Accepted Manuscript

Submission Date: 2024-04-04
Accepted Date: 2024-05-04
Accepted Manuscript online: 2024-05-14

Thrombosis and Haemostasis

2024 Chinese expert consensus guidelines on the diagnosis and treatment of Atrial Fibrillation in the Elderly. Executive Summary

YUTANG WANG, YUTAO GUO, MINGZHAO QIN, JIN FAN, MING TANG, XINJUN ZHANG, HAO WANG, XIAOYING LI, Gregory Y Lip.

Affiliations below.

DOI: 10.1055/a-2325-5923

Please cite this article as: WANG Y, GUO Y, QIN M et al. 2024 Chinese expert consensus guidelines on the diagnosis and treatment of Atrial Fibrillation in the Elderly. Executive Summary. Thromb Haemost 2024. doi: 10.1055/a-2325-5923

Conflict of Interest: The authors declare that they have no conflict of interest.

This study was supported by National Natural Science Foundation of China (http://dx.doi.org/10.13039/501100001809), 82170309, Beijing Natural Science Foundation , L232117

Abstract:
The consensus guidelines of the Geriatric Society of Chinese Medical Association (GSCMA) on the management of atrial fibrillation (AF) in the elderly was first published in 2011 and updated in 2016, with endorsement by Chinese Society of Geriatric Health Medicine (CSGHM). Since then, many important studies regarding the screening and treatment in the elderly population have been reported, necessitating this updated expert consensus guidelines.

The writing committee members comprehensively reviewed updated evidence pertaining to elderly patients with AF, and formulated this 2024 update. The highlighted issues focused on the following: screening for AF, geriatric comprehensive assessment, use of the Atrial fibrillation Better Care (ABC) pathway for the elderly patients, and special clinical settings related to elderly patients with AF. New recommendations addressing smart technology facilitated AF screening, ABC pathway based management and optimal anticoagulation were developed, with a focus on the elderly.

Corresponding Author:
Dr. YUTAO GUO, Chinese PLA General Hospital, 6 FUCHENG Road, 100048 Beijing, China, river23@163.com, guoyutao@301hospital.com.cn

Affiliations:
YUTANG WANG, Chinese PLA General Hospital, Beijing, China
YUTAO GUO, Chinese PLA General Hospital, Beijing, China
YUTAO GUO, University of Liverpool, Liverpool Centre for Cardiovascular Sciences, Liverpool, United Kingdom of Great Britain and Northern Ireland
[...]
Gregory Y Lip, University of Liverpool Institute of Ageing and Chronic Disease, Liverpool Centre for Cardiovascular Science, Liverpool, United Kingdom of Great Britain and Northern Ireland

2024 Chinese expert consensus guidelines on the diagnosis and treatment of Atrial Fibrillation in the Elderly, endorsed by Geriatric Society of Chinese Medical Association (Cardiovascular Group) and Chinese Society of Geriatric Health Medicine (Cardiovascular branch). Executive Summary

Yutang Wang[1], Yutao Guo[2], Mingzhao Qin[3], Jin Fan[4], Ming Tang[5], Xinjun Zhang[6], Hao Wang[1], Xiaoying Li[1], Gregory Y. H. Lip[7,8]

Expert Reviewers:
Xiaoming Wang[9], Jingfeng Wang[10], Xuejun Ren[11], Wei Hua[5], Xiangming Shi[12], Liqun Wu[13], Cuntai Zhang[14], Shu Zhang[5], Xuhua Chen[5], Xiping Tuo[15], Zhaoliang Shan[12,] Shan Yu[16], Lang Hong[17], Yuquan He[18], Yiqiang Yuan[19], Xiang Gu[20], Congxin Huang[21], Dejia Huang[22], Kejiang Cao[23]

Corresponding authors:
Yutang Wang: Email:wyt301@sina.com
Xiaoying Li: Email:xyli301@163.com

1. Department of Cardiology, Second Medical Center, National Clinical Research Center for Geriatric Diseases, Chinese PLA General Hospital, Beijing100853, China
2. Pulmonary Vessel and Thrombotic Disease, Sixth Medical Center, Chinese PLA General Hospital, Beijing100048, China
3. Department of Geriatrics, Beijing Tongren Hospital, Capital Medical University, Beijing 100730, China
4. Beijing Taikang Yanyuan Rehabilitation Hospital, Beijing 102299, China
5. Arrhythmia Center, Fuwai Hospital, Chinese Academy of Medical Sciences, Beijing 100021, China
6. Geriatric Center, West China Hospital, Sichuan University, Chengdu 610044, China
7. Liverpool Centre for Cardiovascular Science at University of Liverpool, Liverpool John Moores University and Liverpool Heart & Chest Hospital, Liverpool, United Kingdom
8. Danish Center for Health Services Research, Department of Clinical Medicine, Aalborg University, Aalborg, Denmark
9. Department of Geriatrics, Xijing Hospital, Air Force Military University, Xi'an 710032,China
10. Department of Cardiology, Sun Yat-sen Memorial Hospital, Sun Yat-sen University, Guangzhou 510120, China
11. Cardiology Center, Beijing Anzhen Hospital, Capital Medical University, Beijing 100029, China
12. Department of Arrhythmia, Sixth Medical Center, Chinese PLA General Hospital, Beijing100048, China

