DIAGNOSTICS AND TREATMENT OF THE PATIENTS WITH CHRONIC CEREBRAL VASCULAR INSUFFICIENCY

The paper observes results of applying various methods of diagnostics and a choice of adequate surgical tactics in improvement of health of patients with chronic cerebrovascular insufficiency (CCI). All 49 (100%) patients with the first stage of the chronic cerebrovascular insufficiency (CCI) in the postoperative period experienced a considerable improvement of hemodynamic indicators; during the follow-up period in patients with the first stage of the CCI the neurologic symptoms were not observed. Symptoms of sensitivity infringement have completely disappeared in 82 (68.3%) patients with the second stage of the CCI after surgical treatment. During the follow-up period the repeated episodes of the transient ischemic attacks were not observed. In 115 (61.5%) patients with the third stage of the CCI in the postoperative period (3-6 months) we have noted clinical improvement, such as absence of complaints on headache, fatigue and memory decrease.

Keywords: Chronic lower extremity ischemia, brachiocephalic artery, classic carotid endarterectomy, linear speed of blood flow.

UDC: 616.831-005:616.08

Introduction

Prevention and treatment of the acute disturbance of the cerebral circulation (ADCC) is the major medico-social problem and has big social and economic value (WHO, 1999; Rosamond et al., 2008). It is known, that ischemic cerebral affection prevails among all kinds of the ADCC. According to international studies (Varlou et al., 1998; Mackey 2000; Gusev et al., 2003) the ratio of the hemorrhagic and ischemic stroke averages 5:1. Among the survived patients the repeated stroke develops in 5-25% within the first year, within 3 years - in 18%, and after 5 years - in 20-40% (Yakhno and Shtulman, 2001; Gusev and Skvortsova, 2001; Victor and Ropper, 2001).

Probability of a lethal outcome and morbidity in recurring AIS is higher, than at the first one. The number of invalids in consequence of strokes exceeds now 2 million people. About 15% of them require a permanent care in in-patient conditions or hospices and 30-40% cannot perform daily work without the aid of family members or guardians. The stroke changes a life of not only those who has survived it; their relatives or those who take care of them experience related changes. Considering it, the general damage from a stroke in the USA estimates more than 29 billion dollars, and for one patient it makes almost 100 thousand dollars per year (Yakhno and Shtulman, 2001; Djeyms and Tul, 2007).

In the USA only heart disease advances a stroke as the reason of long invalidity and death. Nevertheless, according to recently spent sociological interrogation made by (Djeyms and Tul, 2007), only 1% of the population know that a stroke - one of the principal causes of death. Though death rate gradually decreases in process of population aging, disease of a stroke remains in former level or even grows.

In Russia the stroke occupies second place in structure of the general death rate of the population, conceding only cardiovascular pathology, and among the reasons of invalidity it possesses first place (Chambless et al., 2004; Suslina, 2005). Frequency of occurrence of
IS for last 20 years has increased from 1.5 to 5.1 cases to 1000 persons in a year, and death rate has reached 1.5-1.7 cases to 1000 persons. A pathology of branches of aortic arcus register in 4.2-15.2% of the population in the age of 40-60 years, in half from them disturbance of patens of carotids is observed from both parties. With the years frequency of stenosis of carotids sharply increases and in 70-76 years composes 82% in men and 79% in women, the risk of occurrence of an ischemic stroke and death from it for people with bilateral defeats by stenosis of carotids reaches 74% (Gavrilenko et al., 2005; Gavrilenko et al., 2006; Kazanchyan et al., 2001).

As noted by (Pokrovskiy, 2004), principal cause of ADCC is the atherosclerosis and others stenosing lesions of brachycephalic arteries. Early diagnosis of the given pathology allows revealing and warning disturbances of cerebral hemodynamics. Now in the world practice for revealing of carotid arteries pathology it is applied ultrasonic duplex or triplex scanning, CT, MRI-angiography (Walker et al., 2006; Berczi et al., 2006; Miralles et al., 2006).

