

# Risk scores and geriatric profile: can they really help us in anticoagulation decision making among older patients suffering from atrial fibrillation?

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**Objectives:** Anticoagulation for the prevention of cardio-embolism is most frequently indicated but largely underused in frail older patients with atrial fibrillation (AF). This study aimed at identifying characteristics associated with anticoagulation underuse.

**Methods:** A cross-sectional study of consecutive geriatric patients aged  $\geq 75$  years, with AF and clear anticoagulation indication (CHADS<sub>2</sub> [Congestive heart failure, Hypertension, Age  $> 75$ , Diabetes mellitus, and prior Stroke or transient ischemic attack]  $\geq 2$ ) upon hospital admission. All patients benefited from a comprehensive geriatric assessment. Their risks of stroke and bleeding were predicted using CHADS<sub>2</sub> and HEMORR<sub>2</sub>HAGES (Hepatic or renal disease, Ethanol abuse, Malignancy, Older (age  $> 75$  years), Reduced platelet count or function, Rebleed risk, Hypertension (uncontrolled), Anemia, Genetic factors, Excessive fall risk, and Stroke) scores, respectively.

**Results:** Anticoagulation underuse was observed in 384 (50%) of 773 geriatric patients with AF (median age 85 years; female 57%, cognitive disorder 33%, nursing home 20%). No geriatric characteristic was found to be associated with anticoagulation underuse. Conversely, anticoagulation underuse was markedly increased in the patients treated with aspirin (odds ratio [OR] [95% confidence interval]: 5.3 [3.8; 7.5]). Other independent predictors of anticoagulation underuse were ethanol abuse (OR: 4.0 [1.4; 13.3]) and age  $\geq 90$  years (OR: 2.0 [1.2; 3.4]). Anticoagulation underuse was not inferior in patients with a lower bleeding risk and/or a higher stroke risk and underuse was surprisingly not inferior either in the AF patients who had previously had a stroke.

**Conclusion:** Half of this geriatric population did not receive any anticoagulation despite a clear indication, regardless of their individual bleeding or stroke risks. Aspirin use is the main characteristic associated with anticoagulation underuse.

**Keywords:** atrial fibrillation, anticoagulation, antiplatelet therapy, geriatric medicine, under-prescribing

## Introduction

The underuse of indicated medications in elderly patients is currently, and increasingly under scrutiny and known to cause adverse outcomes.<sup>1</sup> The particular issue of anticoagulation underuse in patients with atrial fibrillation (AF) is well documented, including in elderly patients.<sup>2-8</sup>

AF is the most frequent cardiac arrhythmia in the elderly and its prevalence increases with age.<sup>9</sup> Moreover, two-thirds of AF cases concern patients aged  $\geq 75$  years,<sup>10</sup> in whom AF prevalence exceeds 10%. Consequently, AF management is everyday practice for physicians in charge of elderly patients. Guidelines on pharmacological management of AF recommend the use of antithrombotic agents,<sup>11,12</sup> as this arrhythmia largely increases the risk for cardio-embolism and specifically stroke.<sup>13</sup> Oral anticoagulant therapy, such as vitamin K antagonists (VKAs), is recommended in patients at

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high risk of stroke ( $\geq 4\%$  per year), while antiplatelet agents offer a possible alternative in patients at low risk of stroke, an infrequent situation in frail older patients.<sup>11</sup>

