Surgical Treatment of Abdominal Aortic Aneurysms in Octogenarians

Yasuhiko Sugawara, M.D., Atsuhiko Takagi, M.D., Osamu Sato, M.D.
Tetsuro Miyata, M.D., Yutaka Takayama, M.D., Hiroyuki Koyama, M.D.
Hideo Kimura, M.D., Motoaki Shirakawa, M.D.*, Takatoshi Furuya M.D.**
and Masatoshi Makuuchi, M.D., Ph.D.

Due to the increase in life span and the decrease in mortality associated with aortic surgery, many geriatric patients now undergo surgery for abdominal aortic aneurysms (AAAs). Therefore, we studied our surgical results for AAAs in an elderly population to assess the value of such operations. Twenty-six patients aged 80 years or older underwent surgery during an 11-year period from 1984 to 1994 at our institutions, and their outcomes were compared with those of 212 younger patients. The ratio of ruptured to non-ruptured AAAs was significantly higher in the older patients (aged 80 years or older) than in the younger patients (aged 79 years or younger), and aneurysm size in cases of non-rupture was greater in older patients than in younger patients. For octogenarians with non-ruptured AAAs, the survival rate was 85.7% at 5 years, compared with 43.6% at 3 years for those with ruptured AAAs, and these figures were not significantly different from those in younger patients. The present findings support the value of our active surgical approach for octogenarians with AAAs. We believe that an aggressive approach for octogenarians will decrease the incidence of ruptured AAAs and contribute to better patient survival.
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IN Japan, there are currently more than 3,000,000 people aged 80 years or older, and it is expected that about 60% of the population will survive until the age of 80¹. Therefore, more octogenarians will develop abdominal aortic aneurysms (AAAs) in comparison with the younger segment of the population. Recent improvements in perioperative care and surgical techniques have reduced the morbidity and mortality related to the surgical treatment of elderly patients. The operative mortality rate for

elective surgical treatment of AAAs in octogenarians has been decreasing, and currently ranges from 2.2–13%^{2–7}. Nevertheless, it is still widely believed among the general public and a considerable proportion of physicians that elderly patients with aneurysms are unlikely to survive surgery³. The purpose of this report is to describe our surgical experience with the management of infrarenal AAAs in patients over 80 years of age and to assess the value of such operations.

Key words:

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PATIENTS AND METHODS

Three hundred fifty-one patients were

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The Second Department of Surgery, Faculty of Medicine, University of Tokyo, Tokyo, Japan

*Department of Surgery, Shida General Hospital, Fujieda, Sizuoka, Japan

**Department of Surgery, Asahi General Hospital, Asahi, Chiba, Japan

Mailing address: Yasuhiko Sugawara, M.D., The Second Department of Surgery, Faculty of Medicine, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113, Japan

TABLE I SIGNS AND SYMPTOMS IN THE OCTOGENARIANS

	<i>Non-ruptured AAA (n=15)</i>	<i>Ruptured AAA (n=11)</i>
<i>Asymptomatic</i>	11 (73.3%)	0
<i>Symptomatic</i>		
<i>Abdominal pain</i>	2 (13.3%)	4 (36.3%)
<i>Back pain</i>	1 (6.7%)	3 (27.3%)
<i>Intermittent claudication</i>	1 (6.7%)	0
<i>Shock</i>	0	6 (54.5%)

admitted to our institutions with a primary diagnosis of AAA between January 1, 1984 and December 31, 1994. Of these, 67 patients (including 16 octogenarians) were not considered candidates for surgery and the remaining 284 patients underwent aneurysmectomy. Twenty-six patients who had aneurysms extending above the renal arteries that required visceral arterial reconstruction and 20 patients with inflammatory aneurysms and/or aneurysms due to collagen diseases underwent surgery, but were excluded from the present analysis. The remaining 238 patients ranged in age from 39 to 89 years (mean: 70.5 years). The follow-up periods ranged from 1 month to 125 months, with an average of 52.5 months. The patients were divided into 4 groups as follows; 80 years of age or older with non-ruptured AAAs (n=15, mean: 85.3 years), or ruptured AAAs (n=11, mean: 83.0 years), and 79 years of age or younger with non-ruptured AAAs (n=191, mean: 67.1 years) or ruptured AAAs (n=21, mean: 66.6 years). Patients with abdominal pain but no extravasation of blood at surgery were grouped with those having non-ruptured aneurysms. Signs and symptoms in the octogenarians are summarized in Table I. Of the 15 octogenarians with non-ruptured AAAs, 4 had symptoms including abdominal or back pain and intermittent claudication; the other 11 patients were asymptomatic. In contrast, 6 of the 11 patients with ruptured AAAs had shock-like symptoms and were admitted with systolic blood pressures of less than 80 mmHg.