13. Department of Cardiology, Ruijin Hospital, School of Medicine, Shanghai Jiaotong University, Shanghai 200040, China
14. Department of Integrative Medicine, Tongji Hospital affiliated to Tongji Medical College of Huazhong University of Science & Technology, Wuhan 430073, China
15. Department of Geriatrics, Changhai Hospital, Naval Medical University, Shanghai 200082, China
16. Department of Cardiology, Guizhou Provincial People's Hospital, Guiyang 550499, China
17. Jiangxi Provincial Cardiovascular Disease Hospital, Jiangxi Provincial People's Hospital, Nanchang 330006, China
18. Department of Cardiology, The Bethune Third Hospital of Jilin University, Jilin 130033, China
19. Henan Provincial Chest Hospital, Chest Hospital of Zhengzhou University, Zhengzhou 450008, China
20. Department of Cardiology, Northern Jiangsu People's Hospital, Affiliated Hospital to Yangzhou University, Clinical Medical School of Nanjing Medical University, Yangzhou 225001, China
21. Institute of cardiovascular Disease, Renmin Hospital of Wuhan University, Wuhan 430060, China
22. Department of Cardiology, West China Hospital, Sichuan University, Chengdu 610044, China
23. Department of Cardiology, Department of Geriatrics, Jiangsu Province Hospital, The First Affiliated Hospital of Nanjing Medical University, Nanjing 210029 , China

This is an executive summary of the full consensus guideline, which is published in Chinese Journal of Cardiac Arrhythmias (Chin J Cardiac Arrhythm 2024; DOI: 10.3760/cma.j.cnl 13859-20240130-00012)

Abstract

The consensus guidelines of the Geriatric Society of Chinese Medical Association (GSCMA) on the management of atrial fibrillation (AF) in the elderly was first published in 2011 and updated in 2016, with endorsement by Chinese Society of Geriatric Health Medicine (CSGHM). Since then, many important studies regarding the screening and treatment in the elderly population have been reported, necessitating this updated expert consensus guidelines.

The writing committee members comprehensively reviewed updated evidence pertaining to elderly patients with AF, and formulated this 2024 update. The highlighted issues focused on the following: screening for AF, geriatric

comprehensive assessment, use of the Atrial fibrillation Better Care (ABC) pathway for the elderly patients, and special clinical settings related to elderly patients with AF. New recommendations addressing smart technology facilitated AF screening, ABC pathway based management and optimal anticoagulation were developed, with a focus on the elderly.

Keywords
GSCMA, CSGHM, atrial fibrillation, elderly, management, consensus guideline, executive summary

Introduction

The consensus guidelines of the Geriatric Society of Chinese Medical Association (GSCMA) on the management of atrial fibrillation (AF) in the elderly was first published in 2011 and updated in 2016, [1, 2] with endorsement by Chinese Society of Geriatric Health Medicine (CSGHM). Since then, many important studies regarding the screening and treatment in the elderly population have been reported, necessitating this updated expert consensus guidelines.

This is an executive summary of the full consensus guideline, which is published in Chinese Journal of Cardiac Arrhythmias.[3] The writing committee members comprehensively reviewed updated evidence pertaining to elderly patients with AF, and formulated this 2024 update. The highlighted issues focused on the following: screening for AF, geriatric comprehensive assessment, use of the Atrial fibrillation Better Care (ABC) pathway for the elderly patients, and special clinical settings related to elderly patients with AF. New recommendations addressing smart technology facilitated AF screening, ABC pathway based management and optimal anticoagulation were developed, with a focus on the elderly.

Epidemiology of elderly AF population

Atrial fibrillation (AF) prevalence increases with increasing age, being 0.72% in population aged 55- 59 years, 6.52% in aged 80-84 years, and 8.18% in aged over 95 years.[4] The increasing aging population and chronic diseases increases the risk of AF and AF-related stroke in the elderly population in China. The lifetime risk of AF of the population aged over 75 years is doubled compared to those aged 50 years.[5] Thus it is estimated that there are currently 20 million adult AF patients in China. [6, 7] In the 2018 Blue Book on the Prevention and Treatment of Atrial Fibrillation in China, the elderly population with AF was modelled to exceed 9 million by the year 2050. [4]

