CLINICAL STUDY

Rupture of abdominal aortic aneurysm – factors of mortality

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Abstract

Purpose: **The purpose of this study was to evaluate the main factors of the 30-day mortality rate in patients operated on for rupture of abdominal aortic aneurysm (RAAA).**
Patients and method: **Univariate and multivariate analysis of various factors associated with RAAA was performed in the group of 182 patients operated on for RAAA between 1/1/1992 to 1/9/2005.**
Results: **The 30-day mortality rate was 33.5 %. The main mortality factors were: misdiagnosis, cardiopulmocerebral resuscitation (CPCR) on admission, configuration of RAAA($p<0.001$), number of blood transfusions, hypotension on admission ($p<0.0001$) and duration of operation, type of reconstruction and hypertension in history ($p<0.01$). Important factors ($p<0.05$) of postoperative mortality included also low haemoglobin level on admission, abdominal aortic aneurysm (AAA) diameter and ischaemic heart disease in history. The probability of patient's death is the highest ($p<0.003$), if factors like CPCR, number of blood transfusions and aneurysm diameter are combined (multivariate analysis, stepwise method).**
Conclusion: **The early detection and surgical or endovascular elective treatment of AAA, regular dispensarization of patients with small AAA, especially hypertonics, correct diagnosis of RAAA without time delay, are the best tools for patients survival. The patient's survival increases with trained prehospital resuscitation system and experienced team of vascular surgeons and anestesiologists in centres *(Tab. 3, Ref. 20)*.**
Key words: rupture of abdominal aortic anerurysm, predictors of mortality.

Five decades have passed from the first successful elective operation of abdominal aortic aneurysm (AAA) performed by Charles Dubost in Paris 1951. While the mortality of elective operations is decreasing, urgent operations due to a rupture are associated with a high mortality rate which has minimally changed during this period and reached approximately 30–50 %. This study evaluate the main factors related to the mortality of patients with RAAA who were operated on at the Department of Surgery, University Hospital in Plzen, Czech Republic and tries to find measures for reducing the mortality rate.

Patients and method

All patients, admitted and operated on for RAAA at the Department of Surgery, Charles University Hospital in Plzen, Czech Republic, were studied. In a retrospective study, a total of 182 patients were evaluated during a 14-year period (1/1/1992 to 1/9/2005). The male: female ratio was 7:1, and the mean age was 72.3±4.8 years. In the group, there were 119 (65.3 %) hypertonics, 98 (53.8 %) smokers and 132 (72.5 %) patients with history of ischemic heart disease, and 18 (9.8 %) patients with history of stroke. Twenty six (14.2 %) patients suffered from preoperative renal dysfunction and 38 (20.8 %) patients were diabetics. The mean diameter of RAAA was 8.1±2.4 cm.The time interval between the first symptoms of RAAA and admission to our hospital was 3.9±4.1 hours. The general practitioners made the correct diagnosis of RAAA in 63.6 % patients. Forty six (25.2 %) patients were cardiopulmocerebraly resuscitated (CPCR), hemoperitoneum was present in 87 (47.8 %) cases. One hundred and twelve (61.5 %), 64 tube (35.1 %) and two axillobifemoral

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Tab. 1. Baseline characteristics of the study population (n=182, 1992–2005).

Male:female	7:1
Mean age	72.3±4.8 yrs
Ischemic heart disease	72.5 %
Stroke	9.8 %
Hypertonics	65.3 %
Smokers	53.8 %
Diameter of RAAA	8.1±2.4 cm
Time interval – first symptoms to operation:	3.9±4.1 hrs
Proper RAAA diagnosis	63.6 %
CPCR	25.2 %
Hemoperitoneum	47.8 %

Tab. 2. Operation data.

