

Characterization of Patients with Atrial Fibrillation Treated Inadequately with Anticoagulants: Why Hospitalization Is Not an Opportunity to Correct Errors

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ABSTRACT **Background:** Atrial fibrillation (AF) is a common cardiac arrhythmia. Prevalence increases with age. It is a major public health concern due to high risk of thromboembolic complications such as stroke and systemic embolism. Direct oral anticoagulants (DOACs) have been shown to have improved safety and efficacy profiles and are the preferred therapy in all recent guidelines. However, patients are still discharged from internal medicine wards without appropriate DOAC therapy. **Objectives:** To investigate the effectiveness of hospitalization in correcting inappropriate therapy for AF in patients who were hospitalized in the internal medicine departments for any reason and discharged without receiving DOAC therapy. **Methods:** In this retrospective cohort study, we gathered data from electronic medical records at Sheba Medical Center on 222 patients. The patients were divided into three groups based on the anticoagulation therapy they received. **Results:** The patient cohort (mean age of 77.1 years; 42.3% males; 21.6% presented with cognitive impairment. Researchers identified several potential contraindications for DOACs (renal disease in 24.3%, mechanical valves in 14.4%). When comparing patients with and without DOAC contraindications, there were no statistically significant differences regarding cognitive impairment rates or the lack of anticoagulation therapy. We further divided patients who did not receive DOACs into two groups: 134 due to contraindications and 88 mistakenly. Between these groups, baseline factors showed no statistically significant differences. **Conclusions:** We found that older patients received less standardized care. Findings emphasize the need to consider individual patient characteristics and co-morbidities to eliminate management errors and improve the quality of clinical care.

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KEY WORDS: age, anticoagulation, atrial fibrillation (AF), direct oral anticoagulants (DOACs), stroke

Atrial fibrillation (AF) is a common sustained cardiac arrhythmia that increases in prevalence with age. It is a major public health concern due to its association with increased mortality and morbidity, including a higher risk of thromboembolic complications such as stroke and systemic embolism [1]. For many years, vitamin K antagonists, such as warfarin, were the main anticoagulant used to treat AF. However, those antagonists all have a narrow therapeutic index, delayed onset and offset effects, and multiple drug interactions, which require continuous monitoring [2,3]. In contrast, direct oral anticoagulants (DOACs) have been shown to cause less intracranial bleeding and have improved safety and efficacy profiles compared to vitamin K antagonists [4-6]. Recent guidelines, including the 2020 guidelines of the European Society of Cardiology, recommend the use of DOACs over vitamin K antagonists for AF patients [7].

DOACs still increase the risk of bleeding, and may not be suitable for certain subgroups of AF patients [1]. Clinical activity is guided by scores that predict thromboembolism or bleeding, such as the CHA₂DS₂-VASC and HAS-BLED scores, respectively.

Despite these well-defined tools, many patients are discharged from internal medicine wards without appropriate therapy. Common errors include the use of vitamin K antagonists instead of DOACs, underdosing of DOACs, and not prescribing anticoagulants at all to patients at risk for AF [8-10]. Studies have shown that elderly patients and those with multiple co-morbidities are most likely to be inadequately treated [11-13]. In this study, we identified the characteristics and demographics of these patients and aimed to understand the primary reasons for this misguidance.

PATIENTS AND METHODS

STUDY AIM

In this retrospective cohort study, we explored the factors contributing to the decision not to initiate treatment with DOACs or not to correct anticoagulation therapy in patients previously diagnosed with AF who were admitted to the internal medicine departments for any reason.

STUDY DESIGN AND POPULATION

This retrospective analysis was conducted on a cohort of 1200 patients with previous diagnosis of atrial fibrillation aged 60 years and older with CHA₂DS₂-VASc score above 2 points and who were admitted to various internal medicine wards at Sheba Medical Center between January 2018 to December 2020 and subsequently discharged without the use of DOACs. A sample of 300 patients was randomly chosen. From this group, 222 patients met the eligibility requirements, and their medical records were comprehensively documented, and no essential information was missing. The patients were categorized into three groups based on the anticoagulation therapy they received: 101 patients did not receive any anticoagulation

therapy (No AC), 78 patients received vitamin K antagonists (VKAs), and 43 patients received low molecular weight heparins (LMWH).

