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Surgical Strategy of Abdominal Aortic Aneurysm with Preoperative Renal Failure

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Objectives: *To determine the effect of preoperative renal failure on the outcome of patients suffering from infrarenal abdominal aortic aneurysm (AAA).*
Method: *During the period from January 1979 to August 1995, 364 patients with AAA were admitted to our hospital and 323 underwent elective reapir. The patients were retrospectively analysed in three groups. Group I was composed of 273 patients with a normal renal function who underwent an aneurysm repair. Group II was composed of 50 patients who demonstrated a preoperative renal dysfunction (creatinine above 2.0 mg/dl or creatinine clearance below 40 ml/min) and underwent an operation, including three patients maintained on chronic haemodialysis. Group III was composed of 18 patients with a renal dysfunction who did not undergo repair, including one patient maintained on chronic haemodialysis.*
Results: *The operative mortality rate of groups I and II were 0.4% and 2.0%, respectively, although no significant difference was observed. The incidence of postoperative cardiac and pulmonary complications were also comparable in two groups. No patients required acute haemodialysis. The 5-year survival rate of group II (44%) was significantly higher than that of group III (20%), and seven of the 18 patients (39%) in group III ultimately died of a rupture of the AAA.*
Conclusions: *Patients with chronic renal failure can undergo an abdominal aortic aneurysm repair based on the same indications as those without renal failure.*

Introduction

Elective repair of abdominal aortic aneurysm (AAA) can be safely carried out with an operative mortality about 3%.[1,2] Repair is advocated even in high risk patients, including those with severe coronary artery disease[3,4] and those who are 80 years of age and older.[5,6] However, all surgeons recognise that some patients with AAA, because of multiple other medical problems, may be at an increased risk for aneurysm repair. Coronary artery disease is a major cause of morbidity and the major cause of mortality after the elective surgical repair of abdominal aortic aneurysm.[4,7] However, little information is available on the outcome of such patients with renal failure. The purpose of this retrospective study was to determine the effect of preoperative renal failure on the outcome of patients with AAA.

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Materials and Methods

From January 1979 through to August 1995, 364 patients with abdominal aortic aneurysm were admitted to our hospital. A total of 323 consecutive patients underwent elective repair of infrarenal abdominal aortic aneurysms and were classified into three groups: 273 patients had no renal dysfunction (group I), while 50 of the patients had preoperative renal dysfunction (creatinine above 2.0 mg/dl or creatinine clearance below 40 ml/min) (group II). Group II included three patients maintained on chronic haemodialysis. Group III was composed of 18 patients with a renal dysfunction who did not undergo repair, including one patient maintained on chronic haemodialysis. The intra- and postoperative parameters between the groups were compared.

The routine evaluation for all patients with abdominal aortic aneurysm in our department was as follows: full blood count, chemistry, coagulation profile, creatinine clearance, arterial blood analysis, spirogram, chest roentgenogram, electrocardiogram,

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Table 1. Demographics and risk factors of patients with abdominal aortic aneurysm.

	Group I	Group II	Group III
Number	273	50	18
Creatinine (mg/dl)	1.0±0.2	2.9±0.4*	2.2±0.4†
Creatinine clearance (ml/min)	78.6±2.0	29.3±1.6*	25.6±2.5†
Male	227	44	14
Female	46	6	4
Mean age (years)	68.6±8.3	70.0±7.4	72.6±7.7
CT size (cm)	5.5±1.6	5.6±1.9	6.0±1.6
Cardiac disease	32.1%	46.0%*	56.2%†
Hypertension	65.1%	82.0%*	77.8%†
Pulmonary disease	49.0%	51.0%	66.7%
Cerebrovascular disease	8.6%	20.0%*	17.6†
Diabetes mellitus	7.8%	8.0%	16.7%
Smoking	84.1%	95.5%*	83.3%

Group I: patients with normal renal function who underwent AAA repair.
Group II: patients with a renal dysfunction who underwent repair (creatinine above 2.0mg/dl, or creatinine clearance below 40 ml/min), including three patients maintained on chronic haemodialysis.
Group III: patients with renal dysfunction who did not undergo repair.
*Significant difference between groups I and II.
†Significant difference between groups I and III.

abdominal ultrasound scan, computed tomography and arteriography. Dipyridamole-thallium scintigraphy was also performed, regardless of the history of angina or myocardial infarction, followed by coronary arteriography if indicated by scintigraphy.

