[Original article]

Prevalence of atrial fibrillation in adults participating in a large-scale voluntary screening programme in Belgium

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Objective Atrial fibrillation (AF) is a common arrhythmia in clinical practice. AF fulfils many of the criteria for a screening programme. No data about the prevalence of AF in non-hospitalized patients are available in Belgium. The aim of the study was to assess feasibility and effectiveness of a nationwide-organized voluntary screening programme in the general population in Belgium.

Methods A total of 13.564 participants were screened, of whom 10,758 were older than 40 years (GSP group). Participants filled in stroke risk stratification questionnaires (CHADS2 and CHA2DS2-VASc). A one-lead electrocardiogram was performed.

Results 228 participants had AF at the time of screening (AF group), with 125 women and 103 men (i.e. 1.9% and 2.6% of total women and men), representing a prevalence of 2.2% (95% CI 1.3% and 3.0%) of the screened population. Age of the AF group was 67 ± 12 y (range 40-87 y). Using the CHADS2-score, 58% of participants with a positive AF screening had a high risk score, and 21% had an intermediate risk score. Using the CHA2DS2-VASc-score, 72% of the participants had a high risk score, and 21% had an intermediate risk score.

Conclusion AF was present in 2.2% of the respondents. At least 60% of AF group had an increased risk for thrombo-embolism. Although substantial methodological issues limit the exact interpretation of these results, the present study shows that a volunatry screening programme with a simple screening protocol is able to detect an important number of patients with previously undetected AF.

Keywords *Atrial fibrillation – voluntary screening – prevalence.*

INTRODUCTION

Atrial fibrillation (AF) is the most common arrhythmia in clinical practice. It accounts for approximately one-third of hospitalizations for cardiac rhythm disturbances. It has been estimated that over 4 million people in the European Union have paroxysmal or persistent AF[1]. AF is an important public health problem because of its increased risk of death and high medical cost (annual cost per patient is approximately €3000) due to a high hospitalization rate, drug treatment, cardiac consultations and technical investigations, etc.[2,3]

The estimated prevalence of AF is 0.4% to 1% in the general population, but increases substantially with age. Prevalence ranges from < 0.5% at age 40-50, 1.2 to 2.8% in persons aged 60 to 69 years and 5-15% in persons above 80 years of age[4-8]. The median age of the patients with AF is 75 years, with about 70% between age 65 and 85. The age-adjusted prevalence of AF is higher in men[4,9,10]. Arterial hypertension (AHT), ischaemic heart disease, chronic heart failure (CHF), valvular heart

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disease and diabetes mellitus (DM) are frequently associated with AF[11].

Symptomatic AF can reduce quality of life, functional status and cardiac performance, but most of all, it increases the risk of stroke 5-fold[12,13]. More than a dozen stroke risk stratification schemes have been published with varying treatment recommendations[14]. Currently, there is a consensus based on 2 schemes that apply to both patients with paroxysmal and permanent atrial fibrillation[15-19]. The CHADS2 and CHA2DS2-VASc-scores are the most commonly used stroke risk stratification schemes. The CHADS2 scheme uses a point system with 1 point awarded for each of congestive heart failure, arterial hypertension, age >75 and diabetes mellitus, and 2 points for prior stroke/TIA. The CHA2DS2-VASc-score is a more comprehensive scheme, taking into account congestive heart failure, arterial hypertension, age (i.e. 65-74 years = 1 point and >75 years = 2 points), diabetes mellitus, sex (female gender having a score of 1) vascular disease and stroke (score of 2). Both schemes classify patients with AF in 3 groups according to risk for stroke (i.e. low, intermediate and high risk). Patients with intermediate or high risk scores should be treated with oral anticoagulation therapy[20]. The risk of serious sequellae can be reduced by appropriate treatment. Administration of warfarin reduces the relative risk for ischaemic stroke with 68% and the relative risk for mortality with 25%, compared with placebo treatment[21].