Our primary focus was to analyze the demographic and clinical characteristics of the patients, including age, sex, presence of cognitive impairment, weight, anticoagulation therapy, hospitalization due to atrial fibrillation, Padua Prediction Score, prothrombin time-international normalized ratio, creatinine levels, estimated glomerular filtration rate, and platelet count.

We utilized electronic medical records from the Sheba Medical Center, including the Chameleon and MD-CLONE electronic database records, to gather data on the patients.

STATISTICAL ANALYSIS

Baseline characteristics were described by means $\pm$ standard deviations (SD) for continuous variables and percentages for categorical variables. The comparison between different variables was performed using a *t*-test for continuous variables and a Pearson chi-square for categorical variables. *P*-values < 0.05 were considered statistically significant. Statistical analyses were performed using IBM Statistical Package for the Social Sciences

Table 1. Characteristics of patients with atrial fibrillation hospitalized and discharged without DOACs

Characteristics	All (n=222)*	No AC (n=101)	Vitamin K antagonists (n=78)	LMWH (n=43)
Age	77.1 $\pm$ 9	79.0 $\pm$ 10	75.4 $\pm$ 9	75.6 $\pm$ 8
Male sex	94 (42.3)	66 (65.3)	33 (42.3)	29 (67.4)
Cognitive impairment	48 (21.6)	27 (26.7)	11 (14.1)	32 (74.4)
Weight, kg, mean $\pm$ SD	76.0 $\pm$ 16	76.0 $\pm$ 16	71.4 $\pm$ 13	69.6 $\pm$ 13
Hospitalized due to atrial fibrillation	7 (3.2)	2 (2.0)	4 (5.1)	1 (2.3)
Hospitalization length, days, median (IQR)	1.9 (1.0–4.9)	1.9 (1.0–4.2)	1.9 (1.0–7.1)	2.8 (1.1–7.6)
Possible contraindications for DOACs				
None	57 (25.7)	32 (31.7)	15 (19.2)	10 (23.3)
Patient preference	4 (1.8)	3 (3.0)	1 (1.3)	–
Valvular atrial fibrillation	19 (8.6)	2 (2.0)	17 (21.8)	–
Mechanical valve	32 (14.4)	4 (4.0)	21 (26.9)	7 (16.3)
Liver disease	5 (2.3)	4 (4.0)	2 (2.6)	5 (11.6)
Renal disease	54 (24.3)	28 (27.7)	17 (21.8)	9 (20.9)
Gastrointestinal bleeding	24 (10.8)	17 (16.8)	2 (2.6)	5 (11.6)
Intracranial hemorrhage	19 (8.6)	9 (8.9)	3 (3.8)	7 (16.3)
Recurrent falls	2 (0.9)	2 (2.0)	–	–

AC = anticoagulation therapy, DOACs = direct oral anticoagulants, eGFR = estimated glomerular filtration rate, IQR = interquartile range, LMWH = low molecular weight heparins, SD = standard deviation

*The entire cohort

statistics software, version 26 (SPSS, IBM Corp, Armonk, NY, USA). The study was approved by the local institutional review board (SMC-21-8224).

RESULTS

The baseline clinical characteristics of the patients of the study are presented in Table 1. The mean age of the patients was 77.1 years; 94 (42.3%) were male; and 21.6% had cognitive impairment. Only 7 patients (3.2%) were hospitalized due to AF. The median length of hospitalization was 1.9 days (IQR 1.0–4.9), and 46.4% had a Padua Prediction score of 4 or higher. Possible contraindications for DOACs that were found included: valvular atrial fibrillation (8.6%), mechanical valves (14.4%), liver disease (2.3%), renal disease (24.3%), gastrointestinal bleeding (10.8%), intracranial hemorrhage (8.6%), and recurrent falls (0.9%). The patient preference for not receiving AC therapy was documented in 1.8% of patients [Table 1].

We compared 165 patients with DOACs contraindication and 57 patients without a contraindication [Table 2]. Cognitive impairment was reported in 19.4% of patients with a contraindication; 28.6% of patients without a contraindication had cognitive impairment ($P = 0.150$).

