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Quality of Life and Long-term Results After Ruptured Abdominal Aortic Aneurysm

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Objectives. *Quality of life as an endpoint of surgery and the long-term prognosis for patients who have survived surgery for a ruptured abdominal aortic aneurysm (RAAA) is not well-documented.*
Patients and methods. *The records of all patients from 1993 to 2000 who underwent resection of RAAA were reviewed. Survival data were calculated from direct contact with the patients or follow-up records. All patients who were alive at the time of our study were invited to participate in follow-up investigations. They received the internationally comparable WHO-QOL-BREF-test.*
Results. *In a period of 7 years, 80 patients underwent surgery for RAAA. The average follow-up time was 5.1 years (1–7.9 years). Our data show that 51% of our patients died within 6 months postoperatively because of the complications of the aortic rupture (in-hospital mortality 39%). Patients who survived the first 6 months after surgery died for the same reasons as the normal population. However, patients who were younger than 75 at the time of RAAA had a higher relative survival rate than a matched sample of the population. There was no significant difference in the quality of life between the study group and the general population.*
Conclusions. *RAAA survivors had no difference in long-term survival as compared to the general population and also had very few long-term complications. The WHOQOL-BREF-test suggests that the quality of life of survivors of RAAA is similar to the general population.*

Key Words: Ruptured abdominal aortic aneurysm; Quality of life; WHO-QOL-BREF-test; Long-term mortality; Outcome.

Introduction

The outcome of surgery for a ruptured abdominal aortic aneurysm (RAAA) is not encouraging. Perioperative mortality ranges from 40 to 60% in most studies, although the results have steadily improved over the last three decades.[1,2]

However, it is well-documented that elective abdominal aortic aneurysm resection prolongs life.[3] Numerous studies show that the long-term survival rate of patients who have undergone elective aneurysm resection is comparable to that of the general population, and that these patients enjoy an equally positive quality of life.[4] Other quality of life studies were too subjective to be taken into consideration, because patients' responses were limited to 'good' or 'unchanged'[5,6]

Data regarding the long-term prognosis for patients who have survived surgery for RAAA are less well-documented than for elective repair or contradictory; we know little about long-term life-expectancy or quality of life for these patients.[7,8] Only a few studies have measured the health-related quality of life of these patients with a reliable test, using comparisons to an age- and sex-matched general population.[7,9–11] In a time when health care resources are limited, the efficacy of the expensive treatment has been justifiably questioned. Evidence-based data on quality of life as an endpoint of surgery are needed.

The present study was undertaken to define the long-term survival and quality of life of patients after RAAA repair.

Patients and Methods

The records of all patients from 1993 to 2000 who underwent resection for RAAA were reviewed

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from our prospective aortic surgery database. A ruptured aneurysm was defined as the presence of retroperitoneal or intraperitoneal blood at the time of laparotomy with the presence of an AAA. All patients with RAAA arriving in the emergency room underwent surgery and were included in this study. Unconsciousness, anuria, or prolonged hemorrhagic shock syndrome were not contra-indications for exploration. Operative mortality was defined as death occurring before discharge from our hospital, regardless of the elapsed time from surgery. Survival data were calculated from direct contact with patients, clinic follow-up records, and information from families or referring physicians during the period of October 2001–July 2002. All patients who were alive at the time of our study were invited to participate in follow-up investigations which included extensive evaluations of peripheral vascular status including case history, risk factors, comorbidities, medications, physical examination, ankle-brachial pressure index values, and duplex ultrasound of the vascular graft.

They all received a quality of life questionnaire, the WHO-QOL-BREF-test (German version) which exists in different languages and is used to study the categories 'global life quality', 'physical', 'psychological', 'social relations', and 'environment' of life quality.[12] Patients were required to complete the questionnaire by themselves. It contained 26 items to be answered on a scale of 1–5 (Table 1). The results were compared to the life quality of a German age- and sex-matched population.