Taken together, AF fulfils many of the Wilson-Junger criteria for a screening programme[22]. Two major approaches for screening of AF are described in the literature. First, in the opportunistic case-finding approach, a healthcare professional palpates a patient's pulse for 20 seconds during a regular examination. If the pulse is classified as 'irregular', electrocardiography is performed to confirm the presence of AF. Second, in systematic screening, the whole target population is invited for screening by electrocardiography. Both approaches were successfully used in several large screening campaigns in Europe and the United States.

However, most of these campaigns were designed to screen patients with a well-documented medical history in general practices, health maintenance organizations or hospitals. Screening programmes that aim to screen the general public are less frequently organized. Moreover, to the best of our knowledge, no data about the prevalence of AF in non-hospitalized patients are available in Belgium. Therefore, the aim of our current study was to assess the feasibility and the effectiveness of a nationwide voluntary screening programme in the general population, aged 40 years and above, in Belgium.

METHODS

Study population

A nationwide voluntary screening programme was organized as part of the 'Week of the heart rhythm' in 69 Belgian medical centres in June 2010. Volunteers, aged 40 years and above, were invited to participate in a free screening programme via flyers, and via a media campaign on the national radio and in newspapers and magazines. A total of 13,564 participants were screened, of whom 10,758 were older than 40 years (GSP group). Seven hundred and seventy-one (7.2%) participants had a known history of AF. These patients were included in the study. Information about AF in the medical history was missing in 432 participants (4.1%).

Screening protocol

Participants were invited to fill out a validated stroke risk stratification questionnaire. CHADS2 and CHA2DS2-VASc-scores were calculated for each respondent. Next, a one-lead ECG with a hand-held monitor was performed (HeartScan HCG-801, Omron Colin, Australia) by experienced nurses. The presence of AF was defined as: (1) the surface ECG shows 'absolutely' irregular RR intervals , (2) there are no distinct *P* waves on the surface ECG, and (3) the atrial cycle length (when visible), i.e. the interval between two atrial activations, is usually variable and <200 ms (>300 bpm). Participants with diagnosed AF during the screening (AF group) were advised to consult their general practitioner or cardiologist.

Data collection and statistics

All data were collected in a central database and prepared for statistical analysis. Data were analysed with a commercially available statistical software program (SPSS 12.0, SPSS Inc, Chicago, Illinois (USA)). Continuous variables are presented as mean ± standard deviation. Categorical variables are presented as percentages. Prevalence between subgroups was compared using a chi-square test. Analysis of variance (ANOVA) with post-hoc testing was used when appropriate. The significance level of the *P* value was set at 0.05. For the prevalence of AF in the general screened population, 95% confidence intervals were calculated.

Ethics

The study protocol was approved by the ethical committee of all participating medical centres and each patient signed an informed consent form before participating. The National Government was consulted regarding the privacy law on the data collected.

RESULTS

Participant characteristics and prevalence of AF

The mean age of all 10,758 participants (GSP group) was 59 ± 11 y (range 41 to 84 y), of whom 3617 (43%) were 65 y or older, and 6663 (62%) were females. Two hundred and twenty-eight participants had AF at the time of the screening (AF group): 125 women and 103 men (i.e. 1.9% of total women and 2.6% of total men). This represents a prevalence of 2.2% (95% CI between 1.3% and 3.0%) of the screened population. The mean age of the AF group participants was 67 ± 12 y (range 40-87 y). Seventy-four participants in the AF group were between 65 and 75 y (i.e. 32% of the AF group), 74 participants were over 75 y (i.e. 32% of the AF group). Expressed in function of the overall number of screened participants, AF was present in 3.1% of all 65 to 75-year-old participants and in 6.2% of all study subjects > 75 y. Atrial fibrillation was a known co-morbidity in 61 participants (27%) of the AF group. Mean heart rate was 77 ± 13 bpm in the GSP group and 80 ± 20 bpm in the AF group ($P > 0.05$). Three hundred and thirty-three ECGs were difficult to interpret due to undefined irregularities in the ECG and were not included in the statistics.

