

Trends in Mortality and Hospital Morbidity Due to Abdominal Aortic Aneurysms

W.J. Millar, C.W. Cole and G.B. Hill*

Abstract

This article examines national and regional trends in mortality and morbidity due to abdominal aortic aneurysms from 1969 to 1991. Annual age-adjusted mortality and hospital separation rates were calculated for men and women aged 55 and older whose underlying cause of death was abdominal aortic aneurysm, or who were hospitalized with a primary diagnosis of abdominal aortic aneurysm.

In recent decades, abdominal aortic aneurysm mortality rates remained stable, in contrast to substantial declines in mortality rates for cerebrovascular disease and cardiovascular disease. The pattern was similar for both sexes, although rates were four to five times higher among men than among women. In 1991, age-adjusted rates were around 31.0 per 100,000 men aged 55 and over and 8.5 per 100,000 women aged 55 and over. Over the 1969 to 1991 period, mortality rates in all regions tended to converge.

Although mortality rates were stable, hospital separation rates for abdominal aortic aneurysms increased sharply, particularly for unruptured aneurysms. Screening programs have been able to detect asymptomatic abdominal aortic aneurysms, and surgical intervention can substantially reduce mortality. However, the costs and benefits of screening programs should be assessed. If current mortality rates persist, as the baby boom ages there will be an absolute increase in the number of deaths from abdominal aortic aneurysms.

Keywords: aortic aneurysm, abdominal aneurysm, mortality, morbidity

* W. J. Millar (613-951-1631) is with the Health Statistics Division at Statistics Canada, Ottawa, K1A 0T6. C.W. Cole (604-631-5575) is with St. Paul's Hospital, Vancouver, British Columbia, V6Z 1Y6. G.B. Hill (613-951-4113) is with the Social and Economic Studies Division at Statistics Canada, Ottawa, K1A 0T6.

Introduction

An aneurysm is a localized abnormal dilation of an artery caused by structural weakness. An abdominal aortic aneurysm (defined as dilation of the abdominal aorta to more than 3 cm in diameter) most frequently arises below the renal arteries and may extend beyond the bifurcation.¹

Abdominal aortic aneurysms are not a leading cause of mortality, accounting for about 1,000 deaths annually. But unlike mortality rates for cerebrovascular disease and cardiovascular disease, which declined in recent decades, death rates for abdominal aortic aneurysms have remained relatively stable. At the same time, hospital separation rates for this condition have risen substantially.

If an aneurysm ruptures, the probability of survival is low. However, if the condition is detected and surgically repaired, the individual can anticipate a normal life expectancy. For this reason, trends and patterns in abdominal aortic aneurysms have implications for the health status of Canadians. Health Canada's special initiative on aging-related diseases has identified abdominal aortic aneurysms as a priority public health issue.²

This article traces national and regional trends in abdominal aortic aneurysm mortality and hospital morbidity among Canadians aged 55 and over for the 1969 to 1991 period (see *Data source, methods and limitations*). It also reviews some explanations for the relative stability of mortality rates, and considers the efficacy of screening programs.

Data source, methods and limitations

Data on all deaths in Canada with a stated underlying cause of abdominal aortic aneurysm were examined for the years 1969 to 1991. While the primary focus of this article is abdominal aneurysms, information on other types of aortic aneurysm

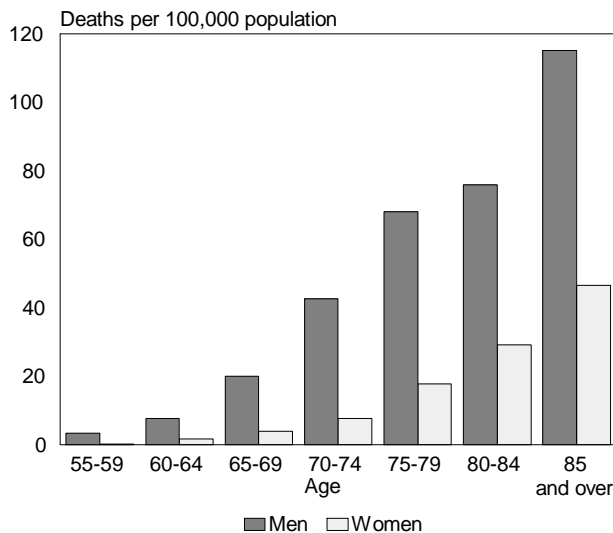
Mortality Rates

Rates rise with age

Abdominal aortic aneurysms rarely affect younger people. Rather, they are most prevalent among older adults, particularly men (Chart 1). For both men and women, mortality rates rise with age. In 1991, the male rate increased from 3.2 deaths per 100,000 at ages 55 to 59 to 115.2 deaths per 100,000 in the 85 and over age group. Corresponding rates for women ranged from 0.2 to 46.5 deaths per 100,000. At all ages, men's mortality rates exceeded those of women.