Table 1. Content of the WHO-QOL-BREF-test. Answers are numeric on a scale of 1–5

Domain	Items
Global	How would you rate your quality of life? How satisfied are you with your health?
Physical health	To what extent do you feel that physical pain prevents you from doing what you need to do? How much do you need any medical treatment to function in your daily life? Do you have enough energy for everyday life? How well are you able to get around? How satisfied are you with your sleep? How satisfied are you with your ability to perform your daily living activities? How satisfied are you with your capacity for work?
Psychological	How much do you enjoy life? To what extent do you feel your life to be meaningful? How well are you able to concentrate? Are you able to accept your bodily appearance? How satisfied are you with yourself? How often do you have negative feelings such as blue mood, despair, anxiety, depression?
Social relationships	How satisfied are you with your personal relationships? How satisfied are you with your sex life?
Environment	How safe do you feel in your daily life? How healthy is your physical environment? Have you enough money to meet your needs? How available to you is the information that you need in your day-to-day life? To what extent do you have the opportunity for leisure activities? How satisfied are you with the conditions of your living place? How satisfied are you with your access to health services? How satisfied are you with your transportation?

Statistics

Survival curves were constructed using the Kaplan–Meier method, and the relationships of age, haemoglobin level, and blood transfusion to the survival rate of RAAA investigated using log-rank test.[13] Statistical significance was defined as $p < 0.05$ (two-sided).

Relative survival is a specific measurement of survival and is defined as the ratio of the proportion of survivors in the cohort to the proportion of survivors in a comparable set of a matched cohort of the regional population.[14] In our study, the rate was calculated by adjusting the survival rate to allow for all causes of death except RAAA.[15] The 1-, 2-, or 5-year relative survival rate was used to estimate the proportion of RAAA patients that were potentially curable. The relative survival rate adjusted for the general survival rate of the regional German population (Saxony) for that sex, age, and date.[16]

Statistical comparisons regarding the quality of life between our patients and the matched population were made using the Mann–Whitney-U-test. The distribution of these non-parametric values were presented as median and range. Calculations were performed by SAS statistical software version 6.12 (SAS Institute, Cary, NC, USA).

Results

Hospital mortality

Eighty patients underwent surgery for RAAA from 1993 to 2000. Their average age was 73 years (ranging from 46 to 90). Eighty percent of the patients were male. Thirty-one patients died intra- or postoperatively, representing a hospital mortality of 39%; 49 (61%) patients with RAAA undergoing surgery survived to be discharged.

Long-term survival

Follow-up data were compiled for 98% (48/49) of patients with RAAA. The longest follow-up period was 7.9 years and the average follow-up time was 5.1 years (range from 1 to 7.9 years). At the time the follow-up investigation was undertaken, 23 of 49 discharged survivors had died, 25 remained alive, and one was lost to follow-up. The average age of the surviving 25 patients was 74 years (range from 56 to 90 years). Fig. 1 shows the survival rate (Kaplan–Meier curve) of the patients discharged from hospital. 50% of them were still alive after 4.4 years. The cumulative incidence of death (Fig. 2) distinguishes deaths from RAAA from deaths from other causes. Nine of the 23 patients died in a prolonged nursing situation within 6 months (nursing home or at home) primarily due to renal, pulmonary, or cardiac complications of RAAA. We detected only one lethal long-term complication: one patient died because of vascular graft infection after 31 months. Thirteen of the 23 patients died from other diseases (three from myocardial infarction, two from stroke, two from cancer, two from pneumonia, four from other causes) (Fig. 2). By the completion of the study, 40 patients (51%) had died because of RAAA and its complications. In total, 53 (67%) of 80 patients undergoing surgery for RAAA had died (Table 2).

