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Diagnostic Algorithms in Patients with Complicated Forms of Abdominal Aortic Aneurysm

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Abstract. In patients with complicated forms of abdominal aortic aneurysm the features of clinical course, errors in the diagnosis of underlying disease at the stages of medical care, as well as diagnostic value of instrumental methods of research were studied. Direct and indirect signs of complicated forms of abdominal aortic aneurysm were identified. Based on the results of the study, diagnostic algorithm for the patients with abdominal aortic aneurysm rupture was developed, depending on the state of hemodynamics at the stages of provision of medical care.

Objective. To study diagnostic algorithms in patients with complicated forms of abdominal aortic aneurysm.

Materials and methods. Results of comprehensive examination and treatment of 131 patients with complicated forms of abdominal aortic aneurysm and 44 patients with chronic aneurysms were analyzed. In 106 patients out of 131 subjects with complicated aneurysms there was a rupture, 17 had tear of the aneurysm wall, 8 had «penetration» of the posterior wall of the aneurysm into the spine. Infrarenal aneurysms were found in 105 patients, suprarenal in 12, and juxtarenal in 14.

Results. Based on the results of angiography, AAA rupture was diagnosed only in 12 (34.3%) patients. However, this method provides most accurate evaluation of the involvement of abdominal aortic branches in the aneurysm and its spread to the iliac arteries. When studying the diagnostic value of instrumental research methods in patients with complicated forms of abdominal aortic aneurysm, it was found that Echo revealed AAA rupture in 52 (54.7%) patients.

The diagnosed rupture of AAA requires emergency hospitalization to the specialized clinic for surgical treatment. Other diagnostic measures (CT, angiography) to determine the strategy of future surgical intervention should be performed in a specialized clinic. The diagnostic algorithm for patients with unstable hemodynamics at the stage of the secondary care should take minimum time and include clinical examination, duplex ultrasound, and then emergency delivery of the patient to the operating room.

Conclusions. Diagnosis and surgical treatment of patients with AAA rupture remains an urgent problem. Mistakes in diagnosis reach the level of 70.7%. Up-to-date instrumental methods (ultrasound, angiography) do not always provide comprehensive diagnostic information. The rate of errors in the diagnosis of aneurysm rupture is 45.2% for ultrasound, and 65.7% for angiography. The most informative method of diagnosis is CT.
Keywords: *abdominal aortic aneurysm, diagnosis, algorithm.*

One of the important problems of modern vascular surgery is the treatment of patients with abdominal aortic aneurysms (AAA) [3]. Prevalence of abdominal aortic aneurysms does not tend to decrease [6]. The natural course of the disease is stably progressive in nature, resulting in a rupture of the aneurysm and a high risk of death. Despite the satisfactory results of planned surgical treatment, the rupture of the abdominal aortic aneurysm is accompanied with an extremely high mortality rate of up to 90% [1, 2, 8].

25-65% of patients are diagnosed incorrectly or with significant delay [4]. It causes the problem of timely diagnosing complicated forms of abdominal aortic aneurysms. However, the peculiarities of the clinical course and causes of late diagnosis of patients with rupture of the abdominal aortic aneurysm have not been sufficiently studied. Examination methods used today have certain disadvantages in the diagnosis of this disease [7]. In addition, the severity of the condition of the patient with a ruptured AAA significantly limits the possibility of their full application [6]. The results of surgical treatment depend on the time from the moment of rupture to the beginning of surgery [2, 9]. Therefore, timely diagnosis in patients with complicated forms of abdominal aortic aneurysms at the stages of medical care (central district hospitals, surgical hospitals) and now remains a pressing issue. There is a need to look for new, highly sensitive and minimally invasive methods for detecting AAA ruptures that can improve the diagnosis of this disease and choose the optimal tactics for patients.

Materials and methods

The results of complete examination and treatment of 131 patients with complicated forms of abdominal aortic aneurysms and 44 with chronic aneurysms were analysed. Out of 131 with complicated aneurysms, 106 patients had a rupture, 17 – tear of the aneurysm wall, 8 – “penetration” of the posterior wall of aneurysm into the spine. Infrarenal aneurysms were found in 105 patients, suprarenal in 12, and juxtarenal in 14.

In 131 patients with complicated forms of abdominal aortic aneurysm, the study included the peculiarities of the clinical course, errors in diagnosing the underlying disease at the stages of medical care (central district hospitals, other non-specialized hospitals), as well as the diagnostic value of instrumental research

methods. The direct and indirect signs of complicated forms of abdominal aortic aneurysms are identified. Based on the results of the study, diagnostic algorithm for the patients with abdominal aortic aneurysm rupture was developed, depending on the state of hemodynamics at the stages of provision of medical care.

The severity of the patient's condition and the volume of internal bleeding were assessed using the Allgower shock index. To assess the intensity of pain in people with complicated forms of abdominal aortic aneurysm, a verbal rating scale (VRS) and a digital rating scale (DRS) were used.

Surgery was performed in 114 (87%) patients with complicated abdominal aortic aneurysms, including 90 – with ruptured AAA, 16 – with tear, and 8 – with "penetration". The following types of reconstructive operations were performed: resection of the aneurysm with linear prosthesis of the aorta (33), aortoiliac prosthetics (40), aortofemoral bypass (40). In one patient with a ruptured AAA reconstruction was impossible due to death during laparotomy.