The surgical indications of octogenarians for elective aneurysmectomy were the same as those of younger patients. Asymptomatic aneurysms greater than 4 cm in diameter and symptomatic aneurysms were all selected

when there were no obvious contraindications. Exclusion criteria for surgery were severe respiratory dysfunction (forced expiratory volume and/or tidal volume less than 40% of the value predicted by spirometry), severe cardiac dysfunction (volume of left ventricular ejection fraction less than 40% of the value predicted by echocardiography and/or angina with minimal exertion or at rest), dementia senilis preventing the patients from managing their daily life by themselves, and coexistence of an advanced malignant disease which would limit the patient's life. In cases of rupture, all of the patients who survived to reach the operating room were included.

Clinical features, preoperative risk factors and survival rates of octogenarians were compared with those of the younger groups. The criteria used to define the risk factors were as follows.

Renal dysfunction: elevation of the serum creatinine level by 1.5 mg/dl or more.

Ischemic heart disease: diagnosis by electrocardiography, history of angina and/or myocardial infarction.

Respiratory dysfunction: confirmation by spirometry of a forced expiratory volume of less than 60% of the predicted value and/or a pO₂ value in room air of less than 60 mmHg determined by blood gas analysis.

Cerebrovascular disease: confirmation from a history of transient ischemic attack, ischemic neurological deficit and subarachnoid hemorrhage and/or symptoms due to these diseases.

Postoperative complications and causes of death were analyzed in the octogenarian groups, and continued survival and completeness of recovery after discharge were assessed by clinic visits and/or telephone questionnaires.

Data were analyzed by a chi-squared test, unpaired t-test and log-rank test as well as regression analysis where appropriate.

RESULTS

Clinical Features and Risk Factors

The general characteristics of the patients and preoperative risk factors are shown in Table II. No significant difference was found between the groups with regard to sex distribution, average preoperative blood

TABLE II CLINICAL DATA IN OCTOGENARIAN GROUPS IN COMPARISON WITH YOUNGER GROUPS

	Non-ruptured AAA (n=206)		Ruptured AAA (n=32)	
	Octogenarian group (n=15)	Younger group (n=191)	Octogenarian group (n=11)	Younger group (n=21)
Average age (yr)	85.3	69.1	83.0	66.0
Male: female ratio	2.75:1	6.35:1	4.5:1	6:1
Average pre-op systolic BP (mmHg)	144±21.2	136±29.5	89.5±45.3	98.3±48.0
Smoking	10 (66.7%)	144 (75.4%)	4 (36.4%)	12 (57.1%)
Hypercholesterolemia	3 (20.0%)	28 (14.7%)	1 (9.1%)	2 (9.5%)
Hypertension	10 (66.7%)	129 (67.5%)	4 (36.4%)	12 (57.1%)
Diabetes mellitus	1 (6.7%)	14 (7.3%)	1 (9.1%)	4 (19.0%)
Renal dysfunction	1 (6.7%)	18 (9.4%)	1 (9.1%)	5 (23.8%)
Ischemic heart disease	5 (33.3%)	37 (19.4%)	5 (45.5%)*	0 (0%)*
Respiratory dysfunction	4 (26.7%)*	12 (6.3%)*	3 (27.3%)	3 (14.3%)
Cerebrovascular disease	0 (0%)	18 (9.9%)	2 (18.2%)*	0 (0%)*

Data for average pre-op systolic BP represent the mean ± one standard deviation. BP, Blood pressure.

*Significant difference: $p < 0.01$

**Significant difference: $p < 0.05$

TABLE III SURGICAL DETAILS IN OCTOGENARIAN GROUPS IN COMPARISON WITH YOUNGER GROUPS

	Non-ruptured AAA (n=206)		Ruptured AAA (n=32)	
	Octogenarian group (n=15)	Younger group (n=191)	Octogenarian group (n=11)	Younger group (n=21)
Number with rupture to free abdominal cavity	—	—	2 (18.2%)	2 (9.5%)
Number with saccular aneurysm	1 (6.7%)	13 (6.8%)	1 (9.1%)	6 (28.6%)
Aneurysm size (mm)	68.7±18.4*	48.3±15.3*	68.6±16.7	70.2±20.9
Number requiring suprarenal cross-clamp	1 (6.7%)	27 (14.1%)	3 (27.3%)	6 (28.6%)
Blood loss (ml)	1207±1416	1795±8727	3680±3472	3920±3003
Blood transfusion (ml)	644±799	691±1190	3456±3728	2950±2264
Number receiving replacement with tube graft	2 (13.3%)	37 (19.4%)	2 (18.2%)	6 (28.6%)
Operation time (min)	202±86.8	230±197	201±109	197±51.2

Data for aneurysm size, blood loss, blood transfusion and operative time represent the mean ± one standard deviation.