The translation of these guidelines into clinical practice remains a challenge.<sup>14,15</sup> Even if there is strong evidence that antithrombotic treatment is beneficial in elderly patients and might effectively prevent numerous ischemic strokes,<sup>16–18</sup> data show that approximately half of the older patients suffering from AF do not receive the recommended cardio-embolic prophylaxis.<sup>19,20</sup> As the Western population gets incessantly older and AF is highly prevalent in elderly patients, it is worth getting a better understanding of older patients' characteristics associated with anticoagulation underuse. Frailty, which increases the risk of stroke but not of major hemorrhages, has been reported to be associated with lower VKA use in a few studies.<sup>21,22</sup> Patient-related reasons cited to refrain from the prescription of anticoagulant therapy in the elderly include strong contraindications, advanced age, comorbidities, a history or increased risk of bleeding, falls, and poor medication.<sup>4,14,23–26</sup> Some of these reasons are supported by evidence while others are not. Withholding anticoagulant therapy seems appropriate and legitimate in the presence of true contraindications (eg, previous major bleed, thrombopenia, poor compliance). In other cases (eg, risk of falls, advanced age), the risk-benefit ratio of anticoagulation is favorable.<sup>27</sup> There is obviously a need for revisiting the prescription of anticoagulant therapy in the light of the individual assessment of the overall risks and benefits. The perception of the opposite risks of stroke and bleeding varies among physicians<sup>25,28</sup> and remains highly challenging.

Tools are currently available to help physicians assess these two risks (clotting or bleeding) in older patients with AF, ie, the CHADS<sub>2</sub> score (Congestive heart failure, Hypertension, Age >75, Diabetes mellitus, and prior Stroke or transient ischemic attack) to predict the annual stroke risk,<sup>29</sup> and the HEMORR<sub>2</sub>HAGES score (Hepatic or renal disease, Ethanol abuse, Malignancy, Older [age >75 years], Reduced platelet count or function, Rebleed risk, Hypertension [uncontrolled], Anemia, Genetic factors, Excessive fall risk, and Stroke)<sup>30</sup> to predict the risk of major bleeding. The aim of this study was to identify characteristics related to the underuse of anticoagulant therapy in geriatric patients in the light of their bleeding and cardio-embolism risk profile.

## Materials and methods

### Study design and patient population

We conducted a cross-sectional study including consecutive older patients with AF admitted between January 2008 and December 2010 in the Cliniques universitaires Saint-Luc,

Brussels, Belgium. Inclusion criteria were: 1) older age ( $\geq 75$  years); 2) evidence of current or recent AF; 3) indication for anticoagulation defined by a CHADS<sub>2</sub><sup>29</sup> score  $\geq 2$ ; and 4) comprehensive geriatric assessment (multi-disciplinary assessment including medical aspects but also psycho-social and relational evaluation, nutritional assessment and physio/ergotherapy testing) by the acute geriatric unit or the inpatient geriatric consultation team (providing geriatric counseling in non-geriatric wards for older patients with frailty defined by an Identification of Seniors at Risk [ISAR] score  $\geq 2$ ).<sup>31</sup> We excluded the few patients with another indication for anticoagulants (eg, prosthetic valve, a history of deep venous thrombosis/pulmonary embolism in the last 6 months) or with anticoagulants contraindication (surgery in the last 3 weeks, peptic ulcer in the last 3 months).

### Data collection

Socio-demographic data included age, sex, and residency (private home versus nursing home). Geriatric profile was assessed through functional dependency for basic activities of daily living using the Katz scale,<sup>32</sup> frailty profile (ISAR) and the presence of cognitive disorders (clinical diagnosis or Mini Mental State Examination <24/30),<sup>33</sup> malnutrition (assessed on the basis of a nutritionist evaluation and/or a body mass index of <21 kg/m<sup>2</sup> and/or a mid-arm circumference <23 cm and/or albumin <3 g/dL), history of recent falls (within the previous 6 weeks), and elevated risk of falls (history of falls, dementia, Parkinson's disease, or evidence according to the team's physiotherapist). The use of antiplatelet therapy and/or anticoagulation therapy (VKAs or low molecular weight heparin at a dosage offering effective anticoagulation) at home the day before admission was recorded. The new oral anticoagulants (NOACs, ie, apixaban, dabigatran, rivaroxaban) were not marketed in Belgium for cardio-embolic prevention in AF before the end of this study. Medical data specifically included the presence or absence of all the items of the CHADS<sub>2</sub> and the HEMORR<sub>2</sub>HAGES scores.

