Improving guideline adherence in the treatment of atrial fibrillation by implementing an integrated chronic care program

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Background / Objectives. Atrial fibrillation (AF) is a very frequent and complex disease often associated with other medical conditions. The Euro Heart Survey (EHS) on AF showed that adherence to guidelines may reduce morbidity and mortality in AF patients. Therefore a nurse-driven, guideline-based, ICT-supported integrated chronic care program (ICCP) was developed and implemented in daily practice. The objective of this study is to evaluate the clinical feasibility of the ICCP, with guideline adherence as the endpoint.

Methods. 111 ambulant patients referred for treatment of their AF were enrolled in the ICCP. In this group, patients underwent standardised clinical testing and were subsequently managed by a nurse, supported by a dedicated ICT program and supervised by cardiologists. For comparison, we used a recent historical control group of 102 patients who participated in the Maastricht part of the Euro Heart Survey (EHS) on AF.

Results. Guideline adherence was excellent within the ICCP and compared favourably with the EHS-AF data concerning both clinical testing (trigger factors recorded in 100 vs. 44%; echocardiogram performed in 99 vs. 88%; thyroid-stimulating hormone level recorded in 96% vs. 63%) as well as treatment (antithrombotic therapy in 90 vs. 78%; rhythm control avoided in completely asymptomatic patients in 100 vs. 54%; class I drugs avoided in patients with structural heart disease in 90 vs. 95%; rhythm control avoided in permanent AF patients in 100 vs. 92%).

Conclusion. The high level of guideline adherence suggests that a nurse-driven, guideline-based, ICT-supported ICCP for AF patients is feasible. (Neth Heart J 2010;18:471-7.)

Keywords: Atrial Fibrillation, Computer-Assisted Decision Support System, Disease Management, Guidelines, Long-term Care, Nursing

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Atrial fibrillation (AF) is a very frequent^{1,2} and complex disease often associated with other medical conditions. Not only the arrhythmia itself but also the underlying medical conditions determine the patient's long-term prognosis.³ Physicians' focus on the arrhythmia frequently distracts their attention from the true problems AF patients face, leading to lack of anticoagulation and heart failure treatment, and futile instalment of rhythm control in asymptomatic patients.^{4,5} The Euro Heart Survey (EHS) on AF showed that adherence to guidelines may reduce morbidity and mortality in AF patients⁶ and may also reduce costs.^{7,8}

Guideline adherence and outpatient care may be enhanced by implementing innovative integrated chronic care programs (ICCP).⁹ The effectiveness of ICCPs is related to interventions that are multifaceted and comprised of various organisational changes such as redefined professional roles, multidisciplinary teams, and use of computer systems and components of quality management.¹⁰ The ICCP is derived from the Chronic Care Model, which is a

synthesis of evidence-based organisational changes intended to guide quality improvement and disease management activities.¹¹⁻¹³ Implementation of changes from traditional care to these new models requires a staged approach aimed at more productive interactions between healthcare providers and patients.

In the present study we report the feasibility of a new collaborative practice model for AF patients for which we developed a nurse-driven, guideline-based, ICT-supported ICCP, with guideline adherence as the endpoint.

Patients and Methods

Patients referred to the outpatient clinic of the Maastricht University Hospital between June 2006 and April 2007 were enrolled in the ICCP. All patients were 18 years or older and had AF recorded on ECG or Holter before visiting the outpatient clinic. To compare the degree of guideline adherence, we used a recent historical control group consisting of the Maastricht patients included in the EHS in 2003 and 2004. For the present study, we recorded all baseline and follow-up data contained within the inclusion visit.

Procedures

The patients in the EHS control group were routinely seen by a cardiologist and received usual care without the support of a specialist nurse. All diagnostic and therapeutic procedures were managed by the attending cardiologist.

Patients enrolled in the ICCP underwent standardised diagnostic procedures (electrocardiogram, echocardiogram, Holter recording, laboratory testing) before visiting the outpatient clinic. During the inclusion visit, the nurse specialist took the patient's history and informed the patient about pathophysiology, symptoms of AF, its possible complications, and treatment options. The nurse specialist uses a dedicated software program (CardioConsult AF®) which directs medical therapy based upon the patient's profile and clinical guidelines. The supervising cardiologist sees the patient at the end of the visit before the start of treatment, confirms the medical diagnosis and informs the patient about the treatment aims and program.

