Ruptured thoracic aortic aneurysms: A study of incidence and mortality rates

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Purpose: **The purpose of this study was to determine the incidence and mortality rate of ruptured thoracic aortic aneurysm (TAA) in a well-defined population.**
Methods: **Retrospective analysis of compiled data from multiple registries in Stockholm, Sweden was performed.**
Results: **Eighty-two and 76 cases were identified from 1980 and 1989, respectively, for an equal incidence of 5 per 100,000. Forty-one percent of the patients were alive on arrival at an emergency hospital, but the overall mortality rate was 97% to 100%.**
Conclusions: **The mortality rate of ruptured TAA is high. To decrease this high mortality rate, efficient screening methods for the diagnosis of TAA must be worked out, characteristics indicating high risk of rupture must be identified, and efforts should be made to increase the number of operations for ruptured TAA. (J VASC SURG 1995;21:985-8.)**

Death from a ruptured thoracic aortic aneurysm (TAA) is not uncommon.[1,2] If diagnosed before rupture, it can be prevented by an elective repair. The first successful outcome of this surgical challenge was reported in 1953.[3] Today it is routine, and mortality rates less than 10% have been achieved for elective operation.[4] Yet the procedure carries a significant morbidity and mortality rate. Therefore every TAA is not a case for surgical repair.

The optimal survival rate in aortic aneurysmal disease is obtained when adequate medical treatment is supported by careful selection of patients for operation based on detailed knowledge of the natural course and the surgical results.[5] Current information with respect to the latter characteristic is insufficient for TAA. This study analyzes some of these aspects in ruptured TAA including incidence and mortality in a well-defined population.

MATERIAL AND METHODS

The study comprises all known cases of ruptured TAA except traumatic ones in persons registered in the Stockholm county, Stockholm, Sweden, in 1980 and 1989. Patients with thoracoabdominal aneurysms that ruptured above the diaphragm and residents in the Stockholm county sustaining a rupture elsewhere were included.

Basic information of population statistics and main and contributary cause of death were provided by the National Bureau of Statistics, Stockholm, Sweden.

Another main source of information was a computer registry containing data concerning all patients treated at the hospitals in the Stockholm county. As a complement, registries at the Department of Thoracic Surgery, Karolinska Hospital, Stockholm, Sweden, were used. This is the only department in the area treating TAA surgically.

The records were reevaluated for all individuals in whom the death certificate stated the cause of death to be aortic aneurysm and for every patient hospitalized because of aortic aneurysm on general and thoracic surgical wards during the actual period of time. In all cases of ruptured TAA the diagnosis was reconfirmed, and if established, the records were studied in further detail. Information of the morbidity rate of syphilis and possible luetic aneurysms in the Stockholm county were obtained by courtesy of Dr. Jan Stillström, Department of Environmental Health and Infection Disease Control, Karolinska Hospital.

RESULTS

The Stockholm county had a population of 1.5 million in 1980 and 1.6 million in 1989 (300,000

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0741-5214/95/$3.00 + 0 **24/1/63748**

Table I. Age distribution and incidence of ruptured thoracic aortic aneurysm in the Stockholm county 1980 and 1989

	Population				*No. of ruptured TAA*				*Age-specific incidence (per thousand)*			
	1980		*1989*		*1980*		*1989*		*1980*		*1989*	
Age (yr)	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
<60	616702	608800	652009	642728	5	1	6	2	0.01	<0.01	0.01	<0.01
60-64	38752	44109	35514	40200	4	3	3	2	0.10	0.07	0.08	0.05
65-69	32591	41817	36069	43958	6	2	6	1	0.18	0.05	0.17	0.02
70-74	24518	36740	26526	36540	9	10	7	5	0.37	0.27	0.26	0.14
75-79	15017	26796	19853	32948	6	12	6	10	0.40	0.45	0.30	0.30
80-84	7579	16966	10941	23468	4	11	4	12	0.53	0.65	0.37	0.51
85-89	3058	8481	4217	12093	3	6	2	5	0.98	0.71	0.47	0.41
≥90	963	3349	1230	5045	0	0	3	2	–	–	2.44	0.40

Table II. TAA/AAA* ratio of ruptured aortic aneurysms in Stockholm county 1980 and 1989 (the values were obtained from the total amount of all ruptures)

Age (yr)	*Men*	*Women*
<64	0.9	4.0
65-74	0.4	1.8
75-84	0.3	1.6
≥85	0.6	1.0

*Original basic data concerning AAA have been reported previously.[5]

and 330,000, respectively, older than 60 years). In 1980, 82 individuals (37 men, 45 women) had rupture of a TAA. In 1989 the corresponding number was 76 (37 men, 39 women). The incidence of rupture, five per 100,000, and the mean ages for men (70 years) and women (72 years) were the same for the 2 years studied. A further analysis of incidence rates with respect to age and sex is shown in Table I. Altogether only two patients with ruptured TAA underwent acute operations; both had hemopericardium from a ruptured dissection, and both survived.

Thus 156 patients died without surgical intervention. The total mortality rate in patients with ruptured TAA was 100% in 1980 and 97% in 1989. Sixty-four (41%) of the 158 subjects were alive on arrival at an emergency hospital, 11 (7%) died at geriatric institutions, and 83 (53%) died outside the hospital. Time from onset of symptoms of rupture to death could be established in 135 cases and was as follows: 0 to 6 hours in 73 (54%), 7 to 24 hours in 30 (22%), and more than 24 hours in 32 (24%) of the cases.