### Scores of cardio-embolism and bleeding risks

The AF-related risks of stroke and of bleeding were assessed using, respectively, the CHADS<sub>2</sub> score<sup>29</sup> and the HEMORR<sub>2</sub>HAGES score.<sup>30</sup> We chose to use the CHADS<sub>2</sub> score for several reasons. In contrast to the CHA<sub>2</sub>DS<sub>2</sub>-VASc score (Congestive heart failure, Hypertension, Age <75 years, Diabetes mellitus, Stroke, Vascular disease, Age 65–74 years, Sex category)<sup>34</sup> (recently developed to identify AF patients at very low risk of cardio-embolism who do not require anticoagulation, ie, a very infrequent situation in frail older

patients), the CHADS<sub>2</sub> score: 1) was developed in a population of older patients; 2) correlates with the stroke risk in a linear, precise (narrow confidence intervals), and valid (C statistics) manner; 3) correlates with the prescription habits in geriatric patients;<sup>35</sup> 4) is easy to remember and to use in the daily practice; and 5) was available at the time of anticoagulation decision in this study. Moreover, according to the CHA<sub>2</sub>DS<sub>2</sub>-VASc score, all the patients aged >75 years should be on anticoagulation, which is controversial in older patients with lower annual stroke risk (<4%) and significant bleeding risk. The CHADS<sub>2</sub> score (range 2–6/6 in this study) gives one point for the presence of each cardio-embolism risk factor, namely congestive heart failure (within the previous year), hypertension (antihypertensive regimen or  $\geq 160/90$  mmHg on several occasions), age  $\geq 75$  years, diabetes mellitus or anti-diabetic drugs or fasting blood glucose  $\geq 126$  mg/dL on several occasions, and two points for stroke or transient ischemic attack (TIA) history.

The HEMORR<sub>2</sub>HAGES score seemed more appropriate to us than the more recent HAS-BLED score (Hypertension, Abnormal renal/liver function, Stroke, Bleeding history or predisposition, Labile international normalized ratio, Elderly [ $>65$  years], Drugs/alcohol concomitantly)<sup>36</sup> for the following reasons: 1) it was developed in a population of older patients; 2) it includes items relevant to a geriatric population (eg, age  $>75$  years, malignancy, anemia, reduced platelet function due to antiplatelet therapy, and elevated falls risk); 3) it precisely predicts (narrow confidence intervals) the risk of major bleeding events when treated by anticoagulation; 4) it correlates with the actual prescription of anticoagulants in geriatric patients.<sup>35</sup> These features are not present in the HAS-BLED score. Furthermore, the HAS-BLED item “labile international normalized ratios (INRs)” item was not available at the time of decision-making on starting anticoagulation.<sup>36</sup> HEMORR<sub>2</sub>HAGES is the most suitable score to assess bleeding risk in older patients according to a recent French expert consensus on the management of AF in older people.<sup>10</sup>

The HEMORR<sub>2</sub>HAGES score (range 1–12/12 in this study) is computed by adding one point for each of the following bleeding risk factors: hepatic (cirrhosis with Child-Pugh score  $\geq 3$ ) or renal failure (estimated glomerular filtration rate<sup>37</sup>  $<30$  mL/min), ethanol abuse, malignancy, older age, reduced platelet count ( $<150,000/\mu\text{L}$ ) or function (use of platelet aggregation inhibitors), uncontrolled hypertension, anemia (hemoglobin  $<10$  g/dL), genetic factors, elevated falls risk, stroke, and by adding two points for rebleed risk, ie, history of a major bleeding event (hemoglobin decline of  $\geq 2$  g/dL, blood transfusion of  $\geq 2$  units, or bleeding in a major organ) and recent bleeding (last 3 years).<sup>38</sup>

## Objectives

The aim of our study was to first assess the underuse of anticoagulation (VKA or low molecular weight heparin at full therapeutic dosage) before hospital admission in older patients with clear clinical indication of anticoagulation according to the CHADS<sub>2</sub> score. Secondly, we wanted to better characterize these non-anticoagulated patients regarding their cardiovascular and geriatric profile and their CHADS<sub>2</sub> and HEMORR<sub>2</sub>HAGES scores in order to search for modifiable characteristics associated with anticoagulation underuse.

