

# Evaluation of compliance with recommendations of prevention of thromboembolism in atrial fibrillation in the elderly, by data reuse of electronic health records

Laurie FERRET <sup>a,1</sup>, Jean-Baptiste BEUSCART <sup>b</sup>, Grégoire FICHEUR <sup>c</sup>,  
Régis BEUSCART <sup>c</sup>, Michel LUYCKX <sup>a</sup>, Emmanuel CHAZARD <sup>c</sup>

<sup>a</sup> *Pharmacology and clinical pharmacy laboratory, EA 4481; University of Lille; F-59000 Lille, France.*

<sup>b</sup> *Geriatric department, Lille University Hospital; F-59000 Lille, France*

<sup>c</sup> *Public Health Department, Lille University Hospital; EA 2694; University of Lille; F-59000 Lille, France.*

**Abstract.** Under-prescription of anticoagulants in the elderly with atrial fibrillation (AF) has been described in several studies, showing that only 15 to 44% of them receive anticoagulants. However, the European Society of Cardiology recommendations state that anticoagulants should be systematically prescribed. In case of refusal of the treatment by the patient, a platelet aggregation inhibitor should be prescribed in monotherapy or bitherapy according to the HAS-BLED bleeding risk score. In all the cases the patient should receive an antithrombotic treatment. In this work we observe the adequacy of prescription practices to the recommendations for AF in the elderly by data reuse on a monocentric observational retrospective cohort. Data of a 222 beds French community hospital were extracted for the year 2013. The patients aged over 75 years and presenting AF were selected. The HAS-BLED score was calculated and the consistency of the prescriptions with the recommendations of the European Society of Cardiology was verified. Then the compliance rate to the recommendations was calculated. The rules detected 433 patients with AF and aged over 75 years. From those patients, 45% received an anticoagulant, 32.1% received platelet aggregation inhibitors and 22.9% did not receive any antithrombotic treatment. When a platelet aggregation inhibitor was prescribed the recommendation for bitherapy was not followed in 97% of the cases. The compliance rate to the recommendations was 47.8%. This work highlights a major problem of quality of the prescriptions in the hospital field and shows how data reuse can help describing this type of issues.

**Keywords.** Data reuse, Big Data, Patient Safety, Inappropriate Prescribing, Anticoagulants, Atrial Fibrillation.

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<sup>1</sup> Corresponding Author: Laurie Ferret, CERIM, Faculté de Médecine pôle recherche, F-59045 Lille Cedex, France; E-mail: laurie.ferret@gmail.com

## Introduction

Atrial fibrillation (AF) is a heart rhythm disorder caused by disorganized electrical impulses leading to irregular contractions of the atria. These disorders can become chronic and their reduction can be difficult. AF increases the thrombotic risk and may cause serious events such as stroke and pulmonary embolism. Anticoagulants are the preventive treatment of thrombosis and recommendations have been provided by the European Society of Cardiology for their prescription in AF [1].

Under-prescription of anticoagulants in AF has been described in several studies, showing that only 15 to 44% of the elderly with AF receive anticoagulants [2–4]. Underuse of potentially beneficial drugs is part of the definition of Inappropriate Prescribing (IP) [5], which is widespread especially among the elderly [5,6].

The computerization of medical records represents a great opportunity for medical informatics research. Data reuse of electronic health records (EHRs) enables to assess the practices at low cost and without sampling, and to follow them over time with an acceptable error related to data quality defects[7,8].

Our objective was to observe the adequacy of prescription practices to the recommendations of thromboembolic prevention in AF in the elderly.

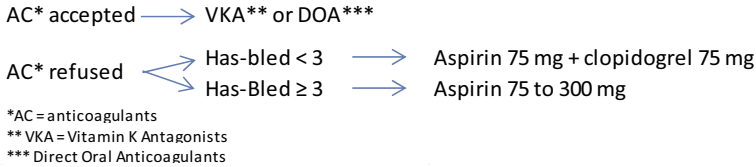
## 1. Methods

The design is a monocentric, observational, retrospective cohort. The study was conducted in a 222 beds French community hospital with surgery, pulmonology, cardiology, angiology, hepato-gastroenterology and internal medicine wards. The health information system is DxCare from Medasys. However the data model is simple and generic and has been successfully tested in five other hospitals[9]. Data were extracted from January to December 2013, corresponding to 18,489 inpatient stays. These records were anonymized. The study was conducted with the agreement of the hospital medical committee, and of the national commission of informatics and freedom (French CNIL). For each record, the following data were extracted from the database: age, gender, dates, diagnoses encoded using the ICD10 classification, medical procedures, drugs administered during the inpatient stay according to the ATC classification, laboratory measurements performed during the inpatient stay according to the C-NPU classification, and free-text reports (e.g. discharge letters).

