SCREENING OF THE ELDERLY POPULATION OF SEMEY REGION FOR INFRA-RENAL ABDOMINAL AORTIC ANEURISM WITH SUBSEQUENT MANAGEMENT

This is the first survey in Kazakhstan designed to evaluate the presence of abdominal aortic aneurism (AAA) in the population 60 years of age and older. The total number of people screened was 1011, of them 363 (35.9±1.5%) were males and 648 (64.1±1.5%) were females. The presence of AAA was established in 31 cases (3.1±0.5%). The vast majority (87.1±6.02%) of AAA cases belonged to small-size lesions. Co-existing impairment of coronary channel was seen in 18 cases (85.7±7.8%), pathology of brachiocephal arteries was diagnosed in 9 cases (42.8±11.06%), impairment of the arteries of lower extremities was seen in 15 cases (71.4±10.1%). The decreased rate and severity of complications as well as improved surgical outcome became possible due to the early identification of patients with AAA, timely correction of co-existing impairment of coronary arteries, brachiocephal arteries and arteries of lower extremities, re-implantation of inferior mesenteric artery and internal iliac arteries and adequate surgical management.

Keywords: Screening, abdominal aortic aneurism, coronary channel, brachiocephal arteries

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Introduction

According to other screening surveys, the prevalence of abdominal aortic aneurysm (AAA) 3 cm in diameter and larger in general population is equal to 4-5%. At the same time, the prevalence of AAA of 4 cm in diameter and larger is within the range of 1-3% (Spiridonov, Tutov, and Arakelyan, 2000). The prevalence of AAA increases with age. The prevalence of aneurysms of 4 cm and larger in males after 60 years is equal to 1% of cases, while in males after 80 years it is as high as 10-12% (Ashton, Buxton, Day et al., 2002; Bengtsson, Bergqvist, Ekberg, and Janzon, 1991).

When surgical interventions on abdominal compartment of aorta or major arteries of lower extremities are provided to the patients with multifocal atherosclerotic arterial impairment, the ischemic neurologic complications develop in 15-17% of cases and cardiac involvement occurs in 17-23% of cases due to decompensation of blood flow in the above mentioned pools (Bespaev, Spiridonov, Alekyan et al., 2003).

Two surgical approaches are applied nowadays to treat the multifocal atherosclerosis - one-step and step-by-step. The first involves the simultaneous revascularization of all impaired arterial pools, whereas the second implies step-by-step correction of atherosclerotic changes. The majority of authors give preference to the primary reconstruction of brachiocephalic and coronary arteries (Popov, Kazanchyan, Sotnikov, Kazakov, and Kozorin, 2008).

However, if abdominal aortic aneurism is complicated, for example when artery laceration, threatened rupture or actual rupture occur, the surgical intervention is the only measure to save patient’s life and, thus, has to be implied urgently in any situation (Pokrovskiy, 2004).
The aim of our research was to develop the strategy for early identification of patients with AAA and to suggest the approaches for surgical intervention in case if there is an involvement of the coronary channel arteries, brachiocephalic arteries and arteries of lower extremities, in order to decrease the fatal complications from the side of vitally important body organs.

Materials and methods

We examined 1011 residents of Semey region: 363 (35.9±1.5%) were males and 648 (64.1±1.5%) were females. The mean age composed 68.4±1.4 years. Before the study was started, the permission from Ethical Committee of Semey State Medical University (SSMU) was obtained.

The local population was informed of the screening proposed via mass media and was invited to take part. All individuals 60 years of age and older were considered as eligible and were invited for examination by a vascular surgeon. After the preliminary examination, the questionnaire was filled out and information for patients on how to prepare for instrumental examination was distributed. After that, the participants were referred for Doppler’s ultrasound of abdominal aorta.

The Doppler’s ultrasound was carried out in 2 medical settings: in the out-patient department “Harmony” and in the Medical Center of SSMU.

The absence of pathologic lesions in abdominal aorta was confirmed in 456 (45.1±1.5%) cases examined and atherosclerotic changes were diagnosed in 555 (54.9±2.4%) cases (table 1).

