

Comorbidity associated with atrial fibrillation: a general practice-based study

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SUMMARY

Background: Atrial fibrillation is an important risk factor for ischaemic stroke. Anticoagulation treatment with warfarin can substantially reduce the risk of stroke in people with atrial fibrillation but concerns about their side-effects have limited their use in clinical practice. However, there has been little population-based research on the comorbidity associated with atrial fibrillation and on the prevalence of potential contraindications to anticoagulation treatment among these patients.

Aim: To determine the prevalence of known risk factors for ischaemic stroke and possible contraindications to anticoagulant treatment among patients with atrial fibrillation.

Method: One-year prospective cohort study in 60 general practices in England and Wales with a total population of 502 493 people. Age and sex specific prevalence rates and relative risks of risk factors for ischaemic stroke and possible contraindications to antithrombotic treatment were calculated.

Results: The number of patients who had a diagnosis of atrial fibrillation during the year was 1414 (0.3%) patients. The prevalence of other risk factors for ischaemic stroke in patients with atrial fibrillation increased with age in men, from 48% (relative risk [RR] = 3.78, 95% confidence interval [95% CI] = 3.23–4.41) at 45 to 64 years to 64% (RR = 2.21, 95% CI = 2.00–2.44) at 75 years and over. A similar increase of 50% (RR = 4.36, 95% CI = 3.54–5.38) to 60% (RR = 2.07, 95% CI = 1.91–2.23) was seen in women. The percentage of men with atrial fibrillation with at least one contraindication to antithrombotic treatment was 5% at 45 to 64 years and 14% at 75 years and over. Among women with atrial fibrillation, 7% had a contraindication at 45 to 64 years and 16% at 75 years and over. The all-ages relative risk of a contraindication was 1.17 (95% CI = 0.92–1.48) in men and 1.53 (95% CI = 1.28–1.83) in women. Forty per cent (575) of patients with atrial fibrillation had at least one risk factor for ischaemic stroke and no contraindications to antithrombotic treatment.

Conclusion: Atrial fibrillation is associated with a substantial increase in the prevalence of risk factors for ischaemic stroke. By contrast, potential contraindications for antithrombotic treatment are more evenly distributed among patients with and without atrial fibrillation. Around 40% of patients with atrial fibrillation in primary care are at high risk of stroke and have no contraindications for antithrombotic treatment.

Keywords: atrial fibrillation; ischaemic stroke; anticoagulant; contraindications.

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Introduction

ATRIAL fibrillation is an important risk factor for stroke, increasing the risk by three to seven-fold in patients with non-valvular atrial fibrillation.^{1–4} The annual risk of stroke in people with atrial fibrillation is around 4% to 8%.⁵ The risk and severity of stroke associated with atrial fibrillation is increased considerably by the presence of comorbidity.^{4,6–8} Furthermore, elderly patients with atrial fibrillation who suffer strokes are more severely disabled and more likely to die than patients without atrial fibrillation.⁹ Because the prevalence of atrial fibrillation increases with age, the proportion of strokes attributable to atrial fibrillation also increases with age, rising from around 1% to 2% for those aged of 50 to 59 years to about 24% for those aged 80 to 89 years. Hence, as the population of the United Kingdom (UK) ages, the public health importance of atrial fibrillation as a cause of stroke, and subsequent death and disability, will increase.

Anticoagulant treatment with warfarin reduces the rate of ischaemic stroke in people with atrial fibrillation by up to 68%.^{6–8,10–14} The major risk associated with the use of warfarin is that of bleeding; fear of this has limited the use of anticoagulation in general practice. In one large trial, major bleeding episodes occurred with an overall frequency of 2.3% each year when receiving warfarin and 1.1% each year when receiving aspirin.¹⁵ This trial confirmed that the risk of bleeding was strongly age related, with major bleeds occurring in 1.7% of those aged under 75 years and 4.2% of older patients. The risk of intracranial bleeding was 0.6% and 1.8% respectively and, among the elderly, 70% of intracranial bleeds were fatal.