Only the patients having age  $\geq 75$  and atrial fibrillation (detected through the I49 ICD10 code) were included in the study. Then the sample was split with respect to the presence and nature of anticoagulant drugs or platelet aggregation inhibitors. The medical records that did not include drug administration nor laboratory results, or that were shorter than 2 days were excluded from this study.

The recommendation from the European Society of Cardiology and the High Health Authority (French HAS) are summarized on Figure 1. They specify that in patients with a CHA2DS2-VASc thrombotic score over 2, which is the case of all the patients aged over 75 years, a treatment by anticoagulants is recommended [1,10]. If the patient refuses this treatment, a treatment by platelet aggregation inhibiting drugs should be considered, according to the bleeding risk score Has-Bled. A Has-Bled score under 3 indicates a low bleeding risk and a treatment by aspirin and clopidogrel should be prescribed. A Has-bleed score equal or greater than 3 indicates a high bleeding risk

and a monotherapy by aspirin should be prescribed. However, a preventive treatment should always be prescribed.



**Figure 1.** Recommendations for the thromboembolic prevention in AF in patients aged over 75 years.

The Has-Bled score formula is presented in Table 1. It was calculated automatically by detection of the ICD10 codes corresponding to the diagnoses and by detection of serum creatinine values over 200 μmol/l for renal dysfunction (as proposed by the French society of cardiology). The labile INR was not evaluated as the Has-Bled was calculated for patients who did not always receive vitamin K antagonists. The HAS-BLED is calculated to determine whether aspirin should be prescribed in monotherapy or bitherapy. Therefore we need to know the score before the prescription of this platelet aggregation inhibitor. Consequently the presence or not of a platelet aggregation inhibitor in this historical cohort was not taken into account for the calculation of the HAS-BLED score.

**Table 1.** The Has-Bled score (0-9) is computed by adding 1 point for each of the following items.

Item	Score
Arterial hypertension	1
Renal dysfunction	1
Hepatic dysfunction	1
Stroke history	1
Bleeding	1
Labile INR	1
Age>65	1
Alcohol	1
NSAI* or platelet aggregation inhibiting drugs	1

\*NSAI = Non-Steroidal Anti-inflammatory drugs

The compliance rate to the recommendation was calculated according to the Equation (2) and Table 2:

**Table 2.** Compliant and non-compliant cases function of the HAS-BLED score, according to the recommendations.

Sample	Non-compliant cases	Compliant cases
HAS-BLED<3 (n <sub>1</sub> )	Aspirin alone or Clopidogrel alone or no treatment (n <sub>2</sub> )	Anticoagulants or Aspirin + Clopidogrel* (n <sub>3</sub> )
HAS-BLED>3 (n <sub>4</sub> )	Aspirin + Clopidogrel or no treatment (n <sub>5</sub> )	Anticoagulants or Aspirin alone* (n <sub>6</sub> )

\* Assuming that the patient has refused the anticoagulation, which cannot be verified.

$$\text{Compliance rate to the recommendations} = (n_3 + n_6) / (n_1 + n_4) \tag{2}$$

It was not possible to know retrospectively the reasons why a platelet aggregation inhibiting drug had been prescribed instead of an anticoagulant drug. According to the recommendations this should happen only when the patient refuses the anticoagulant

treatment or in case of contra-indication of the anticoagulant. For the calculation of the compliance rate to the recommendations, we considered that when an anticoagulant was not prescribed, the reason was a refusal from the patient. This assumption could lead to overestimate the compliance rate, not to underestimate it. The 95% confidence interval of the compliance rate was computed using a binomial law.