## Statistical analysis

All continuous variables not normally distributed were summarized using the median and the inter-quartile range [ $P_{25}$ – $P_{75}$ ] and were compared between groups using Wilcoxon rank sum test or Kruskal–Wallis test, depending on the number of groups in the comparison. Categorical variables were expressed using percentages and were compared using chi-squared test or the Fisher’s exact test, as appropriate. Multivariate logistic regression was used to assess the independent predictors of anticoagulation underuse among the total cohort as well as in this subgroup of patients with a history of stroke. In order to avoid co-linearity, the correlation coefficients between covariates were calculated. In case of co-linearity ( $r$ -value  $>0.90$ ), only one of the two covariates was considered in the multivariate model. Variables with a  $P$ -value  $\leq 0.20$  in univariate analysis were submitted to the multivariate model. A stepwise procedure using Akaike’s information criterion was used to select independent multivariate predictors of anticoagulation underuse. Model goodness of fit was examined using Hosmer–Lemeshow test (null hypothesis: the model is a good fit for the data). All statistical analyses were performed using R version 2.15.1 (R Foundation for Statistical Computing) and a  $P$ -value  $<0.05$  was considered as statistically significant.

## Results

### Patient characteristics

Seven hundred and seventy-three older patients (median age 85.0 years, female sex 57%) met the inclusion criteria. Geriatric syndromes were frequent (eg, malnutrition 47%, recent falls 42%, cognitive disorders 33%). Half of the patients were dependent (median Katz score: 9) and one fifth were nursing home residents.

The annual risk of stroke was high (mean  $\pm$  standard deviation [SD]:  $6.9\% \pm 3.3\%$ , median 5.9%) as predicted by the CHADS<sub>2</sub> score and its items (congestive heart failure 49%, hypertension 83%, age  $\geq 75$  years 100%, diabetes 21%,

and stroke/TIA 32%). The annual risk of bleeding was also high (mean  $\pm$  SD: 9.7% $\pm$ 2.2%, median 10.4%), based on the HEMORR<sub>2</sub>HAGES score and its prevalent items (eg, risk of falls 63%, reduced platelet function/count 56%, in addition to older age, hypertension and stroke history).

## Underuse of anticoagulation

Of these 733 patients with indication for anticoagulant therapy, half (50.3%, n=389) were on VKA (n=330) or low molecular weight heparin (n=59), while the other half was not anticoagulated (49.7%, n=384) at home before hospital admission. Among the 330 patients on VKA treatment, the admission INR was infra-therapeutic (INR <2) in 56%, on target (2 < INR <3) in 21% and supra-therapeutic (INR >3) in 22% (admission INR unknown in 4 patients =1%). Table 1

compares patients on anticoagulation to those with no anticoagulation in terms of socio-demographic data, geriatric syndromes as well as risk factors and predicted annual rates of stroke and bleeding.

Patients with no anticoagulation had significantly higher use of antiplatelet therapy (61% versus 27%,  $P<0.001$ ), less thrombopenia (7.0% versus 18.3%,  $P<0.001$ ), older age (86 versus 85 years,  $P=0.004$ ), and higher annual bleeding risk according to HEMORR<sub>2</sub>HAGES ( $P<0.001$ ). However, the latter was not different when corrected for use of antiplatelet agents (ie, withdrawing one point to all the patients on antiplatelet therapy, 8.4 [8.4; 10.4] versus 8.4 [8.4; 10.4],  $P=0.41$ ).