Despite rapid development of diagnostics and surgical treatment of patients with chronic cerebrovascular insufficiency, a number of problems in angioneurology remains unresolved. Diagnostics and tactics of the surgical treatment of patients with cerebral vascular insufficiency remains rather actual, definitively unresolved problem of modern vascular surgery and, certainly, demands the further researches and new workings outs. Primary preventive maintenance is necessary for reduction of quantity and simplification of consequences of a stroke with early revealing and correction of risk factors, and also secondary preventive maintenance of repeated strokes.

The purpose of the given work was improvement of results of treatment of patients with chronic cerebral vascular insufficiency by application of various methods of diagnostics and a choice of adequate surgical tactics.

**Material and methods**

786 reconstructive operations on carotids in 688 patients (carotid endarterectomy (CE) from both parties in 98 patients) have been performed during 2005-2010 in the department of angioneurology of the 2nd clinic of the Tashkent medical academy. Reason of chronic cerebrovascular insufficiency (CCI) in 463 (67.3%) cases was atherosclerotic lesions of brachycephalic arteries, in 9 (1.3%) cases extravasal compression of an internal carotid. At the same time, it is noted high frequency of pathological deformation of the carotids, observed in 126 (18.3%) cases, and its combination to a stenosis is noted in 74 (10.8%) cases. In 16 (2.3%) patients of the reason occlusion process were non-specific aortoarteritis. 224 (32.6%) patients had multifocal defeats (Table 1).

### Table 1. Multifocal defeats of vessels

<table>
<thead>
<tr>
<th>Localization of defeat of arteries</th>
<th>Number of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid + renal</td>
<td>49</td>
<td>7.1</td>
</tr>
<tr>
<td>Carotid + lower extremities</td>
<td>97</td>
<td>14.1</td>
</tr>
<tr>
<td>Carotid + renal + lower extremities</td>
<td>34</td>
<td>4.9</td>
</tr>
<tr>
<td>Carotid + coronary</td>
<td>31</td>
<td>4.5</td>
</tr>
<tr>
<td>Lesion of 4 arterial pools</td>
<td>13</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>224</strong></td>
<td><strong>32.6</strong></td>
</tr>
</tbody>
</table>

688 patients included into our research comprised 486 (70.6%) men and 202 women (29.4%). Their age ranged from 24 till 83 years, on the average 57.1±7.3 years, the majority of patients were able-bodied age (Figure 1).

The diagnostic algorithm of examination included clinical examination of the patients with definition of the neurologic status (n=688); ultrasonic dopplerography (USDG) with scoping and the hemodynamic importance of lesion (n=525); duplex scanning with
definition of degree of a stenosis and speed of a blood-flow, character and embolism of
the plaques (n=587); echocardioscopy (n=258); computer tomography of a brain (n=312);
computed tomography angiography (n=483); magnet-resonant angiography (n=59), and
roentgen-contrast angiography (n=68). It is necessary to notice, that last years
performance of roentgen-contrast angiography is made only under strict indications - in
patients with nonspecific aorta arthritis, in multifocal lesion, and when angiography from
diagnostic examination transforms to the medical one (catheterization of the arteries for
long intra-arterial catheter therapies in critical ischemia of the lower extremities,
angioplastics and stenting).

**Figure 1. Distribution of patients by age groups**

Majority of the patients had associated pathologies such as an arterial hypertension - 487
(70.8%), diabetes - 111 (16.1%), ischemic heart disease - 243 (35.3%), 63 of them (9.2%)
had acute infarct myocardium in anamnesis. For an estimation of neurologic symptoms we
considered indicators of disturbances of coordination, sensitivity, and also visual
impairment, noise in ear and in a head, fatigue, working capacity and memory decrease.
Volume of movements, muscular force and rate of movements were estimated in patients
experienced ADCC using standard techniques (adapted scale MRC in points). Easy hemi
paresis corresponded to 4-5 points, moderated - to 3-4 points, the sever one - to 0-2
points.

**Results and discussion**

In conformity with Pokrovsky (1979) classification the symptom course (first stage of
CCI) diseases were observed in 49 (7.1%) patients, transitory ischemic attacks (TIA) - in
120 (17.4%), dyscirculator encephalopathy - in 187 (27.2%), and 332 (48.3%) patients had
earlier an ischemic stroke.