Despite its importance, only three studies, all with limitations, have examined the comorbidity associated with atrial fibrillation. One study carried out in the USA used the population registered with a health maintenance organisation in California and thus excluded patients from deprived socioeconomic groups.¹⁶ A second study carried out in Holland examined a limited number of comorbidities.¹⁷ A third study carried out in the UK was based on a relatively small number of patients with atrial fibrillation and did compare the prevalence of comorbidity with that in people without atrial fibrillation.¹⁸

To address the lack of information on the comorbidity associated with atrial fibrillation we carried out an analysis of data from the Fourth National Study of Morbidity Statistics from General Practice.¹⁹ The objectives were, to determine: (a) the prevalence and relative risks of other known risk factors for ischaemic stroke in patients with atrial fibrillation, compared with those without atrial fibrillation; and (b) the proportion of patients with possible contraindications for anticoagulant treatment and thus estimate the proportion of patients with atrial fibrillation eligible for anticoagulation treatment.

HOW THIS FITS IN*What do we know?*

Although atrial fibrillation is an important risk factor for ischaemic stroke, relatively little is known about the comorbidity associated with it.

What does this paper add?

In a large unselected group of patients, risk factors for ischaemic stroke increased with age and were more common in patients with atrial fibrillation. Potential contraindications to anticoagulation were also age related, but their prevalence was similar in patients with and without atrial fibrillation. About 40% of all patients with atrial fibrillation had at least one other risk factor for ischaemic stroke but no recorded contraindications to anticoagulation.

**Method**

The Fourth National Morbidity Survey was a one-year prospective cohort study of 502 493 patients registered with 60 general practices in England and Wales.¹⁹ The main objective of the survey was to examine the workload and pattern of disease in general practice in relation to the age, sex, and socioeconomic status of patients. Sixty general practices in England and Wales took part in the survey. The study population comprised a 1% sample of the population. The sample was representative of the population of England and Wales for characteristics such as age, sex, social class, and housing tenure; however, because relatively few practices from inner cities participated, there was some under-representation of ethnic minority groups and people living alone.

Recording of data

Before the survey started, doctors and staff from each practice attended three two-day training sessions on the recording of morbidity data. Practices then collected data for two to four weeks before the start of the survey. These data were analysed and any errors or inconsistencies reported to the practices. Once the morbidity survey started, general practitioners (GPs) and nurses recorded information on all face-to-face contacts with patients. Each reason for consulting and the place of contact was directly entered into patient records on the practice computer. Every consultation was given a diagnostic Read code and the data were then transferred on disk to the Office of Population Censuses and Surveys where an International Classification of Diseases (Ninth Revision) (ICD-9) code was assigned.

Validation

After the end of the survey, manual practice records were used to identify all patients seen either in the surgery or elsewhere by the 60 practices on four different days. Of the 28 000 patients seen on these four days, 96% of contacts with doctors in the surgery and 95% at home had been recorded in the data submitted by the practices. Finally, for a random sample of 999 patients, diagnostic data from paper records was compared with the electronic data submitted by the practices. This showed that 93% of diagnoses

had been recorded correctly.

Prevalence of atrial fibrillation and comorbidities

We defined the annual period prevalence of atrial fibrillation as the number of people who consulted at least once for this condition during the study year, divided by the total number of patients. The data were stratified by age and sex, and age and sex-specific prevalence rates and directly age-standardised rates were calculated. Comorbidities were divided into two groups. One group contained potential risk factors for ischaemic stroke identified in previous studies (Box 1).^{2,4} The second group contained a range of comorbidities (possible contraindications) that have been associated with an increased risk of bleeding in previous studies (Box 2).^{16,18}

Statistical analysis

Relative risks with 95% confidence intervals (CI) for each comorbidity in patients with and without atrial fibrillation were calculated for each age group by sex. Summary relative risks that were adjusted for age, with 95% CIs were then calculated for each comorbidity. All statistical analyses were performed using Stata.²⁰

Results

The overall prevalence of atrial fibrillation was 2.9 per 1000 (1414/502 493), and was slightly higher in women than men (Table 1). After age standardisation the reverse was true (age-adjusted rate = 2.7 per 1000 in men, versus 2.0 per 1000 in women). Over 98% of all cases of atrial fibrillation occurred in patients aged 45 years and over; all subsequent analyses are therefore restricted to this age group.

