Gender differences in abdominal aortic aneurysm surgery

Greg F. Parsons, Jane F. Gentleman and K. Wayne Johnston

Abstract

Objectives
This article analyzes abdominal aortic aneurysm (AAA) surgery rates by sex for inpatients of Canadian hospitals. Possible reasons for the observed gender differences in surgery rates are discussed.

Data source
For fiscal years 1983/84 to 1993/94, over 100,000 hospitalization records for patients aged 45 and over with an AAA were extracted from the Hospital Morbidity File maintained by Statistics Canada.

Analytical techniques
Surgery rates were calculated by sex for hospitalizations involving non-ruptured and ruptured AAAs. To control for sex differences in AAA prevalence and hospitalization rates, surgery rates were based on the population of hospital inpatients with AAA.

Main results
Rates of elective and emergency AAA surgery were consistently and substantially lower for women than men.

Conclusion
Gender differences in AAA prevalence, hospitalization rates, age, and contraindications for surgery cannot explain the differences in surgery rates between women and men. Possible gender bias in the decision to operate could not be ruled out.

Key words
elective surgery, emergency surgery, gender bias

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In fiscal year 1993/94, about 11,000 hospitalizations in Canada involved an abdominal aortic aneurysm (AAA)—a localized dilation of the main artery in the abdominal region. In most cases, an AAA is not accompanied by symptoms, and a diagnosis is often made coincidentally either by palpation of the abdomen or by ultrasound. Sometimes, abdominal or back pain can draw attention to an aneurysm. Regardless of the path to diagnosis, once a significant non-ruptured AAA has been identified, there is an opportunity to perform surgery to eliminate the chance of rupture and thus reduce the likelihood of death.

From 1991 to 1993, over 1,000 deaths per year were attributed to AAA.[1] However, the number of AAA deaths is likely underestimated, since some of them were probably ascribed to other causes of sudden death such as myocardial infarction.

Methods

Data source

Data on 103,488 hospital stays involving AAA for fiscal years 1983/84 to 1993/94 were taken from Statistics Canada's Hospital Morbidity File.[2] The file contains one record for each separation from Canadian general and allied special hospitals in all provinces, excluding specialized psychiatric and mental hospitals and most services received in military and prison hospitals. The coverage of the file is virtually complete.

"Separation" refers to the discharge or death of a hospital patient. Each record contains up to five diagnosis codes and up to three surgical procedure codes.

Analytical techniques

A hospitalization involving an AAA was defined as a separation record with either of two ICD-9 codes for abdominal aortic aneurysm in any of the diagnosis fields: 441.3 (abdominal aortic aneurysm, ruptured) or 441.4 (abdominal aortic aneurysm, without mention of rupture).[3] ICD-9 codes 441.5 (aortic aneurysm of unspecified site, ruptured) and 441.6 (aortic aneurysm of unspecified site, without mention of rupture) were excluded. The number of records with the last two codes was less than 4% of the total number of separations involving AAA for each of ruptured and non-ruptured cases.

An operation involving the aorta was defined as a record with at least one of the following Canadian Classification of Procedure (CCP) codes in any of the surgical procedure fields: 50.24 (resection of the aorta with anastomosis), 50.34 (resection of the aorta with replacement), 50.54 (other excision of the aorta), 51.25 (aorta-iliac-femoral bypass), or 51.52 (other repair of aneurysm).[4]

Records with the following codes were considered to represent stays involving elective and emergency AAA surgery:

Elective AAA surgery:	ICD-9 = 441.4 (non-ruptured) and CCP = 50.24 or 50.34 or 50.54 or 51.25 or 51.52
Emergency AAA surgery:	ICD-9 = 441.3 (ruptured) and CCP = 50.24 or 50.34 or 50.54 or 51.25 or 51.52

For the population aged 45 and over, frequencies of hospitalizations involving a diagnosis of AAA were tabulated by sex and age group, by whether the ICD-9 codes indicated a ruptured AAA, and by whether the CCP codes indicated aortic surgery.

Annual age-sex-specific surgery rates were calculated at the national level (excluding the two territories) for both elective and emergency surgery. To control for gender differences in AAA prevalence and hospitalization rates, surgery rates were calculated based on the population of hospital inpatients with AAA. For elective surgery, rates were calculated as the number of hospital stays involving elective AAA operations divided by the number of hospitalizations involving a diagnosis of non-ruptured AAA. The emergency surgery rates were calculated as the number of hospitalizations involving emergency AAA operations divided by the number of hospitalizations involving a diagnosis of ruptured AAA.