Chart 1

Abdominal aortic aneurysm mortality rates, population aged 55 and over, by age and sex, Canada, 1991

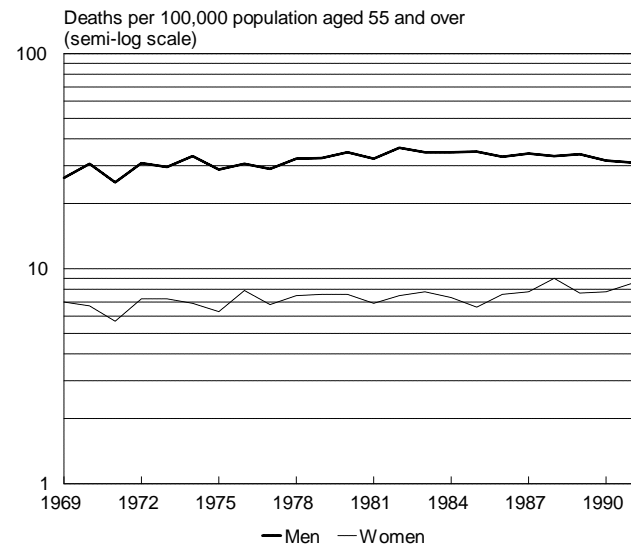


Little change in recent decades

Mortality rates for abdominal aortic aneurysms have changed little in recent decades, and the rate for men has remained well above the rate for women (Chart 2). In 1991, the age-adjusted mortality rate among men aged 55 and over was 31.9 deaths per 100,000, almost four times the comparable rate among women for the same year (8.6).

Chart 2

Age-adjusted abdominal aortic aneurysm mortality rates, population aged 55 and over, by sex, Canada, 1969-1991



Since 1969, the male mortality rate for this condition fluctuated, reaching a low of 25.2 deaths per 100,000 in 1971 and peaking at 36.3 in 1982. The rate among women varied from a low of 5.7 deaths per 100,000 in 1971 to a high of 9.0 in 1988.

Even if abdominal aortic aneurysm mortality rates remain stable or decline slightly, the absolute number of cases will increase as the postwar baby boom population moves into the older age groups that are most at risk.

Mortality rates highest in Ontario and British Columbia

Over the 1969 to 1991 period, abdominal aortic aneurysm mortality rates were generally highest in Ontario and British Columbia (Table 1). However, in any given year, this ranking did not necessarily hold. For example, among men, the 1991 rate was highest in Quebec (36.3 deaths per 100,000), followed by the Prairies (30.7), British Columbia (29.8), Ontario (29.1), and the Atlantic region (28.6).

Table 1**Age-adjusted abdominal aortic aneurysm mortality rates, population aged 55 and over, by region and sex, Canada, 1969-1991**

