Ruptured abdominal aortic aneurysm

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Key words: abdominal aortic aneurysm, rupture of abdominal aortic aneurysm, surgery.

Summary. Rupture of the abdominal aortic aneurysm is a high lethal risk pathology, which requires precise diagnosis and urgent and efficient surgical treatment. Despite improved diagnostic capabilities (echoscopy, in specialized departments – angiography, computed tomography, magnetic nucleus resonance), mortality related to this pathology remains high in intensive care units. In the present article data concerning prevalence and clinical outcomes of the rupture of the abdominal aortic aneurysm for 1999–2001 is presented in detail. During this period 22 patients have undergone surgery due to abdominal aortic aneurysm rupture. Described are most prevalent complications, mortality rates and causes, analyzed are treatment strategy and tactics.

Introduction

An abdominal aortic aneurysm (AAA) is a dilatation of the abdominal part of the aorta above 1.5 concerning the maximal AAA-diameter divided with the supraaneurysmal aortic diameter (WHO definition). In older people normal diameter of aorta is 3 cm (average 1.4 - 3.3 cm), so, local dilatation of abdominal aorta more than 3 cm is abdominal aortic aneurysm (1,2). Not surprisingly, risk factors for expansion are similar to risk factors for rupture (3,4). Autopsy studies have shown, that 17-43% of AAA, diagnosed during autopsies, were ruptured. The most powerful predictor of rupture is the AAA diameter, with rapidly increasing risk, when the AAA size is more than 5 cm (1,5,6,7). Arterial hypertension, smoking, absence of carotid and lower limb atherosclerosis, and chronic obstructive airway disease are also associated with increased risk of rupture (8,9). Rupture of the abdominal aortic aneurysm (AAA) is a high lethal risk pathology, which requires precise diagnosis and urgent and efficient surgical treatment. It is one of the greatest tragedies for the patient and one of the greatest challenges to the vascular surgery team. In the last few years, the incidence of abdominal aortic aneurysms has increased, basically due to increased human life expectancy. If the diagnosis is made in good time, it is possible to recommend elective surgical treatment; however, in case of ruptured AAA, immediate surgery is required. The lethality of ruptured AAA despite of better diagnostic possibilities (sonography, in special vascular departments – angiography, computed tomography, MRI) (Examples 1,2,3), special care in the Intensive Care units is still high; 50-66% die before they reach operation, and those who undergo surgery, 35-60% (2,5,10,11). Elective AAA resection has a mortality of 3-7% (12,13).

Aneurysms rank as a No 13 leading cause of death in the United States (12). According to Abdurahama et al., the incidence of ruptured abdominal aortic aneurysm is 1 in 250 deaths, in persons over 50 years of

![Fig. 1. Diagnostic methods of abdominal aortic aneurysms. Three-dimension computed tomography reorganization](http://medicina.kmu.lt)
Nevertheless, Chen states that the rupture of AAA accounts for 1.5% of all deaths in men over 65 years of age (6). According to Bradbury and Choksy and Bickerstaff, it is estimated that the incidence of ruptured AAA is 25-30 per 100,000 (3,5,10).

Rupture may be the first clinical event of AAA, or the final one for a patient who has refused surgery for personal reasons. The aims of this study are to discuss results of treatment of the ruptured AAA, assess useful and more dangerous complications, strategy and tactic of operative treatment.

**Material and methods**

From January 1986 to November 2001, 51 patients were treated in Department of Vascular surgery at Kaunas University of Medicine Hospital with the diagnosis of ruptured AAA. Results of surgical treatment of AAA in 1986-1998 were published in journal “Medicina” (14), and the results of 1999-2001 are discussed in this article. Twenty two patients were operated on for ruptured aneurysms, 19 males (86.4%) and 3 females (13.6%). Eleven patients (50%) were 60 to 70 years of age, 8 (36.4%) 71 to 80 years of age and 3 (13.6%) above 80 years of age. The mean age was 72.4 years -the youngest patient was 63 years old and the oldest one was 89 years old.(Table I)

Angina pectoris was present in 59% of patients, myocardial infarction in 22.7%, systemic arterial hypertension in 68%, chronic obstructive pulmonary disease in 18% and peripheral occlusive arterial disease in 59% (Table II). Only three of these patients knew about their disease.