The elderly AF population often have a variety of diseases, such as coronary heart disease (CAD), arteriosclerosis, heart failure (HF), valvular disease, pulmonary hypertension, chronic obstructive pulmonary disease, diabetes, chronic anemia,

chronic kidney disease, tumor, etc. Indeed, the optimal thrombophylaxis in the Chinese elderly Patients with atrial Fibrillation (ChiOTEAF) Registry found that 73.2% of the elderly AF population aged over 75 years had ≥ 2 comorbidities and 35.7% were treated with over 5 or more drugs.[8] Such clinically complex phenotypes AF patients with multimorbidity, frailty and polypharmacy have important implications for treatment and prognosis. [9-11]

These comorbidities were independently associated with thromboembolic and bleeding risks, which results in poor adherence to anticoagulation amongst elderly patients with AF.[12] Some evidence suggests that Asian patients are more sensitive to anticoagulation, in terms of bleeding,[13, 14] but ethnic differences in thromboembolism and intracranial bleeding are evident. [15, 16]

Recommendations

1. Aging and chronic disease increase the risk of AF and stroke in the elderly population.
2. The elderly population with AF often have multiple comorbidities, contributing to clinically complex phenotypes, with implications for AF-related complications, such as thromboembolism.
3. A geriatric general assessment and proactive management of comorbidities are needed in these elderly patients (Figure 1).

Atrial fibrillation stages

AF is a progressive disease, contributed by an unhealthy lifestyle and risk factors over an individual patient's lifetime.[17] AF stages, defined as those at risk for AF, pre-AF, AF, and permanent AF, emphasizes prevention through addressing modifiable risk factors and the appropriate treatments based on AF burden.[18]

The population *at risk for AF* includes susceptible factors to AF, such as obesity, obstructive sleep apnea (OSA), physical inactivity, alcohol, diabetes, hypertension, and other nonmodifiable risk factors.[19] At *pre-AF stage*, there is the evidence of structural or electrical changes further predisposing to AF, such as atrial enlargement, frequent atrial ectopy, short bursts of atrial tachycardia, with HF, valve disease, CAD, hypertrophic cardiomyopathy, thyroid disease, etc. At the *AF stage*, AF burden can be ongoing monitored to track the progression of disease. At the *permanent AF* stage, rhythm control approaches are discontinued.

Recommendations

1. AF stages can be classified into as at risk for AF, pre-AF, AF and permanent AF.
2. Holistic risk factor management is recommended to reduce naive or recurrent onset of AF at the earlier stages.
3. Appropriate stroke prevention and individualized patient-centred symptom

directed rate or rhythm management should be administered, as appropriate.

AF screening

Screening techniques for AF include photoplethysmography (PPG), single/multi-lead electrocardiogram (ECG), and accelerometer, etc. There are a variety of screening devices, such as handheld devices, wristbands/watches, chest straps, and stickers. The common screening strategies are as follows: general population screening and "targeted" population screening, intermittent testing/continuous monitoring, consumer-led screening, or physician/nurse-led screening. The detected rate of targeted screening is higher than that of general population screening.

The more frequent and longer AF monitoring, the higher the sensitivity of AF detection.[20] Compared with intermittent testing of single-lead ECG, PPG-based wearables demonstrated the good detection of AF,[21] with the advantage of the continuous monitoring and low cost. Moreover, the wearables can detect the susceptible factors to AF (e.g. OSA, hypertension).[22] With the use of validated wearables, a consumer-led screening approach can be applied for the detection of AF [23] and its susceptible risk factors.[24]

Screening for AF with validated wearables in the elderly,[25] or the high-risk population, such as with OSA, hypertension, diabetes, and post-stroke, will facilitate the early detection and management of AF.

Recommendation

1. With the updated evidence on the application of wearable device technology, the use of smart devices, with PPG or single/multiple-lead electrocardiogram, for AF screening is recommended in the elderly population, or in high-risk populations, eg. those with OSA, hypertension, diabetes, post-stroke, etc. (Figure 2)

Holistic or integrated care management for the elderly

A holistic or integrated care approach, with the well-validated Atrial fibrillation Better Care (ABC) pathway is recommended for the elderly population with AF to improve clinical outcomes (Figure 3).

“A”: Avoid stroke with anticoagulation using non-vitamin K antagonist oral anticoagulants (NOAC) or well-managed warfarin (International normalized ratio, INR 2.0-3.0 with time in therapeutic range ≥70%) in patients at high-risk of stroke. An INR 1.6-2.5 may be considered in frail elderly patients aged over 75 years or HAS-BLED score ≥ 3, as lower INR targets appear to reduce bleeding but increases thromboembolism in AF.[26] Good quality anticoagulation control with time in target range (TTR) ≥ 70% is associated with low thromboembolism and bleeding risks.