Risk factors

The prevalence of possible risk factors for ischaemic stroke is shown in Tables 2 and 3. In men, with the exception of diabetes, all the risk factors were significantly more common in

ICD-9 codes	Disorders
250	Diabetes mellitus
401-405	Hypertension
410-414, 4293	Ischaemic heart disease
428	Heart failure
430-434, 436-437	Stroke
435	Transient ischaemic attack
444, 557	Arterial thromboembolism

Box 1. Risk factors for stroke (in addition to atrial fibrillation).

ICD-9 codes	Disorders
140-208	Malignant neoplasms
286-287	Coagulation defects and haemorrhagic conditions
046, 290-294, 298	Psychoses and dementias, and alcoholic and other psychoses
331-332	Other cerebral degenerative disorders and Parkinson's disease
345	Epilepsy
531-533	Peptic ulceration
5780, 5781, 5789, 5997	Gastrointestinal bleed and haematuria
571	Chronic hepatitis and cirrhosis
584-586	Acute or chronic renal failure

Box 2. Possible contraindications for antithrombotic treatment.

Table 1. Age and sex-specific prevalence of atrial fibrillation per 1000.

Age group (years)	Men		Women	
	n	Rate	n	Rate
Up to 44	22	0.1	7	0
45-64	174	3.4	88	1.7
65-74	226	13	195	9
75+	244	22	487	23
All ages	666	2.7	777	3.0

those who had atrial fibrillation; in absolute terms, heart failure, ischaemic heart disease, and hypertension were the most common risk factors. In women, with the exception of hypertension, all the risk factors were significantly more common in those who had atrial fibrillation. The proportion of patients with any of the risk factors increased with age in both men and women. In general, prevalence rates increased with age more rapidly in people without atrial fibrillation; hence, relative risks were highest in the youngest age group, those aged 45 to 64 years. The overall age-adjusted prevalence for any risk factor for ischaemic stroke (defined as all diagnoses in Tables 2 and 3) was over twice

as high in people with atrial fibrillation as in those without atrial fibrillation.

Possible contraindications to anticoagulants

The prevalence of possible contraindications to anticoagulant treatment is shown in Tables 4 and 5. In men, the most common possible contraindications were malignancies, psychoses, dementias, and neurodegenerative disorders. None of the individual contraindications were significantly more common in men who had atrial fibrillation, nor was the overall prevalence of these disorders (age-adjusted relative risk = 1.17, 95% CI = 0.92-1.48). In women, a few contraindications were significantly more common in those who had atrial fibrillation, including psychoses and dementias, malignancies, epilepsy, and chronic liver disease. In contrast to men, the overall prevalence of possible contraindications was significantly increased in women with atrial fibrillation (age-adjusted relative risk = 1.53, 95% CI = 1.28-1.83). The percentage of men with at least one contraindication present increased from 5.2% among 45 to 64-year-olds, to 13.9% among 75-year-olds and over. In women, the prevalence of at least one contraindication increased from 6.8% to 16%.

Table 2. Men: age group-specific prevalence rates (%) with age-specific and age-standardised relative risks.