Variables

Adherence to the guidelines was evaluated by calculating the percentage of patients who fulfilled the following criteria: (a) trigger factors for AF recorded; (b) echocardiogram; (c) laboratory testing for thyroid-stimulating hormone (TSH); (d) appropriate prescription of antithrombotic treatment; (e) inadvertent prescription of Vaughn-Williams class I drugs in patients with structural heart disease avoided; (f) inadvertent application of rhythm control strategy to completely asymptomatic patients

avoided; and (g) no antiarrhythmic medication for rhythm control in patients with permanent AF.

These variables were chosen since they are unambiguously indicated in the 2006 guidelines.¹⁴ Assessment of AF trigger factors is needed to guide targeted preventive treatment. Two-dimensional Doppler echocardiography is part of the initial evaluation of AF patients since it may reveal associated medical conditions related to AF, which may be amenable to treatment. The TSH level should be evaluated at least once to detect hyper- or hypothyroidism (also when the patient is given amiodarone treatment). Antithrombotic treatment was considered appropriate for ICCP patients (2006/2007) as outlined in the 2006 guidelines,¹⁴ using the CHADS₂ stroke risk score.¹⁵ The CHADS₂ model is a stroke risk classification scheme, using a point system to determine the yearly risk index. With a CHADS₂ score 2 or higher consideration of a vitamin K antagonist (VKA) is strongly recommended. In case of a score of 1, either aspirin or a VKA is recommended. In these patients, the presence of one or more 'less well established' risk factors, including age between 65 and 75 years, coronary artery disease, or female gender may tip the scale towards use of a VKA, but patient preference should also be considered. With a CHADS₂ score of 0, it is appropriate to give either aspirin or no antithrombotic therapy. Appropriate antithrombotic treatment for EHS patients was considered to be adherence to the 2001 guidelines,¹⁶ with VKA recommended for all patients with a CHADS₂ score of 1, but was also similar to the 2006 guidelines. Concerning the use of Vaughn-Williams class I or class III antiarrhythmic drugs, the guidelines advise avoiding class I drugs in patients with structural heart disease, i.e. coronary artery disease, heart failure, valvular heart disease, and thyroidism; to refrain from rhythm control (including ablation) in asymptomatic patients; and to avoid class I and III drugs in permanent AF. Those with permanent AF should receive only classical rate-control drugs including β -blockers, digitalis, or non-dihydropyridine calcium antagonists as needed. Class I and III drugs should be stopped in case permanent AF develops in paroxysmal or persistent AF patients under rhythm control.

Data collection and analysis

Permission to perform this research was obtained from the Institutional Review Board of the University Hospital Maastricht. Data were retrieved from the CardioConsult AF® database. Data from the EHS were retrieved from the original EHS database available at our institution.⁴ Data analyses were performed with SPSS statistical software (SPSS, Inc., release 12.01). Continuous variables are reported as the mean $\pm$ standard deviation, and categorical variables as the observed number and percentage. The number and percentages of pa-

Table 1. Characteristics of the patients enrolled in the Integrated Chronic Care Program (ICCP) versus patients enrolled in the Euro Heart Survey (EHS) control group.

	ICCP n=111	EHS n=102	P value
Demographics			
- Age, mean $\pm$ SD, years	67 $\pm$ 13	70 $\pm$ 11	0.051
- Age >75 years, n (%)	37 (33)	39 (39)	0.456
- Males, n (%)	66 (59)	62 (61)	0.844
Underlying disease, n (%)			
- Hypertension	50 (45)	58 (57)	0.085
- Coronary artery disease	15 (14)	41 (41)	0.000
- Congestive heart failure	12 (11)	30 (29)	0.000
- Previous stroke /TIA	12 (11)	10 (10)	0.809
- Diabetes mellitus	9 (8)	14 (14)	0.187
- Hyperthyroidism	9 (8)	6 (6)	0.526
- Valvular heart disease	7 (6)	30 (29)	0.000
- Lone AF	19 (17)	24 (24)	0.244
CHADS ₂ score, n (%)			
- 0	34 (31)	18 (18)	0.014
- 1	39 (35)	30 (29)	
- >1	38 (34)	54 (53)	
Type of AF *1,2			
- Paroxysmal	59 (53%)	42 (41%)	0.000
- Persistent	29 (26%)	30 (29%)	
- Permanent	23 (21%)	13 (13%)	
- Missing	0	17 (17%)	

*1 unknown type of AF (EHS, n=3) and first detected AF (EHS, n=14) is not reported and is labelled as missing; *2 in contrast with the EHS, first detected AF in the ICCP (n=55) is not calculated as part of the 3 P classification on type of AF. AF=atrial fibrillation, CHADS₂ score=stroke risk classification scheme representing congestive heart failure, hypertension, age $\geq$ 75 years, diabetes, and prior stroke or TIA, EHS=Euro Heart Survey on atrial fibrillation, ICCP=Integrated Chronic Care Program, TIA=transient ischaemic attack.

tients with guideline adherent treatment were compared between the ICCP and EHS control group and were tested for differences with χ^2 statistics or Fisher's exact test. Differences for continuous variables were tested with independent t-test.