Influence of age on long-term survival

Patients who were 75 years of age or older at the time of RAAA had a significantly higher long-term mortality compared to patients younger than 75 years at the time of rupture ($p = 0.0189$; log-rank test). Patients older than 75 years of age also had a significantly lower life expectancy than the age- and sex-matched regional population (Fig. 3).[16] The relative survival rate is an estimate of the chance of surviving the effects of aneurysm rupture. Patients younger than 75 years, after surviving RAAA, had a higher relative life expectancy than the matched population in this region of Germany (Fig. 3).[16]

Influence of other clinical variables on survival

Patients with a large loss of blood (defined as a transfusion requirement of more than five units) had a

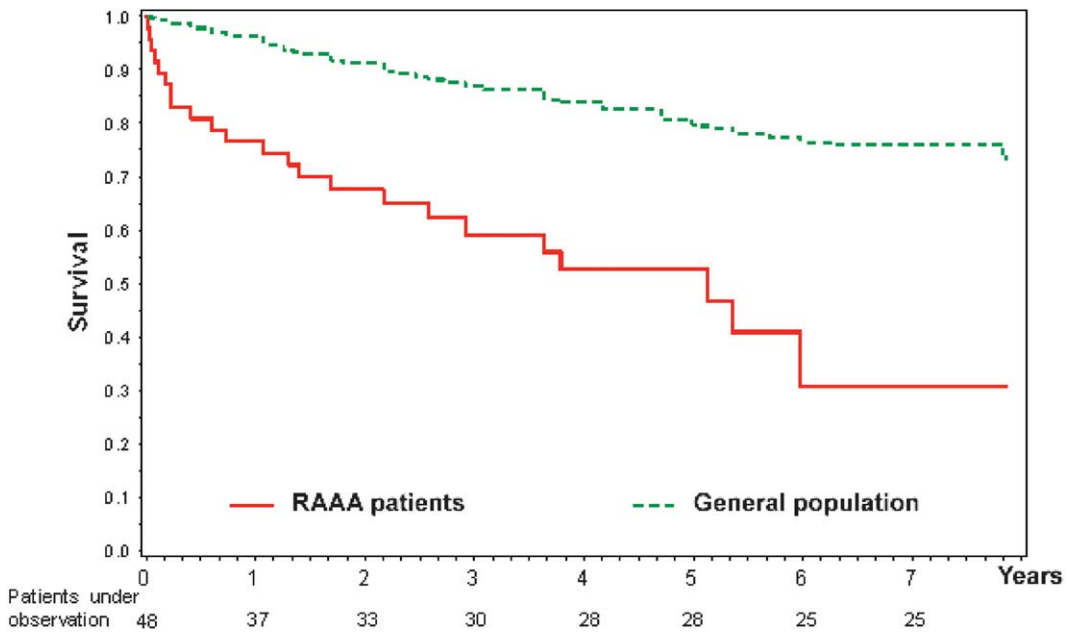


Fig. 1. Cumulative survival of discharged patients ($n = 48$) after surgery for RAAA in comparison to a matched general population.

