<td>OA (n=8)</td>
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<td>TOTAL (n=107)</td>
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It should be noted that 8 patients (19.5%) with OE and 2 patients (25%) with OA had previously amputated opposite lower limb in their medical history. Besides, the lumbar sympathectomy was performed on the damaged side to 10 patients (24.4%) with OE, which had a positive effect ranging from 5 months to 6 years.

Patients with OA and OE, usually, were at the critical stages of the lower extremities ischemia. The lower extremities ischemia of 2nd grade was registered only with 6 patients suffering from OE. Moreover, this condition used to be aggravated by the fact that 10 patients (24.4%) with OE had also the ischemia of upper extremities of 3rd and 4th grades, while 5 patients (12.2%) suffered from 2nd grade ischemia. Accordingly, OE that caused predominantly the lower extremities ischemia used to be registered in 26 cases (46.3%).

TSSE had been also performed on the patients with the RS and the RD with background ischemia of extremities of 3rd and 4th grades according to classification of Pokrovsky, since we managed to achieve positive results by means of non-operative treatment in case of 1st and 2nd grade ischemia. Only 5 patients (5.9%) with 2nd grade ischemia of the upper extremities had short-term positive effect from non-operative treatment, therefore a surgical intervention had been performed in their cases.
Therefore, out of the number of the analyzed patients, in case of the predominant damage of the upper extremities arteries, TSSE had been applied in 77 cases (with RS in 50 cases, with RD in 27 cases); under predominant damage of the upper extremities arteries in 34 cases (with OE in 26, with OA in 8 cases); under combined damage in 18 cases (with RS - 3, with OE - 15).

All patients had been exposed to the Doppler sonography (DS), pulse oximetry, chest radiography, and to some patients the angiography had been applied.

According to the data of the angiography performed on the patients with OE, the following had been noted: occlusion of the lower leg artery in 16 cases (39%), in other cases, damage of the entire arterial basin of the lower leg. At that, in 3 cases (7.3%) the damage used to be concentrated at the level of femoral artery. In case of the arterial channel damage in the upper limb, occlusion of one of the brachium artery had been registered in 8 cases (53.3%), in other cases - damage of the entire arterial basin of the brachium.

Initial damage at the level of femoral artery had been registered with all OA patients, whose distal channel was unsustainable as well.

According to DS, in case of damage localization in the lower one-third of femoral artery or in case of one of the lower leg artery's occlusion, reduction of collateral blood flow of the linear blood velocity (LBV) of 10-14 cm/s used to be registered, while in the finger arteries it made 4-6 cm/s (22 cases (44.9%)). In case of occlusion of both arteries of the lower leg, with distal vascular permeability of LBV in the finger arteries, it made 2-4 cm/s (4 cases (8.2%)). In 6 cases (12.2%) the blood flow in both arteries of the lower leg and finger arteries had not been registered.

In the upper extremities, in case of occlusion of the one of the brachium arteries, LBV made 6-8 cm/s, while in finger arteries it made 4-6 cm/s (23 cases (46.2%)). In case of occlusion of both arteries of the brachium with permeability of distal channel in the arteries of wrist and fingers, reduced blood flow of 3-5 cm/s had been registered (in 7 cases (14.3%)). In one case the blood flow in both arteries of the brachium and in finger arteries had not been registered.

According to the pulse oximetry data the patients with OE and OA in case of one damaged artery of the lower leg had SpO2 of 91.3±1.4% in average, while in case of both arteries’ occlusion in the lower leg and the registered blood flow in fingers it made 86.7±1.2%, in case of absence of blood flow in finger arteries it made 81.1±1.7%.

Patients with the Raynaud’s syndrome and disease had been limited to DS and detection of SpO2. Consequently, DS data had revealed that the patients with RD and RS had preserved the permeability of the arteries of brachium and shoulder, whereas average LBV made 19.8±0.9 cm/s. At that SpO2 varied from 80% to 93% depending on the extent of ischemia.

Therefore, research that had been carried out in pre-operation period helped us to determine, first of all, that all patients with distal damage of the extremities’ arteries have proved a real reduction of tissue blood flow.