	Men						Women					
	Canada	Atlantic	Quebec	Ontario	Prairies	British Columbia	Canada	Atlantic	Quebec	Ontario	Prairies	British Columbia
	Deaths per 100,000 population aged 55 and over											
1969	26.3	15.9	15.0	35.7	18.0	41.2	7.0	6.3	5.5	8.2	6.2	6.9
1970	30.6	17.4	22.7	41.7	21.2	38.8	6.7	6.8	3.7	7.4	6.9	9.1
1971	25.2	18.1	13.9	35.7	19.3	31.3	5.7	5.6	3.7	6.6	4.8	7.5
1972	30.9	20.4	17.3	45.5	23.7	32.4	7.2	5.1	5.7	8.4	6.8	8.4
1973	29.7	20.8	21.7	39.1	20.9	37.4	7.2	5.1	5.8	8.8	5.3	8.5
1974	33.0	23.5	23.0	42.8	25.9	42.1	6.9	7.2	3.6	7.5	8.6	8.5
1975	28.8	17.4	17.8	35.7	28.6	37.6	6.3	2.7	4.5	8.0	6.7	7.0
1976	30.7	19.0	25.5	39.8	22.1	36.7	7.9	7.3	7.6	7.4	7.3	11.4
1977	29.1	19.2	25.2	33.9	21.5	40.1	6.8	5.6	6.2	7.4	5.0	9.9
1978	32.3	30.2	30.3	37.6	18.8	41.5	7.5	5.8	6.8	8.5	6.1	9.1
1979	32.6	30.6	27.2	34.6	28.6	38.2	7.6	4.6	8.0	6.8	8.6	10.6
1980	34.7	41.1	33.6	38.2	28.7	33.1	7.6	6.4	6.3	8.4	7.6	8.2
1981	32.3	32.4	25.3	36.5	26.6	41.0	6.9	5.7	6.7	6.9	7.4	6.9
1982	36.3	34.0	30.6	35.6	41.1	43.1	7.5	8.6	6.2	7.0	8.8	9.0
1983	34.7	32.6	27.2	43.4	24.9	38.6	7.8	9.8	7.7	7.8	8.2	6.2
1984	34.8	29.0	30.2	40.1	33.8	33.2	7.3	4.9	7.1	8.4	7.6	5.8
1985	34.9	27.9	31.0	40.8	32.2	35.3	6.6	9.6	4.7	7.8	6.5	5.9
1986	33.0	24.8	35.4	35.5	30.1	30.8	7.6	5.0	6.4	9.2	6.2	8.9
1987	34.1	33.3	33.5	36.9	33.2	30.3	7.8	6.3	8.4	9.0	6.8	5.9
1988	33.2	26.8	31.4	37.0	33.9	30.0	9.0	6.8	11.3	8.9	7.3	8.6
1989	34.0	33.2	34.0	36.3	34.4	29.0	7.7	6.1	7.8	8.3	9.9	4.5
1990	31.8	28.9	35.9	31.1	28.7	32.5	7.8	6.0	8.0	8.4	7.6	7.4
1991	31.0	28.6	36.3	29.1	30.7	29.8	8.5	7.1	10.9	8.2	8.5	6.3

As well, year-to-year variations in the mortality rates in the different regions were substantial. Nonetheless, since 1969, the male and female mortality rates in all regions tended to converge toward the national average.

Most common aortic aneurysm

Abdominal aneurysms have generally constituted the major component of aortic aneurysm mortality for both men and women (Chart 3). This was true for men since 1969, although in the early years of the period, women's mortality rate for aortic aneurysms in unspecified sites exceeded the rate for abdominal aortic aneurysms. Since 1969, for both sexes, mortality rates for aortic aneurysms in unspecified sites declined overall. At the same time, mortality rates for thoracic aneurysms

increased slightly, but were generally much lower than those for abdominal aneurysms.

Ruptured aneurysms usually fatal

Ruptured aneurysms more often cause death than those that are unruptured (Table 2). Among both men and women, approximately eight out of ten abdominal aortic aneurysms that result in death are ruptured. Mortality from ruptured abdominal aortic aneurysms ranges from 80% to 90% of cases. In fact, up to 62% of patients with ruptured aneurysms die before reaching a hospital.^{3,4} Of those who do reach hospital alive, 50% to 70% may be saved by emergency surgery.⁵ If the aneurysm is detected before rupture and elective surgery is performed, the operative risk is about 5%.^{6,7}

Chart 3

Age-adjusted aortic aneurysm mortality rates, population aged 55 and over, by sex and type of aneurysm, Canada, 1969-1991