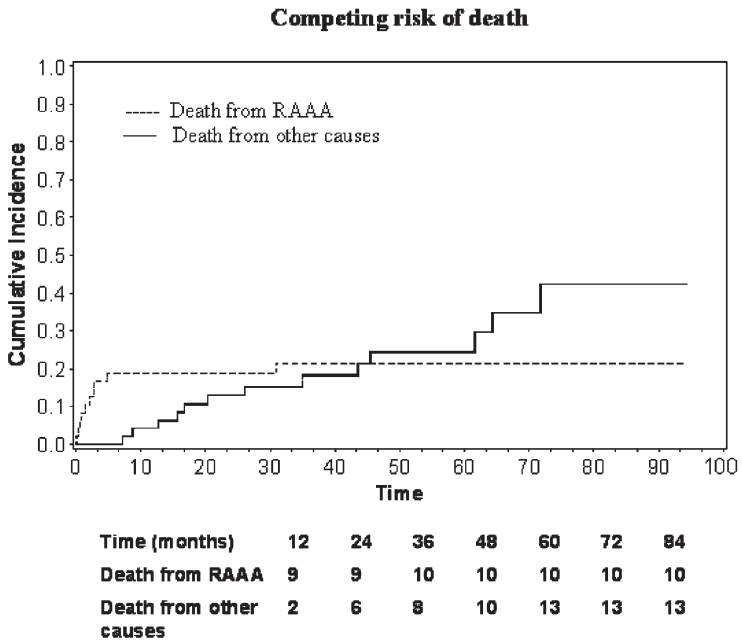


Fig. 2. Cumulative incidence of death (23/48) from living discharged patients (48/80) after surgery for RAAA.

significantly higher hospital mortality ($p = 0.008$, data not shown). Patients who were discharged after aneurysm repair required an average of 10.7 units of blood (range from 2 to 38 units). However, patients who needed more than five units of blood (each with 300 ml of blood) during surgery also had a significantly higher long-term mortality ($p = 0.048$, log-rank test) (Fig. 4). Gender, renal impairment (preoperative creatinine level $>140\ \mu mol/l$), COPD (chronic obstructive pulmonary disease) and coronary heart disease had no significant influence on the long-term survival of our RAAA population ($p > 0.05$, log-rank test).

Clinical follow-up

Long-term surgical complications were detected during physical examination with evaluation of peripheral vascular status and duplex ultrasound of the vascular graft. Two (8%) patients had a distal anastomosis aneurysm, one (4%) had stenosis at the distal anastomosis without hemodynamic significance, and 13 (52%) had incisional hernias. Six (24%) patients had additional arterial aneurysms (one multiple, one iliac, one popliteal, one renal artery, two thoracic aortic). Two (8%) patients (87 and 90 years of age) required permanent nursing home care.

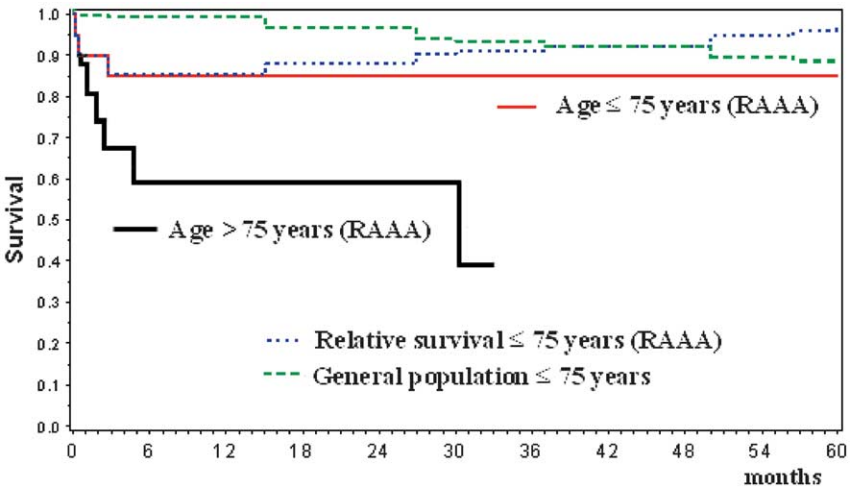
Table 2. Fate of 80 patients with RAAA after average follow-up of 5.1 years

	n	Percent
Hospital mortality	31	39
Underwent follow-up investigation	48	60
No follow-up information	1	1
Long-term mortality from RAAA	40	51
Death from other causes	13	17
Alive at time of follow-up	25	32

Quality of life

The WHO-QOL-BREF-questionnaire for quality of life was completed by 24 of the 25 patients (96%) who were still alive at the time of the survey. One patient (resident in a nursing home) was unable to participate because of advanced cerebrovascular disease.