Time of operation	162±40.1 min
Bifurcated grafts	61.5 %
Tube grafts	35.1 %
Axillobifemoral grafts	1.1 %
Endograft	2.2 %

grafts (1.1 %) and 4 (2.2 %) endovascular grafts were done. The mean operating time was 162± 40.1 minutes (Tab. 1). The multivariate analysis of various factors – age, gender, history of ischemic heart disease, hypertension, stroke, smoking, chronic obstructive pulmonary disease, chronic renal insuficiency and diabetes, time delay from the first symptoms to operation, blood pressure, hemoglobin and hematocrit levels on admission, CPCR, hemoperitoneum, diameter and configuration of AAA, type of operation, operating time, number of blood transfusions, length of hospitalization – was done with the end point of the 30-day postoperative patient's mortality. The variables were evaluated by their means, standard deviations, and medians. The Analysis of Variance, the Wilcoxon test, median and t-test were used for statistical evaluation. Probability values 0.05 were considered significant.

Results

The 30-day mortality rate was 33.5 % (n=61). The main causes of patients' death (n=26) were hemorrhagic shock in 56.5 % (n=103) and acute myocardial infarction in 25.2 % (n=46). The main factors correlated significantly with mortality were following: misdiagnosis ($p<0.0001$), CPCR on admission ($p<0.001$), configuration of RAAA ($p<0.001$), hemorrhagic shock ($p<0.02$), per- and postoperative complications ($p<0.02$), artificial ventilation over 24 hours ($p<0.05$) and hypertension ($p<0.05$) (Tab. 2, 3).

Discussion

The mortality rate of RAAA remained high over five decades despite the improvement in operative techniques (including endovascular techniques in recent years) and perioperative management. The hospital mortality rate is between 30–50 %, but the overall mortality of patients with RAAA is even higher (1, 2, 3). The incidence of RAAA is still growing. One third of the patients suffering from AAA have RAAA during their lives. Almost 40 % of patients with AAA have as the first symptom the rupture of AAA (4, 5). The most frequent area of the rupture is the posterolateral wall of AAA with bleeding to retroperitoneum. The RAAA directed to the free abdomen is the most dramatic situation with the rapid development of hemorrhagic shock and imminent danger of the patient's death.

The classic symptoms of RAAA are back or abdominal pain, hypotension and pulsatory intraabdominal mass. Full symptoms are present in only half of patients and are often misleading, leading doctors to a misdiagnosis as simple back pain or urinary colic, or sigmoid diverticulitis etc (6, 7). In our group of patients, there were almost 60 % of the patients misdiagnosed. The misdiagnosis usually requires more time to establish the proper diagnosis by various radiodiagnostic methods (ultrasonography or computerised tomography). During this time, a patient's chance to survive is gradually decreasing.

Some manifestations of RAAA are difficult to evaluate by a simple clinical examination. In hemodynamically stable patients we prefer an emergency bedside abdominal ultrasonography as the optimal diagnostic method which takes only few minutes to establish the diagnosis of RAAA. Establishing a proper, rapid diagnosis has the utmost value for the result of surgical intervention in patients with RAAA (8, 9). The Cleveland Vascular Society (1982) indicates that the operative mortality of patients with accurate initial diagnosis of RAAA was only 35 %, whereas mis-

Tab. 3. 30-day mortality rate, significant factors of mortality (n=182).

Mortality rate	33.5 % (n=61)			
	Survival n	Non survival n	p n	value
Misdiagnosis	116	31	85	0.0001
CPCR	46	13	33	0.001
Configuration of RAAA (AA/AIC)	79/82	76/39	3/43	0.001
Hemorrhagic shock	87	29	58	0.02
Per/postoperative complications	18/27	8/9	10/18	0.02
Hypertension	98	37	61	0.05

AA – AAA localised in abdominal aorta, AIC – AAA localised in abdominal aorta and common iliac arteries

diagnosis was the cause of 75 % mortality. In this study, the misdiagnosis has caused the delay of the operative treatment in about five hours which has passed between the onset of the RAAA first symptoms and patient's arrival at the operating theatre. The time delay was one of the most significant factors of mortality in our patients.

If hemoperitoneum is present, the patients' survival is very low due to ongoing hemorrhagic shock. Although the total mortality in the group was 33.5 %, the mortality of patients with the hemoperitoneum was 56.5 % and the hemorrhagic shock was a significant factor for patients' survival. Any delay in establishing the proper diagnosis and following urgent operation or in using radiodiagnostic techniques in hemodynamically unstable patient is a serious mistake, which decreases the patient's survival.