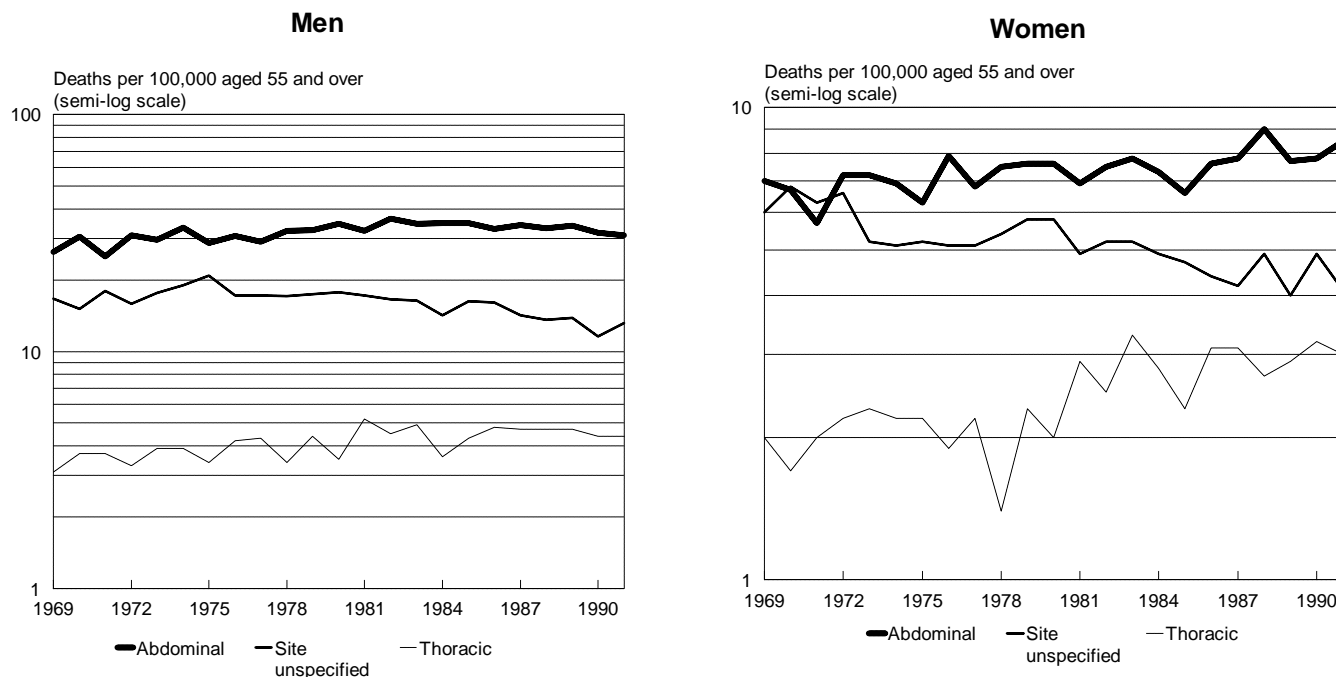


Table 2

Age-adjusted abdominal aortic aneurysm mortality rates, population aged 55 and over, by sex and type of aneurysm, Canada, 1979-1991

	Abdominal		Thoracic		Site unspecified	
	Ruptured	Unruptured	Ruptured	Unruptured	Ruptured	Unruptured
Deaths per 100,000 population aged 55 and over						
Men						
1979	27.2	5.4	3.6	0.8	12.7	4.9
1980	28.5	6.2	2.7	0.8	13.7	4.1
1981	27.3	4.9	4.2	0.9	14.1	3.1
1982	30.2	6.1	3.5	0.9	13.9	2.6
1983	28.8	5.9	4.3	0.7	13.2	3.3
1984	28.4	6.4	2.9	0.7	11.5	2.7
1985	27.6	7.3	3.4	0.9	13.3	3.0
1986	25.9	7.0	3.6	1.2	12.4	3.6
1987	28.0	6.1	3.7	0.9	11.3	2.9
1988	26.7	6.5	3.9	0.8	10.9	2.7
1989	26.2	7.8	3.9	0.9	11.0	3.0
1990	26.0	5.8	3.2	1.2	9.3	2.4
1991	25.8	5.1	3.1	1.3	10.2	3.0
Women						
1979	6.0	1.6	1.9	0.4	3.9	2.0
1980	5.9	1.7	1.5	0.5	3.8	1.9
1981	5.1	1.7	2.1	0.8	3.6	1.3
1982	5.8	1.7	2.0	0.5	4.2	1.1
1983	6.3	1.6	2.4	0.9	4.3	0.9
1984	5.9	1.4	2.0	0.7	3.9	1.0
1985	5.2	1.4	1.7	0.0	3.6	1.1
1986	6.1	1.5	2.2	0.9	3.4	1.0
1987	5.9	1.9	2.5	0.7	3.3	0.9
1988	6.4	2.6	1.9	0.8	3.8	1.1
1989	5.9	1.8	2.1	0.8	3.2	0.8
1990	6.2	1.6	2.3	0.9	3.8	1.1
1991	6.7	1.9	2.1	1.0	3.2	0.9