The median 'global life quality' score of the 24 patients who participated was 62 (scale 1–100) with a range from 50 to 75. The sex- and age-matched German population scored 63. The 'physical' life quality for the patients was 68 (range from 20 to 89) and 66 in the matched group. 'Psychological' quality of life in the study group was 67 (range from 38 to 100) and 72 in the normal population. Median scores for 'social relationships' and 'environment' were 71 (range from 50 to 92) and 75 (range from 53 to 97) in the patient group *versus* 68 and 71 in the matched population group. There was no significant difference ($p > 0.05$, Mann–Whitney-U-test) between the study group with RAAA and a normal age- and sex-matched population in Germany for all criteria assessed by the WHO-QOL-BREF-test (Fig. 5).

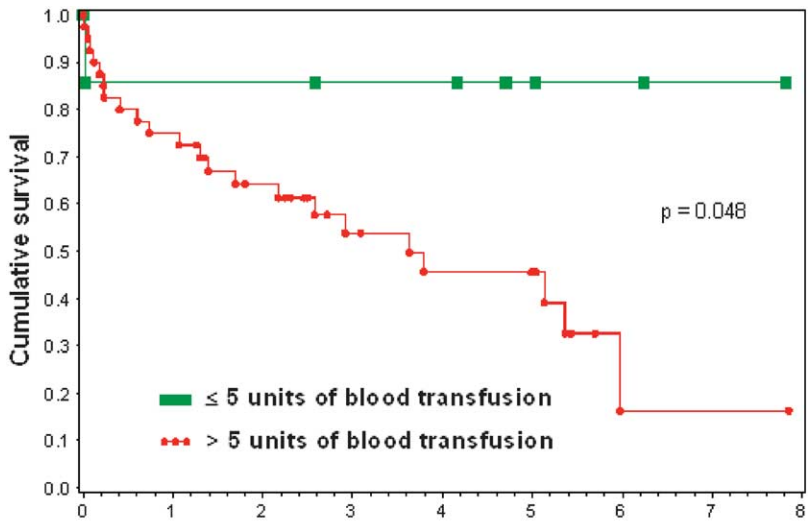


Time (months)	12	24	36	48	60
≤ 75 years (n=28)	24	22	21	19	19
> 75 years (n=20)	13	11	9	7	7

Fig. 3. Age-related long-term survey of 48 discharged RAAA survivors with relative survival rate for patients younger than 75 years compared to an age- and sex-matched regional population.

Discussion

Our data show that 51% of our patients died intraoperatively or within 6 months postoperatively because of complications of RAAA. However, the hospital mortality rate was only 39%. This mortality rate compares favourably to other published data. Patients who survived the first 6 months after surgery died for the same reasons as the normal population in Germany (except for one patient with a vascular graft infection who died after 31 months).[17] In a recently published meta-analysis from 74 studies, Bown *et al*.[1]



Time (years)	1	2	3	4	5	6	7
≤ 5 units (n=8)	7	7	7	7	7	7	7
> 5 units (n=40)	30	26	23	21	21	18	18

Fig. 4. Influence of number of units of blood transfused during surgery on long-term survival ($p = 0.048$).