Risk factor	45-64 years			65-74 years			>74 years			All ages Standardised RR
	With AF (n = 174)	No AF (n = 51 505)	RR	With AF (n = 226)	No AF (n = 17 575)	RR	With AF (n = 244)	No AF (n = 11 009)	RR	
Ischaemic heart disease	17.2	3.8	4.45 ^a	22.6	8.7	2.56 ^a	20.9	8.2	2.50 ^a	2.65 ^a
Heart failure	13.8	0.4	33.47 ^a	21.7	2.8	7.47 ^a	30.7	8.1	3.74 ^a	5.36 ^a
Hypertension	18.4	7.3	2.46 ^a	19.5	14.2	1.35	14.7	9.4	1.54 ^a	1.54 ^a
Diabetes mellitus	3.5	2.1	1.62	5.7	4.1	1.38	4.5	4.2	1.06	1.21
Strokes	4.0	0.5	8.59 ^a	4.9	1.5	3.19 ^a	8.6	2.9	2.94 ^a	3.42 ^a
Transient ischaemic attack	0.6	0.2	2.41	5.3	1.2	4.54 ^a	4.5	2.7	1.62	2.38 ^a
Arterial thromboembolism	0.0	0.0	-	0.0	0.1	-	0.8	0.1	9.84 ^a	4.95 ^a
Any risk factor for ischaemic stroke	48.3	12.8	3.78 ^a	58.9	27.4	2.14 ^a	63.9	28.8	2.21 ^a	2.41 ^a

^aStatistically significant at $P < 0.05$. AF = atrial fibrillation. RR = relative risk. Note that confidence intervals for relative risks have been removed for clarity of presentation.

Table 3. Women: age-group specific prevalence rates (%) with crude relative risks and age-standardised relative risks.

Risk factor	45-64 years			65-74 years			>74 years			All ages Standardised RR
	With AF (n = 88)	No AF (n = 50 559)	RR	With AF (n = 195)	No AF (n = 21 590)	RR	With AF (n = 487)	No AF (n = 20 658)	RR	
Ischaemic heart disease	7.9	1.7	4.67 ^a	18.5	4.7	3.93 ^a	14.8	5.9	2.49 ^a	2.82 ^a
Heart failure	13.6	0.3	39.85 ^a	21.0	2.1	10.09 ^a	34.5	7.5	4.61 ^a	5.12 ^a
Hypertension	21.6	8.3	2.59 ^a	20.0	17.1	1.17	12.5	12.8	0.98	1.13
Diabetes mellitus	4.6	1.5	3.06 ^a	5.6	3.2	1.74	6.4	3.1	2.06 ^a	1.99 ^a
Strokes	2.3	0.2	10.5 ^a	6.1	1.0	6.38 ^a	7.0	2.7	2.62 ^a	3.19 ^a
Transient ischaemic attack	1.1	0.2	5.63	3.1	0.8	4.03 ^a	5.1	2.1	2.48 ^a	2.59 ^a
Arterial thromboembolism	-	0.01	-	1.0	0.04	27.68 ^a	0.8	0.05	15.43 ^a	16.61 ^a
Any risk factor for ischaemic stroke	50.0	11.5	4.36 ^a	55.9	25.6	2.19 ^a	59.6	28.7	2.07 ^a	2.21 ^a

^aStatistically significant at $P < 0.05$. AF = atrial fibrillation. RR = relative risk. Note that confidence intervals for relative risks have been removed for clarity of presentation.

Table 4. Men: age group-specific prevalence rates (%) with crude relative risks and age-standardised relative risks.