<table>
<thead>
<tr>
<th>Doppler’s ultrasound of abdominal aorta</th>
<th>No pathology, N (%)</th>
<th>Atherosclerosis - N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No complications, n=456</td>
<td>245</td>
<td>31</td>
</tr>
<tr>
<td>Stenosis, n=105</td>
<td>105</td>
<td>174</td>
</tr>
<tr>
<td>Calcinosis, n=174</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As table 1 presents, AAA was identified in 31 (3.1±0.5%) patients with complicated atherosclerosis of abdominal aorta, stenosis of abdominal aorta was diagnosed in 105 (10.4±0.9%) cases and calcinosis of abdominal aorta was established in 174 (17.2±1.4%) patients examined.

When calcinosis and stenosis were diagnosed, they differed in severity and extent; all identified cases of stenosis did not exceed the 1/3 of abdominal aorta’s clearance and did not result in significant impairment of blood flow.

In all 31 cases of AAA, the causative factor was atherosclerosis, which was confirmed by clinical presentation and Doppler’s ultrasound data.

According to classification, AAA was graded as follows: small - from 3 to 5 cm in diameter, moderate - from 5 to 7 cm in diameter, and large - over 7 cm in diameter. Out of all cases of aneurisms, 4 (12.9±6.02%) patients had moderate-size lesions (5.2-6.1 cm) and 27 (87.1±6.02%) patients had small-size lesions.

Out of 31 patients with AAA, 10 presented with the size of aneurism within 3.0 to 3.5 cm range. This category of patients was closely followed-up: 2 times a year they were
undergone to the Doppler’s ultrasound of abdominal aorta, and in case if aneurism’s enlargement occurs, they would be undergone to additional tests with subsequent referral for surgical management.

The remaining group of 21 patients had aneurisms in the diameter of 3.5 cm and larger, and, thus was undergone to detailed examination, including Doppler’s ultrasound of brachiocephalic arteries and arteries of lower extremities, ECG, Echo CG, Seldinger’s aortography and colonoscopy.

After Doppler’s ultrasound of brachiocephalic arteries was carried out, the atherosclerotic changes were diagnosed in 9 (42.8±11.1%) patients out of 21 examined. According to the classification of chronic cerebro-vascular insufficiency by Pokrovsky (1979), the indications for surgical intervention in the pool of carotid arteries were established in 5 (23.8±9.5%) patients. Of them, 2 patients had stenosis of internal carotid artery’s lumen for more than 60% with the presence of heterogenic plaque and acute impairment of cerebral blood flow in the past history; in the other 2 patients the constriction exceeded 50% and transitory ischemic attacks were present; in 1 patient the extension of stenosis exceeded 70%.

Doppler’s ultrasound of the arteries of lower extremities revealed the impairment of arterial flow in 15 (71.4±10.1%) patients out of 21. However, only 9 patients (42.8±11.1%) had clinical manifestation of intermittent claudication of different extent. The Doppler’s ultrasound established significant impairment of blood dynamics in 5 (23.8±9.5%) patients. In addition to aortography, all of them were undergone to the angiography of lower extremities. The crucial stenosis and occlusion at the level of crural arteries was diagnosed in 3 (14.3±7.8%) patients, 1 (4.8±4.7%) patient had occlusion at the level of femoral-popliteal segment and 1 (4.8±4.7%) patient had occlusion of popliteal artery. Because these impairments were considered to be significant, the combined surgery of abdominal aorta and arteries of the lower extremities was proposed.

Electrocardiogram (ECG) and echo cardiogram (EchoCG) tests revealed the presence of ischemic heart disease (IHD) in 18 (85.7±7.8%) patients out of 21 (Table 2).

**Table 2. Diagnostic categories of ischemic heart disease in patients with abdominal aortic aneurysm**

<table>
<thead>
<tr>
<th>Diagnostic category</th>
<th>Males</th>
<th>Females</th>
<th>Total (%)</th>
<th>n=21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angina pectoris</td>
<td>16</td>
<td>2</td>
<td>18 (85.7±7.8)</td>
<td></td>
</tr>
<tr>
<td>Angina pectoris grades III-IV of functional class (by NYHA)</td>
<td>3</td>
<td>1</td>
<td>4 (19.1±8.7)</td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction in past history</td>
<td>5</td>
<td>1</td>
<td>6 (28.6±10.1)</td>
<td></td>
</tr>
<tr>
<td>Ventricular arrhythmias</td>
<td>4</td>
<td>1</td>
<td>5 (23.8±9.5)</td>
<td></td>
</tr>
<tr>
<td>Cardiac failure</td>
<td>3</td>
<td>1</td>
<td>4 (19.1±8.7)</td>
<td></td>
</tr>
<tr>
<td>Ejection fraction of left ventricle less than 50%</td>
<td>2</td>
<td>-</td>
<td>2 (9.5±6.5)</td>
<td></td>
</tr>
</tbody>
</table>