Prior to performance of thoracic sympathectomy, we considered as necessary to do testing in order to prognosticate efficiency of upcoming sympathectomy. For this purpose, at the initial stage we have used the nitroglycerine test. As it is well known, the effect of nitroglycerine test includes both sympatholytic and peripheral antispasmodic component. However, taking into account the fact that during the thoracic sympathectomy the operative effect is being achieved only by blocking the sympathetic trunk’s influence to micro-circulation, we suggest a radically different method of prognostication of upcoming thoracic sympathectomy.

This method is based on percutaneous electrical stimulation of hand by low-frequency short-pulse high-amplitude current of the electric neuro exciter “DiaDens-T”. Its application in neuro-excitement mode under the frequency of 200 mHz within 5 minutes had caused inhibition of sympathetic activity.
In order to define the effect of forthcoming sympathectomy SpO2 used to be measured before and after electric stimulation, and the growth factor (P) used to be calculated afterwards. Therefore, the test was regarded as positive, if P was more than 0.5. This was an evidence of possibility to achieve a positive result from thoracic sympathectomy. In order to calculate the value of P, the following formula, suggested from our side, had been used:

$$P(\text{SpO2}) = \frac{(\text{SpO2}_C - \text{SpO2}_B)}{\text{SpO2}_N - \text{SpO2}_B}$$

where P is a growth factor, SpO2 C, SpO2 B, SpO2 N are indicators of tissue’s saturation with oxygen before and after neuro-stimulation, accordingly, and in normal state.

Application of this prognostication method had allowed reliable decrease of prognosis error frequency in performance of thoracic sympathectomy from 15.2% to 2.5%.

Considering the low traumatic rate of TSSE, possibility of its performance was much higher and was covering the larger number of patients with distal damages of extremities’ arteries. Whereas, TSE on the left side was applied in 75 cases (58.1%), on the right side in 32 cases (24.8%), and in 22 cases (17.1%) on both sides.

**Results and discussion**

While performing TSSE, we have noticed the following intra-operation complications: bleeding out of the pleura incision place - 2 cases (1.5%), bleeding out of the trocar puncture - 3 cases (1.5%), damage to the lung’s tissue by Veresh’s needle during pneumothorax application - 1 case (0.7%). Associated complications had been easily eliminated without transition to conversion, and they did not have impact to the post-operative period.

Duration of operation made 25.5±2 minutes, while the intra-operation blood loss was minimal. Post-operation hospitalization period made, in average, 5.2±0.8 in-patient days.

As for the hemodynamic effect of TSSE, normally, all patients during early post-operation period used to show positive results in their ischemic limbs, which is proved by subjective and objective data (Table 2).

At the same time, effectiveness of TSE depended both from the limb ischemia grade and disease causation. Thus, the better results had been registered among the patients with RD and RS and under 3rd grade of ischemia. Positive effect from operation in the nearest period used to be observed among all patients with RD and RS, during separate period the same effect remained with RD patients in 80% of cases, with RS in 65% of cases. Absence of TSSE positive effect in the remote period, generally, used to be registered with the patients suffering from 4th grade of ischemia.

<table>
<thead>
<tr>
<th>Ischemia Grade</th>
<th>Linear blood velocity (cm/s)</th>
<th>SpO2(%)</th>
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<tr>
<td></td>
<td>Before</td>
<td>After</td>
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<tr>
<td>3rd grade of ischemia of upper limbs</td>
<td>20.9±1.8</td>
<td>23.2±2.1*</td>
</tr>
<tr>
<td>4th grade of ischemia of upper limbs</td>
<td>19.5±1.5</td>
<td>21.4±1.9</td>
</tr>
<tr>
<td>2nd grade of ischemia of lower limbs</td>
<td>21.8±2.7</td>
<td>24.5±2.8*</td>
</tr>
<tr>
<td>3rd grade of ischemia of lower limbs</td>
<td>19.1±1.8</td>
<td>22.9±2.7*</td>
</tr>
<tr>
<td>4th grade of ischemia of lower limbs</td>
<td>18.2±2.1</td>
<td>21.3±2.4</td>
</tr>
</tbody>
</table>

* - reliable result (p<0.05)

In this respect, we used to apply extended sympathectomy in case of 4th grade ischemia, i.e. not only 2 and 3 ganglions used to be removed, but 1 and 4 too. At the same time, no complications like Horner’s syndrome or Arlekino’s syndrome were observed.