Risk factor	45–64 years			65–74 years			>74 years			All ages Standardised RR
	With AF (n = 174)	No AF (n = 51 505)	RR	With AF (n = 226)	No AF (n = 17 575)	RR	With AF (n = 244)	No AF (n = 11 009)	RR	
Coagulation defects/haemorrhagic conditions	0.6	0.04	13.45	0.0	0.1	–	0.0	0.2	–	1.32
Psychoses and dementias	0.6	0.2	3.52	0.4	0.5	0.98	4.5	2.6	1.72	1.67
Peptic ulceration	1.7	1.1	1.50	2.2	1.3	1.70	0.8	1.1	0.73	1.31
Malignant neoplasms	0.6	0.9	0.64	2.7	3.0	0.88	5.7	5.0	1.14	0.96
Other cerebral degenerative disorders/ Parkinson's disease	0.6	0.6	0.94	1.8	1.4	1.27	1.6	2.2	0.75	0.89
Epilepsy	0.6	0.4	1.49	0.0	0.4	–	0.4	0.4	1.02	0.78
Gastrointestinal bleeds/haematuria	0.0	0.4	–	1.3	0.9	1.42	1.6	1.6	1.02	1.00
Chronic hepatitis and cirrhosis	0.6	0.1	5.69	0.4	0.1	4.32	0.0	0.0	–	3.86
Acute or chronic renal failure	0.6	0.07	8.46 ^a	0.4	0.3	0.69	0.8	0.5	1.70	2.1
Any possible contra-indication present	5.2	3.6	1.44	8.4	7.4	1.13	13.9	12.2	1.13	1.17

^aStatistically significant at $P < 0.05$. AF = atrial fibrillation. RR = relative risk. Note that confidence intervals for relative risks have been removed for clarity of presentation.

Table 5. Women: age group-specific prevalence rates (%) with crude relative risks and age-standardised relative risks.

Contraindication	45–64 years			65–74 years			>74 years			All ages Standardised RR
	With AF (n = 88)	No AF (n = 50 559)	RR	With AF (n = 195)	No AF (n = 21 590)	RR	With AF (n = 487)	No AF (n = 20 658)	RR	
Coagulation defects/haemorrhagic conditions	0.0	0.0	–	0.5	0.15	3.46	0.0	0.1	–	1.19
Psychoses and dementias	1.1	0.1	1.45	1.5	0.5	2.91	5.8	3.5	1.64 ^a	1.76 ^a
Peptic ulceration	1.1	0.6	1.84	0.5	0.7	0.74	0.6	0.8	0.81	0.89
Malignant neoplasms	3.4	1.4	2.37	4.1	2.4	1.69	4.5	3.0	1.48	1.54 ^a
Other cerebral degenerative disorders/ Parkinson's disease	2.3	1.0	2.20	1.5	1.8	0.78	3.3	2.5	1.31	1.19
Epilepsy	0.0	0.4	–	0.5	0.4	1.24	1.2	0.3	3.63 ^a	2.45 ^a
Gastrointestinal bleeds/haematuria	0.0	0.3	–	0.5	0.4	1.26	0.4	0.8	0.49	0.57
Chronic hepatitis and cirrhosis	1.1	0.10	11.72 ^a	1.0	0.08	13.02 ^a	0.2	0.04	5.30	9.36 ^a
Acute or chronic renal failure	0.0	0.06	–	0.0	0.2	–	0.2	0.3	0.67	0.53
Any possible contra-indication present	6.8	3.9	1.74	10.3	6.6	1.55 ^a	16.0	10.6	1.50 ^a	1.53 ^a

^aStatistically significant at $P < 0.05$. AF = atrial fibrillation. RR = relative risk. Note that confidence intervals for relative risks have been removed for clarity of presentation.

Association between risk factors and contra-indications

In total, 575 (40%) of the 1414 patients with atrial fibrillation had at least one risk factor for ischaemic stroke but no contra-indications to anticoagulant treatment (Table 6). A further 92 (6.5%) patients had another risk factor for stroke but also had a contra-indication to anticoagulation treatment. Older patients were more likely to have the combination of a risk factor for stroke and a contra-indication to treatment. Around 53% of patients with atrial fibrillation had no other risk factors

for stroke and so could be considered at low risk of a thromboembolic event.

Discussion

This is the largest population-based study thus far in the UK to examine the comorbidity associated with atrial fibrillation. The unadjusted prevalence of atrial fibrillation in this study was about three per 1000, with a female excess. After age adjustment, prevalence rates were higher in men. Atrial fibrillation was very uncommon in people under 45 years of

Table 6. Number and percentage of patients with atrial fibrillation with one or more risk factors for stroke, stratified by age group and presence of a possible contraindication to anticoagulant treatment.

