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ORIGINAL PAPER

Management of atrial fibrillation by primary care physicians in Germany: baseline results of the ATRIUM registry

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Abstract
Background In contrast to surveys in cardiologist settings, presentation and management of atrial fibrillation (AF) in primary care patients is less well studied.
Methods and results The prospective ATRIUM (Outpatient Registry Upon Morbidity of Atrial Fibrillation) collected data from patients with AF seen by 730 physicians representing a random sample of all primary care physicians in Germany. ATRIUM enrolled 3,667 patients (mean age, 72 ± 9 years; 58% male, mean $CHADS_2$ score 2.2 ± 1.3), 994 (27.1%) with paroxysmal, 944 (25.7%) with persistent or long-standing persistent and 1,525 (41.6%) with permanent AF (no AF type was specified in 204 patients). Mean duration since initial diagnosis of AF was 61 ± 66 months (median 42, interquartile range 14–88). Reported symptoms included palpitations (43%), shortness of breath (49%), fatigue (49%), dizziness (37%) and angina (20%). Most common concomitant conditions were hypertension (84%), heart failure (43%), coronary artery disease (345%), diabetes (35%) and chronic kidney disease (20%). Prior myocardial infarction was present in 11% of patients, prior stroke in 10% and prior transient ischemic attack in 10%. Antithrombotic medication was used by 93% of the patients (oral anticoagulants, 83%). Rate control therapy was reported in 75% and rhythm control therapy in 33%, often added to rate control. Drugs for rhythm and rate control included ß-blockers (75%), calcium antagonists (15%), digitalis (29%), sodium channel blockers of type IA (quinidine, 1.0%) or IC (flecainide or propafenone, 5%), and potassium channel blockers including amiodarone (11%). In the year prior to enrollment, 46% of the patients had been cardioverted (23% by drugs, 22% electrically), catheter ablation had been performed in 5%, and 10% received a pacemaker or defibrillator. A high proportion (44%) of the patients were hospitalized in the year prior to enrollment.
Conclusions Patients with AF managed in primary care often receive guideline-conforming therapy including antithrombotic therapy, rate control and rhythm control (numbers given above). Despite this apparent adherence, almost half of the patients were hospitalized in the year prior to enrollment, suggesting that the therapies applied do not stabilize patients sufficiently to keep them out of hospital.

Keywords Atrial fibrillation · Management · Anticoagulation · Survey · Therapy

The ATRIUM registry was compiled by Sanofi-Aventis, Germany in cooperation with the German Atrial Fibrillation NETwork (AFNET).

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Background

Atrial fibrillation (AF) is the most commonly sustained arrhythmia and affects at least 1% of the population in Germany [1]. AF prevalence increases markedly with age, resulting in an estimated two- to threefold increase in AF patients in the next two decades [6, 31]. Many AF patients suffer from concomitant conditions including hypertension, vascular disease, heart failure and diabetes mellitus among others. In addition to variable but often relevant symptoms, AF appears to cause every fourth to fifth stroke and is associated with a doubling of mortality [34, 36].

AF management therefore consists of antithrombotic therapy, which is guided by clinical stroke risk estimation [1, 21], rate control therapy to improve left ventricular function and symptoms during AF, and rhythm control therapy to prevent AF recurrences. Despite the widely perceived notion that AF may cause severe complications, rhythm control therapy using common drugs does not prevent deaths in AF patients [11, 26, 33, 39], resulting in recommendations that rhythm control therapy should be pursued in patients who remain symptomatic on rate control [1].

Based on the variable presentation of AF and on slightly differing recommendations in clinical practice, differences in AF management depending on the type of treating physician can be expected [24]. Unfortunately, most registry data so far report that most AF patients are managed by cardiologists or other specialists.

We therefore initiated the prospective German ATRIUM registry to characterize AF management in patients treated by primary care physicians. Here, we report the baseline observations of this registry.

Methods

Design ATRIUM (Outpatient Registry Upon Morbidity of Atrial Fibrillation) is a prospective, multicenter, epidemiological, non-interventional cohort study. ATRIUM enrolled 3,667 patients in 730 primary care practices in Germany in 2009. Baseline data included current management and information on interventions and complications in the year prior to enrollment. This data set is reported here. The ethics committee of the Technical University Dresden approved the study protocol. All patients gave written consent prior to enrollment.