In patients at intermediate risk for stroke (ie. stroke prevalence of 1%-2%/year, ie. CHA_2DS_2-VASc =1 in male or =2 in female) could benefit from the modification of risk factors. No antithrombotic therapy is recommended in low-risk subjects, ie. CHA_2DS_2-VASc =0 in male or =1 in female, but elderly AF patients would not be in this category, being at age ≥ 65 years.

For the patients with intermediate- or high- risk stoke, but with long-term oral anticoagulant contraindications due to irreversible causes, percutaneous left atrial appendage closure (LAA) is recommended.

If the patients with high-risk for AF, e.g. left atrial enlargement, chronic obstructive pulmonary disease, chronic obstructive pulmonary disease (COPD), HF, stroke prevalence of >2%/year, it is recommended to monitor for AF occurrences and consideration of oral anticoagulation.

In a systematic review, patients with atrial high-rate episode (AHRE) detected by cardiac implantable electronic devices (CIEDs), the risk ratio (RR) for thromboembolic events in AHRE patients was 2.13 (95% CI: 1.53-2.95, I2: 0%), while the RR for incident clinical AF was 3.34 (95%CI: 1.89-5.90, I^2: 73%).[27] In other studies, AHRE ≥24 h developed more ECG-diagnosed AF (17.0%/patient-year) than patients with shorter AHRE (8.2%/patient-year, detected by implanted cardiac device in recent trials).[28, 29]

In a real world cohort of CIED patients with median follow-up of 24.3 (10.6-40.3) months, 29.8% patients experienced the composite outcome of clinical AF or AHRE episodes lasting ≥24 h.[30] Baseline CHA_2DS_2-VASc score and the longest AHRE episode at enrollment lasting 12 h-23 h 59 min were independently associated with the composite outcome (hazard ratio, HR; 95% confidential interval, CI: 1.40; 1.07-1.83 and HR: 8.15; 95% CI 2.32-28.65, respectively).[30] Thus, baseline patients' characteristics (CHA_2DS_2-VASc score) and AHRE duration may help to intensify monitoring and decision-making, being independently associated with clinical AF at follow-up.

Two randomized trials, the NOAH-AFNET 6 and ARTESiA trials, provides high-quality evidence on the anticoagulation for patients with device-detected AF.[28, 31] Among patients with subclinical AF, with at least one episode lasting 6 minutes or longer but no episodes lasting longer than 24 hours, detected by implanted cardiac device , apixaban resulted in a lower risk of stroke or systemic embolism than aspirin but this was with a higher risk of major bleeding.[31] For the patients with AHRE also detected with implanted cardiac device in the NOAH-AF trial, anticoagulation with edoxaban did not significantly reduce the incidence of a composite of cardiovascular death, stroke, or systemic embolism as compared with placebo in NOAH-AFNET 6.[28, 29] Meta-analysis of NOAH-AFNET 6 and ARTESiA trials demonstrated that oral

anticoagulation reduced the risk of stroke in patients with device-detected AF and increased the risk of major bleeding. [32] Taking into account these results, dynamic monitoring AHRE/AF progression and CHA_2DS_2-VASc, considering the benefits and related risks of oral anticoagulants, and individualized decision making of stroke prevention approach, is proposed for patients with CIED and AHRE.

"B": Better patient-centered symptom-directed rate or rhythm control strategies are recommended to reduce AF burden, as well as improve clinical outcomes with early rhythm control for selected patients.

"C": Cardiovascular risk and comorbidity management (OSA, diabetes, hypertension, HF, CAD, COPD, pulmonary hypertension, etc.) **as well as lifestyle changes** (obesity reduction, regular exercise, reducing alcohol/stimulants, psychological morbidity, etc.).

Digital health technology can be used to facilitate AF care pathways.[33] In the mAFA-II randomised trial, smart technology facilitated ABC pathway (mobile Atrial Fibrillation, mAFA) reduced clinical adverse in the elderly patients with AF, reducing the composite endpoints of all-cause death, thromboembolism and rehospitalization in the elderly patients aged over 75 years, or HF, diabetes, prior thromboembolism, or with multiple morbidity（Figure 4).[34-38] In a systematic review and meta-analysis, adherence to the ABC pathway was associated with a reduction in mortality, stroke and bleeding.[39] The potential cost-effective use of streamlining and integrating care via the Atrial fibrillation Better Care (ABC) pathway for AF has been reported.[40] The substantial healthcare burden associated with AF, from strokes, bleeds and mortality over the next decades can be reduced if patients are managed with a holistic or integrated care approach based on the ABC pathway, equating to substantial healthcare cost reductions.[41]

Recommendation

1. The Atrial fibrillation Better Care (ABC) pathway is recommended for the elderly population with AF.
2. Validated smart technology facilitated ABC pathway management, e.g. mAFA, is a cost-effective tool for the elderly AF population to reduce all-cause death, thromboembolism, and other clinical adverse events.