Surgery rates by sex were age-standardized. For elective surgery, the standard population was the national population of inpatients with a non-ruptured AAA, combined across sexes and fiscal years 1983/84 to 1993/94. For emergency surgery, the standard population was defined similarly for inpatients with a ruptured AAA.

Limitations

The Hospital Morbidity File does not contain information about AAA size or the severity of diagnosed conditions, two factors that may partly explain the gender differences in elective surgery rates. AAA size is not relevant in comparing emergency surgery rates.

The frequencies presented in this article refer to the number of hospital stays involving AAA, not the number of patients. An individual may be hospitalized more than once during a year because of an AAA. Moreover, the principal reason for hospital admission cannot always be reliably identified among the diagnostic and surgical codes on the separation record, so in some cases, the AAA diagnosis could be incidental.[5,6] For example, a woman could be admitted to hospital for suspected coronary heart disease, be found to also have a small AAA, and be released without AAA surgery. If the same woman was readmitted to hospital within the same fiscal year, her two stays involving AAA would be counted separately in calculating AAA surgery rates, because the hospital data are organized by hospital stay, not by individual patient.

If a non-ruptured AAA is diagnosed and repaired early, the prognosis is good. The operative mortality rate for strictly elective AAA surgery is generally below 5%.[7,8] When symptomatic and/or urgent cases are included, this rate rises to about 10%.[9,10]

If an AAA is undiagnosed or left untreated, additional enlargement will further weaken the wall of the artery, increasing the likelihood of rupture. In the event of a rupture, most patients will die before reaching hospital.

For those who undergo emergency surgery to repair a ruptured AAA, the operative mortality rate is about 50%.[7,8] Sadly, in some cases, a patient with a ruptured AAA may make it to hospital but other factors may preclude surgery. Estimates of the mortality rate after rupture—including cases not taken to hospital—have ranged from 80% to 95%.[11,12] Clearly, early diagnosis and elective surgery, when indicated, are important in reducing AAA mortality.

Among those admitted to hospital, women are less likely than men to receive elective and emergency AAA surgery. These differences in surgery rates may stem from surgical guidelines that may not be equally valid for women and men. Or, the discrepancy may be explained by differences between women and men with AAAs with respect to the presence of accompanying conditions that may contraindicate surgery. Or, gender bias could be involved in the decision to operate for AAA.

Outside Canada

In Australia (1971-81),[13] Scotland (1971-84),[14] and Michigan (1980-90),[15] a smaller proportion of women than men diagnosed with an AAA proceeded to surgery. The Australian study reported that 35% of female patients but 53% of male patients with an AAA received surgical repair in 1980/81. The Scottish study reported that only 26% of women but 49% of men with an AAA had surgery in 1984. The American study found that during the 1980 to 1990 period, surgery rates for male inpatients with non-ruptured and ruptured AAAs were, respectively, 80% and 40% higher than for female inpatients. The authors concluded that it remained to be determined whether these gender differences were the result of clinical practice patterns or biological factors.

Using data from Statistics Canada's Hospital Morbidity File, this article analyzes AAA surgery rates for hospital inpatients by sex from 1983/84 to 1993/94 (see *Methods*). Possible reasons for the gender differences in surgery rates are discussed.

Previous studies have suggested the possibility of gender bias in the management of AAA (see *Outside Canada*), as well as of other medical conditions. Examples of the latter are the application of diagnostic and revascularization procedures for coronary heart disease, referral for suspected Parkinson's disease, and the use of venous ultrasonography for the diagnosis of deep venous thrombosis.[16-23]

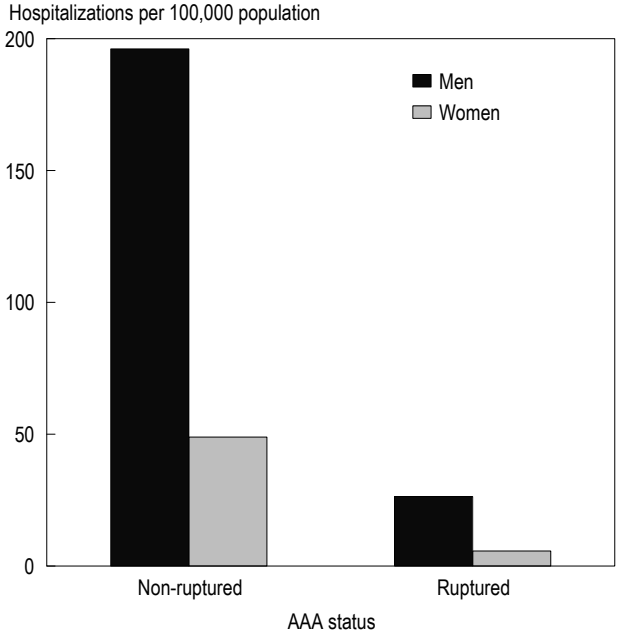
Who is at risk?