In total, 41.8% of patients with contraindication to DO-ACS had no anticoagulation therapy, compared to 56.1% of those without a clear contraindication ($P = 0.154$). The comparison of characteristics between these two subgroups of patients not receiving AC [Table 3] showed that the patients with a DOACs contraindication ($n=69$) were older, had a higher rate of cognitive impairment, and had a lower mean weight compared to those without a contraindication ($n=32$).

Table 4 shows the comparison of factors between patients who were not initiated with DOACs appropriately and those who were not initiated mistakenly during hospitalization.

There were 134 patients who were not initiated with DOACs appropriately (due to contraindication to DO-ACS) and 88 patients who were not initiated with DO-ACs mistakenly.

The mean age of the patients who were not initiated with DOACs appropriately was 76.2 years, while the mean age of the patients who were mistakenly not initiated with DOACs was 78.5 years ($P = 0.071$). The proportion of male sex was similar between the two groups (53.7% vs. 63.6%, $P = 0.144$). The proportion of patients with cognitive impairment was similar in the two groups (21.8% vs. 21.6%, $P = 0.970$). The length of hospital-

Table 2. Comparison of characteristics between patients with an established DOACs contraindication versus those with no contraindication

Characteristics	DOACs contraindicated (n=165)	DOACs not contraindicated (n=57)	P-value
Age	76.5 ± 9	78.8 ± 10	0.108
Male sex	94 (57.0)	34 (59.6)	0.724
Cognitive impairment	32 (19.4)	16 (28.6)	0.150
Weight, kg, mean ± SD	72.3 ± 15	75.5 ± 16	0.171
AC therapy			0.154
None	69 (41.8)	32 (56.1)	–
Vitamin K antagonist	63 (38.5)	15 (26.3)	–
Low molecular weight heparin	33 (20.0)	10 (17.5)	–
Hospitalized due to atrial fibrillation	5 (3.0)	2 (3.5)	0.859
Creatinine, mg/dl, mean ± SD	2.1 ± 1.7	0.9 ± 0.3	< 0.001
eGFR, ml/min/1.73 m ²			–
Mean ± SD	43.1 ± 28	71.4 ± 18	< 0.001

DOACs = direct oral anticoagulants, eGFR = estimated glomerular filtration rate, SD = standard deviation

Table 3. Comparison of characteristics between patients with an established DOACs contraindication versus those with no contraindication in a subgroup of patients not receiving DOACs

Characteristics	DOACs contraindicated (n=69)	DOACs not contraindicated (n=32)	P-value
Age	79.2 ± 10	78.7 ± 10	0.815
Male sex	46 (66.7)	20 (62.5)	0.682
Cognitive impairment	17 (24.6)	10 (31.3)	0.485
Weight, kg, mean ± SD	74.2 ± 15	80.0 ± 18	0.099
Hospitalized due to atrial fibrillation	2 (2.9)	0	0.331
PT-INR	2.1 ± 1.9	1.7 ± 1.3	0.189
Creatinine, mg/dl, mean ± SD	2.1 ± 1.5	0.9 ± 0.3	< 0.001
eGFR, ml/min/1.73m ²			
Mean ± SD	42.6 ± 26	74.4 ± 18	< 0.001

DOACs = direct oral anticoagulants, eGFR = estimated glomerular filtration rate, PT-INR = prothrombin time-international normalized ratio, SD = standard deviation

Table 4. Factors associated with appropriate non-initiation of DOACs during hospitalization

Characteristics	Not initiated appropriately (n=134)*	Not initiated mistakenly (n=88)	P-value***
Age, years; mean $\pm$ SD	76.2 $\pm$ 9	78.5 $\pm$ 9	0.071
Male sex	72 (53.7)	56 (63.6)	0.144
Weight, kg; mean $\pm$ SD	72.9 $\pm$ 15	73.5 $\pm$ 15	0.757
Cognitive impairment	29 (21.8)	19 (21.6)	0.970
Hospitalized due to atrial fibrillation	4 (3.0)	3 (3.4)	0.860
Hospitalization length, days, mean $\pm$ SD	4.8 $\pm$ 8	6.5 $\pm$ 15	0.336
eGFR**, ml/min/1.73 m ²	51.5 $\pm$ 29	48.8 $\pm$ 27	0.492