To draw a random sample of centers, a multi-step procedure was used in which more than 25,000 physicians were contacted (Department of Medical Informatics, Biometry and Epidemiology, University of Bochum). Based on a comprehensive nationwide database of physicians (Schwarzeck-Verlag), a representative sample of 25,000 primary care physicians was drawn by Abteilung für Medizinische Informatik, Biometrie und Epidemiologie, Ruhr-Universität Bochum. These physicians were contacted via letter and informed about the study, and the first 730 respondents were offered participation. The centers agreed to consecutively enroll patients with AF documented by ECG in the 12 months prior to enrollment. No exclusion criteria were defined to minimize selection bias. All data were recorded during an outpatient visit and included information from the patient charts.

Parameters The following baseline parameters were documented: age, sex, body weight, height, blood pressure, risk factors for cardiovascular disease, cardiac history and concomitant diseases. The CHADS2 score was specifically recorded and the CHA_2D_2SVASc score, which was recently proposed as a refinement of the $CHADS_2$ score [1], was computed using the available information. In addition, we recorded the month of initial diagnosis of AF, type of AF (paroxysmal, persistent including long-lasting persistent, or permanent), type of diagnostic tests performed, suspected triggering factors of AF, therapy in the year prior to enrollment, hospitalizations in the year prior to enrollment and referral to a specialist. Drugs were recorded by drug class. Quality of life was assessed by EQ-5D in its validated German version [9].

Data analysis and statistics

All data were recorded on paper case report forms (CRF), and double-entered by a contract research organization (CRO Dr. Schauerte, Grünwald) into the study database.

A prespecified validation plan was used to check for plausibility. Analysis was done by SAS Institute Inc., version 9.2 (Cary, NC, USA). Continuous parameters are given as means ± standard deviation and categorical parameters as the number of patients and percentages. Continuous parameters were compared between groups using ANOVA, and non-continuous parameters were compared using chi-square test. Throughout the paper, two-sided p values are given.

Results

Enrolling centers Of the 730 enrolling physicians (65% males), 63% were primary care phsyicians ("Facharzt für Allgemeinmedizin"), 34% internists with a license and practice in primary care ("Internist in hausärztlicher Praxis") and 4% practising physicians. Practices were distributed among cities (29%), small towns (30%) and in rural areas (40%, data not recorded in 0.7%) Enrolling physicians were 50 ± 8 years old and worked in their practice for an average of 14 ± 9 years or in a polyclinic ("Medizinisches Versorgungszentrum") for 9 ± 11 years.

Patient characteristics ATRIUM enrolled 3,667 patients, 58% male, with a mean age of 72 ± 9 years; 80% of the patients were retired (Table 1). The mean age was higher in patients with permanent AF than in those with paroxysmal AF, most likely reflecting the progressive nature of AF and the fact that older age was one of the factors that favored rate control therapy [1]. Paroxysmal AF was present in 994 (26%) patients, persistent including long-standing persistent AF in 944 (27%) and permanent AF in 1,525 (42%); in 204 patients (6%), AF type was not specified. Mean duration since the initial diagnosis of AF was 61 ± 66 months (median 42, interquartile range, 14–88).

The mean $CHADS_2$ score was 2.2 ± 1.3. The mean CHA_2DS_2VASC score was 3.8 ± 1.7. CHA_2DS_2VASC score was lower in patients with paroxysmal AF (3.4 ± 1.7) compared to persistent AF (3.7 ± 1.6) or permanent AF (4.1 ± 1.7). Categorical distribution of scores is shown in Fig. 1.

Reported symptoms included palpitations (43%), shortness of breath (49%), fatigue (49%), dizziness (37%) and angina (20%). Most common concomitant conditions were hypertension (84%), heart failure (43%), coronary artery disease (35%), diabetes (35%) and chronic renal dysfunction (20%). Patients with a higher number of risk factors were more frequent in the groups with permanent AF (Fig. 2). Prior myocardial infarction was present in 11%, prior stroke in 10% and prior transient ischemic attack in 10%.

Therapeutic goals Enrolling physicians reported the following therapeutic goals: prevention of thromboembolic events (77%), prevention of hospitalizations (57%), reduction of cardiovascular mortality (61%), rate control (76%) and rhythm control (33%; Table 2).