In the operating room the patient received at least two intravenous lines and an indwelling urinary catheter. Central venous pressure was measured by subclavian vein puncture. An arterial line was placed for blood pressure. A Swan-Ganz catheter was also used for the serial measurements of cardiac output and pulmonary capillary wedge pressure, which are monitored in patients with cardiac dysfunction. In the event of cardiac dysfunction, coronary vasodilators such as calcium-blocker or nitrovasodilators were administrated during the operation and continued until at least the third postoperative day. If the patient had renal dysfunction, prostaglandin E1 was given during the operation and continued until the fifth postoperative day.

Statistics

The results are expressed as mean±S.E.M. The statistical evaluation of the data was performed using Student's *t*-test for paired or unpaired observations. When more than two means were compared, an analysis of variance was used. If the value was statistically significant, Scheffe's test for multiple comparisons was used to identify differences among the groups. A value of $p<0.05$ was considered to indicate statistical significance.

Results

In Table 1 the details of the patient demographics and the preoperative risk factors are given. There was a significant difference of creatinine and creatinine clearance between the groups I and II and between the groups I and III. There was no significant difference regarding the age of the patients or the size of the aneurysm between the three groups. The incidence of accompanying complications such as hypertension, cardiac disease and cerebrovascular disease in groups II and III was higher than that of group I.

Table 2. Intraoperative parameters.

	Group I	Group II
Operative time (min)	250±77	239±89
Clamping time (min)	55.8±8.0	59.8±3.1
Intraoperative blood loss (ml)	1509±1413	1338±1123

Table 3. Postoperative parameters.

	Group I	Group II
Initiation alimentation (days)	4.6±0.5	4.5±0.3
Postoperative hospitalisation (days)	18.0±1.6	18.4±0.4
Postoperative mortality rate (%)	0.4	2.0

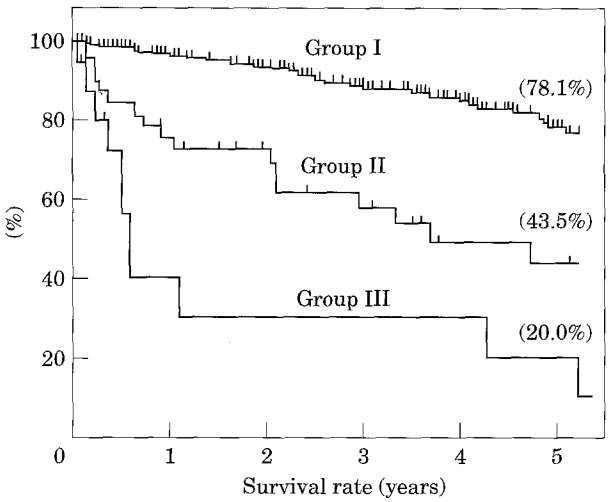

Fig. 1. Survival curves demonstrating the influence of renal failure on long-term survival in the patients with abdominal aortic aneurysm. The survival rate of group I was significantly higher than that of group II. The survival rate of group II was significantly higher than that of group III.

The intraoperative parameters evaluated are illustrated in Table 2. No significant difference was observed regarding the operation time, aortic clamping time and blood loss between groups I and II. The complications observed in group I were: fifteen patients (5.5%) with pulmonary complications and seven patients with cardiac complications (2.6%). The complications seen in group II were: five patients (10%) with pulmonary complications and four patients with cardiac complications (8%). No significant difference was observed in the incidence of complications between the two groups.