Other risk factors present	Contraindication present		
	Yes (%)	No (%)	Total
45–64 years			
Yes	6 (6.6)	85 (93.4)	91
No	9 (5.2)	162 (94.8)	171
65–74 years			
Yes	15 (7.5)	178 (92.5)	198
No	24 (10.5)	204 (89.5)	228
75+ years			
Yes	71 (18.5)	312 (81.5)	383
No	41 (11.8)	307 (88.2)	348
All ages (45+ years)			
Yes	92 (13.8)	575 (86.2)	667
No	74 (9.9)	673 (90.1)	747

age. Prevalence rates then increased substantially with age in both sexes.

We found that the disorders most commonly associated with atrial fibrillation were ischaemic heart disease, heart failure, and hypertension. All known risk factors for stroke, with the exception of diabetes in men and hypertension in women, were significantly associated with atrial fibrillation. In patients with atrial fibrillation aged 45 to 64 years, 35% had at least one other risk factor for ischaemic stroke, increasing to around 53% in people aged 75 years and over. None of the possible contraindications to anticoagulant treatment were significantly more common in men with atrial fibrillation. In women, psychoses and dementias, epilepsy, malignant neoplasms, and chronic liver disease were significantly associated with atrial fibrillation. The prevalence of contraindications increased from around 6% at age 45 to 64 years, to 15% at 75 years and over.

Strengths and weaknesses of study

The strengths of this study are that it was population-based, the patients were followed up for one year, and there was good recording of morbidity data. The morbidity survey involved 60 practices with a total list size of over 500 000 patients drawn throughout England and Wales. The population is therefore large enough to demonstrate clinically important differences between patients with and without atrial fibrillation. The data collection and validation procedures employed during the morbidity survey were rigorous. A review of a sample of patient records found an accuracy of over 90% in diagnostic coding.¹⁹

A potential weakness of the study is that there is no information available on the criteria upon which GPs based their diagnoses. Given the size of the population studied and the number of GPs involved, the effect of misclassifications is likely to be random rather than systematic and the validity of the results should not be affected. A second limitation is that the morbidity survey relied on diagnoses recorded at the time of a contact between the patient and either the GP or another member of the primary care team. Hence, patients with atrial fibrillation or other disorders who did not consult during the survey period would not have been identified.

However, it is unlikely that this would have been a significant source of bias, since most patients with chronic conditions would be expected to consult at least once a year and GPs were encouraged by the survey protocol to record all appropriate diagnoses at each contact. Finally, atrial fibrillation is most common among the elderly and in people aged 75 years and over; 12% did not consult during the period of the survey. Consequently, there is no diagnostic information on these patients.

Comparison with previous studies

The prevalence of atrial fibrillation found in this study was lower than has been reported in some other investigations. Prevalence rates of 3% to 6% have been reported in over 65-year-olds in North American and European studies.^{18,21–23} In our study, the prevalence in this age group was 1.7%. Most previous studies have actively sought cases, either by the review of medical notes or by some form of screening accompanied by an electrocardiograph (ECG). Studies that actively screen for patients generally report the highest prevalence rates, because many patients with atrial fibrillation are asymptomatic. In the Cardiovascular Heart Study,²¹ 12% of the cases were first identified by ECG screening. Similarly, Wheeldon *et al*²² found that of 65 elderly patients with atrial fibrillation, five (8%) were first identified by ECG screening. The lower prevalence of atrial fibrillation in our study may, in part, be a consequence of the failure to detect asymptomatic cases. Furthermore, the Fourth National Morbidity Survey was conducted in 1991/1992, before the role of anticoagulation in the prevention of stroke in patients with non-valvular atrial fibrillation was fully appreciated. This may have contributed to lower recording rates of atrial fibrillation during the period of the survey. However, most other studies involved relatively small samples and may not have been representative of the general population.