AF management Antithrombotic medication was used by 93% of the patients (oral anticoagulants 83%, antiplatelet drugs 27%, heparin 4%; Table 3). Contraindications for oral anticoagulants were reported in 6.4%. Of the 3,667 patients, 262 had $CHADS_2$ score 0 and 79 CHA_2DS_2-VASc score 0 and were therefore rated as not eligible for OAC; 900 ($CHADS_2$) and 240 (CHA_2DS_2-VASc) patients had a score of 1 and were potentially eligible; 2,486 ($CHADS_2$) had a score ≥2 and thus were eligible for OAC for anticoagulation according to the guidelines in place at the time of the survey. [5, 28] Many patients received OAC despite being not eligible according to the scores (Fig. 3a, b). Further, of the 3,667 patients, 3,329 patients had a CHA_2DS_2-VASc score of 2 or more, rendering approximately 90% of the surveyed patients eligible for oral anticoagulation according to current recommendations [1]. Most patients at risk for stroke were adequately anticoagulated (Fig. 2) and, especially in patients without an indication for anticoagulation according to $CHADS_2$ score, over-anticoagulation was also found (Fig. 2).

A total of 2,738 patients (75%) received rate control therapy, while 16% received rhythm control therapy either alone (189 patients; 5%) or in combination (404 patients; 11%). Drugs for rhythm and rate control included beta-blockers (75%), calcium antagonists (15%), digitalis (29%), potassium channel blockers including amiodarone (11%), and sodium channel blockers of the type IA (usually quinidine, 1.0%) or IC (usually flecainide or propafenone, 5%). In the year prior to enrollment, 46% of the patients had been cardioverted (23% by drugs and 22% electrically; Table 4). Catheter ablation had been performed in 5%, and 10% received a pacemaker or defibrillator.

A total of 1,602 patients (44%) were hospitalized in the year prior to enrollment, with 772 patients having been hospitalized more than once (Table 5). The mean hospitalization rates were somewhat higher for paroxysmal and persistent AF compared to permanent AF (1.2 vs. 1.1 vs. 0.7 stays during 1 year).

In the surveyed period, only 41% of the patients fulfilled the criteria for stable disease, defined as stable medication without AF-associated interventions.

Quality of life The EQ-5D was obtained from 3,460 patients. The mean EQ-5D index was 0.86 ± 0.19, close to the maximum value of 1. The corresponding VAS, in contrast, showed a mean value of 67 ± 18, indicating reduced quality of life.

Discussion

The data from ATRIUM described here provide information on the type of AF management in a sample of patients in primary care collected through a random sample of primary care physicians. Thereby, the report fills an information gap, as most prior registries include predominantly patients managed by cardiologists and/or in hospitals [2, 4, 17, 24, 27], which likely induced a selection bias based on center selection. Another registry, similar to ATRIUM, enrolled patients managed by German cardiologists [14]. Other information is available from population-wide samples [3, 6–8, 12, 13, 16, 30, 34, 35, 37], but information on the large proportion of patients managed as outpatients in primary care is scarce [19, 20, 22]. The central registry of the Germany AFNET more closely reflects the situation of AF patients managed by different types of physicians through enrollment of almost 10,000 patients from different levels of care [15, 23]. But even in the AFNET registry, only 811 patients were enrolled by primary care physicians (9%), demonstrating the need for further data from this sector of health care [23].

Classification ATRIUM enrolled a large unselected cohort of outpatients with AF in different stages of their disease (paroxysmal, persistent and permanent). We did