The diagnosis of ruptured TAA was confirmed by autopsy or operation in 151 of the 158 cases. The ruptures were localized in the ascending aorta in 81 (54%), the arch in 23 (15%), and the descending aorta in 45 (30%) of the cases. In nine cases the exact location of the rupture could not be identified by available records. At least 61 aneurysms were caused by dissection, and in all but eight of these the location of the rupture was in the ascending aorta. No luetic aneurysm was found.

DISCUSSION

According to a previous report three times more men than women have a ruptured abdominal aortic aneurysm (AAA).[5] In this study, which involved the identical population, the incidence of ruptured TAA was about the same in both sexes. This finding is interesting, because in all published series before 1982 TAAs were reported to occur predominately in men,[6] whereas in recent studies no such difference was observed.[1,2,6]

The proportion of TAA in the total number of aortic aneurysms has decreased continuously throughout the past century. Autopsy studies from 1903 showed a TAA/AAA ratio of 1:0.2, and in 1952 a corresponding ratio of 1:0.4 was reported.[7,8] This general trend is further underlined by this and a previous report[5] showing an overall ratio of ruptured TAA/AAA ratio of 1:1.3 (men 1:2.2, women 1:0.6) (Table II). In women ruptured TAA was found to be more common than ruptured AAA. With increasing age this difference is equalized. An increasing prevalence of AAA may contribute to the changing TAA/AAA ratio,[1,9-12] but the main reason is decreasing morbidity in patients with luetic aortitis. In 1980 a total of 180 cases of syphilis were diagnosed in the Stockholm county. In 1989 the corresponding number was 18. In the same area only one case of luetic aortitis was diagnosed from 1980 to 1990.

A superior aim of studies on TAA is to decrease

the high mortality rate from ruptured TAA. Progress can be achieved by three different approaches: prophylaxis and operation performed either electively or after rupture.

The prophylactic approach has minimized the incidence of luetic aneurysm efficiently. Because hypertension is an important risk factor for ruptured TAAs, particularly those caused by dissections,[6,13-16] it may also be assumed that a number of ruptured TAAs might be prevented by adequate hypertension therapy.

The definitive cure of a TAA requires surgical repair. The large difference between the mortality rate after elective and emergency operation suggests that TAAs at risk of rupture should be operated electively. On the other hand, a number of individuals die with and not because of the TAA, because many TAAs never rupture.

To justify an elective repair to prevent rupture, the overall mortality rate must be lower than that without operation, i.e., $r/a > m_e/m_r$,[5] where a = the total number of aneurysms that according to given criteria should be operated, r = the number of the aneurysms (a) that eventually will rupture if no elective surgery is performed, m_e = the mortality at elective operation, and m_r = mortality at rupture.

This condition is minimal, because death from elective operation comes earlier, and serious nonlethal complications such as paraplegia are not considered in the equation. Consequently knowledge of the risk of rupture is a prerequisite for adequate selection of patients for elective repair of TAA. The rupture rate of aortic aneurysms caused by dissections is high. Pressler and McNamara[17] reported a 77% rupture rate, and an even higher rupture rate (95%) was observed in the series of Bickerstaff et al.[6] In fact, more than 80% of all deaths caused by dissecting aortic aneurysms are due to a rupture.[13]

TAAs with a cause other than dissection have a lower risk of rupture.[18] The lowest rate (12%) was observed in an autopsy study, whereas a rate of 44% to 56% was found in selected clinical materials.[6,17,19] It should be emphasized that patients with TAAs that have a rupture rate of 10% will benefit from operation only if the operative mortality rate is significantly less than 10%. There are subsets of TAAs with such a low risk of rupture.[15,18,20]

The rate of serious complications such as paraplegia is higher after repair of a TAA than after an AAA. The management of small AAAs is controversial,[21] but according to our experience an AAA with a maximal transverse diameter smaller than 5 cm is generally not a case for elective repair.[5,22] An atherosclerotic TAA with an equal size of an AAA is less liable to rupture.[15] Thus atherosclerotic TAAs should be substantially above 5 cm to justify an elective resection.

The recent endoluminal technique might extend the indication for elective repair.[23,24] However, the assumed improved results in terms of complication rate and survival remain to be established.

To decrease the mortality rate from ruptured TAA by the elective approach, the appropriate cases must be identified. Because many TAAs are silent until rupture occurs, it implies some sort of screening procedure. This is a problem awaiting further methodologic development, because plain ultrasonography is not applicable in thoracic disease, and methods such as computed tomography and magnetic resonance imaging are cumbersome and too expensive for large-scale screening programs.

Finally, mortality rates can be lowered by an improved treatment of patients with ruptured TAA. A mortality rate as low as 20% has been reported after surgical repair after rupture.[25] This rate refers to the highly selected fraction of patients who reached the operating room and had a ruptured aneurysm of the descending thoracic aorta. Most patients die within 6 hours after rupture, and only 41% of the patients in this report arrived at an emergency hospital alive. Most of them were first taken to local emergency cardiac units. As a result, time for diagnostic procedures and transport to a thoracic surgical unit was often too short. In fact, only a few patients were admitted, which explains the very low rate of surgically treated aneurysms in this report. However, according to the present data even a 100% survival rate after operation for ruptured TAA would result in an estimated overall mortality rate well more than 50%.

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Submitted Nov. 14, 1994; accepted Jan. 27, 1995.