Carried out investigation has revealed the isolated lesion of one carotid in 154 (22.4%)
cases, bilateral - in 236 (34.3%), and plural defeat of BCA - in 298 (43.3%).

In 331 patients the stenosis of carotids made more than 70%, in 143 patients - less than
70%; occlusion of one internal carotid artery (ICA) was noted in 58 patients, bilateral
occlusion in brachycephalic arteries (BCA) - in 5, and occlusion of the general carotid
(GCA) - in 4. It is necessary to notice, that in 52 patients occlusion of the BCA was
combined with a stenosis of an external carotid artery (ECA). In 21 patients BCA
pathological deformation was combined with pathological deformation the GCA. Study of
character of atherosclerotic plaques (AP) using Gray-Weale classifications has noticed that
second and third types of AP appeared in 72.5% of cases, complicated AP was observed
in 27.5% of cases.
Indications to performance of carotid endarterectomy in atherosclerosis for symptomatic lesions (TIA or after ADCC) were all types of plaques narrowing a vessel gleam on 60% and more, noticed plaques with a stenosis of 50% and more. Indications in case of asymptomatic lesions were homogeneous plaques narrowing gleam of a vessel on 70% and more; heterogeneous and hypoechogenic, ulcerated plaques with a stenosis of 60% and more. In pathological deformation the indications to operative treatment were presence of symptoms of cardio vascular insufficiency and significant hemodynamic infringement on carotids.

Mattas compression test was used to specify brain ischemic tolerance; neurologic status of the patient, linear speed of a blood-flow on a middle brain artery, and also electric activity of a brain were observed. High degree of brain ischemic tolerance was noted in 536 cases, satisfactory degree - in 127, and critical degree - in 11 cases.

All operations were carried out under the general intubation narcosis, their duration was from 60 till 180 minutes with time cross-clamping BCA from 9 till 42 minutes, on the average 21±4.3 minutes.

For protection of a brain we used a method of an artificial hypertension, deepening of narcosis and pharmacological protection, with application of antihypoxants and stabilizers of cellular membranes, irrespective to initial degree of brain ischemic tolerance. All patients before and after the operation were introduced anticoagulants subcutaneously, also in infusion program included the preparations improving blood rheology and cerebroprotectors. Clearance shunt was used in 25 cases in low and critical brain ischemic tolerance. Reconstruction of carotids were made not earlier than 4 weeks after the beginning of cerebral circulation sharp disturbance; in 2-4 weeks in case of “small” strokes; in few days, hours and even with emergency in case of TIA. The choice of carotids reconstruction method considered character of lesion, in particular, degree and extent of occlusive process and degree of tolerance of a brain.

Following kinds of operative interventions were executed: classical CE with expanding patch in 337 cases, eversion CE - in 147, BCA resection with redressation and reimplantation in an old opening - in 145, a resection and bandaging of BCA + endarterectomy from ECA with imposing of an expanding patch - in 49, eversion classical CE + BCA resection with redressation - in 76, a resection the GCA with GCA and BCA redressation - in 9, endarterectomy from carotids + carotid-subclavian bypass - in 6, GCA resection with prosthetics - in 4, aortocarotid bypass - in 2, periarterial sympathectomy - in 3 and removal of chemodectoma - in 8 cases.

After performance of reconstructive operation we estimated dynamics of neurologic symptoms and hemodynamic changes in 8-10 days and after 2-18 months. Considerable improvement of hemodynamic indicators was achieved in all 49 (100%) patients of first stage of CCI in the postoperative period: linear speed of the blood flow (LSBF) on BCA decreased from initial 160±12cm/s to 74±5cm/s (t=3.1; p <0.05). Neurologic symptoms were not observed during the remote period in patients of first stage of CCI.

All 120 patients with the second stage of CCI (transient ischemic attacks in the anamnesis) had initial complaints to disturbance of sensitivity in the form of sensation stupor, ants crawling, prickling on limited skin sites of the lower extremities.

In 44 (36.7%) patients in tilting the head back appeared blurred vision, photopsia and timely loss of sight, in 79 (65.8%) patients the right-hand hemiparesis and aphasia was observed in admission.