Table 1 Patient characteristics

	Paroxysmal		Persistent		Permanent		Tests[#]
	$n = 994$		$n = 944$		$n = 1{,}525$		
	n	Value	*n*	Value	*n*	Value	*p*
Demographics							
Age (years)		69.8 ± 9.9		71.4 ± 9.1		73.7 ± 8.4	<0.0001
>65 years	725	72.9	729	77.2	1,307	85.7	<0.0001
Male	565	56.8	564	59.7	891	58.4	0.4435
Body mass index (kg/m^2)		28.4 ± 4.6		28.8 ± 4.8		28.6 ± 4.8	0.0851[§]
Overweight	468	47.1	440	46.6	702	46.0	0.2291
Obese	300	30.2	324	34.3	488	32.0	
Occupational status							
Occupied	150	15.1	102	10.8	89	5.8	<0.0001
Retired	731	73.5	733	77.6	1,293	84.8	
Prematurely retired	55	5.5	53	5.6	68	4.5	
Other	54	5.4	55	5.7	72	4.8	
Risk factors							
Arterial hypertension	818	82.3	799	84.6	1,277	83.7	0.3875
Hyperlipidemia	611	61.5	574	60.8	912	59.8	0.7932
Diabetes mellitus	297	29.9	314	33.3	599	39.3	<0.0001
Smoking status							0.3971
Never	571	57.4	509	53.9	821	53.8	
Previously	368	37.0	376	39.8	614	40.3	
Currently	50	5.0	55	5.8	87	5.7	
Hyperthyreosis	55	5.5	55	5.8	91	6.0	0.9508
Alcohol abuse	32	3.2	48	5.1	60	3.9	0.1271
Concomitant diseases							
Chronic kidney disease	167	16.8	179	19.0	335	22.0	0.0051
Dialysis	1	0.6	1	0.6	4	1.2	0.6903
Serum creatinine (mg/dl)		1.4 ± 0.5		1.3 ± 0.5		1.4 ± 0.6	0.1850
Creatinine clearance (ml/min)		53.9 ± 20.9		56.6 ± 21.4		56.5 ± 18.1	0.7005
Transitory ischemic attack	105	10.6	83	8.8	158	10.4	0.3434
Prior stroke	101	10.2	82	8.7	160	10.5	0.3254
Ischemic	81	80.2	62	75.6	127	79.4	0.8450
Hemorrhagic	7	6.9	4	4.9	7	4.4	
Cardiac risk factors/conditions							
Coronary artery disease	302	30.4	315	33.4	587	38.5	<0.0001
Myocardial infarction	98	9.9	102	10.8	186	12.2	0.1345
PTCA	161	16.2	160	16.9	244	16.0	0.9075
Chronic heart failure	297	29.9	399	42.3	790	51.8	<0.0001
Highest NYHA stage in history							
I	36	12.1	55	13.8	104	13.2	0.5018
II	107	36.0	153	38.3	323	40.9	
III	95	32.0	130	32.6	243	30.8	
IV	36	12.1	37	9.3	66	8.4	
Current NYHA stage							
I	111	37.4	147	36.8	292	37.0	0.8135
II	142	47.8	207	51.9	386	48.9	
III	39	13.1	43	10.8	104	13.2	
IV	1	0.3	1	0.3	5	0.6	

Table 1 continued

	Paroxysmal		Persistent		Permanent		Tests[#]
	$n = 994$		$n = 944$		$n = 1,525$		
	n	Value	*n*	Value	*n*	Value	*p*
AF							
Atrial fibrillation	911	91.6	884	93.6	1,488	97.6	<0.0001
Atrial flutter	72	7.2	63	6.7	24	1.6	<0.0001
$CHADS_2$ score		1.9 ± 1.2		2.1 ± 1.2		2.4 ± 1.3	<0.0001
CHA_2DS_2-VASc		3.4 ± 1.7		3.7 ± 1.6		4.1 ± 1.7	<0.0001

[#] χ^2-test or *F* test for analysis of variance (ANOVA)

[§] Nonparametric Kruskal–Wallis test, $p = 0.0415$

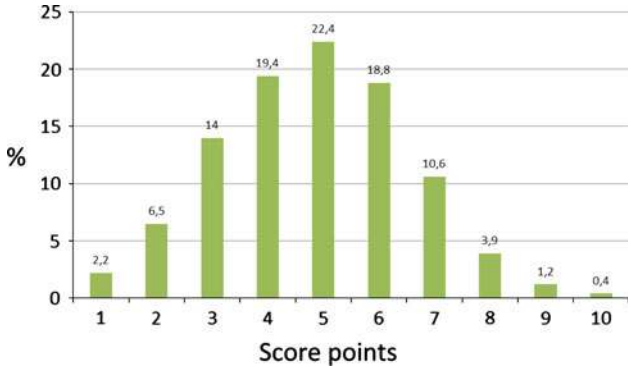

Fig. 1 CHA_2DS_2-VASc score. Score points based on available data for the calculation of the score in 3,667 patients