Univariate analysis confirmed that anticoagulation underuse was neither associated with geriatric syndromes

**Table 1** Characteristics of older patients with atrial fibrillation regarding their anticoagulation status

	On anticoagulation n=389	No anticoagulation n=384	P-value
Socio-demographic			
Age, median [P <sub>25</sub> -P <sub>75</sub> ]	85 [81-88]	86 [82-89]	0.004
Female sex, %	54.8	58.6	0.28
Living in nursing home, %	17.2	23.2	0.04
Geriatric features, %			
Malnutrition	45.0	48.6	0.32
Recent falls	42.7	42.2	0.89
Cognitive disorders	31.9	34.6	0.42
Dependency in ADL (Katz $\geq$ 10/24)	45.9	49.3	0.33
CHADS <sub>2</sub> , stroke risk			
Score, median [P <sub>25</sub> -P <sub>75</sub> ]	3 [2-4]	3 [2-4]	0.17
Risk, %/year, median [P <sub>25</sub> -P <sub>75</sub> ]	5.9 [4.0-8.5]	5.9 [4.0-8.5]	
Items, %			
Congestive heart failure	50.4	47.1	0.37
Hypertension	82.2	83.1	0.77
Age $\geq$ 75 years	100	100	
Diabetes mellitus	21.6	21.0	0.80
Stroke or TIA	34.0	30.7	0.34
HEMORR <sub>2</sub> HAGES, bleeding risk			
Score, % median [P <sub>25</sub> -P <sub>75</sub> ]	4 [3-4]	4 [3-5]	<0.001
Risk, %/year, median [P <sub>25</sub> -P <sub>75</sub> ]	10.4 [8.4-10.4]	10.4 [8.4-12.3]	
Items, %			
Hepatic/renal failure	14.6	13.8	0.74
eGFR <30 mL/min	13.4	11.5	0.42
Ethanol abuse	1.3	3.6	0.03
Malignancy	9.0	10.7	0.43
Reduced platelets	45.0	68.0	<0.001
Antiplatelet therapy	26.5	60.7	<0.001
Thrombocytopenia	18.3	7.0	<0.001
Rebleed risk	6.9	4.9	0.24
Anemia (Hb <10 g/dL)	16.5	16.9	0.86
Elevated falls risk	60.4	65.4	0.15
Stroke	30.8	28.4	0.45

**Abbreviations:** ADL, activities in daily living; eGFR, estimated glomerular filtration rate (using the Modification of Diet in Renal Disease Study-4 formula); Hb, hemoglobin; TIA, transient ischemic attack; CHADS<sub>2</sub>, Congestive heart failure, Hypertension, Age >75, Diabetes mellitus, and prior Stroke or transient ischemic attack; HEMORR<sub>2</sub>HAGES, Hepatic or renal disease, Ethanol abuse, Malignancy, Older (age >75 years), Reduced platelet count or function, Rebleed risk, Hypertension (uncontrolled), Anemia, Genetic factors, Excessive fall risk, and Stroke.

**Table 2** Determinants of anticoagulation underuse in the study population (n=773)

	Univariate analysis			Multivariate analysis		
	OR	[95% CI]	P-value	OR	[95% CI]	P-value
Antiplatelet use	4.28	[3.17–5.83]	<0.001	5.27	[3.75–7.48]	<0.001
Ethanol abuse	2.91	[1.10–9.07]	0.043	4.00	[1.39–13.31]	0.014
Age						
≥90 years	1.67	[1.03–2.71]	0.039	2.00	[1.18–3.43]	0.011
≥85 and <90 years	1.07	[0.70–4.66]	0.745	1.11	[0.69–1.79]	0.673
≥80 and <85 years	0.99	[0.64–1.54]	0.976	0.86	[0.53–1.40]	0.549
≥75 and <80 years	1.00			1.00		
Elevated falls risk	1.24	[0.92–1.66]	0.154	1.36	[0.95–1.93]	0.090
Living in nursing home	1.45	[1.02–2.08]	0.038	1.37	[0.93–2.03]	0.115

**Note:** Hosmer-Lemeshow goodness-of-fit  $P$ -value =0.76, indicating that the model is a good fit for the data.

**Abbreviations:** OR, odds ratio; CI, confidence interval.

(malnutrition, falls, cognitive disorders, functional dependency) nor with the CHADS<sub>2</sub> score. Potential risk factors ( $P$ -value  $\leq 0.2$ ) of anticoagulation underuse were antiplatelet therapy, ethanol abuse, age >90 years, falls risk, and nursing home residency (Table 2, left column). The HEMORR<sub>2</sub>HAGES score, which includes three of the abovementioned risk factors (ethanol abuse, antiplatelet therapy and falls risk), was associated with anticoagulation underuse in the univariate analysis. However, the multivariate analysis (Table 2, right column) identified three variables as independent predictors of anticoagulation underuse, namely antiplatelet therapy (OR 5.3), ethanol abuse (OR 4.0) – a feature present in only 2.5% of the patients – and age >90 years (OR 2.0).