Hospital Separations

Hospital separations rising

Since the early 1970s, hospital separations for abdominal aortic aneurysms increased considerably among both men and women. In 1990, this condition accounted for 5,638 hospital separations, compared with 1,542

Majority of abdominal aortic aneurysms unruptured

Among both men and women aged 55 and over, hospital separation rates for unruptured abdominal aortic aneurysms were much higher than for those that were ruptured. Men's separation rates for unruptured abdominal aortic aneurysms rose substantially from 91.5 per 100,000 in 1979 to 148.4 in 1990 (Chart 4). The corresponding figures for ruptured abdominal aortic aneurysms were relatively stable: 32.1 and 39.7 per 100,000.

Women's separation rates for both ruptured and unruptured abdominal aortic aneurysms also increased overall. The rates for unruptured aneurysms were 28.2 per 100,000 in 1979 and 35.1 in 1990; for ruptured aneurysms, the comparable rates were 5.6 and 7.2 per 100,000.

Discussion

Although there is consensus that many factors are involved in abdominal aortic aneurysms, no unified theoretical framework currently exists to explain the etiology of the condition.^{3,8}

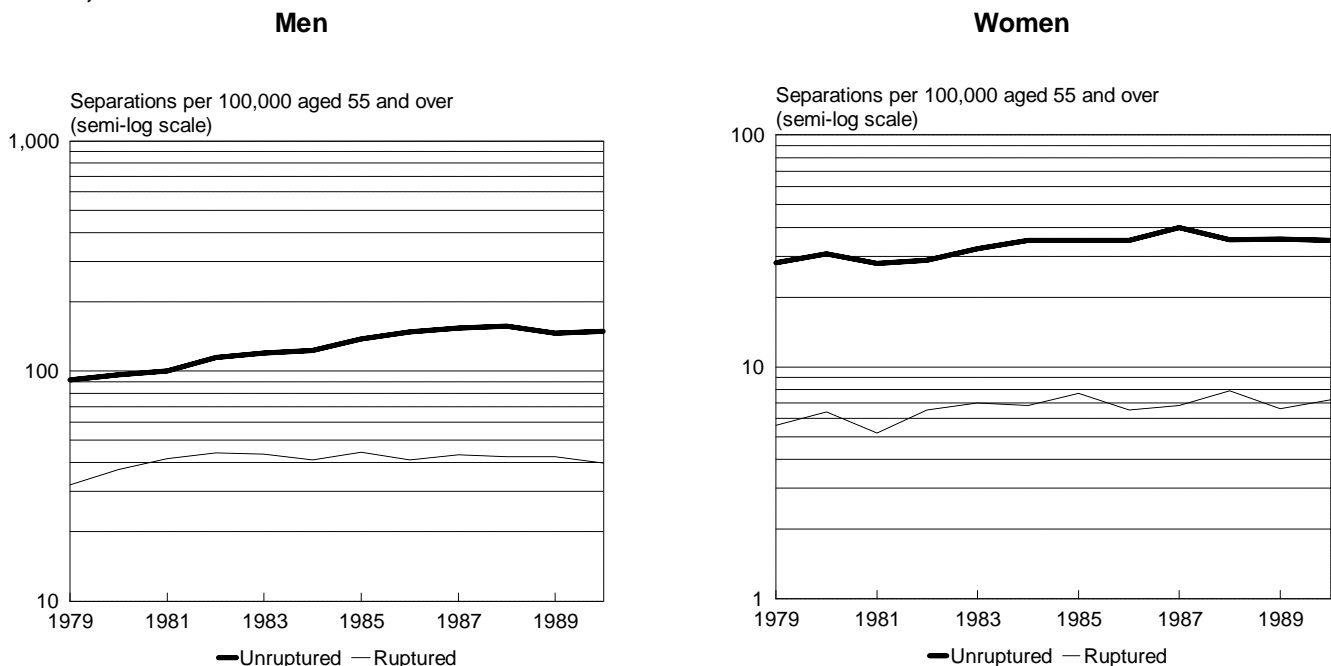
Arteriosclerotic heart disease and stroke have been cited as possible risk factors for the development of aneurysms. However, death rates for cardiovascular disease and ischaemic heart disease have declined in Canada among both men and women since the 1960s, and deaths due to stroke have fallen by about 2% a year since the 1950s.⁹

The relative stability of mortality rates for abdominal aortic aneurysms and the rising hospital separation rates have led researchers to question whether arteriosclerotic disease is a primary cause of abdominal aortic aneurysms. The diminishing regional differences in mortality from abdominal aortic aneurysms in recent years are also relevant, since regional variations in mortality from other arterial diseases are marked.