AAAs are most prevalent among the elderly and rarely occur in young people. In 1993/94, Canadians aged 65 and over experienced the majority (83%) of hospitalizations involving an AAA, and virtually all individuals hospitalized with an AAA were aged 45 and over. Consequently, the analysis presented here is restricted to hospital inpatients aged 45 and over.

AAA does not afflict both sexes equally. Prevalence rates for men are typically five or six times those for women.[15,24,25] In 1993/94, men accounted for 75% of AAA hospitalizations, and hospitalization rates for men were four or five times those for women (Chart 1). Understandably, more deaths among men than among women have AAA as the underlying cause.[15,24-26]

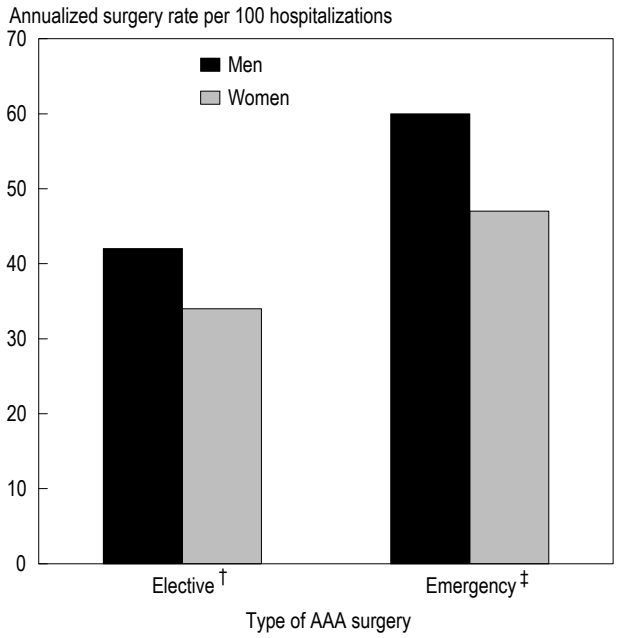
Between 1983/84 and 1993/94, age-standardized non-ruptured AAA hospitalization rates increased substantially for men, from 146 to 196 per 100,000 population. The rates for women rose less sharply from 40 to 49. Hospitalizations for men with ruptured AAA decreased (from 32 to 26 between 1983/84 and 1993/94) and were quite stable for women (5.6 and 5.7, respectively). As the population ages, the frequency of AAA hospitalizations is expected to increase further.

Chart 1
Age-standardized hospitalization rates involving AAA, by sex, age 45 and over, Canada, 1993/94



Data source: *Hospital Morbidity File*
Note: *Age-standardized to the 1991 Canadian population*

Chart 2
Age-standardized AAA surgery rates, by sex, age 45 and over, Canada, 1983/84 to 1993/94 combined



Data source: *Hospital Morbidity File*
Note: *Age-standardized to the hospitalized population involving non-ruptured or ruptured AAA, 1983/84 to 1993/94 combined*
† Rate per 100 non-ruptured AAA inpatients
‡ Rate per 100 ruptured AAA inpatients

Table 1
AAA hospitalizations and surgery rates, age 45 and over, Canada, 1983/84 to 1993/94

	Non-ruptured AAA				Ruptured AAA			
	Number of hospitalizations		Elective surgery rate†		Number of hospitalizations		Emergency surgery rate‡	
	Men	Women	Men	Women	Men	Women	Men	Women
			Per 100 hospitalizations				Per 100 hospitalizations	
Total	**66,840**	**22,743**	**41.8§**	**33.9§**	**11,023**	**2,882**	**59.8§**	**46.5§**
1983/84	4,381	1,552	40.1	33.3	940	222	58.4	51.0
1984/85	4,637	1,739	41.4	33.5	919	224	56.8	45.0
1985/86	5,079	1,786	41.6	33.9	978	244	58.3	35.3
1986/87	5,710	1,875	42.2	34.9	962	226	59.3	41.5
1987/88	6,110	2,089	41.3	34.8	1,024	237	60.6	44.9
1988/89	6,477	2,039	42.4	32.7	1,033	276	59.2	51.0
1989/90	6,280	2,173	41.8	33.5	1,031	242	63.4	49.7
1990/91	6,588	2,193	43.0	34.7	1,023	280	60.2	51.0
1991/92	7,007	2,327	42.4	35.8	1,066	288	63.7	47.7
1992/93	6,913	2,358	41.7	32.7	1,029	328	59.2	48.1
1993/94	7,658	2,612	41.0	33.3	1,018	315	59.8	46.5