## Anticoagulation underuse and antiplatelet therapy

As antiplatelet therapy was the strongest determinant of anticoagulation underuse, we raised the hypothesis that

patients on antiplatelet agents but no anticoagulation (n=233) had been at higher bleeding risk (HEMORR<sub>2</sub>HAGES score) and/or lower stroke risk (CHADS<sub>2</sub> score) than those on anticoagulation (n=389). Table 3 shows that this was not the case. These two groups did not show a difference in the CHADS<sub>2</sub> score nor in the HEMORR<sub>2</sub>HAGES score corrected for use of antiplatelet agents (ie, withdrawing one point to all the patients on antiplatelet therapy). In stable vascular disease, antiplatelets can indeed be stopped in patients under anticoagulant treatment.<sup>10,11,39,40</sup>

## Anticoagulation underuse after stroke

We further studied the 229 patients with AF and a history of stroke, in whom anticoagulation underuse was expected to be lower. Surprisingly, anticoagulation underuse was present in 109 (48%) of these patients with a previous stroke, and not lower than in those free of stroke (51%) ( $P=0.45$ ). The geriatric profile of these 229 frail older stroke patients

**Table 3** Comparison between patients on anticoagulant and patients on antiplatelet agents

	Anticoagulant <sup>a</sup> (n=389)	Antiplatelet <sup>b</sup> (n=233)	P-value
<b>Significant variables, %</b>			
Antiplatelet therapy	26.5	100	<0.001
Vascular disease	48.9	62.2	0.003
Ethanol abuse	1.3	3.9	0.036
<b>Risk prediction</b>			
CHADS <sub>2</sub> score			
Median score [P <sub>25</sub> –P <sub>75</sub> ]	3 [2–4]	3 [2–4]	NS
Risk, %/year, median [P <sub>25</sub> –P <sub>75</sub> ]	5.9 [4.0–8.5]	5.9 [4.0–8.5]	
HEMORR <sub>2</sub> HAGES score			
Median score [P <sub>25</sub> –P <sub>75</sub> ]	4 [3–4]	4 [4–5]	<0.001
Risk, %/year, median [P <sub>25</sub> –P <sub>75</sub> ]	10.4 [8.4–10.4]	10.4 [10.4–12.3]	
Corrected HEMORR <sub>2</sub> HAGES score <sup>c</sup>			
Median score [P <sub>25</sub> –P <sub>75</sub> ]	3 [3–4]	3 [3–4]	NS
Risk, %/year, median [P <sub>25</sub> –P <sub>75</sub> ]	8.4 [8.4–10.4]	8.4 [8.4–10.4]	

**Notes:** <sup>a</sup>Anticoagulant: with or without antiplatelet therapy; <sup>b</sup>antiplatelet: without anticoagulation; <sup>c</sup>corrected HEMORR<sub>2</sub>HAGES: no point given for antiplatelet therapy.

**Abbreviations:** NS, non-significant; CHADS<sub>2</sub>, Congestive heart failure, Hypertension, Age >75, Diabetes mellitus, and prior Stroke or transient ischemic attack; HEMORR<sub>2</sub>HAGES, Hepatic or renal disease, Ethanol abuse, Malignancy, Older (age >75 years), Reduced platelet count or function, Rebled risk, Hypertension (uncontrolled), Anemia, Genetic factors, Excessive fall risk, and Stroke.

(median age 85 years, female 52%, nursing home 27%) was similar to that of the overall study group. In multivariate analysis, the single independent factor associated with anticoagulation underuse in these stroke patients was antiplatelet agent use (OR [95% CI]: 5.0 [2.9; 8.8]) ( $P < 0.001$ ). Neither CHADS<sub>2</sub> nor HEMORR<sub>2</sub>HAGES score was determinant of anticoagulation underuse in patients with AF and stroke.