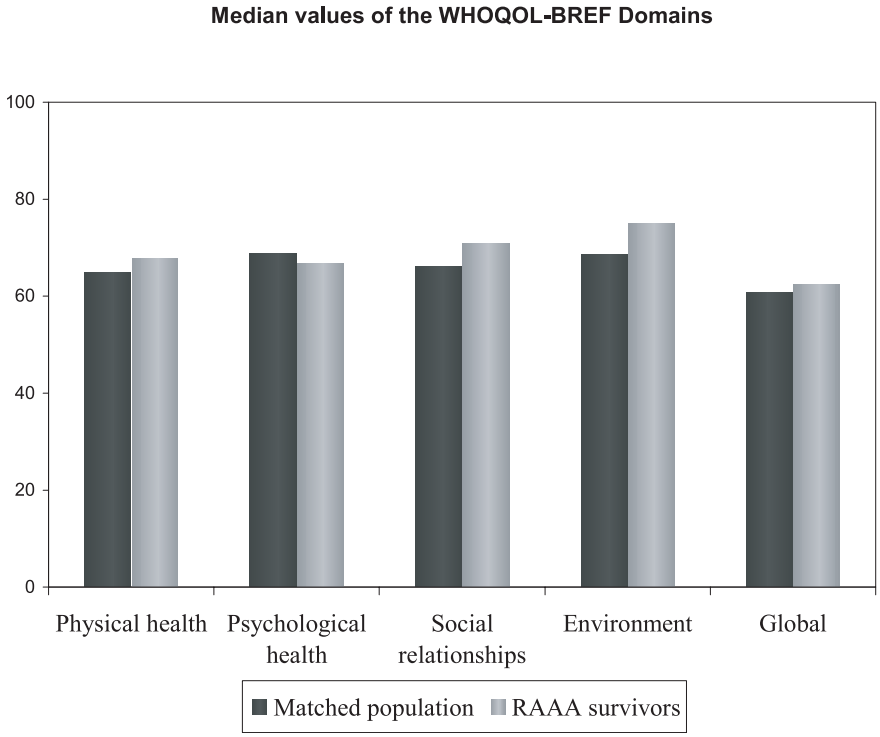


Fig. 5. Differences in quality of life in patients who survived RAAA compared to an age- and sex-matched German population ($p > 0.05$ for each domain).

reported an estimated hospital mortality of 48%. However, most studies regarding outcome of RAAA describe only the hospital or 30-day mortality.[18,19] Real life conditions and life expectancy after discharge for these patients remains unclear. Data on long-term survival have caused controversy: some studies report that the life expectancy of survivors of RAAA repair was the same as that of the general population or survivors of elective AAA repair.[7] Others show a lower long-term survival rate than after elective aneurysm repair or than that of the general population.[20]

Our data show that long-term survival is age-related (Fig. 3), which is intuitive. Curiously, patients who were younger than 75 at the time of RAAA had a higher relative survival rate than an age-, sex- and geographically-matched sample of the general population (Fig. 3). One explanation for that could be the assumption that these patients had better medical care because of more common aftercare measures compared to the normal population. However, a positive patient selection bias could also be possible. Although this trend is not statistically significant, the apparent resilience of these individuals would be interesting to evaluate further.

The reviewed literature demonstrates different results regarding age-related survival.[1,21,22] But only one study in 2000 also described increasing age as being associated with late mortality.[2] Matsushita[6] found a significantly shorter long-term survival rate in patients over 75 who underwent aneurysmectomy than in those who were younger, but he did not separate the outcome of elective and ruptured aneurysms by age. Increased hospital mortality rates are associated with severity of hemorrhagic shock, using the initial hematocrit and number of transfusions to gauge severity.[18,22] In our patients the intraoperative transfusion of more than five units of blood was linked not only with a higher in-hospital mortality, but also with a higher long-term mortality when comparing the survival curves (Fig. 4). This effect could not have been tested in our series with the widely used logistic regression model because of a non-proportional hazard and the small number of patients. However, it is statistically correct to compare the generated survival curves with a non-parametric test (log-rank test). Nevertheless, this interesting result must be proved with a proportional hazard model in a series with a larger number of patients.

Our data show that in patients surviving 6 months following repair of RAAA serious long-term complications are rare. Only one patient died of a genuine long-term complication (an infected vascular graft). Postoperative incisional abdominal hernias were the

most frequent complication. This complication did not influence the quality of life of our surviving patients. All patients underwent a median laparotomy. We conclude from the literature that there seems to be an increased incidence of abdominal wall hernias and inguinal hernias as well as postoperative incisional hernias in patients undergoing surgery for AAA as compared to other intraabdominal surgical diseases.[23] Adye[24] described an incidence of incisional hernias of 31% after aneurysm repair after a follow-up period of 1-year. Genetic and biochemical abnormalities have been considered as possible explanations. It has been theorized that an imbalance between proteinases and their naturally occurring inhibitors is the cause of these observed abnormalities. In particular, the leukocyte-derived matrix metalloproteinases seem to be associated with aortic wall degeneration and aneurysm formation.[25]