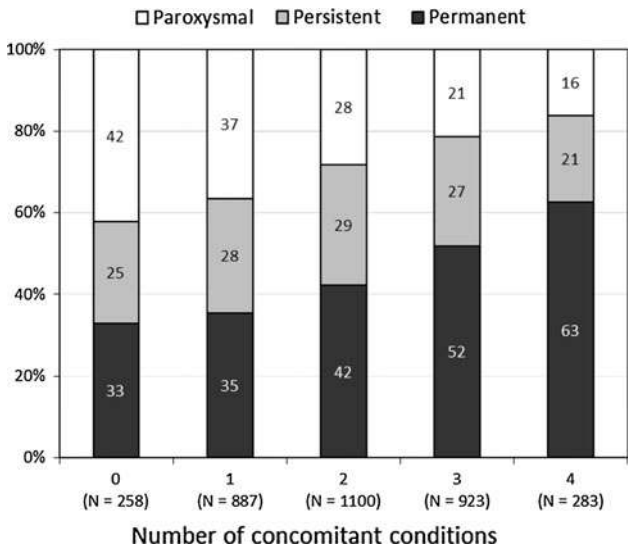

Fig. 2 Numbers of concomitant conditions, by AF type. Risk factors: age ≥75 years, arterial hypertension, diabetes mellitus and chronic heart failure. Values are missing for AF type in 204 patients and for concomitant conditions in 18 patients

not differentiate between first diagnosed AF and other forms of AF in this setting, as the classification "first diagnosed AF" is more relevant in acute settings such as emergency rooms or hospitals, as reflected by the rates of first diagnosed AF in the ALFA (26%) [19], Euro Heart Survey (18%) [24] and AFNET [23] (11%) registries.

Patient characteristics in relation to other registries Consistent with the expected flow of management in which patients with AF may be initially seen by a specialist, but later continue their treatment in primary care [1], mean age in ATRIUM (72 years) was higher than in the Euro Heart Survey (69 ± 10 years) or the AFNET registry (67 ± 13 years), and mean AF duration was over 5 years (66 months). Males slightly outnumbered females, comparable to other surveys. As expected, concomitant conditions were common, but there were slight differences: arterial hypertension was more often found in ATRIUM than in Euro Heart Survey (64%) or AFNET registries (69%). Also, coronary artery disease was surprisingly prevalent when compared with the aforementioned surveys [23, 24]. Similar to the AFNET registry, permanent AF was associated with more concomitant conditions.

Therapy and interventions In ATRIUM, 46% of the patients underwent cardioversion in the year prior to enrollment. Half of all cardioversions (23% of the total patient cohort) were achieved by drugs, which represents a higher rate than in MOVE (18%) [14], the AFNET registry (3–16% depending on the AF type) [23] or the Euro Heart Survey (3–14% depending on AF type) [24]. Electrical cardioversion was also relatively frequent in ATRIUM (22% in the total AF cohort) compared to AFNET (7–23% depending on AF type), MOVE (18%), or the Euro Heart Survey (3–24%) [14, 23] [24].

The type of rate control therapy was not markedly different from other trials and registries, with the exception of slightly lower use of digitalis glycosides, potentially already reflecting the growing experience that these agents only control heart rate well in sedentary patients [14, 23].

In ATRIUM, almost all patients received (any) antithrombotic therapy (92.5%), suggesting that stroke prevention was a firmly established therapeutic goal in the

Table 2 Goals of therapy

	Paroxysmal		Persistent		Permanent		Tests[#]
	$n = 994$		$n = 944$		$n = 1,525$		
	n	%	*n*	%	*n*	%	*p*
Prevention of thrombo-embolic complications	718	72.2	728	77.1	1,238	81.2	<0.0001
Prevention of hospitalizations	537	54.0	524	55.5	943	61.8	<0.0001
Reduction of cardiovascular mortality	553	55.6	568	60.2	1,020	66.9	<0.0001
Rhythm control	623	62.7	336	35.6	205	13.4	<0.0001
Rate control	596	60.0	722	76.5	1,301	85.3	<0.0001
Other	52	5.2	65	6.9	81	5.3	0.1961