Stroke risk stratification scores

Table 1 shows the prevalence of stroke risk factors in the general screening population and the respondents with AF during screening. Over 30% of the screened participants had a known history of AHT. In the AF group, this number increased to nearly 50% of participants. A known history of AF or presence of CHF was present in 20-25% of participants in the AF group, while a history of stroke/TIA and vascular disease was present in 10-15% of these patients. Figure 1 presents the stroke risk stratification scores in the AF group.

Using the CHADS2-score, 58% of participants with a positive AF-screening had a high risk score for stroke (i.e. score of 2 or more), and 21% had an intermediate risk score of 1. Using the CHA2DS2-VASc-score, 72% of participants with a positive AF screening had a high risk score for stroke (i.e. score of 2 or more), and 21% had an intermediate risk score of 1.

Table 1 Prevalence of stroke risk factors in the general screening population (GSP-group) and the respondents with AF (AF-group) during screening

Stroke risk factors	GSP (n = 10,758)	AF (n = 228)
Arterial hypertension	3294 (30.6%)	106 (46.5%) *
Diabetes mellitus	927 (8.6%)	29 (12.7%)
Chronic heart failure	775 (7.2%)	49 (21.5%) *
Previous stroke	582 (5.4%)	27 (11.8%) *
Vascular disease	1310 (12.2%)	40 (17.5%)
Previous AF	771 (7.2%)	61 (26.8%) *
Age between 65 and 75 y	2417 (22.5%)	74 (32.5%) *
Age > 75	1199 (11.1%)	74 (32.5%) *

*significant difference in prevalence of stroke risk factors between GSP en AF groups; $P < 0.05$

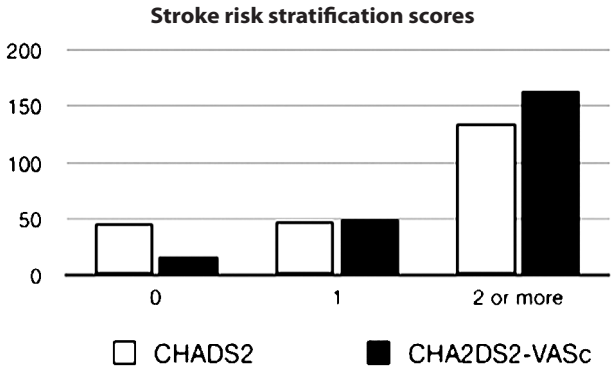

Fig. 1 Stroke risk stratification scores in the AF group

DISCUSSION

The main results of this study can be summarized as follows: (1) a nationwide call for voluntary screening of AF in the general population in Belgium was feasible and attracted a sufficient number of respondents, (2) atrial fibrillation was present in 2.2% of the respondents.

Atrial fibrillation is the most common arrhythmia in the Western world. Setting up large screening campaigns in the general population could significantly reduce the number of deaths and strokes due to AF. Our study was the first nationwide screening for AF in Belgium that used a systematic screening approach to detect the presence of AF in an unselected large population. Respondents were invited to voluntarily participate in the screening programme through a media campaign on national radio stations and in written press in the weeks prior to the screening. More than 60 test centres throughout the country participated in the study and over 13,500 people were screened in a 5-day period. The testing protocol was deliberately limited to a nurse-led registration of a one-lead ECG and the completion of a risk-stratification questionnaire in order to facilitate participation by as many people as possible in the screening programme. In our study 2.2% of all participants were found to have AF at the time of the screening. This number increased with age, up to 6.2% of all participants over 75 years of age.

Although our approach differed from most of the screening approaches described in the literature (i.e.

review of medical records, bi- or triennial patient surveys with or without single screening electrocardiogram, self-reported suspicion of AF, single-screening electrocardiogram and physical examination among selected patients in general practices, etc.), our results are consistent with those from studies in other countries and in other clinical settings[4,5,7-10,23-25].