The association between risk factors for stroke and atrial fibrillation is consistent with results from smaller studies that used selected samples.^{4,17} Sudlow *et al*¹⁸ found that in a sample of 228 elderly patients with atrial fibrillation, 66% of women and 60% of men over 74 years of age had at least one other risk factor for stroke, compared with 60% and 62% respectively found in our own study. Among 65 to 74-year-olds, they found that 47% of women and 66% of men had at least one risk factor, compared with 56% and 59% respectively in our study. Our results confirm that patients with atrial fibrillation are more likely to have additional risk factors for stroke than patients without atrial fibrillation and that this risk is strongly related to age. Our study also quantifies the strength of these associations.

We tried to estimate the prevalence of disorders that are potential contraindications to the use of anticoagulants. Because there is no clear evidence about which disorders should be considered to be contraindications to antithrombotic treatment, we adapted the exclusion criteria used in the SPAF trials.⁶ We selected groups of diagnoses that might be associated with an increased risk of bleeding if patients with them were taking antithrombotics. With the exception of psychoses and dementia, epilepsy, malignant neoplasms, and chronic liver disease in women, we found no significant associations with atrial fibrillation.

Implications for clinicians and policy makers

This study has shown in an unselected population that patients with atrial fibrillation are much more likely to have additional risk factors for ischaemic stroke than individuals without atrial fibrillation. The principal risk factors identified in previous studies (in addition to age) are a history of a transient ischaemic attack, stroke, arterial thromboembolism, heart failure, hypertension, and diabetes.^{2,4} Overall, 40% of patients with atrial fibrillation had additional risk factors for ischaemic stroke and no contraindications for anticoagulation. This compares with 40% to 60% of patients in the study performed by Sudlow *et al.*¹⁸ In a cross-sectional study carried out in a US health maintenance organisation, of 13 428 patients with atrial fibrillation, 65% had at least one risk factor for stroke, and 17% had one or more contraindications to anticoagulation.¹⁶ Again, these findings are similar to our own. In the UK study¹⁸ 23% of patients with atrial fibrillation (around 50% of those eligible for anticoagulation) were receiving warfarin. In the US study 45% of patients with atrial fibrillation (55% of those eligible for anticoagulation) had evidence of treatment with warfarin. In our study we were unable to determine the proportion of eligible patients treated with warfarin because information about treatment had not been collected during the survey.

Conclusions

We have provided information on the prevalence of comorbidities in patients with and without atrial fibrillation from a large, unselected UK-based cohort of patients. Our findings suggest that around 40% of all patients with atrial fibrillation have at least one additional risk factor for ischaemic stroke and no contraindications to anticoagulant treatment.