As table 2 presents, of 18 patients with angina pectoris, 4 (19.1±8.7%) had severe course: grades III-IV of functional class (by NYHA). In 6 (28.6±10.1%) cases the post-infarction cardiocscerosis with relevant ECG changes was diagnosed. Transmural post-infarction changes were seen in 4 (19.1±8.7%) of 21 patients examined with AAA, which commonly had posterior localization - 3 patients (14.3±7.8%). Ventricular cardiac rhythm impairments were identified in 5 (23.8±9.5%) patients and manifested as extrasystoles, bigeminy and trigeminy. The presence of zones of hypokinesia and akinesia was revealed in 4 (19.1±8.7%) patients, that was also confirmed by trans-mural myocardial infarction identified on ECG and from the past history. Small lesion cardiac sclerosis was seen in 2 (9.5±6.5%) patients. It was not surprising to see the high frequency of left ventricular hypertrophy as arterial hypertension was common - 12 (57.1±11.1%) patients.
All patients with severe angina pectoris of II-IV functional class (by NYHA), with post-infarction cardiac sclerosis and cardiac rhythm impairment, were referred to coronary angiography. The total number of such patients was equal to 11. Aortography is planned as an additional test.

As coronary angiography and aortography were performed on 11 patients with symptomatic cardiac pathology, the Seldinger's aortography was conducted in the remaining 10 patients of 21 with AAA.

The diagnosis of AAA, made on the basis of Doppler ultrasound test, was confirmed in all cases. In addition, we evaluated the condition and the pathways of inferior mesenteric artery (IMA), internal iliac artery (IIA) and arteries of lower extremities (if indications were present).

The selective catheterization of IIA was successfully performed in 6 patients. In addition to staining of IIA's branches, we injected the sterile solution of methylene blue inside the artery with subsequent colonoscopy in order to test the collateral blood flow in the left half of colon (license No62718 from 01.12.2008). Colonoscopy was performed 30 minutes after aortography, with careful hemostasis of femoral artery’s puncture place. By colonoscopy we examined the state of colon’s left half: the coloration of mucous, the presence of hypo- and atrophic zones, ulcerations, erosions and other pathologic changes, and also took the piece of tissue for biopsy. In all cases when sterile solution of methylene blue was injected inside IIA on colonoscopy, the mild bluish coloration of colon’s mucous layer was observed. The presence of atrophic and hypotrophic zones was revealed in 1 patient.

Statistical processing was carried out by determining the relative index (P) and error of representativeness of the relative index (m).

**Results**

Thirty one (3.1±0.5%) patients with AAA were identified due to the screening of the population aged 60 years and older residing in Semey region. The indications for surgical management were established in 21 patients, to whom the resection of aneurism was proposed. Out of those patients, 16 (76.2±9.5%) had co-existing impairment of arterial channels in vital organs: 11 patients had clinical manifestation of cardiac pathology and were referred for coronarography, 4 patients had co-existent significant impairment of circulatory dynamics in carotid arteries and 1 patient had myocardial infarction in the past history and was presented with the 50-60% stenosis of internal carotid artery, heterogenic ulcerated plaque in the place of stenosis, transitory ischemic attacks of cerebral blood flow at the time of examination.

Taking into account the above stated, all 5 patients with carotid arteries’ impairment were operated in the first term. They were undergone to carotid endarterectomy, and post-surgically presented with no complications. This surgery served as the 1st stage for the major intervention - resection of AAA.

The remaining 16 patients of 21, to whom the primary resection of AAA was indicated, were operated in case if significant co-existent impairment of circulatory dynamics in aortoiliac segment and the arterial impairment of lower extremities were present. Up to now, we successfully operated on 7 patients, of whom 6 were males and 1 was female (Table 3).
### TABLE 3. SURGICAL INTERVENTIONS IN PATIENTS WITH ABDOMINAL AORTA ANEURISM

<table>
<thead>
<tr>
<th>Type of surgery</th>
<th>Total number, n=7</th>
</tr>
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<tbody>
<tr>
<td>Resection of AAA</td>
<td>1</td>
</tr>
<tr>
<td>Resection of AAA, re-implantation of IIA on the left, re-implantation of IMA</td>
<td>2</td>
</tr>
<tr>
<td>Resection of AAA, re-implantation of IMA, lumbar sympathectomy</td>
<td>2</td>
</tr>
<tr>
<td>Resection of AAA, re-implantation of IMA</td>
<td>2</td>
</tr>
</tbody>
</table>

According to the table 3, when resection of AAA was performed, we paid the particular attention to the state of IMA and IIA located directly in the zone of surgical intervention in addition to reconstruction of the major blood flow and improvement of collateral blood flow in the pool of arteries of lower extremities. This was done to prevent the development of ischemia of the left colon. As a result, re-implantation of IMA was performed in 6 cases, re-implantation of IIA from the left side was done in 2 cases.