Percentages did not sum up to 100% because multiple answers were possible

[#] χ^2-test

Table 3 Therapy in the previous 12 months

	Paroxysmal		Persistent		Permanent		Tests[#]
	$n = 994$		$n = 944$		$n = 1,525$		
	n	Value	*n*	Value	*n*	Value	*p*
Antiarrhythmic drugs class							
IA	13	1.3	13	1.4	7	0.5	0.0273
Duration (months)		9.4 ± 4.4		10.2 ± 3.1		9.3 ± 4.4	0.8008
IC	107	10.8	46	4.9	27	1.8	<0.0001
Duration (months)		9.0 ± 4.1		7.0 ± 4.7		9.5 ± 4.3	<0.0001
II	754	75.9	724	76.7	1,112	72.9	0.0122
Duration (months)		10.1 ± 3.4		9.8 ± 3.7		11.5 ± 1.9	<0.0001
III	140	14.1	119	12.6	112	7.3	<0.0001
With ß-blocker activity	54	5.4	52	5.5	76	5.0	0.7330
Duration (months)		8.9 ± 4.4		9.3 ± 3.7		10.5 ± 3.3	0.0593
Other	83	8.4	65	6.9	35	2.3	<0.0001
Duration (months)		7.8 ± 4.4		6.7 ± 4.4		9.6 ± 3.3	0.0052
IV	130	13.1	140	14.8	273	17.9	0.0046
Duration (months)		9.8 ± 3.9		9.8 ± 3.6		11.5 ± 1.9	<0.0001
Digitalis	204	20.5	262	27.8	547	35.9	<0.0001
Duration (months)		9.4 ± 4.0		8.8 ± 4.1		11.3 ± 2.3	<0.0001

[#] χ^2-test or *F* test for analysis of variance (ANOVA)

primary care setting. Furthermore, over 70% of patients with an evidence-based indication for oral anticoagulation received such therapy, a high proportion compared to other surveys. [38] Consistent with other registries [23, 25], a substantial portion of patients potentially ineligible for oral anticoagulation received such therapy (Fig. 3). This may in part reflect the "subconscious" application of a broader indication of anticoagulation in AF patients, as formalized in the CHA_2DS_2VASc score [1, 21]. Furthermore, the parameter "vascular disease" was somewhat underreported in this survey, as the components atherosclerosis of the aorta and peripheral arterial disease, were not recorded in the CRF.

Frequent hospitalizations despite enrollment of presumably "stable" patients The outpatient setting of ATRIUM also resulted in a high proportion of patients with permanent AF (42%, more than in Euro Heart Survey (29%) or AFNET (33%)), consistent with the AFNET data set showing a higher proportion of patients with permanent AF in outpatient centers [23]. The mean hospitalization rates were higher in paroxysmal and persistent AF compared to permanent AF, which is in contrast to earlier findings in the COCAF study [18]. Despite relatively frequent hospitalizations, the mean quality of life score in ATRIUM was slightly better than in the Euro Heart Survey (EQ-5D men 0.85, women 0.73) [24]. The outpatient setting and the

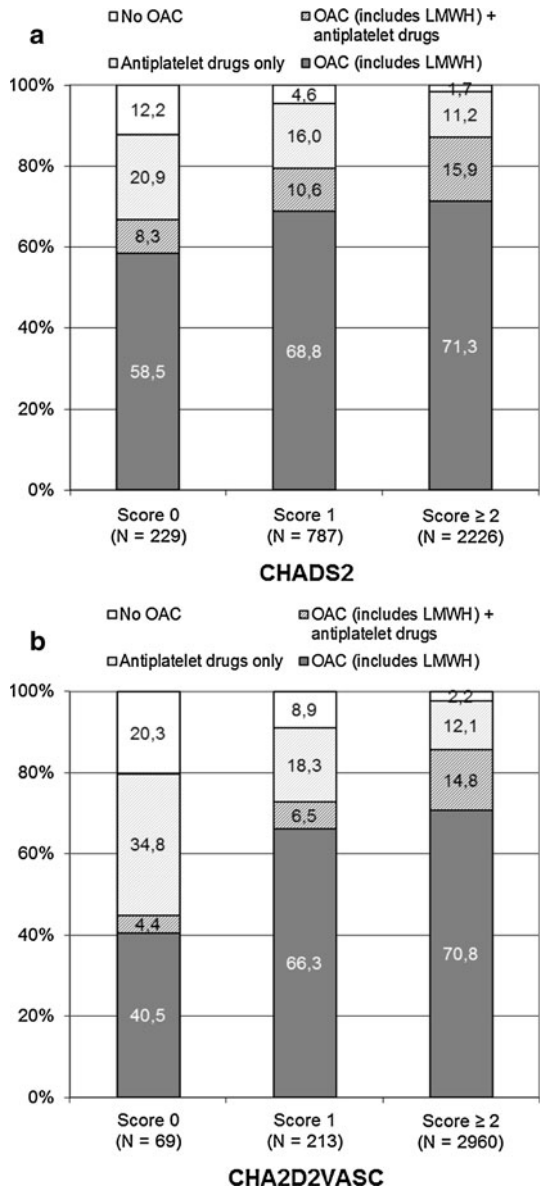

Fig. 3 Antithrombotic prophylaxis and oral anticoagulation (OAC) in patients with various eligibility categories for OAC by CHADS2 or CHA_2DS_2-VASc. *Score 0* (=no risk factor) = no OAC recommended; *Score 1* (=only 1 non-major risk factor) = either ASS or OAC recommended, OAC preferred; *Score* ≥ 2 (=at least 1 major or at least 2 non-major risk factors) = OAC recommended. Information on antithrombotic prophylaxis and oral anticoagulation was missing in 409 patients