Results

Patient characteristics

ICCP patients were slightly younger and had a lower burden of individual associated cardiovascular diseases, but had lone AF slightly less often (table 1). This indicates that EHS patients had multiple associated diseases more often and consequently a higher stroke risk, as depicted by the higher CHADS₂ score. Hypertension was by far the most prevalent stroke risk factor, followed by age over 75 years and congestive heart failure. AF types were similar among the groups.

Guideline adherence

The average percentage of patients treated according to the guidelines was 96% in the ICCP group compared with 70% in the control group ($p<0.001$). Figure 1 shows the percentage adherence per number of recommendations in both groups. Guideline adherence in the ICCP group was much better when three or more recommendations should have been followed.

Clinical diagnostic investigation

In the control group, AF trigger factors were recorded in only 45 cases (44%) whereas these were reported for all ICCP patients. An echocardiogram was recorded during the EHS in 90 patients (88%). All but one of the ICCP patients (99%) underwent echocardiogram as a routine evaluation ($p<0.001$). TSH level was measured in only 64 patients (63%) in the control group, while TSH level

Figure 1. Guideline adherence per number of recommendations, as calculated among patients in whom the number of recommendations concerned should be followed, in the Euro Heart Survey (EHS) control group versus the Integrated Chronic Care Program (ICCP) group.

was measured at least once in 107 ICCP patients (96%) ($p < 0.001$).

Antithrombotic therapy

Figure 2 shows the use of antithrombotic therapy per CHADS₂ score in both study groups. In the ICCP patients, antithrombotic treatment was largely in accordance with recommendations. Most ICCP patients without stroke risk factors received aspirin or no antithrombotic drugs as recommended by the guidelines, and 18% (six patients) received VKA because of a scheduled cardioversion. On the other hand, 39% (seven patients) of all risk-free patients in the control group used VKA and only two of these patients were in preparation for a cardioversion.

In ICCP patients with only one stroke risk factor (CHADS₂ score of 1) there was a balanced

mix between aspirin and VKA use, again steered by the presence of non-CHADS₂ risk factors.¹⁴ In this subgroup, 23 of 25 VKA users (92%) had at least one additional non-CHADS₂ stroke risk factor compared with 5 of 14 (36%) of the aspirin/no antithrombotic drugs users. In the control group, almost all patients were on VKA and 23 out of these 28 patients (82%) had additional non-CHADS₂ risk factors (p is non-significant compared with 92% in the ICCP). When the EHS data were collected, the 2001 guidelines were active,¹⁶ suggesting that antithrombotic guidelines were well followed at the time.

In 34 out of 38 (90%) ICCP high-risk patients (CHADS₂ scores >1), VKA was prescribed. In two (5%), aspirin was given, and in another two (5%), no antithrombotic therapy was given because of a moderate to high risk of bleeding.

According to the 2006 guidelines,¹⁴ appropriate antithrombotic treatment was administered to 37 (97%) of the high-risk ICCP patients. On the other hand, according to the 2001 guidelines,¹⁶ appropriate treatment was given to 41 (79%) of the high-risk control group patients ($p < 0.05$).

Antiarrhythmic medication

Inadvertent use of class I antiarrhythmic agents in patients with underlying cardiovascular disease (table 2) was seen in two of the ICCP patients (7%) versus two patients (5%) in the control group (p =non-significant).

There were 14 asymptomatic patients in the ICCP, none of whom were on rhythm control (no antiarrhythmic drugs, no ablation). In contrast, 24 of 52 (46%) asymptomatic patients ($p < 0.001$) in the control group received rhythm control (19 class I or III drugs, 12 planned cardioversion, two planned ablations). However, the 2001 guidelines were active during the EHS data collection, which did not stringently recommend avoiding rhythm control in asymptomatic patients.¹⁶

Figure 2. Antithrombotic therapy per CHADS₂. Therapy per CHADS₂ score is significantly different in the Integrated Chronic Care Program (ICCP) group compared with the Euro Heart Survey (EHS) group ($p < 0.001$).