Twenty seven percent of the patients presented a transverse aneurysm diameter of less than 6 cm, 50% ranged from 6 to 10 cm and 22.8% were over 10 cm (Table III).

Seven patients (31.8%) were operated on in hemorrhagic shock and 15 patients (68.2%) were operated on in profound shock (Table IV).

Table VII shows the onset of symptoms and the beginning of surgical treatment - its correlation with mortality rates. Six patients were operated on in the first 6 hours after onset, with 2 deaths (33.3%); 11 were operated on between 6 and 12 hours, with six deaths (54.5%); five patients were operated on 24 hours after the onset of symptoms, with 4 deaths (80%).(Table V).

**Surgical management**

The surgical procedure must begin as soon as possible so that the surgeon can place an aortic clamp to...
Table 2. Associated disease

<table>
<thead>
<tr>
<th>Disease</th>
<th>Operated patients</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number</td>
<td>percentage</td>
<td></td>
</tr>
<tr>
<td>Arterial hypertension</td>
<td>15</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>13</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Angina pectoris</td>
<td>13</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>5</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td>Chronic pulmonary disease</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Peripheral arteriosclerosis</td>
<td>13</td>
<td>59</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Abdominal aortic aneurysms size distribution

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Operated patients</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number</td>
<td>percentage</td>
<td></td>
</tr>
<tr>
<td>&lt;6 cm</td>
<td>6</td>
<td>27.2</td>
<td></td>
</tr>
<tr>
<td>6–10 cm</td>
<td>12</td>
<td>54.4</td>
<td></td>
</tr>
<tr>
<td>&gt;10 cm</td>
<td>4</td>
<td>18.4</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Hemodynamic status: percentage and mortality

<table>
<thead>
<tr>
<th>Hemorrhagic index</th>
<th>Number of operated patients</th>
<th>Number of deaths</th>
<th>Percentage of operated patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8–1.0</td>
<td>7</td>
<td>2</td>
<td>28.5</td>
</tr>
<tr>
<td>&gt;1.0</td>
<td>15</td>
<td>10</td>
<td>66.6</td>
</tr>
</tbody>
</table>

Immediate postoperative care is very important. These patients are maintained in the intensive care unit for two or more days, until complete stabilization. Usually, mechanical ventilation is maintained during 24 hours or more. If the patient at the end of operation was anuric, it was indication for early hemodialysis in the ICU. All possible postoperative complications may be diagnosed immediately, allowing prompt attention.

Results

Out of 22 patients, who have undergone surgery within the aforementioned period, 10 survived (45.5%). The operated patient is defined as a patient, who reached an operating-theater and on whom the laparotomy was performed. In many cases poor outcome was determined by multiple damages of organs due to disorders of hemodynamics related to protracted hypotension and ischemia. During operations 4 straight prostheses, 9 aortic-iliac artery prostheses and 5 aortic-femoral prostheses were implanted and in 1 case an extraanatomical underarm-femoral artery bypass was formed (Example 4). Due to severe patient condition, in 3 cases only central anastomosis was performed.

Cardiac pathologies constituted the most marked portion of complications of our patients. Myocardial infarction was diagnosed to 5 patients (repeated MI in 2 cases) and in 2 cases life-threatening arrhythmias were diagnosed.

One of the most serious complications was anuria. Out of 8 patients, to whom hemodialysis procedures were performed, only 3 survived. Kidney function recovered for 2 patients, while for one patient a chronic deficiency of kidney function developed and he was transferred to the nephrology department.

Intestine ischemia was also a frequent complication. Out of 5 patients, to whom hemicolecction was...
performed during operation or within first several days after operation, 2 patients survived. Other patients experienced myocardial infarction between 2\textsuperscript{nd} and 4\textsuperscript{th} day after operation. Postoperative treatment of surviving patients on average lasted 42 days.

In case of 1 female patient, postoperative treatment was complicated by pneumonia, but she successfully went home after 15 days.

Bleeding-related relaparotomy was performed to only 1 patient. The source of bleeding was removed by reforming lumbar arteries and the patient has recovered.

Four patients died during the operation. On the arrival they had been diagnosed with deep hemorrhagic shock and laparotomy and revision of the abdominal organs were performed in the operation theater. All of these patients died from complications of cardiac origin, which are myocardial infarction and life-threatening arrhythmias.