The outcomes of treatment were studied for early postoperative period only. The complications of early postoperative period were mild and temporary and could be fixed prior to the patients’ discharge. All patients were discharged from in-patient department in good health state.

### Discussion

The screening of population aged 60 years and older in Semey region was the first study in Kazakhstan to obtain the new reliable data. The prevalence of AAA in Semey region in the above defined age group is equal to 3.1±0.5%. The data obtained are comparable with the data of multi-center screening surveys conducted in the Russian Federation, Europe and in the USA (Shirinbek, 2008; Burakovskiy and Bokeriya, 1989).

It should be noted that we surveyed the people only by one risk factor - it is age older than 60 years. Currently, a number of randomized clinical trials have been published that recommend in addition to age consider the risk factors such as smoking and family history (Lindholt, Juul, Fasting, and Henneberg, 2005; Norman, Jamrozik, Lawrence-Brown et al., 2004). It is possible to limit the number of participants from the general population and conduct the screening more targeted.

In our research in 87.1±6.02% of cases the size of AAA was small and did not exceed 3-5 cm. Because of that, this category of patients was closely followed-up and surgical treatment was provided if considered to be necessary.

According to the data of pathology bureau, 35 people died in Semey city from the rupture of AAA within the 1998-2009 time period because of the delayed provision of specialized medical aid. 15 patients with AAA were undergone to emergency surgical treatment in the vascular surgery department of the Medical Center of Semey State Medical University. Of them, 11 had signs of aneurysm laceration and 4 - of aneurysm rupture. The average cross-sectional diameter of AAA in this category of patients was equal to 83.8±9.8 mm. Complications of early post-operative period led to lethal outcome in 6 (40±13.1%) cases.

The early identification of patients with AAA is appropriate as it provides timely diagnostics of systemic co-morbidities and assessment of other arterial pools’ involvement. It also helps to identify the patients eligible for preliminary medical or surgical management before the major surgery. The most important risk factor is considered to be the coronary involvement and impairment of brachiocephal arteries. At present, cardiac complications are the major cause of lethal outcome in patients undergone to surgical interventions due to AAA. The frequency of such complications exceeds 20% and leads to mortality in 50-70% of cases. The neurologic complications of AAA resection are relatively rare (0.5-1.0%) but they are responsible for 30-40% of mortality (Pokrovskiy, 2004).
Twelve patients identified in our screening study were operated because of AAA. Of them, 5 were undergone to carotid endarterectomy as the first step with no complications in post-operative period. The remaining 7 patients were undergone to the primary resection of AAA. These were the patients in whom the severe cardiac and cerebral disorders were excluded by the additional diagnostic interventions (ECG, EchoCG, Doppler’s ultrasound, coronarography). They had no significant complications in the early postoperative period.

Conclusion

On the basis of our study, the following conclusions could be made.

1. The prevalence of AAA in the population of Semey region is equal to 3.1±0.5%, which is comparable with the data of other multi-center studies. The 87.1% cases of AAA are of small size.
2. During the screening for AAA enough survey of persons 60 years and older who smoke or smoked previously, and also have a family history for the presence of AAA.
3. The early diagnostics of asymptomatic AAA gives an opportunity to manage the co-existing pathologies medically and/or surgically. The combined impairment of coronary channel was seen in 18 (85.7±7.8%) cases, the involvement of brachiocephal arteries was diagnosed in 9 (42.8±11.1%) patients, the impairment of arteries of the lower extremities was identified in 15 (71.4±10.1%) cases.
4. Early identification of patients with AAA, timely surgical management of co-existent impairment of coronary arteries, brachiocephal arteries and the arteries of lower extremities, re-implantation of IMA and IIA, provision of surgery in favorable conditions help to decrease the frequency and the severity of complications dramatically and, thus, to improve the outcomes of surgical intervention.

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