*Defined by the absence of any of the reasons listed in Table 1 for not treating with DOACs or an indicated treatment with warfarin or low-molecular-weight heparin

**Defined as the presence of mechanical valve, valvular atrial fibrillation or eGFR under 30 ml/min/1.73 m²

***Pearson's chi-square test for categorical variables and independent sample Student's t-test for continuous variables

DOACs = direct oral anticoagulants, eGFR = estimated glomerular filtration rate, SD = standard deviation

ization was not significantly different between the two groups (4.8 days vs. 6.5 days, $P = 0.336$), the mean creatinine levels were similar between the two groups (1.88 mg/dl vs. 1.78 mg/dl, $P = 0.614$).

We compared factors between patients who received appropriate treatment with warfarin or LMWH to those who did not receive appropriate treatment. Some notable differences between the two groups was the younger mean age of patients treated appropriately 74.1 years compared to the patients who did not receive appropriate treatment (77.6 years). The difference was statistically significant ($P = 0.03$).

No significant differences were found between the two groups in terms of sex, weight, cognitive impairment, hospitalization due to atrial fibrillation, hospitalization length, PADUA score, and platelet count.

DISCUSSION

Atrial fibrillation is a highly prevalent condition observed in many patients hospitalized in internal wards. Oral anticoagulant treatment offers patients the advantage of ease, as it eliminates the need for regular INR monitoring or

subcutaneous injections. Such an approach promotes adherence and compliance and contributes to the success of primary prevention of complications associated with atrial fibrillation and thrombotic events. Real-world data have also shown higher adherence to DOAC therapy than to warfarin in patients with non-valvular atrial fibrillation, which may further support their use when clinically appropriate [19,20]. In this study, we aimed to investigate the factors behind inadequate initiation of oral anticoagulant therapy during hospitalization in internal wards.

Our results showed that a significant number of patients were either prescribed VKA or LMWH treatment inappropriately, or not treated at all, despite being eligible for oral anticoagulant therapy. The mean age of our patients who received suboptimal treatment stood at 79 years, which may suggest a plausible inference that advanced age may present a potential impediment to the initiation or optimization of anticoagulation therapy. We concluded that advanced age is a risk factor for the non-administration of anticoagulant treatment, this phenomenon is called *ageism*.

Ageism is defined as: "a process of systematic stereotyping and discrimination against people because they are old [14], stereotyping, prejudice, and discrimination toward people based on age." Ageism has negative effects on the physical and mental health of older people. The World Health Organization has identified reducing ageism as a key target for improving human health [15], while in Israel the strategies have not considered ageism as a modifiable risk factor. The first reference in the Supreme Court of Israel to the ageism phenomenon occurred in the early 2000s [16]; nevertheless, there was no public influence in general, or in the Israeli health system, regarding the attitude to ageism. This result may stem from the clinical judgment of bedside physicians. Since older patients frequently have multiple conditions, predicting the exact benefits and risks of pharmacotherapy is often challenging and based on the attending physician discretion.

Prescribing and monitoring drugs to older people provides major challenges to many physicians [17]. Numerous regulatory and clinical obstacles contribute to a lack of comprehensive understanding regarding the therapeutic efficacy of drugs in octa, nano, and decagenerians [18]. In this case, the basic example is the dilemma prescribing an anticoagulant for older patients with a history of gastrointestinal bleeding or a high risk of falls. Therefore, under prescribing is prevalent across different settings, including community health centers, hospitals, and nurs-

ing homes. We conclude that internal medicine departments also under prescribe.

Factors such as patient co-morbidities, ageism, and concerns about potential adverse events may contribute to the inadequate prescription of recommended drugs. However, in certain cases, factors such as limited life expectancy, an unfavorable risk-to-benefit ratio, or a patient's refusal may appropriately justify the decision not to prescribe a drug.

The insufficient inclusion of older adults in randomized controlled trials leads to challenges in both clinical and ethical realms when prescribing established standard dosing/drug therapies.