## Discussion

The main finding of this study in frail older patients with AF was that the strongest predictor of anticoagulation underuse was the use of antiplatelet therapy, a reversible characteristic allowing improvement in prescribing and stroke prevention. Aspirin (acetylsalicylic acid) is known to be of limited efficacy in stroke prevention,<sup>41</sup> especially as age increases.<sup>42</sup> Warfarin is more effective than aspirin, also in older patients.<sup>43</sup> Moreover, warfarin is safer than aspirin in octogenarians, as shown in the WASPO trial (warfarin versus aspirin for stroke prevention in octogenarians with atrial fibrillation), which found significantly more adverse events with aspirin (33%) than with warfarin (6%), including serious bleeding.<sup>44</sup> Surprisingly, the large anticoagulation underuse (69%) in our patients on antiplatelet therapy was not explained by a lower risk of cardio-embolism or a higher risk of bleeding. Thus, we found no clinical rationale underlying the withholding of anticoagulation. We suspect that aspirin was prescribed in some patients for AF-related stroke prevention, while in the others – the majority probably – for underlying cardiovascular ischemic disease. It has been proposed not to add aspirin for associated stable vascular disease<sup>45</sup> in patients with AF receiving anticoagulation, as there is no evidence that adding aspirin to warfarin reduces stroke or other vascular events in these patients.<sup>39,46</sup> In such patients, in line with recent guidelines, we suggest that aspirin be withdrawn and anticoagulation prescribed in monotherapy if the coronary ischemic event occurred more than 1 year ago.<sup>18,47</sup>

The observation that history of stroke was not related to higher use of anticoagulation is another important finding of our study. Nearly half (48%) of these high risk patients in secondary stroke prevention presented with anticoagulation underuse, despite no significant difference in their geriatric profile, stroke risk or bleeding risk. A similar observation was reported in elderly patients with AF and recent ischemic stroke, in whom warfarin use decreased with age,<sup>6</sup> a finding not observed in our study. However, we have not considered possible hemorrhagic conversion of stroke as potential cause of not prescribing anticoagulant therapy.

Medical decision making in terms of anticoagulation in older patients is complex. The more advanced the age, the higher the risks of both clotting and bleeding. Warfarin and other VKAs are feared by clinicians in the elderly because of complex kinetics, multiple interactions, and narrow therapeutic index. We used the CHADS<sub>2</sub> and the HEMORR<sub>2</sub>HAGES scores, which offer several advantages in the elderly population. However, these tools also present limitations, including the inclusion of similar items. Neither the CHADS<sub>2</sub> score nor the corrected HEMORR<sub>2</sub>HAGES score was found to be an independent determinant of VKA underuse in our hospital admitted patients. Our observations differ from those reported in long-term care residents where warfarin use increased with higher stroke risk and with lower bleeding risk.<sup>48</sup> Our results confirm the observation of Marcucci et al that cardio-embolic and bleeding risks are not the main determinants of the therapeutic choice in elderly patients with AF.<sup>19</sup>

We believe that risk prediction tools, eg, the CHADS<sub>2</sub> and the HEMORR<sub>2</sub>HAGES scores, should be used more generally in primary care practice to help physicians balance the risk–benefit ratio for anticoagulation in individual frail older patients, who are often at high risk of thromboembolism and bleeding. On one hand the CHADS<sub>2</sub> score predicts cardio-embolism events, which imply significant morbi-mortality, and on the other hand the HEMORR<sub>2</sub>HAGES score predicts “major bleedings” without any distinction between muscular or digestive bleedings, which are manageable, and intracranial or life-threatening bleedings. Maybe we should consider weighting this “global bleeding” risk score in order to allow a reasonable comparison between both risk scores and so determine the net clinical benefit for the patient more accurately, especially at the cerebral level. This is a crucial point knowing that Friberg et al<sup>49</sup> already demonstrated that the cerebral risk of ischemic stroke without anticoagulant treatment exceeds the cerebral risk of intracranial bleeding with anticoagulant treatment at almost every combination of stroke and bleeding risks.