permanent nature of AF render the number of patients with hospitalizations and "unstable disease" in our cohort remarkable, especially when this number was compared to the markedly lower hospitalization rate (about 25–27%) in large, recently published trials in AF patients such as ADONIS/EURIDIS [29], ATHENA [10] and RACE II [32]. While it is conceivable that lower hospitalization rates in trials reflect a selection bias toward "healthier" patients and possibly better overall management owing to the close follow-up regimen in clinical trials, the reasons for hospitalizations in this "all-comer" population with long-standing AF are worthy of further study.

Table 4 Pharmacological and electrical conversions

	n	%
Pharmacological (drug) conversion	855	23.3
Ambulatory	351	41.1
Hospital based	454	53.1
Ambulatory/hospital based	26	3.0
Unknown	24	2.8
Number of drug conversions		
1	540	63.2
2	165	19.3
3	36	4.2
4	18	2.1
5	6	0.7
6	6	0.7
7	3	0.4
8	8	0.5
9	1	0.1
10+	9	1.0
Unknown	67	7.8
Duration since last conversion (months); $n = 794$[a]		
Mean ± SD	27.4 ± 40.5	
Median	11.0	
Range	0.0–340.0	
Electrical conversion	820	22.4
Ambulatory	62	7.6
Hospital based	684	83.4
Ambulatory/hospital based	4	0.5
Unknown	70	8.5
Number of electrical conversions		
1	482	58.8
2	171	20.9
3	59	7.2
4	19	2.3
5	2	0.2
6+	7	0.8
Unknown	80	9.8
Duration since last conversion (months); $n = 751$[a]		
Mean ± SD	30.3 ± 37.8	
Median	14.0	
Range	0.0–286.0	
Catheter ablation	194	5.3
Implantation of pacemaker/defibrillators	384	10.5

Data from 3,367 patients

SD standard deviation

[a] Subpopulation with information on duration since last conversion

Table 5 Hospitalizations

	n	%
Number		
0	2,015	54.9
1	830	22.6
2	341	9.3
3	185	5.0
4	110	3.0
5	54	1.5
6+	82	2.2
Unknown	50	1.4
Number of hospitalizations	Mean ± SD; median	
Total ($n = 3{,}617$)	1.0 ± 1.9; range 0–61	
Paroxysmal ($n = 978$)	1.2 ± 1.7[#]	
Persistent ($n = 937$)	1.1 ± 1.8[#]	
Permanent ($n = 1{,}512$)	0.7 ± 2.0[#]	
Rhythm control ($n = 185$)	1.5 ± 2.0	
Rate control ($n = 2{,}728$)	0.8 ± 1.8	
Rhythm + rate control ($n = 401$)	1.8 ± 2.1	

[#] $p < 0.0001$ for comparison of means by F test (analysis of variance/ANOVA)

Methodological considerations In selecting centers, care was taken to represent all regions in Germany equally. Nonetheless, it is conceivable that there remained a selection bias for centers with interest and/or expertise in AF management associated with the agreement to participate. Further limitations of this study are possible reporting bias (e.g., underreporting of diseases by physicians), misclassification of disease (e.g., AF type), selection bias of patients (only those willing to participate), neglect of patient-related factors such as treatment compliance and patient recall bias (e.g., on number of procedures or hospitalizations in the previous 12 months). Despite the systematic process for selecting participating centers (see "Methods"), selection bias of participating physicians is also possible. Furthermore, it was not possible to verify consecutive enrollment or the completeness of the information on the paper CRF by source data monitoring.

Conclusion

ATRIUM provides a hitherto unknown insight into details of current AF management in primary care in Germany. The good overall antithrombotic management is remarkable, but the frequent AF-related hospitalizations and the overall, often unstable, course of AF indicate unsolved problems. Challenges in the treatment of AF in these often multimorbid patients (with high rates of coronary artery disease and hypertension, for example) pose challenges to treating physicians.

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