Furthermore, most patients in our study were hospitalized for conditions unrelated to their atrial fibrillation, and the study population was predominantly with significant co-morbidities. These results highlight the importance of considering individual patient characteristics when making decisions about anticoagulation therapy in patients with atrial fibrillation.

While some patients may have contraindications to DOACs or other anticoagulation therapies, the decision to not initiate therapy should be carefully considered based on the patient's overall risk of thromboembolic events and risk of bleeding.

In a considerable proportion of cases, healthcare providers may have missed errors in anticoagulant treatment. Implementing electronic alerts could potentially improve the optimization of treatment and reduce the errors. However, we were unable to accurately assess errors related to incorrect dosage of anticoagulant therapy.

This study is a retrospective cohort study and is therefore subject to certain limitations. First, the results may be influenced by confounding factors that were not accounted for in the analysis. Second, the results of this study may not be generalizable to other populations or healthcare settings as the study was conducted at a single medical center and the patient population. Future research should include a more robust analysis of the impact of hospitalization on AF treatment to provide more definitive answers regarding the effectiveness of this approach.

Additional research is warranted to verify whether ageism is a risk factor for the under prescription of anticoagulant treatment. Remembering that prevention of thromboembolism complications from AF, if not treated fairly, may represent a bleak prognosis for many geriatric patients while prescribing these medications increases the risk of major bleeding as age increases.

CONCLUSIONS

Our study highlights the prevalence of inadequate initiation of oral anticoagulant therapy during hospitalization in internal wards for eligible patients with AF. Despite the advantages of oral anticoagulants, some patients in our study did not receive appropriate treatment. Some evidence indicated that older patients were not given sufficient attention in the standardization of their anticoagulation therapy, turning ageism into a significant factor in patient management. Other predictive factors for errors could not be identified. Our study underscores the importance of considering individual patient characteristics when making decisions about anticoagulation therapy, especially for patients with significant co-morbidities.

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References

1. Michaud GF, Stevenson WG. Atrial Fibrillation. *N Engl J Med* 2021; 384 (4): 353-61.
2. Ansell J, Hirsh J, Hylek E, Jacobson A, Crowther M, Palareti G. Pharmacology and management of the vitamin K antagonists: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). *Chest* 2008; 133 (6 Suppl): 160S-98S.
3. Eikelboom JW, Wallentin L, Connolly SJ, et al. Risk of bleeding with 2 doses of dabigatran compared with warfarin in older and younger patients with atrial fibrillation: an analysis of the randomized evaluation of long-term anticoagulant therapy (RE-LY) trial. *Circulation* 2011; 123 (21): 2363-72.
4. Amin A, Keshishian A, Dina O, et al. Correction to: Comparative clinical outcomes between direct oral anticoagulants and warfarin among elderly patients with non-valvular atrial fibrillation in the CMS Medicare population. *J Thromb Thrombolysis* 2021; 51 (2): 552-8.
5. Ruff CT, Giugliano RP, Braunwald E, et al. Comparison of the efficacy and safety of new oral anticoagulants with warfarin in patients with atrial fibrillation: a meta-analysis of randomised trials. *Lancet* 2014; 383 (9921): 955-62.
6. Granger CB, et al. Apixaban versus warfarin in patients with atrial fibrillation. *N Engl J Med* 2011; 365 (11): 981-92.
7. Camm AJ, et al. 2020 ESC Guidelines for the management of atrial fibrillation developed in collaboration with the European Association of Cardio-Thoracic Surgery (EACTS). *Eur Heart J* 2020; 41 (4): 407-97.
8. Brunetti E, Presta R, Okoye C, et al. Oral anticoagulant nonprescription at discharge in geriatric patients with atrial fibrillation and reduced expected survival. *Eur J Intern Med* 2026;146:106639.