Data source: *Hospital Morbidity File*
† Age-standardized to the hospitalized population involving non-ruptured AAA, 1983/84 to 1993/94 combined
‡ Age-standardized to the hospitalized population involving ruptured AAA, 1983/84 to 1993/94 combined
§ Annualized rate over 11 years

Elective surgery

Among those admitted to hospital, women are less likely than men to receive elective AAA surgery (Chart 2). From 1983/84 to 1993/94, the annualized age-standardized elective surgery rate for women was 34 per 100 hospitalizations. For men, the rate was higher at 42 per 100 hospitalizations (Table 1). This gender difference in elective surgery rates persists across all age groups (Chart 3).

Emergency surgery

Similarly, women admitted to hospital with a ruptured AAA are less likely than male inpatients to receive emergency surgery (Chart 2). From 1983/84 to 1993/94, women's emergency surgery rates fluctuated around 50 per 100 hospitalizations, excluding a substantial dip from 1984/85 to 1987/88. (This temporary decline at the national level was the result of unexplained lower rates for women in the Atlantic region, Quebec, and Ontario.) Men's surgery rates centred around 60 per 100 hospitalizations. Lower emergency AAA surgery rates for women were evident across all age groups.

Explaining the differences

If multiple AAA hospitalizations during one year were more common for women than men, this could decrease elective surgery rates for women relative to men. This appears not to be the case. Crude rates based on patient-linked hospital morbidity data for 1992/93 and 1993/94 show similar rates of multiple AAA hospitalizations for women and men. Of the persons with at least one hospital stay involving an AAA diagnosis, 15% of the women and 16% of the men had more than one stay involving AAA. Multiple hospitalizations are not an issue with ruptured AAAs and thus, cannot explain gender differences in emergency surgery rates.

Patients are able to affect the decision to operate. In two recent studies, one involving cardiac defibrillator implantation and the other involving cardiac transplant, women showed a significantly lower rate of acceptance of surgical therapy than did men.[27,28] However, it seems unlikely that differential acceptance rates could explain the AAA surgery rate differences, especially those for emergency surgery.

As has been previously suggested, gender bias may contribute to differences in AAA surgery rates. This article examines that possibility by considering three hypotheses:

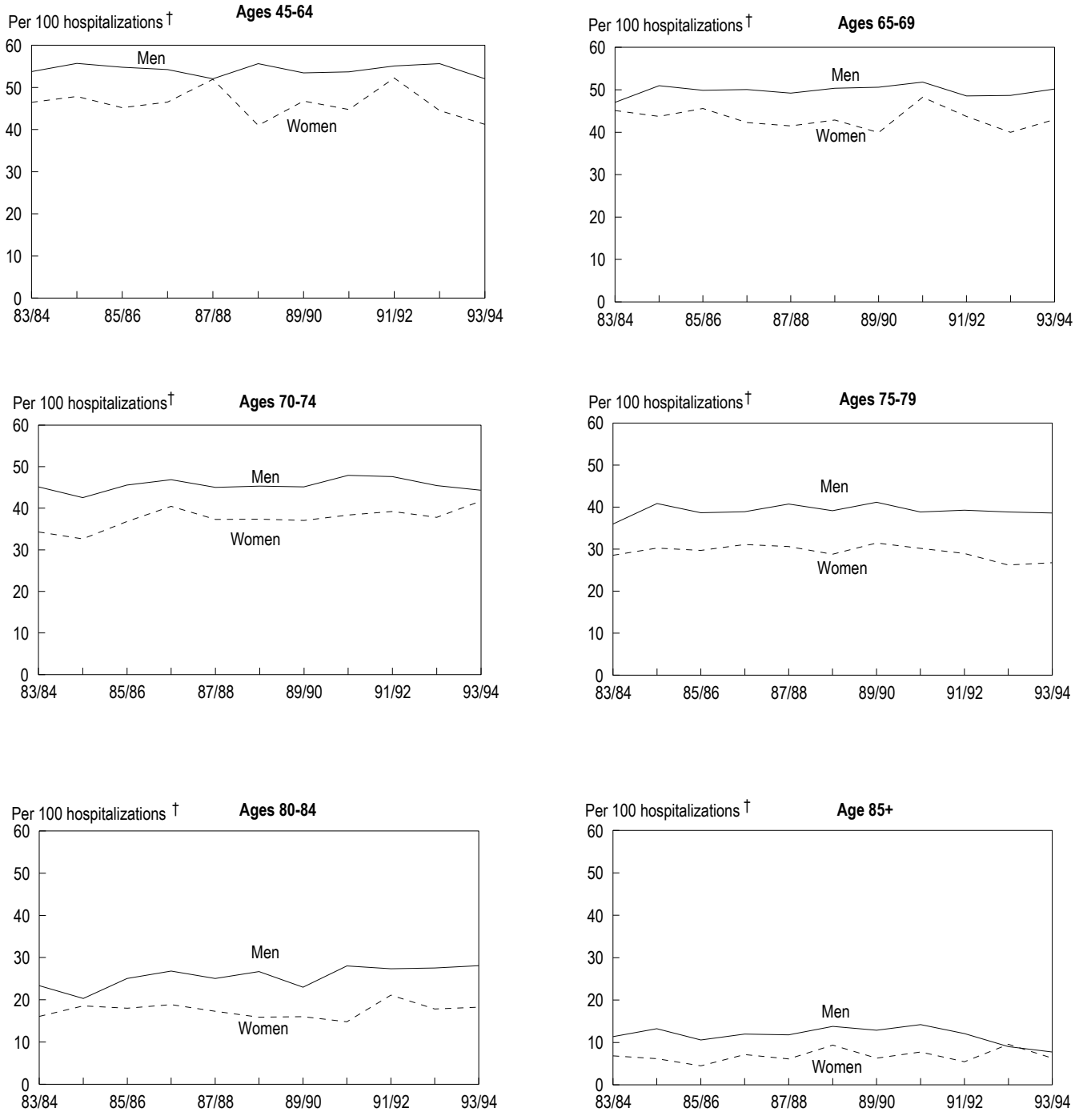
- the criteria used to make the decisions to operate were equally valid for women and men;
- the medical conditions of female and male AAA inpatients were similar with respect to contraindications for surgery;
- the decisions to operate, which were based on both the criteria for surgery and the medical conditions of AAA inpatients, were unbiased.

Surgery rates could be expected to be approximately the same for women and men if all three hypotheses were true.

Criteria for surgery

The criteria used to determine if surgery for a non-ruptured AAA is indicated may depend on several factors: the size of the AAA, either in absolute terms or relative to the normal infrarenal aorta; the rate of expansion of the aneurysm; and contraindications for surgery. In 1992, an expert committee recommended indications for AAA surgery (see *Surgical guidelines*).[29] These and previous recommendations do not explicitly consider the sex of the patient, although the aorta of a woman is generally smaller than that of a man.[30] While the use of relative AAA size as a criterion (for example, more than twice the diameter of the normal infrarenal aorta) would adjust for natural size differences between women and men, measures of absolute size (for example, greater than 4 cm in diameter) are the standard approach in research and clinical practice.[30] However, one study reported that criteria involving the absolute size of the AAA have sometimes been applied differentially by sex, with surgery being performed at a smaller AAA size for women.[31]

Chart 3
Age-sex-specific elective AAA surgery rates, Canada, 1983/84 to 1993/94



Data source: *Hospital Morbidity File*
† Involving non-ruptured AAAs

In a woman and a man of the same age, each with a non-ruptured AAA, the aneurysm in the woman is likely to be smaller, because women's aortas are generally smaller, and women who develop an AAA tend to do so later in life than men. It is possible that AAA size differences could explain some of the differences in age-specific elective surgery rates. However, differences in age of onset cannot explain them, as elective surgery rates are lower not just for women in the same age group as men, but also for women in older age groups (Table 2 and Chart 3). In the case of a ruptured AAA, size differences are irrelevant and cannot explain gender differences in age-specific emergency surgery rates.