Risk assessment for the elderly patients

The risk assessment for the elderly AF patients includes assessment of stroke risk, bleeding risk, and comprehensive geriatric assessment.

In our 2016 consensus document, we recommended the use of the CHA_2DS_2-VASc score for stroke risk assessment for the elderly AF patients. In this 2024 update, we still recommend the use of the CHA_2DS_2-VASc score as the most validated stroke risk

prediction scheme. The assessment of dynamic changes on stroke risk with re-evaluation of the CHA_2DS_2-VASc score is recommended at least annually.[42] For the patients with a CHA_2DS_2-VASc score of low or intermediate risk at baseline, more frequent stroke risk evaluation,[43] e.g. every 4 months, is proposed.

The HAS-BLED score is recommended for the bleeding risk for the elderly patients with AF, with the advantage of simplicity, as well as a better predictive ability of hemorrhage and major bleeding (including intracranial bleeding).[44] The HAS-BLED score has been extensively validated in patients without anticoagulant, with oral anticoagulants, and NOAC.[45-47] With the initiation of anticoagulant, regular bleeding risk assessment with HAS-BLED score helps to mitigate modifiable bleeding risk factors, schedule high bleeding risk patients for early review and follow-up, and to improve oral anticoagulant uptake.[48]

The comprehensive geriatric assessment, including disability assessment (ADL scale),[49] frailty screening (FRAIL scale),[50] gait abnormality and fall risk assessment (TUGT scale),[51] fall scale screening, cognitive function assessment (Mini-Cog scale),[52] renal function [eGFR, CKD-EPI (Scr/Cys-c) formula], nutritional status, diet and weight, depressive status, comorbidities, and combined with multiple drugs, is recommended.

Recommendation

1. The CHA_2DS_2-VASc score for stroke risk and HAS-BLED for bleeding risk are recommended for risk stratification in elderly AF patients.
2. The Comprehensive Geriatric Assessment should be performed to improve the adherence to the anticoagulant.

Rhythm/rate control with drugs

The purpose of rhythm or rate control for the elderly patients with AF is to relieve the symptoms, reduce the frequency and duration of AF episodes, maintain cardiac function, prevent from the tachycardia cardiomyopathy, improve quality of life, and reduce the hospitalization.

The antiarrhythmic drugs for cardioversion include Class I c (propafenone) and Class III (amiodarone, ibutilide). Amiodarone can effectively convert AF to sinus rhythm, with the successful rate of 35%-90% during 8-24 hours. However, the concurrent use of amiodarone and NOACs might increase the risk of major bleeding among older patients.[53, 54] Ibutilide is an effective drug for conversion of recent-onset AF and flutter in elderly patients, with the overall rate of successful conversion was 59%.[55] There is up to a 4% risk of torsade de pointes and a 4.9% risk of monomorphic ventricular tachycardia, especially for the elderly patients, female, low weight, or with HF. In addition, propafenone can increase the blood concentration of warfarin and digoxin.

Hence, close monitoring is warranted during and after drug infusion for the elderly patients receiving cardioversion.

Intravenous sotalol is less effective than ibutilide in AF, with the underlyingly increased risk of mortality for maintaining sinus rhythm.[56] Dronedarone was less sufficient than amiodarone in converting AF. Therefore, we don't recommend the use of sotalol and dronedarone for the cardioversion in elderly patients with AF.

Recommendation

1. A patient-centered symptom-directed rhythm or rate control approach is recommended for the elderly population with AF.

Rhythm/rate control with invasive procedures

Cardioversion:

Early rhythm-control therapy was associated with a lower risk of adverse cardiovascular outcomes than usual care among elderly patients with early AF and cardiovascular conditions.[57, 58] For elderly patients with AF diagnosed ≤12 months, or the uncontrolled ventricular rate, or severe symptom with controlled ventricular rate, or patient's willing to restore sinus rhythm, cardioversion is recommended. However, in patients with left atrial thrombosis, or sick sinus syndrome without pacemaker, atrioventricular block, or QT interval correction prolongation (>500 ms) are contraindications to cardioversion.

Electrocardioversion can be used as an effective means of emergency management for patients with AF with obvious hemodynamic disturbance, myocardial ischemia, or preexcitation syndrome with rapid ventricular rate, and can also be used for selective cardioversion treatment for patients with persistent and long-duration persistent AF. Electrocardioversion may lead to complications in the elderly population, including sedation-related complications, cardiac arrest, skin burn, etc., and there is a risk of inducing pulmonary edema in patients with left ventricular dysfunction or HF.

Oral anticoagulant during peri-procedure significantly reduces the risk of thromboembolism. In patients with AF of ≥48h or unknown duration, warfarin (INR 2.0 -3.0, or 1.6 to 2.5 for those aged ≥75 years) or NOAC therapy should be used for at least 3 weeks prior to cardioversion. For those with AF <48 h, cardioversion may be performed with heparin, low molecular weight heparin, or NOAC during the peri-procedure. Anticoagulation therapy is required for 4 weeks after cardioversion, regardless of the duration of pre-cardioversion. After 4 weeks, long-term anticoagulation therapy can be determined based on the stroke risk.