Studies of scientists, particularly of Sluka and collaborators, had been used as grounds for extended sympathectomy. They had found that “reduction of neurons’ number under 4th grade ischemia, and in the ganglions of patients with insignificant hemodynamic effect of
sympathectomy, relates to the progressive degeneration of nerve cells and their further death. Functions of the “lost” cells are being performed by the neurons of upper and lower ganglia. Consequently, the reflex arch goes to the vessels of distal sections of upper extremities by-passing 2-3 ganglia, and after their removal the arch preserves its integrity, which causes a slight hemodynamic effect of the video-thoracoscopic sympathectomy of upper chest in case of the Raynaud’s disease and syndrome” (Sluka et al., 2002). Our research had confirmed the above mentioned findings.

Moreover, the pulse-therapy had been applied to 30 patients with RS along with standard treatment being conducted before TSSE, with consideration to systematic nature of main disease. At that, the last one used to be applied in the course of 3 days by “Solumedrol” medicine (methylprednisolone) dosed to 1000 mg with physiologic saline by intravenous line. No complications had been observed after performed pulse-therapy.

Above mentioned methods that had been introduced into the treatment course had allowed achievement of positive long-term effect (up to 4 years of monitoring) with the RD patients in all cases and in 90% of cases with RS patients. We would like to point out that ischemia regression had been registered in 3 cases of patients with RS combined with ischemia of upper and lower extremities.

Out of 41 cases of performed TSSE in patients with OE, positive effect in the nearest post-operation period used to be registered in 30 cases (73.2%). At the same time, its application allowed achievement of the lower extremities’ ischemia regression with the patients, who suffered also from the upper extremities ischemia of various grades. In 11 cases we had to amputate limbs due to the expansion of gangrene, in 3 cases at the level of the lower one-third of hip, in 6 cases - Sharp’s amputation, in 2 cases - disarticulation of toe.

Usually, we did not observe proper regression of ischemia in cases, when according to ultrasonic diagnosing there was no blood flow both via main arteries and finger arteries.

Out of 8 patients with OA, the positive effect used to be registered in the nearest post-operation period with 5 patients (62.5%). Three patients did not have any clinical effect from TSSE due to the progressing gangrene of limb; amputation of the lower one-third of hip was performed in their cases.

We would like to highlight that we link potential positive results of TSSE among the patients with OE and OA to the inclusion of the long-term intra-arterial link therapy (LTIALT) into the treatment course.

LTIALT scheme proved that it potentiates TSSE effect, especially, when its application starts 3-4 days prior to operation. In post-operation period LTIALT should be applied again for no less than 3-4 days in order to potentiate the clinical effect. High concentration of medicines gets accumulated in the damaged limb, which causes regression of the critical ischemia and recovery of the limbs.

Application of this scheme helped to avoid high amputation of lower extremity and preservation of its bearing function with 14 OE patients, while only in 2 cases (14.3%) Sharp’s amputation of foot had been performed and in 2 cases (14.3%) disarticulation of one toe.

**Conclusion**

Accordingly, to date TSSE is more and more popular with the patients suffering from the distal damage of the limb arteries due to its low-traumatic character, especially among the patients with RS and RD. In order to increase the TSSE effectiveness for this category of patients, we consider it would be practical to apply an extended sympathectomy, which is thanks to the endoscopic technology being performed with high precision and without particular complications.

Effectiveness of TSSE for the patients with OE and OA is related to possibility to retain the bearing function of the limb, when there are no conditions for reconstructive
operation, and especially in case of combination of the lower and upper limbs ischemia. Low traumatic level of TSSE allows performing it from both sides within a short period of time. This is particularly important for the patients with bilateral damage of the arteries of upper and lower extremities. Moreover, TSE performed on the patients, who previously had been successfully operated by lumbar sympathectomy, gives another chance to keep the limb to such a seriously affected group of patients. TSSE can be complemented with pre-operation and post-operation intra-arterial line therapy, which would prevent the high amputation of extremity.

References