*Significant difference: $p < 0.01$

pressure, incidence of smoking, hypercholesterolemia, hypertension, diabetes mellitus or renal dysfunction. In the non-rupture groups, the incidence of respiratory dysfunction in octogenarians was significantly higher than that in the younger patients. In the rupture groups, the octogenarians had

a considerably higher prevalence of cerebrovascular disease and ischemic heart disease than the younger patients.

Table III summarizes the surgical details for each group. In the non-rupture groups, the aneurysm size in octogenarians was considerably greater (68.7 ± 18.4 mm) than that

TABLE IV OPERATIVE MORTALITY RATES, CAUSES OF EARLY DEATH AND HOSPITAL STAY AFTER SURGERY FOR SURVIVORS IN THE OCTOGENARIAN GROUPS IN COMPARISON WITH YOUNGER GROUPS

	Non-ruptured AAA (n=206)		Ruptured AAA (n=32)	
	Octogenarian group (n=15)	Younger group (n=191)	Octogenarian group (n=11)	Younger group (n=21)
Operative mortality rate	0% (0/15)	3.7% (7/191)	45.5% (5/11)	28.6% (6/21)
<i>Causes of early death</i>				
Bowel infarction	0	3	0	0
Pneumonia	0	2	0	0
MNMS	0	1	0	0
AMI	0	1	2	3
MOF	0	0	3	3
Hospital stay for survivors (days)	19.4±5.4	21.4±14.2	25.5±15.3	31.2±32.8

Data for hospital stay represent the mean ± one standard deviation. No significant difference was found between the groups.

MNMS, myonephropathic metabolic syndrome; AMI, acute myocardial infarction; MOF, systemic multi-organ failure.

in the younger patients (48.3 ± 15.3 mm, $p=0.0016$). No significant difference was evident between the groups with regard to operation time, volumes of blood loss or transfusion, incidence of saccular AAAs or the incidence of AAAs requiring suprarenal cross-clamping.

Operative Mortality and Morbidity

There were no operative deaths in the octogenarian group with non-ruptured AAAs. In contrast, 5 patients in the rupture group died after surgery due to acute myocardial infarction (2 cases) and systemic multi-organ failure (3 cases). Thus, the operative mortality rates of octogenarians were 0% in those with non-ruptured AAAs and 45.5% in those with ruptured AAAs. The average hospital stay after surgery for the survivors was 19.4 ± 5.4 days for octogenarians with non-ruptured AAAs and 25.5 ± 15.3 days for those with ruptured AAAs. These figures were not significantly different from those for the younger patients, as shown in Table IV.

Non-fatal but significant postoperative complications occurred in 4 of the octogenarian survivors, including pneumonia in 3 and temporary oliguric azotemia not requiring hemodialysis in 1.

Late Follow-Up and Survival

In the octogenarian groups, 4 patients died

during the follow-up period. One patient in the non-rupture group died of lung cancer 16 months after surgery, and 3 patients in the rupture group died after 16, 38 and 53 months, postoperatively. The causes of death in the latter group were colon cancer, gastric cancer and sudden death of unknown cause, respectively. One patient was lost to follow-up 44 months after surgery and the remaining 16 patients are all doing well and have attended our institutions for regular check-ups. The cumulative survival rate for octogenarians was 85.7% at 5 years for the non-rupture group, with no significant difference from the general octogenarian population (age, 85 years)! On the other hand, the cumulative survival rate for octogenarians with ruptured AAAs was 43.6% at 3 years. There were no significant differences in comparison with the younger groups, as shown in Figs 1 and 2.

DISCUSSION

The published results of surgery for non-ruptured AAAs uniformly show a high probability of successful outcome in all age groups, including octogenarians²⁻⁷. In our series, the 5-year cumulative survival rate was 85.7% and the survivors showed no significant morbidity. This justifies our elective surgical management of octogenarians with non-ruptured AAAs. However, a

Fig 1. Life table of survival following our operative management of non-ruptured AAAs. Survival of octogenarians in the general population is also shown. Broad solid line, octogenarian group (n=15); broken line, younger group (n=191); solid line, general octogenarian population (age, 85 years). Numbers of patients at risk at the beginning of each period are also indicated. Numbers in normal typeface, younger group; bold typeface, octogenarian group.