Other complications such as graft infection and distal anastomosis aneurysms were rare in our study. Previous studies report distal anastomosis aneurysms occurring in 9% and graft infection occurring in 3%,[20] which is similar to our results. Major abdominal surgery may have a long-lasting influence on a patient's quality of life and sense of well-being that is not accurately measured by the usual morbidity and mortality statistics. Therefore, when evaluating expensive and high-risk surgery for RAAA, the functional outcome and the subjective quality of life of patients after surgery must be considered. Quality of life is an even more important outcome than mortality. In most studies, quality of life is assessed from comments made in follow-up records or from interviews with the patient's general practitioner or family. In general, they say that the patient's lifestyle is good or similar to the one they had before.[5,6,26] Only a few studies have assessed the quality of life of patients following RAAA with a reliable test, i.e. with the SF-36 questionnaire or the classification of Rosser and Watts.[7,9,10,29] Unfortunately, they compared all aneurysmectomies without differentiating ruptured, symptomatic, and elective cases.

A number of different generic quality of life assessments have been used in different studies since there is no disease-specific questionnaire for patients with AAA. A specific test for vascular patients should be short and easily understandable. The WHO initiated a quality of life test that can be used internationally, for all diseases, and is suitable for a distinction between health and illness. They developed the WHO-QOL-100 test and a shorter version, the WHO-QOL-BREF-test.[12,27] We decided to use the WHO-QOL-BREF-test to measure life quality because of its international comparability and its brevity. The more widely known SF-36 is more extensive and, in our view, takes longer for the patients to answer the questions. The WHO-QOL-BREF-test is considered to be valid in testing long-term effects of chronic diseases on life quality.[27] This test has also been found to be valid in a Danish population.[28] So, in this study we used an objective, quantifiable method to show that the life quality of survivors of RAAA was similar to that of an age- and sex-matched regional population (Fig. 5). From our experience with this test, we would recommend it as the preferred test for long-term outcomes in all fields of vascular surgery, and we would encourage other authors to use this test to allow comparison with other studies. Our results suggest that patients who survived an operation for RAAA had a good life expectancy and the same quality of life as the general population. However, we acknowledge that this conclusion requires confirmation because of the limited number of patients in our series, and the failure to assess quality of life in the 12% of our patients who died within 6 months after discharge.

In reviewing the literature, only one study showed that emergency repair of RAAA had a significantly more detrimental effect on quality of life than an elective repair.[30] Another comparable study regarding quality of life only for patients after RAAA was recently published by Korhonen *et al*.[11] They used the RAND 36-item health survey questionnaire and were able to show a significant impairment in certain physical functions for the RAAA survivors. Our data were unable to demonstrate an impairment of physical health. However, because of the similarity in all other quality of life domains, they concluded that an almost identical quality of life existed for these survivors as compared to the general population. One disadvantage of most studies and also of our study is the number of patients. As a university hospital, we have a great deal of experience in the treatment of this disease in older patients. However, the rarity and severity of the disease makes it difficult to acquire enough patients. Only 32% of all treated patients were still alive and available to be interviewed after an average follow-up of 5.1 years.

We observed that the postoperative course after RAAA operation did not end at the time of discharge. With a RAAA-related mortality of approximately 51% within 6 months postoperatively one might propose that an aggressive approach without adequate patient selection is a poor policy in a time of limited health care resources. Nevertheless, the long-term results for the survivors of RAAA are encouraging. In long-term follow-up, survivors of surgery for RAAA were likely to have a quality of life as rewarding as those patients undergoing elective repair or even as in the general,

healthy population. We found no significant predictors for perioperative mortality or long-term outcome for these patients, and therefore, feel ethically bound to refrain from subjectively selecting appropriate patients preoperatively.

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