References

1. Wolf PA, Abbott RD, Kannel WB. Atrial fibrillation as an independent risk factor for stroke: The Framingham study. *Stroke* 1991; **22**: 983-988.
2. Wolf PA, Abbott RD, Kannel WB. Atrial fibrillation: A major contributor to stroke in the elderly. The Framingham Study. *Arch Intern Med* 1987; **147**: 1561-1564.
3. Cerebral Embolism Task Force. Cardiogenic brain embolism: The second report of the Cerebral Embolism Task Force. *Arch Neurol* 1989; **46**: 727-743.
4. Atrial Fibrillation Investigators. Risk factors for stroke and efficacy of antithrombotic treatment in atrial fibrillation: analysis of pooled data from five randomised controlled studies. *Arch Intern Med* 1994; **154**: 1449-1557.
5. Roy D, Marchand E, Gagne P, *et al.* Usefulness of anticoagulant therapy in the prevention of embolic complications of atrial fibrillation. *Am Heart J* 1986; **112**: 1139-1143.
6. Stroke Prevention in Atrial Fibrillation Investigators. Stroke Prevention in Atrial Fibrillation Investigators study: final results. *Circulation* 1991; **84**: 527-539.
7. Stroke Prevention in Atrial Fibrillation Investigators. Warfarin versus aspirin for prevention of thromboembolism in atrial fibrillation: Stroke Prevention in Atrial Fibrillation II study. *Lancet* 1994; **343**: 687-691.
8. Stroke Prevention in Atrial Fibrillation Investigators. Adjusted dose warfarin versus low-intensity fixed-dose warfarin plus aspirin for high-risk patients with atrial fibrillation: Stroke Prevention in Atrial Fibrillation III randomised clinical trial. *Lancet* 1996; **348**: 633-638.
9. Kaarisalo MK, Immonen-Raiha P, Marttila RJ, *et al.* Atrial fibrillation in older stroke patients: association with recurrence and mortality after first ischemic stroke. *J Am Geriatr Soc* 1997; **45**: 1297-1301.
10. Boston Area Anticoagulation Trial for Atrial Fibrillation Investigators. The effect of low-dose warfarin on the risk of stroke in patients with non-rheumatic atrial fibrillation. *N Engl J Med* 1990; **323**: 1505-1511.
11. Petersen P, Boysen G, Godtfredsen J, *et al.* Placebo-controlled, randomised trial of warfarin and aspirin for prevention of thromboembolic complications in chronic atrial fibrillation: the Copenhagen AFASAK Study. *Lancet* 1989; **1(8631)**: 175-179.
12. Connolly SJ, Laupacis A, Gent M, *et al.* Canadian Atrial Fibrillation Anticoagulation (CAFA) study. *J Am Coll Cardiol* 1991; **18**: 349-355.
13. European Atrial Fibrillation Trial Study Group. Secondary prevention in non-rheumatic atrial fibrillation after transient ischaemic attack or minor stroke. *Lancet* 1993; **342**: 1255-1262.
14. Stroke Prevention in Atrial Fibrillation Investigators. A differential effect of aspirin on prevention of stroke in atrial fibrillation. *J Stroke Cerebrovasc Dis* 1993; **3**: 181-188.
15. Stroke Prevention in Atrial Fibrillation Investigators. Bleeding during antithrombotic therapy in patients with atrial fibrillation. The Stroke Prevention in Atrial Fibrillation Investigators. *Arch Intern Med* 1996; **156(4)**: 409-416.
16. Go AS, Hylek EM, Borowsky LH, *et al.* Warfarin use among ambulatory patients with non-valvular atrial fibrillation: The anticoagulation and risk factors in atrial fibrillation (ATRIA) study. *Ann Intern Med* 1999; **131**: 927-934.
17. Langenberg M, Hellemons BSP, van Ree JW, *et al.* Atrial fibrillation in elderly patients: prevalence and comorbidity in general practice. *BMJ* 1996; **313**: 1534.
18. Sudlow M, Thomson R, Thwaites B, *et al.* Prevalence of atrial fibrillation and eligibility for anticoagulants in the community. *Lancet* 1998; **352**: 1167-1171.
19. McCormick A, Fleming D, Charlton J. *Morbidity Statistics from General Practice. Fourth National Study 1991-1992.* Study by the Royal College of General Practitioners, the Office of Population Censuses and Surveys, and the Department of Health. [OPCS Series MB5 No 3.] London: HMSO, 1995.
20. *Stata Version 6.* Stata Corporation: Texas: USA, 1999.
21. Furberg CD, Psaty BM, Manolio TA, *et al.* Prevalence of atrial fibrillation in elderly subjects (the Cardiovascular Health Study). *Am J Cardiol* 1994; **74**: 236-241.
22. Wheeldon NM, Tayler DI, Anagnostou E, *et al.* Screening for atrial fibrillation in primary care. *Heart* 1998; **79**: 50-55.
23. Lip GY, Golding DJ, Nazir M, *et al.* A survey of atrial fibrillation in general practice: the West Birmingham Atrial Fibrillation Project. *Br J Gen Pract* 1997; **47**: 285-289.

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