Surgical guidelines

A sub-committee of the Joint Council of the Society for Vascular Surgery and the North American Chapter of the International Society for Cardiovascular Surgery specified as indications for elective surgery that the AAA be greater than 4 cm in diameter, or more than twice the diameter of the normal infrarenal aorta.[29] A six-month expansion rate of 0.5 cm or more was identified as a supplementary indication.

For aneurysms between 4 and 5 cm, these guidelines specify a variety of comorbid conditions that may justify not offering AAA repair: myocardial infarction in the previous six months, intractable congestive heart failure, severe angina pectoris, severe kidney dysfunction, decreased mental acuity, and markedly advanced age. Cerebrovascular disease and severe pulmonary insufficiency have also been documented as additional operative risk factors.[32-34] For aneurysms exceeding 5 cm, the guidelines indicate that the medical comorbid condition must be considerably worse to preclude elective surgery (that is, life expectancy of less than two years, overwhelming medical problems, or the expectation of an unacceptable quality of life).

For a ruptured AAA, surgery is generally offered unless there are significant comorbid conditions that would limit the patient's life span or quality of life. "Most vascular surgeons recommend repair for all symptomatic or ruptured AAA ... in the absence of overwhelming contraindications."[35]

Although there is general agreement that a diagnosed or suspected rupture is sufficient indication for emergency surgery, there is disagreement about the contraindications. The sub-committee listed only preterminal conditions that preclude long-term survival (for example, cancer), and conditions relating to quality of life that make repair unreasonable (for example, dementia).

Medical condition of AAA inpatients

If female inpatients, compared with male inpatients, had more accompanying conditions or illnesses that preclude AAA surgery, this might also explain some of the gender differences in surgery rates.

From prior research, seven diagnoses were chosen that may contraindicate elective AAA surgery (Table 3).[29-32,35] As expected, rates of elective AAA surgery were lower when one or more of these conditions were present. Hospitalized women with a non-ruptured AAA were somewhat more likely than men to have one or more of these conditions. At least one of the seven occurred among 26% of the women, compared with 23% of the men. However, among patients free of all these comorbid conditions, elective surgery rates were still lower for women (Table 2).

From hospital records, 19 diagnoses were identified that might have been considered contraindications for emergency surgery (Table 4). For each of these potential contraindications, a majority of hospital patients with a ruptured AAA and that accompanying diagnosis did not receive emergency surgery. Women with a ruptured AAA were slightly more likely than men to have one or more of the identified comorbid conditions. At least one of these diagnoses appeared on 52% of the records for women, compared with 50% of the records for men. But even among patients with none of these conditions, lower emergency surgery rates persisted for women (Table 2).

Thus, although female AAA patients do appear to be more likely to have accompanying illnesses that may contraindicate surgery, the differences in the prevalences of these conditions among AAA inpatients are appreciably smaller than the gender differences in surgery rates.

It is also possible that gender differences in the severity of comorbid conditions (which cannot be determined from the available data) could explain some of the gender differences in AAA surgery rates. But in light of the persistence of

gender differences in both elective and emergency surgery rates for patients with none of these comorbid conditions, gender bias cannot be ruled out.

Is gender bias involved?

Studies in other countries have found gender differences in the decision to operate for AAA. Also, a recent study by Johnston, reporting for the Canadian Vascular Surgery Aneurysm Study Group, argued that evidence in the literature suggests a gender bias in the diagnosis of AAA and/or patient selection for AAA surgical treatment.[7] The proportions of women in surgical series for repair of non-ruptured and ruptured AAA were generally less than the proportions of women having AAA who were identified in autopsy studies, ultrasound studies, hospital discharge data and national mortality data. Two possible explanations were provided: the difference may reflect a gender bias, and for women, the prevalence of AAA is highest among the elderly, who may not be considered for repair due to their age and/or comorbid conditions.

Concluding remarks

The data strongly confirm differences between AAA surgery rates for women and men. Women have substantially lower elective and emergency AAA surgery rates, and these differences persist in all age groups and throughout the 11-year period of analysis. In attempting to account for these differences, this study could not rule out the possibility of gender bias.