Epidemiological studies support the hypothesis that smoking is an important risk factor for abdominal aortic aneurysms.^{10,11} Yet the proportion of people who smoke is falling. In 1991, 26% of Canadian men aged 15 and over smoked daily, down from 54% in 1966. Women's smoking rates also dropped, but only slightly from 29% in 1966 to 26% in 1991.¹² The apparent failure of the decline in smoking to affect abdominal aortic aneurysm

Chart 4

Age-adjusted abdominal aortic aneurysm hospital separation rates, population aged 55 and over, by sex, Canada, 1979-1990



mortality rates may reflect a lag between smoking cessation and the manifestation of health benefits. Persons at particularly high risk include men aged 65 and over (especially those with a history of smoking), persons with clinical evidence of peripheral arterial occlusive disease, persons with hypertension, and persons with a family history of abdominal aortic aneurysms.

Most abdominal aortic aneurysms are asymptomatic until they rupture, and mortality rates for ruptured aneurysms are much higher than for those that are unruptured. At present, the only treatment before rupture is surgical repair. More cases are being detected before rupture, although data are lacking on the size and growth rate of abdominal aortic aneurysms, factors that affect the probability of rupture and the decision for surgical intervention.

Selective screening of high-risk populations may reduce the premature mortality associated with abdominal aortic aneurysms. However, research on the efficacy of screening has not been conclusive.

Screening programs in Great Britain have been able to detect asymptomatic abdominal aortic aneurysms. Ultrasound is highly sensitive for the diagnosis of this condition, and low-cost portable ultrasound devices make community screening feasible.^{6,13} It has been estimated that the number of deaths that can be prevented with aneurysm screening surpasses the number preventable with a breast screening program.¹⁴

But while ultrasound can detect the presence of abdominal aortic aneurysms, the precision of ultrasound estimates of the extent of aneurysmal dilation has been questioned. In addition, questions have been raised about the frequency of screening, the type of screening, and the merits of surgical intervention or medical management of small aneurysms.¹⁵

Few formal evaluations have been made of the benefit of screening programs and surgical intervention from an economic, community, and individual perspective. However, a recent analysis of the cost-effectiveness of screening in men aged 60 to 80 concluded that a single screen for abdominal aortic

aneurysms by abdominal palpation might be cost-effective but of small benefit; a single screen with ultrasonography might be cost-effective and of modest benefit; repeated screening may not be cost-effective.¹³

Randomized trials are necessary to provide direct evidence of the effectiveness of surgical versus medical management.^{16,17} Randomized trials of elective surgery for abdominal aortic aneurysms of 4 to 5.5 cm in diameter are now under way in Great Britain and in the United States,^{18,19} and in Canada, a randomized trial of treatment of aneurysms less than 4.5 cm in diameter with propranolol has just begun.

The increase in hospital separations between 1979 and 1990 for unruptured abdominal aortic aneurysms suggests that even without systematic screening programs, clinical examinations are picking up more cases. Most cases, in fact, are detected by clinical or radiological examinations done for other purposes.²⁰ As well, the increase in hospital admission rates for unruptured aneurysms may reflect family practitioners' greater use of ultrasound and increased elective surgery. Another factor that may account for the upturn in separation rates could be repeat admissions to hospital. And of course, the incidence of the condition itself may be rising.

International trends

Trends in abdominal aortic aneurysms in other countries have generally been similar to those in Canada. In the United States, age-adjusted mortality from aortic aneurysms reached a plateau around 1968, and then declined slightly.²¹ In England and Wales, crude hospital admission rates for abdominal aortic aneurysms in men increased from 2.4 per 100,000 in 1968 to 11.3 in 1983. Among women, the rate was constant at about 1.0 per 100,000 until 1977, after which it started to rise, reaching 3.0 in 1983.²² A similar increase in the incidence of abdominal aortic aneurysms was noted in Scotland, where the frequency of diagnosis increased from 25.8 per 100,000 population aged 55 and over in 1971 to 63.6 in 1984.²³

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