Those who need early cardioversion should be performed after transesophageal ultrasound to rule out intra-atrial thrombus. In patients with hemodynamic instability, cardioversion should be initiated immediately while anticoagulant therapy is initiated

with heparin or low molecular weight heparin.

Pacemakers:
The elderly AF patient with bradyarrhythmias can be a candidate for pacemaker therapy. For elderly patients with AF and HF, cardiac resynchronization therapy improves left ventricle ejection fraction, quality of life, and all-cause mortality.

Catheter ablation
Left atrial enlargement and fibrosis increased with aging. AF ablation-related complications showed the increased trend over aging, such as cardiovascular adverse events, death, AF recurrence, and postoperative atrial flutter, etc. Therefore, catheter ablation in elderly patients needs to fully weight the benefits and risks. Catheter ablation should not be proposed for the patients with contraindications to anticoagulant therapy.

Appropriate measures should be taken to reduce AF recurrence after the ablation for the elderly patients (Figure 5). The decision on long-term anticoagulation after ablation depends on the individual's risk profile.

Recommendation

1. The risk and benefits should be weighted for the elderly patients receiving invasive rhythm or rate control.
2. Long-term anticoagulation should be considered for patients at high-risk stroke.

Antithrombotic treatment

The elderly patients with AF often clinically complex, with the cardiac, venous, and arterial thromboembolic risks. The ChiOTEAF demonstrated that elderly patients with AF were often at risk of falls, with associated atherosclerosis, chronic kidney disease/liver disease, or malignancy, increasing the risks of thrombosis and bleeding (Figure 6).[59]

Nonetheless, oral anticoagulation therapy for high-risk elderly AF patients, even with fall risk, HF, chronic kidney disease/liver disease, and malignant tumor, is associated with a reduction in the composite end points of acute myocardial infarction, ischemic stroke, cerebral hemorrhage, and all-cause death (Figure 6).[60] In elderly patients aged over 85 years of age, optimized oral anticoagulant therapy decreased the composite end point of thrombosis and all-cause death by 54% without increasing the risk of major bleeding events (OR 0.46; 95%CI 0.32~0.66; P<0.001).[34]

However, less than half of elderly Chinese patients with AF at high-risk for stroke receive oral anticoagulation.[59] In the ChiOTEAF registry, for example, only 26.4% received oral anticoagulation therapy in Chinese elderly patients aged over 85 years

old.[60] Chronic kidney disease, liver disease, dementia, and prior bleeding were independent risk factors for the poor adherence to oral anticoagulant therapy. Such poor adherence to the anticoagulant therapy increased the risk of thromboembolism and all-cause death by 2- and 4- fold, respectively (Figure 6).[61]

A meta-analysis of 22 studies confirmed that NOACs, compared to warfarin, reduced the risk of stroke and systemic embolism, intracranial bleeding, haemorrhagic stroke and fatal bleeding in the elderly patients aged over 75 years.[62] Even for the extremely-high-risk, very elderly (> 90 years) patients, NOACs were associated with a lower risk of composite endpoint of ischemic stroke, intracranial haemorrhage, major bleeding, or mortality compared to warfarin or non-oral anticoagulants. [63] However, the bleeding risk associated with anticoagulant still needs to be monitored and proactive management, especially gastrointestinal bleeding among elderly patients.[62]

Moreover, inadequate off label underdosing of oral anticoagulants is common in elderly patients with AF. In China, for example, one in five elderly aged over 75 years old received inadequate dosage of oral anticoagulant (warfarin or NOAC), with a higher risk of the composite outcome and thromboembolic events compared with standard dose NOAC.[61]

In AF patients over 80 years in high-risk elderly AF patients at increased bleeding risk, use of very low dosage (edoxaban 15 mg o.d., dabigatran 110 or 150 o.d., apixaban 2.5 mg o.d., or rivaroxaban 10 mg) was associated with a greater risk of arterial (major adverse limb events requiring lower limb revascularization or amputation, hazard ratio, HR: 1.54, 95% confidential interval, CI: 1.09-2.18; P = 0.014) and venous thrombosis (HR: 3.75, 95% CI: 1.56-8.97; P = 0.003), death (HR: 1.21, 95% CI: 1.15-1.29; P <0.001), when compared with that of regular-dosage NOAC.[64]

Adherence to the ABC pathway was associated with a lower composite outcome of all-cause death and any thromboembolism event (stroke, TIA, peripheral embolism) even amongst the elderly patients with AF.[65]

Recommendation

1. Elderly patients, especially high-risk patients, would benefit from the optimal label or guideline recommended oral anticoagulant after balancing bleeding risk, with a preference for NOACs. More intensive follow-up, e.g. risk factor monitoring, the intensity and safety of anticoagulant, liver/renal function, etc should be taken to improve poor adherence to oral anticoagulant. Cognitive function should be assessed, and patient's education encouraged to avoid missing doses or noncompliance.