Reasons suggested for the apparent tendency to be less aggressive in treating women with an AAA as opposed to men include: the perception that the disease is more benign in women; that

Table 2
AAA surgery rates, by presence of accompanying diagnoses, age group and sex, Canada, 1983/84 to 1993/94

	One or more accompanying diagnoses present			None of accompanying diagnoses present		
	Age group			Age group		
	45-64	65-79	80+	45-64	65-79	80+
	Per 100 hospitalizations					
Elective surgery†						
Men	37	31	14	58	49	24
Women	28	22	7	51	41	15
Emergency surgery‡						
Men	66	60	43	75	67	48
Women	43	45	27	63	56	36

Data source: *Hospital Morbidity File*
† See diagnoses listed in Table 3; rate per 100 non-ruptured AAA inpatients
‡ See diagnoses listed in Table 4; rate per 100 ruptured AAA inpatients

Table 3
Selected accompanying diagnoses that may contraindicate elective AAA surgery

Diagnosis	ICD-9 code
Senility, other cerebral degenerations	290,331
Myocardial infarction	410-412
Angina pectoris	413
Diseases of pulmonary circulation	415-417
Heart failure	428
Cerebrovascular disease	430-438
Renal failure and disorders resulting from renal dysfunction	584-588

Table 4
Selected accompanying diagnoses that may contraindicate emergency AAA surgery

Diagnosis†	ICD-9 code
Malignant neoplasms	140-208
Disorders of fluid, electrolyte and acid-base balance	276
Obesity and other hyperalimentation	278
Other and unspecified anemias	285
Hypertensive heart disease	402
Acute myocardial infarction	410
Old myocardial infarction	412
Other forms of chronic ischaemic heart disease	414
Cardiac dysrhythmias	427
Heart failure	428
Late effects of cerebrovascular disease	438
Atherosclerosis	440
Other peripheral vascular disease	443
Other disorders of circulatory system	459
Pneumonia, organism unspecified	486
Emphysema	492
Chronic airways obstruction, not elsewhere classified	496
Pleurisy	511
Chronic renal failure	585

Data source: *Hospital Morbidity File*
† Majority of inpatients with ruptured AAA accompanied by the diagnosis did not have surgery

intervention is more hazardous in women; and that AAA is mostly a disease of men.[15] Whatever the reason, a lower likelihood of referral of women for elective AAA surgery could increase their likelihood of death from a ruptured AAA.

References

1 Statistics Canada. *Causes of Death, 1993* (Catalogue 84-208) Ottawa: Minister of Industry, 1995.

2 Statistics Canada. *Hospital Morbidity and Surgical Procedures 1993-94* (Catalogue 82-216-XPB) Ottawa: Minister of Industry, 1995.

3 World Health Organization. *International Classification of Diseases*. 1975 rev. Geneva: World Health Organization, 1977.

4 Statistics Canada. *Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures* (Catalogue 82-562E) Ottawa: Minister of Industry, 1992.

5 Statistics Canada. *Health Reports: Hospital Morbidity 1988-89* (Catalogue 82-003S1) Ottawa: Minister of Industry, Science and Technology, 1991.

6 Statistics Canada. *Health Reports: Surgical Procedures and Treatments 1988-89* (Catalogue 82-003S2) Ottawa: Minister of Industry, Science and Technology, 1991.

7 Johnston KW. Influence of sex on the results of abdominal aortic aneurysm repair. *Journal of Vascular Surgery* 1994; 20(6): 914-26.

8 Poulias GE, Doundoulakis N, Skoutas B, et al. Abdominal aneurysmectomy and determinants of improved results and late survival: Surgical considerations in 672 operations and 1-15 year follow-up. *The Journal of Cardiovascular Surgery* 1994; 35(2): 115-21.

9 Nasim A, Sayers RD, Thompson MM, et al. Trends in abdominal aortic aneurysms: A 13-year review. *European Journal of Vascular and Endovascular Surgery* 1995; 9(2): 239-43.

10 Samy AK, Whyte B, MacBain G. Abdominal aortic aneurysm in Scotland. *British Journal of Surgery* 1994; 81(2): 1104-6.

11 Johansson G, Swedenborg J. Ruptured abdominal aortic aneurysms: A study of incidence and mortality. *British Journal of Surgery* 1986; 73(2): 101-3.

12 Thomas PRS, Stewart RD. Mortality of abdominal aortic aneurysm. *British Journal of Surgery* 1988; 75(8): 733-6.

13 Castleden WM, Mercer JC, Members of the West Australian Vascular Service. Abdominal aortic aneurysms in Western Australia: Descriptive epidemiology and patterns of rupture. *British Journal of Surgery*. 1985; 72(2): 109-12.

14 Naylor AR, Webb J, Fowkes FGR, et al. Trends in abdominal aortic aneurysm surgery in Scotland (1971-1984). *European Journal of Vascular Surgery* 1988; 2: 217-21.