Fig 2. Life table of survival following our operative management of ruptured AAAs. Broad solid line, octogenarian group (n=11); broken line, younger group (n=21). Numbers of patients at risk at the beginning of each period are also indicated. Numbers in normal typeface, younger group; bold typeface, octogenarian group.

TABLE V PUBLISHED SERIES OF AAAS IN OCTOGENARIANS

Series	Time frame of series	Non-ruptured AAA		Ruptured AAA	
		No. of patients	Mortality rate (%)	No. of patients	Mortality rate (%)
O'Donnell et al [2]	1962-1975	65	4.7	23	74
Petracek et al [3]	1970-1978	26	12	12	67
Treiman et al [4]	1963-1981	35	8.6	17	59
Harris et al [5]	1974-1983	45	2.2	27	37
Robson et al [6]	1980-1988	20	10	14	36
Dean et al [7]	1985-1992	23	13	11	91
Present series	1984-1994	15	0	11	46

Reference numbers are given in parentheses.

reliable approach for evaluating and selecting octogenarians for elective surgery has not yet been established. In principle, we believe that octogenarians who have a poor quality of life due to mental and/or physical handicap should not be selected for surgery. Clearly, the social and psychological conditions, as well as the physical conditions, of the patient must be taken into account. However, if there are no obvious contraindications, octogenarians should not be denied the chance of elective repair of aneurysms on the basis of age alone, since many are anxious about possible rupture of their aneurysms⁸ and once rupture occurs, the prognosis is very poor.

In contrast, conditions are quite different in cases of rupture. The reported results of surgery for ruptured AAAs in octogenarians vary considerably from those for non-ruptured AAAs, as summarized in Table V. Most authors have recommended an aggressive approach for these patients, since a conservative approach almost invariably leads to a fatal outcome. Dean and associates⁷ reviewed their experience with ruptured AAAs over a 7-year period. Ten of 11 patients died in the immediate postoperative period, and all of them showed hemodynamic instability before surgery. They advocated limiting surgery to patients who were hemodynamically stable in the preoperative period. In our series, 6 of the 11 patients who underwent surgery for ruptured AAAs had a preoperative systolic blood pressure of below 80 mmHg, but 3 of them survived the operation. Thus, since there was no correlation between preoperative blood pressure and survival in our series, we consider that patients in shock should not be excluded as candidates for surgery.

In our series, the ratio of ruptured to non-ruptured AAAs in octogenarians was greater than that in patients under 80 years of age.

In addition, AAAs were significantly larger in the octogenarian group than in younger patients undergoing elective surgery. This may have been due to the fact that the age of the aneurysms reflected the age of the patients. However, we also think that it reflects the reluctance of general practitioners to refer octogenarians for surgical consultation.

In summary, this study showed good operative results of abdominal aortic aneurysm repair in octogenarians, comparable to those in younger patients. We believe that an aggressive approach for these patients will decrease the incidence of ruptured aneurysms and contribute to better patient survival.

REFERENCES

1. Health and Welfare Statistics Association: The trend of national health condition. Tokyo, Japan: Kosaido Press, 1994; 72–74 (in Japanese)
2. O'Donnell TF, Darling RC, Linton RR: Is 80 years too old for aneurysmectomy? *Arch Surg* 1976; **111**: 1250–1257
3. Petrcek MR, Lawson JD, Rhea WG, Richie RE, Dean RH: Resection of abdominal aortic aneurysms in the over-80 age group. *South Med J* 1980; **73**: 579–581
4. Treiman RL, Levine KA, Cohen JL, Cossman DV, Foran RF, Levin PM: Aneurysmectomy in the octogenarian. A study of morbidity and quality of survival. *Am J Surg* 1982; **144**: 194–197
5. Harris KA, Ameli FM, Lally M, Provan JL, Johnston KW, Goldberg MR et al: Abdominal aortic aneurysm resection in patients more than 80 years old. *Surg Gynecol Obstet* 1986; **162**: 536–538
6. Robson AK, Currie IC, Poskitt KR, Scott DJA, Baird RN, Horrocks M: Abdominal aortic aneurysm repair in the over eighties. *Br J Surg* 1989; **76**: 1018–1020
7. Dean RH, Woody JD, Enarson CE, Hansen KJ, Plonk GW: Operative treatment of abdominal aortic aneurysms in octogenarians. When is it too much too late? *Ann Surg* 1993; **217**: 721–728
8. Tada Y, Takagi A: How to apply reconstructive vascular surgery to octogenarians. *Rinshogeka* 1989; **44**: 231–234 (in Japanese)