Laparotomy access was used upon infrarenal localization of the aneurysm, thoracophrenolumbotomic access was used upon juxta and suprarenal localization in 7 (6,1%) cases. During the operation, invasive hemodynamic monitoring was performed. In order to prevent ischemia of the left half of the colon, revascularization of the inferior mesenteric artery was performed in 25 cases or blood flow was restored on the left internal iliac artery (95 patients). In the postoperative period, prolonged epidural analgesia (4–6 days) was performed.

Results and discussion

When studying the diagnostic value of instrumental research methods in patients with complicated forms of abdominal aortic aneurysms, the ultrasound showed that the AAA rupture was diagnosed in 52 (54.7%) patients. Absolute signs of aneurysm rupture in the form of a wall defect were diagnosed in 20 (38.4%) persons, presence of extraperitoneal hematoma – in 40 (76.9%). In 18 (18.9%) cases, the ultrasound provided a pseudo positive diagnosis of "dissecting" aortic aneurysm. AAA wall tear was diagnosed in 5 (29.4%) cases. Ultrasound signs of "penetration" of the posterior wall of the aneurysm into the spine and a breakthrough into the inferior vena cava (IVC) were not detected. According to CT scans, AAA rupture was diagnosed in 46 (73%) patients. In 41 (89.1%) patients a para-aortic abdominal hematoma was detected, in 12 (26%) there was passage of the contrast agent outside the abdominal aorta, in 10 (21.7%) there was a defect in the wall of the aneurysmal sac. The aneurysm wall tear was diagnosed in 6 (35.2%) patients, penetration into the spine – in 2 patients. In these patients, CT showed destruction of the anterior surface of the lumbar vertebra and no contours of the posterior wall of the aneurysm.

Based on the results of angiography, AAA rupture was diagnosed in only 12 (34.3%) patients. However, this method provides most accurate evaluation of the

involvement of abdominal aortic branches in the aneurysm and its spread to the iliac arteries. With the administration of the contrast agent there is a risk of recurrent bleeding, which occurred in 7 (20%) patients.

The tendency to decrease diagnostic errors in computed tomography thanks to the spread and improvement of this method should be noted. The algorithm of diagnostics in patients with complicated abdominal aortic aneurysms with stable hemodynamics at the stage of non-specialized medical care involves the collection of clinical data, ultrasound examination. The diagnosed rupture of AAA requires emergency hospitalization to the specialized clinic for surgical treatment. Other diagnostic measures (CT, angiography) to determine the strategy of future surgical intervention should be performed in a specialized clinic.

The use of the described algorithm allowed reducing the time before surgery in persons with AAA rupture from 36.8 ± 7.7 to 9.18 ± 1.6 hours ($p = 0.004$). Diagnosis in patients with unstable hemodynamics at the stage of providing non-specialized medical care includes the study of the clinical picture of the disease, ultrasound. With diagnosed AAA rupture, it is necessary to either perform emergency surgery by cardiovascular surgeons in the setting of central district hospitals, or (upon relative stabilization of the state) transportation to a specialized vascular hospital, where upon stabilization of central hemodynamics, urgent CT scan is required to determine the level of aneurysm spread and to select the optimal access for future surgery. Upon unstable hemodynamics and signs of continuous bleeding the patient is referred to the operating room. The application of this algorithm reduced the time to surgery from 18.7 ± 1.8 to 8.3 ± 0.9 hours ($p = 0.0001$). The algorithm for diagnosing patients with stable hemodynamics, initially hospitalized in the cardiovascular unit, includes the entire complex of diagnostic examination methods, ultrasound and CT. The use of this algorithm reduced the time to surgery from 15.5 ± 2.2 to 6.3 ± 2.02 hours ($p = 0.01$).

The diagnostic algorithm for patients with unstable hemodynamics at the stage of specialized care should be as short as possible and include clinical examination, ultrasound duplex scanning, and then – emergency delivery of the patient to the operating room. Only in extremely rare clinical situations, with relative stabilization of hemodynamics and ambiguity regarding involvement in renal artery aneurysm, can CT be performed. The use of this examination algorithm reduced the time to the start of the surgery from 15.4 ± 3.2 to 4 ± 1.03 hours ($p = 0.01$).

Postoperative prolonged epidural analgesia also made it possible to eliminate enteroparesis in the short term. Active peristalsis was diagnosed 1.3 ± 0.2 days after surgery. The overall mortality rate among operated patients with AAA rupture was 51.1%.

Conclusions

Diagnosis and surgical treatment of patients with AAA rupture remains a complex problem. Diagnosis errors can reach 70.7%. Current instrumental research

methods (ultrasound, angiography) do not always provide comprehensive diagnostic information. The rate of errors in the diagnosis of aneurysm rupture is 45.2% for ultrasound, and 65.7% for angiography. The most informative method of diagnosis is CT. The main way to reduce the mortality rate in patients with AAA rupture is to reduce the time from the time of the aneurysm rupture to the start of surgery. The use of developed algorithms for diagnosis of patients with rupture of abdominal aortic aneurysms at the stages of medical care allows reducing the diagnostic time by about three times – from 22.3 ± 2.5 to 8 ± 0.8 hours ($p = 0.002$) and to reduce mortality upon surgical treatment from 58.3% to 37.5% ($p < 0.05$).

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