2. NOACs are preferred for the elderly patients with AF than warfarin, except those with mechanical valve or severe mitral stenosis. If on warfarin, INR should remain between 2.0-3.0, or 1.6-2.5 for those aged over 75 years old. Good quality anticoagulation control (TTR ≥ 65%) should be aimed for.

3. Minor bleeding associated with NOAC can be managed conservatively and if necessary, the NOAC could be discontinued for 12-24h. Moderate bleeding requires blood products, etc., depending on the type of oral anticoagulant. The specific antagonists (vitamin K, idarucizumab, or andexanetα, etc.) can be used for the life-threatening bleeding. Whether or when to resume anticoagulant therapy after bleeding events should be weighted, balancing the risk of thrombosis and bleeding.

Elderly patients with CAD

PIONEER-AF,[66] REDUAL,[67] AUGUSTUS,[68] ENTRUST[69] trials confirmed that the double or triple antithrombotic approach with NOAC were at low risk of major bleeding, especially cerebral haemorrahge, compared with warfarin. Compared to triple antithrombotic approach (NOAC plus dual antiplatelet), there was a similar stroke risk for patients receiving NOAC with single antiplatelet. Nonetheless, myocardial infarction and stenosis thrombus may be slightly increased in patients with NOAC plus single antiplatelet.[70] The duration of dual or triple antithrombotic approach should be based on the risk of arterial thrombosis, cardiogenic thrombosis, and bleeding.

Recommendation

1. For patients undergoing elective percutaneous coronary intervention (PCI), it is recommended to stop aspirin within 1 week, continue to "double therapy" (clopidogrel + oral anticoagulant), and with single oral anticoagulant (ideally a NOAC) after one year. For the patients at high risk of bleeding, anticoagulant monotherapy can be considered after 6 months.

2. For patients with acute coronary syndrome (ACS) and PCI, triple therapy should be used for 1 month, followed by double therapy, and single anticoagulant therapy 1 year later. Standard-dose single anticoagulant is recommended for stable coronary heart disease or chronic coronary syndrome.

Elderly patients with comorbidities

The prevalence of multimorbidity was reported as 31.8% among the Chinese population aged over 60 years, increasing with the aging.[71] Multimorbidity leads to increased risks of functional decline, polypharmacy, disability and hospitalization. Cardiovascular disease (hypertension, CAD, HF, etc), non-cardiovascular disease

(diabetes, COPD, OSA, chronic kidney/liver disease, cancer, etc.) and mental disorders are common in the elderly population, which raising the risk of AF onset and AF-related complications.[72]

Lifestyle factors and comorbidities cannot be considered in isolation in relation to the progression of AF. [73] Thus, lifestyle modification may not just decrease AF risk and common comorbidities of AF in the 'naïve-AF' general population, but can also effectively reduce recurrent AF in patients receiving AF ablation and its related complications. Such lifestyle and risk factor modification interventions are related to the prevention and treatment of AF and AF-related complications.[19]

Polypharmacy, with the use of more than five drugs at the same time, is common in elderly patients with AF, especially those over 75 years (Figure 7). The presence of polypharmacy in AF patients is associated with adverse clinical outcomes.[74] The risk of major bleeding and non-major bleeding also increased significantly.[75]

Smart tools might help the elderly patients with AF for the cardiovascular risk and comorbidities management.[33] A web-based integrated management program improved medication adherence and quality of Life, and reduced readmission in AF patients with mean age of 73 years.[76] In the mAFA II trial, the hazard risk for the acute coronary syndrome, heart failure, and uncontrolled blood pressure, as the C criterion of the ABC pathway, reduced 71%, compared to the usual care group (HR, 0.29; 95% CI, 0.19-0.45; P <0 .001).[35]

Recommendation

The elderly population is commonly associated with multimorbidity and polypharmacy, leading to the risk of AF and AF-related complications. Lifestyle modification and appropriate measures should be taken to reduce AF progression and inappropriate use of the drugs. Smart tools might be used to facilitate risk factor and comorbidities management for the elderly patient.

Elderly patients with stroke

The annual prevalence of ischaemic stroke is 1-2% among AF patients on NOAC.[77] Older patients with acute ischemic stroke have a worst prognosis, with higher bleeding risk and mortality than younger patients, but can still benefit from the thrombolysis.