9. Drenth-van Maanen AC, Wilting I, Jansen PAF. Prescribing medicines to older people-How to consider the impact of ageing on human organ and body functions. *Br J Clin Pharmacol* 2020; 86 (10): 1921-30.
10. Masarwi M, Bassalov H, Koren-Michowitz M, Berkovitch S, Blickstein D. Persistent challenges in direct oral anticoagulant prescriptions: time to optimize medication safety in hospital and community settings. *IMAJ* 2025; 27 (9): 577-82.
11. Barr D, Epps QJ. Direct oral anticoagulants: a review of common medication errors. *J Thromb Thrombolysis* 2019; 47 (1): 146-54.
12. Kezerle L, Tsadok MA, Berliner Senderey A, et al. Use of oral anticoagulation therapy in the first 3 months after the diagnosis of atrial fibrillation in Israel: a population study. *J Cardiovasc Electrophysiol* 2020; 31 (6): 1356-63.
13. Angel Y, Zeltser D, Berliner S, et al. Hospitalization as an opportunity to correct errors in anticoagulant treatment in patients with atrial fibrillation. *Br J Clin Pharmacol* 2019; 85 (12): 2838-47.
14. Cherubini A, Corsonello A, Lattanzio F. Underprescription of beneficial medicines in older people: causes, consequences and prevention. *Drugs Aging* 2012; 29 (6): 463-75.
15. Butler RN. Why survive? Being old in America. Why survive? Being old in America. New York: Harper & Row. 1975.
16. Doron I. Ageism and anti-ageism in the rulings of the Supreme Court. *HaMishpat* 2010; 14: 65-126. [Hebrew].
17. Fialová D, Laffon B, Marinković V, et al; EUROAGEISM H2020 project and WG1b group "Healthy clinical strategies for healthy aging" of the EU COST Action IS 1402. Medication use in older patients and age-blind approach: narrative literature review (insufficient evidence on the efficacy and safety of drugs in older age, frequent use of PIMs and polypharmacy, and underuse of highly beneficial nonpharmacological strategies). *Eur J Clin Pharmacol* 2019; 75 (4): 451-66.
18. Burnes D, Sheppard C, Henderson CR Jr, et al. Interventions to reduce ageism against older adults: a systematic review and meta-analysis. *Am J Public Health*. 2019; 109 (8): e1-e9.
19. Gabarin M, Arnson Y, Neuman Y, Arow Z, Assali A, Pereg D. Cardiac tamponade in patients treated with direct oral anticoagulants. *IMAJ* 2023; 25: 430-3.
20. Shani M, Comaneshter D, Lustman A. Adherence to oral anticoagulant medications. *IMAJ* 2021; 23 (9): 580-3.

It is by character and not by intellect the world is won.

Evelyn Beatrice Hall (1868–1956), wrote under the pseudonym S[tephen] G. Tallentyre, an English writer best known for her biography of Voltaire

The pen is the tongue of the mind.

Miguel de Cervantes (1547–1616), Spanish writer widely regarded as the greatest writer in the Spanish language and one of the world's pre-eminent novelists

Capsule

Timing of PCI in patients undergoing transcatheter aortic-valve implantation

Patients with severe aortic stenosis frequently have concomitant coronary artery disease requiring revascularization. In this randomized trial, **Stahli** and co-authors compared PCI performed before TAVI with PCI performed after TAVI. Performing TAVI first proved noninferior to PCI before valve implantation regarding death, myocardial infarction, stroke, and repeat revascularization at one year. Delaying PCI until after

TAVI simplified procedural planning without compromising clinical outcomes. These findings support a flexible strategy in which coronary intervention can safely be deferred until after successful valve implantation in appropriately selected patients.

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Eitan Israeli

Capsule

Catheter-directed thrombolysis in intermediate-high-risk pulmonary embolism

In this randomized trial, **Kroupa** and co-authors evaluated catheter-directed thrombolysis combined with anticoagulation in patients with intermediate-high-risk acute pulmonary embolism. Compared with anticoagulation alone, catheter-directed fibrinolysis significantly reduced the composite outcome of pulmonary embolism-related death, hemodynamic deterioration, or recurrent pulmonary embolism during the early treatment

period. Importantly, the intervention achieved these benefits without a substantial increase in major bleeding or intracranial hemorrhage. These findings support catheter-directed thrombolysis as an effective treatment option for carefully selected patients with intermediate-high-risk pulmonary embolism.

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