The postoperative parameters evaluated are described in Table 3. No significant difference was seen regarding the initiation of alimentation and the length of postoperative hospitalisation between groups I and II. The postoperative mortality rates in groups I and II were 0.4% and 2.0%, respectively (not significant). After operation, no patients required haemodialysis during hospitalisation, except for three patients maintained on chronic haemodialysis.

Figure 1 shows the survival rate of the patients with AAA. The 1-, 3- and 5-year survival rates were 96.2%, 88.0%, 78.1% in group I, and 75.7%, 57.9%, 43.5% in group II, respectively. The survival rate of group I was significantly higher than that of group II. The 1-, 3- and 5-year survival rates in group III were 40.0%, 30.0%, 20.0%, respectively. The survival rate of group II was significantly higher than that of group III. The main cause of late death in group III was a rupture of the AAA. Seven of the 18 patients (39%) who did not undergo a resection of the AAA ultimately died due to rupture.

Discussion

Low mortality rates for the elective surgical treatment of abdominal aortic aneurysm justify an aggressive approach in most patients.[11–13] Repair is now advocated even in high risk patients, including those with severe coronary artery disease[3,4] and those who are 80 years of age and older,[5,6] and patients with concomitant AAA and gastrointestinal malignancy.[8] However, in high risk patients with small aneurysms and no symptoms, the decision to operate still has to be made after carefully weighing the potential risk and benefits.

Contraindications to elective resection have been well summarised,[9–11] and include recent acute myocardial infarction (within 3 months), intractable angina pectoris, severe pulmonary insufficiency (dyspnoea at rest), chronic renal insufficiency (BUN greater than 80, creatinine greater than 3), or other associated disease with a life expectancy of less than 2 years.

The most striking finding of the present study was that in renal failure group, the 5-year survival rate of the patients who underwent repair was higher than those who did not. However, in the patients with renal failure who underwent repair, the 5-year survival rate was significantly lower than that of the patients without renal failure. It has been shown by many authors that coronary artery disease is a major cause of morbidity and the major cause of mortality after an elective surgical repair of AAA.[3,4] Our results demonstrate that renal failure also affects the 5-year survival rate after AAA repair.

Cohen *et al.*[14] recommended that patients with severe renal dysfunction (serum creatinine greater than 4 mg/dl) who are not on haemodialysis should be considered for dialysis preoperatively in an attempt to reduce the high incidence of serious postoperative renal functional deterioration. In the present study no patients, including those with severe renal failure (serum creatinine greater than 4 mg/dl), required acute haemodialysis during hospitalisation. Cohen *et al.* reported that four of the six patients with severe renal dysfunction developed significant postoperative deterioration of renal function which required acute haemodialysis. Niva *et al.* reported an improvement of the renal function with prostaglandin E1 infusion in patients with chronic renal failure.[15] The protective mechanism of PGE1 on postischaemic renal failure is not only a consequence of vasodilatation, but may also be due to a cytoprotective effect.[16] In order to protect the renal function during operation, prostaglandin E1 was given intravenously (10–20ng kg min) and was continued until the fifth postoperative day. The infusion of PGE1 may lead to renal protection.

In our department, the main indication to operate on patients with asymptomatic aneurysms is a diameter of 4 cm, or twice the diameter of the normal infrarenal aorta.[1] Our results have demonstrated that there was no significant difference between the groups in either the intra- or postoperative parameters, including the operative time, the intraoperative blood loss, the initiation of oral intake and the duration of postoperative hospitalisation. In addition, no significant difference was observed in either the operative mortality rate or the incidence of postoperative complications.

Eight of twenty-four patients who did not undergo repair ultimately died of an AAA rupture. Therefore, aggressive repair of abdominal aortic aneurysms in patients with renal dysfunction may result in a better survival rate, as the mortality rate for ruptured AAA is still high.[17]

We conclude that patients with chronic renal dysfunction can undergo abdominal aortic aneurysm repair based on the same indications as those without renal failure. A more aggressive surgical approach is recommended for the treatment of AAA in patients with preoperative renal failure.

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