After surgical treatment in 82 (68.3%) patients the symptoms of disturbance of sensitivity completely disappeared, in 38 (31.7%) they remained due to double-sided lesion (Table 2, 3.). Repeated episodes of TIA and progressing CCI in the operated pool were not observed during the remote period. Linear speed of blood flow (LSBF) in these patients decreased from initial 174±16cm/s to 71±7cm/s (t=2.8; p <0.05).
TABLE 2. SUBJECTIVE COMPLAINTS BEFORE SURGICAL TREATMENT

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Second stage of CCI</th>
<th>Third stage of CCI</th>
<th>Fourth stage of CCI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before before after after before after before after</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dizziness</td>
<td>64 36 111 26 197 48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain in the temporoparietal area</td>
<td>83 19 89 18 237 93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain in occipital region of head</td>
<td>67 14 74 9 95 31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise in head</td>
<td>74 21 81 19 79 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ear noise</td>
<td>48 23 35 18 52 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbness of hands and feet</td>
<td>103 - 68 21 278 57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term loss of consciousness before</td>
<td>15 3 1 - 7 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a change of head position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shroud before eyes, photopsia and</td>
<td>44 7 44 16 28 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>temporary loss of sight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 3. NEUROLOGIC SYMPTOMS BEFORE AND AFTER SURGICAL TREATMENT

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Second stage of CCI</th>
<th>Third stage of CCI</th>
<th>Fourth stage of CCI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before before after after before before after before after</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nystagmus</td>
<td>47 3 49 12 77 22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central paresis of 7th nerve</td>
<td>113 - 63 15 328 278</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central paresis of 12th nerve</td>
<td>91 - 59 16 124 43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulbar disturbances</td>
<td>- - - - 63 46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motional disturbances</td>
<td>79 - - - 303 179</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance of sensitivity</td>
<td>118 - - - 189 73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor aphasia</td>
<td>34 - - - 74 14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensorial aphasia</td>
<td>20 - - - 42 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebellar aphasia</td>
<td>- - 9 4 31 19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In 163 (87.2%) patients in the 3rd stage of CCI the were complaints to headache localized in occipital, temporal and parietal area on the party of defeat and sense of “heavy head”; all patients had undue fatigability and working capacity decrease. In the postoperative period (3-6 months) 115 (61.5%) patients were found with clinical improvement in the form of absence of complaints to headaches, fatigues and memory decrease; though they remained in 27 (14.4%) patients (Table 2, 3). Improvement of regional hemodynamics was also noted. According to duplex scanning the linear stream of blood flow on BCA after operation decreased from 181±9cm/s to 79±7 cm/s (t=2.1; p<0.05). 3 (1.6%) patients within 6 months have had hemorrhagic stroke in not operated carotid pool with a lethal outcome. ADCC of ischemic type have developed in operated carotid pool in 6 (3.2%) patients in the nearest postoperative period; 4 (2.3%) of cases were with lethal outcome (an indicator “a stroke + lethality” - 2.3%). In conformity with MRC scale, 208 (62.7%) patients with the fourth stage of CCI had hemiparesis of light degree, 92 (27.7%) had moderated hemiparesis, and 32 (9.6%) patients - hemiparesis of heavy degree.

The analysis of the latest results of operative treatment has shown, that full restoration of impellent infringements, speech and sensitivity infringements was observed in 153 (73.6%) patients with light degree of hemiparesis on 3-6 months after operation.

51 (55.4%) cases of patients with moderated hemiparesis in 3-12 months after surgical treatment have shown marked restoration of neurologic deficiency, so they could be related to group of patients having hemiparesis of light degree; full restoration of neurologic symptoms in the given category of patients was not observed.

Hemiparesis reduced to moderated degree in 9 (28.1%) patients with hemiparesis of heavy degree; 23 (71.9%) patients did not show disease recourse (Tables 2, 3). LSFB linear stream of blood flow on BCA decreased from initial 178±6cm/s to 69±6cm/s (t=2.4; p<0.05).
During remote period in 11 (3.3%) patients with the fourth stage of the CCI the ischemic stroke was observed in operated in carotid pool with development of a lethal outcome in 6 (1.8%) (an indicator “a stroke + lethality” - 1.8%). Hemorrhagic stroke in not operated carotid pool developed in 3 (0.9%) patients. On 3-12 days of the postoperative period the sharp heart attack of myocardium developed in 5 (1.5%) patients with 3 fatal outcomes.