Even though the number of cases is not large, it is thought that the main causes of death were preoperative bleeding and pronounced hemodynamic disorders. Out of 22 patients, who had undergone surgery, 7 (31.8%) were operated in light hemodynamic shock and out of these 2 patients (28.5%) died. Fifteen patients (68.2%) were operated in deep hemodynamic shock and 10 (66.6%) of them died.

Another important factor is the time elapsed from first appearance of clinical symptoms to the beginning of the operation (Table 5). We can see that among the patients operated within the first 6 hours mortality rate was 33.3%, among those operated within first 6-12 hours – 54.5%, and among those operated after more than 12 hours – 80%.

**Discussion**

Surgical mortality in treatment of the AAA rupture remains high and results of various authors vary within the wide range of 35-70%. However, only very few specialized Centers of Vascular surgery managed to achieve the mortality rate of 35% (5,10,13,15,16).

In our opinion the main problems treating patients with SAA rupture are the following:

2. Early arrival of the patient to the specialized Department of Vascular surgery.
3. Avoidance and timely treatment of bleeding and complications induced by it.
4. Selection of such time and technique of operation depending on the condition of the patient.
5. A very important factor is timely diagnosis of the AAA (before the rupture) and operative treatment in the planned order.

Preliminary diagnosis of the patients with ruptured AAA is difficult because this pathology oftentimes stimulates pathology of other abdominal cavity organs. For this reason often the diagnosis is given and the patient is brought to the Department of Vascular surgery late, only
after hemodynamic changes become apparent. This fact is described in the literature by many authors. In 1996 Hardman et al. found that the mortality rates differed depending on the speed of diagnosis. For patients, to whom AAA rupture was diagnosed early, the mortality rate was 35 percent, while for patients, to whom correct diagnosis was given late, the mortality rate was 53.6 percent (4,16,17). In 2001 Cronenwett JL and Rutherford RB proposed an algorithm for diagnosis and treatment of patients with suspected rupture of abdominal aorta aneurysm (4) (Figure 5).

In most cases the simplest and fastest diagnostic method is echoscopy of top level of the abdomen. It is recommended to perform such echoscopy at the level of the 3rd and 4th lumbar vertebra (2,7,17). (Figure 6).

Some researchers note relationship between patients age and treatment outcome. Average age of surviving patients tend to be lower (7,9,11,16). According to our data, average age of the surviving patients was 69.7 while average age of the dying patients was 71.3. The men to women ratio was 6:1.

Another important risk factor is hemodynamic condition of the patient. This depends on preoperative and intraoperative blood loss and the amount of time spent in hypotension. It is indicated that many authors obtained similar results operating patients in mild and severe hemorrhagic shock. Choksy et al. reports

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**Fig. 5. Algorithm of evaluation and management patients with symptoms of ruptured AAA**
(by Cronenwett J.L., Rutherford R.B., 2001)

respectively 24.4% and 69.5%, Chen reports 11.1% and 51%, Drott – 12.5% and 56.4% (6,10,17,18). In our study the percentages were 17% and 83%, respectively. Between 1986 and 1998 29 patients were operated at Department of Vascular surgery at Kaunas University of Medicine Hospital, while between 1991 and 2001 this figure reached 22. This indicates that the condition studied is becoming more prevalent and is more often diagnosed before operation rather than during autopsy.

In summary we can note that after AAA rupture the patient can die anytime for various reasons. In the immediate postoperative period most dangerous is hemorrhage due to coagulation disorders caused by massive blood transfusions, and the accompanying shock.

**Conclusions**

1. Mortality can be decreased by timely diagnosis of the AAA rupture and urgent operation in the specialized Department of Vascular surgery.
2. As the average age of the population increases so does the prevalence of the abdominal aorta aneurysms.
3. In case of diagnosis of AAA larger than 5cm, the best prevention of the AAA rupture is elective surgical treatment.

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**Fig. 6. Ultrasound investigation of ruptured abdominal aortic aneurysm**

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**Pilvo aortos aneurizmos plyšimas**

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**Raktažodžiai:** pilvo aortos aneurizma, pilvo aortos aneurizmos plyšimas, chirurginis gydymas.


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