Table 2. Use of rhythm-control drugs in ICCP and EHS control patients in relation to the absence or presence of underlying heart disease (UHD).

	ICCP n (%)		EHS n (%)	
	UHD n=29	Non-UHD n=82	UHD n=37	Non-UHD n=65
Flecainide	2 (7)	15 (18)	2 (5)	3 (5)
Sotalol	1 (3)	11 (13)	6 (16)	9 (14)
Amiodarone	0	3 (4)	5 (14)	14 (22)

In the ICCP group, permanent AF was present in 23 patients (21%). All patients were on appropriate rate-control drugs and no class I or III antiarrhythmic medication was prescribed (table 3). In the control group, permanent AF was present in 13 patients (13%), who also received rate-control medication; however, sotalol was inappropriately prescribed in one patient (8%) (p =non-significant).

Discussion

This report shows that ACC/AHA/ESC AF guideline adherence for AF patients within an ICCP compares favourably with that seen in general clinical practice. Considering guideline adherence was only 70% with general practice in the EHS, a remarkable 96% of ICCP patients were completely diagnosed and treated according to all major recommendations of the current guidelines, which is most likely because of the systematic approach we implemented. This finding supports the notion that an ICCP is highly feasible.

Integrated systematic care protects patients from the risks of incomplete diagnostic and therapeutic procedures. Too often, medical specialists take an approach that is too narrowly focused. In the EHS it appeared that when AF occurred in the setting of heart failure, the recommendations provided by AF and HF guidelines were followed in only 13% of patients with both conditions.⁶ Not only in clinical practice, but also in well-known randomised trials, incomplete treatment may be observed.¹⁷⁻¹⁹ Our study as well as previous ones²⁰⁻²² suggest that integrated care leads to an improved application of diagnostic procedures and therapy which may save lives, improve quality of life, and enhance patient compliance.

Cost-effectiveness was not part of the study. However, it is most likely that implementing the ICCP increases initial costs. On the other hand, improved evidence-based care with the ICCP is likely to enhance quality of life and prevent mortality, strokes and hospitalisations. We anticipate that cost savings related to these beneficial effects will

Table 3. Use of rhythm-control and rate-control medication in 36 patients with permanent (accepted) AF.

	ICCP (n=23) n (%)	EHS (n=13) n (%)
Flecainide	0	0
Sotalol	0	1 (8)
Amiodarone	0	0
Verapamil	2 (11)	0
Diltiazem	0	0
Beta blocker	13 (68)	10 (77)
Digitalis	6 (32)	7 (54)

Proportions add up to >100% due to combinations of prescribed drugs.

eventually overrule the increased cost burden related to implementing the ICCP.

Many reasons underlie the lack of adherence to the guidelines during routine clinical care, including lack of time and high workload for the physician. 'Time is money' seems most applicable to this subject. To characterise AF patients effectively and install proper follow-up diagnostics and treatments is time-consuming, but should be done systematically. For installing proper therapy, following the guidelines, and informing and instructing patients, there is a role for the nurse specialist. Trials in nurse-led management interventions show significant improvements mainly due to rigorous application of guidelines.²³⁻²⁵ Systematic reviews indicate that involving a nurse specialist to control blood pressure²⁶ and to help patients stop smoking²⁷ is beneficial. Our results suggest that a nurse specialist can also be reliable and effective in the more complex process of care required by AF patients. As a result, the workload during the cardiologists' consulting hours may be lessened while the quality of care is maintained or improved.

Study limitations

The baseline characteristics of the study groups differed. The historical EHS control group was observed three years before the implementation of the ICCP. In addition, ICCP patients were all new referrals to the outpatient clinic, whereas the EHS included both new and existing outpatients and inpatients. If anything, the longer arrhythmia history for most of these patients, as well as the fact that many were already known for some time within our department, should have increased rather than decreased guideline adherence in the EHS control group.

Because the EHS was performed at our institution a few years previously, this may have led to improved awareness and adherence. It is hard to

separate the actual effect of an intervention from temporal changes in any before-after study. We considered the present results as an indication that the ICCP can work and feel that the ICCP contributed significantly to the adherence figures.

Conclusion

An ICCP driven by a specialised nurse, supervised by a cardiologist and supported by a dedicated ICT program, may be implemented safely while maintaining and potentially improving cardiac care for patients with AF. ■

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