## 2. Results

We detected 433 patients presenting the following elements: atrial fibrillation & age  $\geq$  75 years & hospital length of stay  $\geq$  2 days & at least one drug prescription and one laboratory result. Twenty patients were excluded because they did not have drug data or laboratory data. Among the detected records, 45% of the patients received an anticoagulant, 32.1% received platelet aggregation inhibitors and 22.9% received no antithrombotic treatment (Table 3).

**Table 3.** Antithrombotic treatments in the patients aged over 75 years with atrial fibrillation.

Conditions	Number	Proportion
Age $\geq$ 75 years & atrial fibrillation [All]	433	(reference)
Age $\geq$ 75 years & atrial fibrillation & Anticoagulants	195	45,0%
Age $\geq$ 75 years & atrial fibrillation & Platelet aggregation inhibitors	139	32,1%
Age $\geq$ 75 years & atrial fibrillation & No antithrombotic treatment	99	22,9%

Tables 4 and 5 present the detailed results compared to the recommendations: 156 patients received a vitamin K antagonist (VKA) and 45 received a direct oral anticoagulant (DOA). Six of these patients received a VKA and a DOA during the stay, due to a change in the anticoagulant therapy during the hospital stay. 238 patients did not receive any anticoagulant, among which 99 patients did not receive platelet aggregation inhibiting drugs and 127 patients did not receive the appropriate platelet aggregation inhibiting drugs according to the HAS-BLED score. The data used to compute the compliance rate with the recommendations are shown in Table 6. The compliance rate to the recommendations was therefore 47.8% [43.0; 52.6].

**Table 4.** Summary of the cases that were compliant with the recommendations

Premise	Recommendation	Nb patients
AC* accepted	VKA**	156
	DOA***	45
AC* refused	HAS BLED < 3 Aspirin & clopidogrel	9
	HAS BLED $\geq$ 3 Aspirin	3

\*AC = anticoagulants      \*\* VKA = Vitamin K Antagonists      \*\*\* Direct Oral Anticoagulants

**Table 5.** Summary of the cases that were not compliant with the recommendations

Premise	Observed treatment	Nb patients
HAS BLED < 3	Aspirin	118
	Clopidogrel	9
	No treatment	96
HAS BLED $\geq$ 3	No treatment	3

**Table 6.** Elements for calculation of the compliance rate to the recommendations.

Sample	Non-compliant cases	Compliant cases
HAS-BLED<3      n <sub>1</sub> =417	n <sub>2</sub> =223	n <sub>3</sub> =194
HAS-BLED>3      n <sub>4</sub> =16	n <sub>5</sub> =3	n <sub>6</sub> =13

### 3. Discussion

We have conducted a historical cohort to assess whether the recommendations of thromboembolism prevention treatment were applied in elderly patients suffering from AF. Anticoagulants are the standard treatment of AF in the elderly over 75 years and should be prescribed routinely, with the exceptions of cases of refusal of the anticoagulant by the patient or contra indication. However the overall compliance rate is 47.8% [43.0; 52.6] with the most favorable assumption, which is that antiplatelet treatments were always prescribed because of a refusal by the patients. Only 45% of the elderly patients with AF are treated with anticoagulants, 22.9% of them do not receive antithrombotic therapy at all. Antiplatelet aggregation inhibitors were prescribed in 32.1% of these patients, but one can assume that the rate of contra-indication and refusal for anticoagulants may be much lower. Finally we note that when treatment with platelet aggregation inhibitors is preferred, the prescription is often inappropriate. Indeed, among the patients whose HAS-BLED score was lower than 3 and who received antiplatelet agents, 93% of them received a monotherapy with aspirin, which was not recommended.

This score could be impacted by data quality issues. For instance, the under-coding of medical diagnoses in ICD10 could have led us to underestimate the HAS-BLED score, and then to classify some patients with aspirin as having a non-compliant treatment, although the treatment was appropriate, due to a higher actual HAS-BLED score than evaluated in the study.

Further research could be realized to identify with more subtlety the factors that influenced the decision of non-prescription of anticoagulants, which could be for example a high risk for falls or a lack of compliance with the treatments. To our knowledge only a prospective study could address this issue.

This work highlights a major problem of quality of the prescriptions in the hospital field and shows how data reuse can help describing this type of issues.

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