15 Katz DJ, Stanley JC, Zelenock GB. Gender differences in abdominal aortic aneurysm prevalence, treatment, and outcome. *Journal of Vascular Surgery* 1997; 25(3): 561-8.

16 Khan SS, Nessim S, Gray R, et al. Increased mortality of women in coronary artery bypass surgery: Evidence for referral bias. *Annals of Internal Medicine* 1990; 112(8): 561-7.

17 Rybicki BA, Johnson CC, Gorell JM. Demographic differences in referral rates to neurologists of patients with suspected Parkinson's disease: Implications for case-control study design. *Neuroepidemiology* 1995; 14(2): 72-81.

18 Tobin JN, Wassertheil-Smoller S, Wexler JP, et al. Sex bias in considering coronary bypass surgery. *Annals of Internal Medicine* 1987; 107(1): 19-25.

19 Maynard C, Litwin PE, Martin JS, et al. Gender differences in the treatment and outcome of acute myocardial infarction. *Archives of Internal Medicine* 1992; 152: 972-6.

20 Kostis JB, Wilson AC, O'Dowd K, et al. Sex differences in the management and long-term outcome of acute myocardial infarction. *Circulation* 1994; 90(4): 1715-30.

21 Bergelson BA, Tommaso CL. Gender differences in clinical evaluation and triage in coronary artery disease. *Chest* 1995; 108(6): 1510-3.

22 Beebe HG, Scissons RP, Salles-Cunha SX, et al. Gender bias in use of venous ultrasonography for diagnosis of deep venous thrombosis. *Journal of Vascular Surgery* 1995; 22(5): 538-42.

23 Giles WH, Anda RF, Casper ML, et al. Race and sex differences in rates of invasive cardiac procedures in U.S. hospitals. *Archives of Internal Medicine* 1995; 155: 318-24.

24 Pleumeekers HJCM, Hoes AW, van-der-Does E, et al. Aneurysms of the abdominal aorta in older adults: The Rotterdam study. *American Journal of Epidemiology* 1995; 142(12): 1291-9.

25 Scott RAP, Wilson NM, Ashton HA, et al. Influence of screening on the incidence of ruptured abdominal aortic aneurysm: 5-year results of a randomized controlled study. *British Journal of Surgery* 1995; 82(8): 1066-70.

26 Millar WJ, Cole CW, Hill GB. Trends in mortality and hospital morbidity due to abdominal aortic aneurysms. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 19-27.

27 Horton HL, Marinchak RA, Rials SJ, et al. Gender differences in device therapy for malignant ventricular arrhythmias. *Archives of Internal Medicine* 1995; 155(21): 2342-5.

28 Aaronson KD, Schwartz JS, Goin JE, et al. Sex differences in patient acceptance of cardiac transplant candidacy. *Circulation* 1995; 91(11): 2753-61.

29 Hollier LH, Taylor LM. Ochsner J. Recommended indications for operative treatment of abdominal aortic aneurysms: Report of a subcommittee of the Joint Council of the Society for Vascular Surgery and the North American Chapter of the International Society for Cardiovascular Surgery. *Journal of Vascular Surgery* 1992; 15(6): 1046-56.

30 Ballard DJ, Etchason JA, Lee HH, et al. *Abdominal Aortic Aneurysm Surgery: A Literature Review and Ratings of Appropriateness and Necessity*. Santa Monica, California: RAND, 1992.

31 Starr JE, Hertzer NR, Mascha EJ, et al. Influence of gender on cardiac risk and survival in patients with infrarenal aortic aneurysms. *Journal of Vascular Surgery* 1996; 23(5): 870-80.

32 Hallett JW Jr., Bower TC, Cherry KJ, et al. Selection and preparation of high-risk patients for repair of abdominal aortic aneurysms. *Mayo Clinic Proceedings* 1994; 69(8): 763-8.

33 Aune S, Amundsen SR, Evjensvold J, et al. Operative mortality and long-term relative survival of patients operated on for asymptomatic abdominal aortic aneurysm. *European Journal of Vascular Endovascular Surgery* 1995; 9(3): 293-8.

34 Steyerberg EW, Kievit J, de Mol Van Otterloo JC, et al. Perioperative mortality of elective abdominal aortic aneurysm surgery: A clinical prediction rule based on literature and individual patient data. *Archives of Internal Medicine* 1995; 155(8): 1998-2004.

35 Ernst CB. Abdominal aortic aneurysm. *The New England Journal of Medicine* 1993; 328(16): 1167-72.