CPCR at admission is a factor of a low patient's survival in spite of urgent operation. It is questionable whether patients with cardiac arrest, with no hemodynamic answer to CPCR, should be operated urgently. We think that very old patients, unconscious with cardiac arrest and without response on the CPCR have no chance for survival. The decision to withhold the aggressive life support in these patients is always a very difficult ethical and medical problem (10, 11, 12). It should be performed by an experienced vascular surgeon and anestesiologist. But each patient, who is resuscitable with the symptomatology of hemorrhagic shock, hemodynamically unstable, immediately has to be transported to the operating theatre for urgent laparotomy and clamping of the AAA neck. Spending too much time trying to stabilize the hypotensive patient is a serious error.

Other factors contributing to the RAAA are aneurysm and patient-related factors. Size, expansion rate and configuration of AAA are well known aneurysm-related factors, which have a fundamental influence on the development of RAAA. Size and age have almost no importance for mortality of patients with RAAA. The configuration of AAA has an indirect impact on patient's survival after rupture. If the AAA was localised not only in abdominal aorta, but also in the iliac or femoral arteries, or the aneurysm was juxtarenal or suprarenal, the time of operation was significantly longer in our group of patients. Altogether it was a significant factor of mortality in opposite to the patients with AAA localised only in abdominal aorta, where the tube graft was placed after AAA resection. Although we preferred to use the tube graft also in cases where the terminal aorta was atherosclerotic without significant stenoses of iliac arteries, we had to use more often bifurcated grafts due to aneurysms in iliac arteries. It was in contrast to other authors, who used in 90 % of patients only tube graft (13, 14, 15).

From the factors related to the patient's 30-day postoperative mortality, statistically significant were hypertension and smoking. Hypertension, especially uncontrolled is a risk factor for the development of RAAA in general. More than 60 % of our patients operated on for RAAA were hypertonics. Hypertension leads to the left ventricle hypertrophy with decreased relaxation during diastole and an increased dependence on the filling blood pressure. Severe disturbances of the hemodynamic system, such as tachycardia or other arythmia can develop during hypotension in hypertonics with RAAA. Hypertension was also a significant factor of the early (first 30 days) postoperative mortality due to cardiac failure in our group of patients. An acute myocardial infarction was one of the leading factors of the postoperative death in the whole group of RAAA patients (25.2 %) (16, 17, 18).

Smoking was present in almost 66 % of patients operated on for RAAA. It is a factor associated with the rapid expansion and danger of the rupture of abdominal artery aneurysm (AAA) (19, 20). Smoking is closely associated with pulmonary dysfunction and has an influence on the operative and late mortality rate in patients after elective operations for AAA. In our study, continued smoking was a significant factor of early patient's mortality after operation for RAAA. If the current smokers have more rapid grow of aneurysm, the highest probability of aneurysm rupture and more complicated postoperative course, it is questionable, if they should be offered an earlier elective AAA operation. Because the risk of athe rupture of a small aneurysm in smokers is low (<2 %), it seems to be more rational to follow the smokers with small AAA. The elective open or endovascular operation are indicated according to general principles of AAA treatment. Prophylactic operation of AAA in smokers will have probably more complication arising from the pulmonary dysfunction after an elective operation.

We can conclude that the early detection and surgical or endovascular elective treatment of AAA, regular follow up of patients with small AAA, especially hypertonics and smokers, proper diagnosis of RAAA without time delay, are the best preoperative tools for overall survival of patients with AAA. The patient's survival in pre- and perioperative period also increases with trained pre/hospital resuscitation system and experienced vascular team (surgeon, anestesiologist, intensive care). We can recommend the transfer of patients to big specialized medical centers, especially in small areas with high concentration of Vascular Units as in the Czech Republic.

The incidence of RAAA and result of its repair can be also induced by the patient. Regular taking of antihypertensive drugs and recommended follow up of hypertension and small AAA are the best preventive patient's means of RAAA.

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