However, some important remarks should be considered when interpreting these data. It is difficult to estimate the true number of patients with AF from our data. First, we most likely missed some participants with paroxysmal AF or well-treated patients with controlled AF. The only way to detect such arrhythmia would be through frequent repeated electrocardiograms or continuous 24-hour ambulatory electrocardiographic monitoring. Neither of these diagnostic interventions was feasible, due to the large population and the use of several test centres. In addition, our screening approach required the participants to be mobile. As a result, we probably missed a substantial number of persons at the highest risk for AF, i.e. inactive, elderly people with significant co-morbidities and limited mobility.

The consequence of these observations is that the prevalence of AF, as a disease, in a screened population of volunteers is probably underestimated due to the relatively low sensitivity of the used screening approach in detecting AF. The fact that less than 10% of the participants with a self-declared history of documented AF were diagnosed with AF at the time of screening, supports our assumption. Second, the way the screening programme was organized may have caused an important selection bias. One can imagine that people with palpitations or a history or arrhythmia are eager to participate in a voluntary screening for AF. The fact that about 7% of the screened subjects had a previously documented history of AF (i.e. much higher than the expected rate) strongly suggests the presence of such a selection bias. Therefore, it is reasonable to assume a possible overestimation of the prevalence of AF. Taking into account these important remarks, it is difficult to speculate on the relative weight of the suspected overestimation and/or underestimation and, as a consequence, on the observed prevalence of AF in the screened population and extrapolated to the Belgian population.

Although these are important limitations, the present results show that the organisation of a relatively simple screening programme allows to detect a substantial number of new patients with previously undetected AF. Whether our approach is cost-efficient and cost-effective compared to other established forms of screening, like opportunistic case-finding or organized systematic screening in general practices, needs to be addressed in a future study.

Finally, the majority of the participants with a positive AF screening in our study had an increased risk for thrombo-embolism. Twenty-one percent had a score of 1 on one of the two stratification scores used, whereas 58% (for CHADS2-score) and 72% (for CHA2DS2-VASc-score) of participants with AF scored 2 points or more (i.e. high risk for stroke). These results are in contrast to those of Zimetbaum et al.[26] and Sandhu et al.[27], who both reported that the majority of patients with AF had a CHADS2-score of 0 or 1. In addition, these authors reported that 20 to 30% of AF patients had a score of 2 and only 12% of the investigated population had a score between 3 and 6. The reason for this discrepancy is not entirely clear. The age and gender distribution in our study, together with the high proportion of arterial hypertension could have induced CHADS2- and CHA2DS2-VASc-scores different from 1 in the majority of the screened participants. Another explanation could be found in the way participants were recruited. It is likely that the voluntary screening programme attracted people who already had some health problems and missed those with healthy and active lifestyles. However, we did not have access to the medical history of the participants and, as a result, this assumption cannot be proved. Further studies are needed to clarify this issue.

Furthermore, our study lacked information on the use of medication and other relevant medical data of the participants screened. This is a major limitation in the interpretation of the presented stroke risk stratification scores. We were not able to detect the number of participants with AF and a concomitant increased risk for thrombo-embolism, who were on adequate anticoagulation at the time of screening. Although this is an important clinical shortcoming, it does not interfere with the message that over two-third of the participants with AF have an increased risk of thrombo-embolism.

CONCLUSION

This study investigated the prevalence of AF in a screening programme in 69 medical centres in Belgium. Atrial fibrillation was present in approximately 2% of all respondents older than 40 years. Depending on the chosen risk stratification score, at least 60% of the participants with a positive AF screening have an increased risk for thrombo-embolism. Although substantial methodological issues limit the exact interpretation of these results, the present study shows that a voluntary screening programme with a very simple and straightforward screening protocol is able to detect an important number of patients with previously undetected AF. The cost-effectiveness of this approach needs to be addressed in future studies.

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