During the observation period in the operated patients different complications were noted. CCI of ischemic type in operated carotid pool in 25 (2.6%) patients, in 11 (1.6%) of them had a lethal outcome. False carotid aneurysm developed in 9 (1.3%) patients, a suppuration of a wound - in 3 (0.4%) patients, lymphorrhoea - in 1 (0.15%) patient, a sharp thrombosis in the early postoperative period - in 6 (0.9%) patients, bleeding from a wound - in 9 (1.3%) patients, damage of cranial nerves - in 16 (2.3%) patients, restenosis - in 23 (3.3%) patients, transitory ischemic attacks after roentgen-contrast angiography - in 6 (0.9%) patients.

The majority of the specified complications were noted in initial stage of the department work, with accumulation of experience the quantity of complications and lethality considerably decreased. It is necessary to notice, that recourse of neurologic deficiency was observed even at blood-flow restoration through an external carotid.

Advantages and lacks of operative treatment of the patients with chronic cerebral vascular insufficiency are widely discussed in studies of angiosurgeons. However, the fact of efficiency of vascular reconstructive operations in respect of preventive maintenance of the development of ischemic strokes in this category of patients is not already contested. Discussions involve only specific issues on indications and contra-indications, methods of diagnostics, rehabilitation of patients and particular questions of techniques in operative interventions. More and more works appear in the last years (e.g., Kazanchyan et al., 2001; Pokrovskiy, 2004; Pokrovskiy et al., 2007; Ballotta et al., 2002) proving clinical efficiency of these operations in patients who had ischemic stroke.

Possessing considerable own experience of operative treatment about 700 patients we have reconsidered all tactics of conducting and treatment of the patients with chronic cerebral vascular insufficiency in various stages of the development of disease. Medicamentous therapy till today has not led to reduction of development of ischemic strokes in human population; it also has not reduced frequency of heavy complications and consequences of this disease. It is suggested that surgical treatment of the CCI represents the only effective treatment. Correction of the broken blood-flow in carotid pool not only allows warning ischemic stroke, but it is also option for rehabilitation of patients who already had ischemic stroke or having neurologic deficiency. In the beginning of our departmental work the operations in patients with the first stage of CCI made 6%, nowadays there is an insignificant growth - 7.1% whereas in the countries of Europe and the USA this indicator makes 40-72% (Varlou et al., 1998; Yakhno et al., 2001; Djeyms and Tul 2007).

**Conclusion**

We consider that today the maximum coordination of interaction in services of emergency medicine, planned neurology, intensive therapy, otorinoloringologists, oculists, cardiologists and surgeons is necessary.

All patients who had a stroke, TIA or suffering vertebral-basilar disturbances; patients having systolic murmur in BCA, gradient asymmetry of the AP between hands from above 20mm Hg; patients older than 50 years with other vascular defeats (arterial hypertension, aorta aneurysms, and chronic ischemia of lower extremities) should necessarily undergo instrumental examinations for identifying or excluding lesions of BCA. Upon confirmation of the diagnosis the patients should be examined by vascular surgeon. Thus, the doctor of any specialty should know that the ischemic stroke is only complication of some pathology. It is necessary to understand that without elimination of the reason which led once to a stroke or transitory ischemic attack, the probability of the
subsequent ischemic damages of a brain remains very high. It is essential constant informing of doctors of the general practice, otorinolaringologists, oculists, cardiologists, therapists and neurologists about modern approaches to diagnostics and treatment of patients with CCI. In this context, it becomes important to create unified national register in the Kazakhstan for ordering and unification of diagnostics and treatments of the patients with acute and chronic disturbances of cerebral circulation.

References


Gusev, Е., Skvortsova, V., 2001. Brain ischemia [Ishemiya golovnogo mozga], in Russian, Moscow.