Our study confirms the general tendency among physicians to underuse anticoagulants in the elderly with AF. This large underuse rate (~50%) is concordant with previous literature data.<sup>19,20,25,50–54</sup> Besides antiplatelet therapy, discussed above, two other characteristics were found to be independent predictors of anticoagulation underuse in our multivariate analysis: ethanol abuse and patient’s very old age ( $\geq 90$  years). The former was infrequent and strong, while the latter was frequent and weak. Although age is an independent risk factor for bleeding with all anticoagulation

modalities,<sup>42,55</sup> age should not be regarded as a contraindication to anticoagulation treatment. In a large study on very old patients (median age 84 years) on VKA carefully monitored by anticoagulation clinics, the rate of major bleeding was low (1.9%/year).<sup>56</sup> Moreover, the risk for stroke increases with older age in patients with AF.<sup>9,57</sup> Therefore, the withholding of anticoagulation for the sole reason of older age can be considered as ageism.<sup>1</sup> We did not find any association between anticoagulation underuse and geriatric syndromes, as reported by De Breucker et al (dementia, malnutrition, functional dependency, risk of falls),<sup>20</sup> or Sanchez-Barba et al (depression, cognitive disorders),<sup>22</sup> neither with sex, hemorrhage history or malignancy.<sup>19,58</sup>

Our study presents several strengths. Firstly, it focuses on a highly relevant and complex topic in the daily medical practice, as the elderly population constantly grows and anticoagulation drugs are frequent long-term medications in elderly patients. Secondly, it is quite original, as few previous studies analyzed both medical and geriatric characteristics as potential predictors of anticoagulation underuse in a large and representative frail older population with AF. Thirdly, there is currently little data in literature comparing both risk scores in a face-to-face way, especially among geriatric patients.<sup>59</sup>

The study shows some limitations. It was cross-sectional and based on assessments conducted during a hospital stay and from patients recruited from our single center. Nevertheless, we had access to a large population, the pharmacological treatment used at home, and a valuable amount of information from the comprehensive geriatric assessment. We could not explore all the potential factors affecting the anticoagulation decision, particularly the general practitioner-related reasons or the patient's preferences. It has already been demonstrated that anticoagulation under-prescribing is partially explained by the fact that general practitioners would feel personally responsible for an iatrogenic hemorrhagic complication, as opposed to a cardio-embolic complication in the absence of treatment.<sup>60</sup> In the same way, it was not possible to evaluate patients' compliance and psychosocial factors that could significantly influence the bleeding risk.<sup>61</sup> We think qualitative and prospective work would help to understand reasons underlying anticoagulant underuse.

This study was conducted before the marketing of NOACs in our country (2012), nowadays used in AF. We believe that these NOACs will be of little help in decreasing the anticoagulation underuse during the coming years in the frail older population. Due to a short half-life, treatment adherence remains a challenge with these drugs. The lack of reliable monitoring tests and of reversal agents, and cost are

other barriers to the prescribing of NOACs, which were not encountered with VKAs.<sup>62</sup> Three characteristics associated with anticoagulation underuse in our study, namely renal impairment, antiplatelet use, and ethanol abuse, will not disappear with the use of NOACs. We believe that the decision to prescribe anticoagulation is a global concept and that the type of molecule (VKA versus NOAC) is not significantly influencing the decision-making in this specific population. Future studies should compare the prevalence of underuse after the marketing of NOACs with the present results in order to test this hypothesis.

In summary, our study showed that underuse of anticoagulation concerns half of the frail older patients with AF and anticoagulation indication. Underuse of anticoagulation could not be clinically explained in this population, and was mainly related to the use of aspirin. In this context, risk scores may be useful to help the clinician in the decision making process. Nevertheless, the net clinical benefit remains difficult to assess knowing that these scores predict events of varying severity and therefore remain difficult to compare for each individual case.

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