AF patients with ischemic stroke or transient ischemic attack have a high risk of recurrent stroke. Infarct size, NIHSS score, CHA_2DS_2-VASc and HAS-BLED score should be taken into the account to decide the anticoagulant approach. For patients with NIHSS score <15 and low bleeding risk, oral anticoagulant can be initiated 2-14 days. For patients with NIHSS score ≥15 and high risk of bleeding, oral anticoagulant

should be restarted after 14 days. During the initial period <14 days, aspirin can be used before initiation of oral anticoagulant therapy.[78]

In addition to cardiogenic factors, ischaemic stroke in patients with AF may be caused by large atherosclerosis diseases (such as symptomatic intracranial vascular stenosis). If a patient has recently undergone carotid stent implantation and the risk of bleeding is low, oral anticoagulant therapy in conjunction with antiplatelet drugs may be considered.

AF patients receiving carotid endarterectomy can receive only aspirin before and for a few days after surgery, and discontinue aspirin after resuming NOAC therapy. Patients with AF who have asymptomatic atherosclerosis and narrow internal carotid and/or intracranial arteries should be treated with statins and oral anticoagulant without additional antiplatelet therapy.

The intracranial hemorrhage (ICH) rate is about 0.23-0.55%/year in patients with NOAC. Based on the available evidence, the restart of NOAC can be cautiously considered 4 weeks after ICH after a multidisciplinary review, including cardiologists, stroke neurologists, etc. For the elderly patients at high risk, the potential ICH risk factors, such as cerebral amyloidosis, cerebral microbleeds, should be assessed with Magnetic Resonance Imaging (e.g. susceptibility weighted imaging), prior to deciding on oral anticoagulation.

Periprocedural and perioperative management

About 10% of patients with AF undergo invasive procedure or surgery each year. The common operation received by the elderly patients with AF were cardiovascular, gastrointestinal, and mouth. Patients aged over 75 years were more likely to receive orthopedic and ophthalmic operations.[79] The comorbidities, liver/ renal dysfunction of the elderly patients was associated with the time of stopping and restarting anticoagulants during peri-operation. The perioperative anticoagulation strategy in elderly patients with AF should consider the patient's factors, the type of the operation (interventions with minor bleeding risk, low bleeding risk, or high bleeding risk)[80] and the anticoagulant drugs (Figure 8).

Warfarin is usually stopped at least 5 days prior to the procedures with low/high bleeding risk with the obvious clinical impact. The elderly with comorbidities, patients with very low-dose warfarin requirements, and those with a higher target INR range, a longer period of warfarin interruption may be needed.

NOACs can be stopped close to the procedure usually without bridging. There was no significant difference of continuing NOAC on the thromboembolic or bleeding rates, compared to a bridging approach.[81] [82]Also, if NOACs are interrupted for >72 h the

likelihood of any residual NOAC level appears very low.[83, 84]

The continuation, discontinuation, bridging, and resumption of anticoagulation, with regarding to the time points in the perioperative period is illustrated in Figures 9, 10.

Recommendation

1. Warfarin is stopped at least 5 days prior to the intervention with low/high bleeding risk, depending on the INR range, and restart with the bridging of low weight molecular heparin (Figure 9).
2. NOACs should be stopped at least 24 h and up to 96 h depending on the bleeding risk and the urgency of surgery/operation (Figure 10).

Elderly patients with cancer

Both AF and tumors increase the risk of thrombosis. Gastrointestinal or hematological tumors also raise the risk of bleeding. Warfarin, low molecular weight heparin or NOAC can be considered when CHA_2DS_2-VASc score is ≥2 and platelet count is $>50\times10^9$/L. Careful and regular monitoring is advised.

Frailty

Both AF and frailty increase with aging. The reported rate of the frailty ranges from 4.4% to 75.4%.[85] AF contribute to the risk of frailty, while frailty results in poor adherence to anticoagulant.

Recommendation

NOACs are recommended for the elderly patients with AF and frailty.

The management of chronic conditions in the elderly population with AF is summarized in Figure 11.

References

1. Li X, Ding W, Hua Y Wang Y, Qin M, Fan J. Expert consensus on the management of atrial fibrillation in elderly population (2011), endorsed by Geriatric Society of Chinese Medical Association (Cardiovascular Group) . *Chin J Geriatric*. 2011;30:894-908.

2. Qing M, Zhang X, Zhang Y, Guo Y, Li X. Expert consensus on the management of atrial fibrillation in elderly population (2016), endorsed by Geriatric Society of Chinese Medical Association (Cardiovascular Group) and Chinese Society of Geriatric Health Medicine. *Chin J Geriatric*. 2016;35:14-27.

3. Wang Y, Guo Y,Qin M,Fan J,Tang M, Wang H, Li X. 2024 Chinese expert consensus guidelines on the diagnosis and treatment of Atrial Fibrillation in the Elderly, endorsed by Geriatric Society of Chinese Medical Association (Cardiovascular Group) and Chinese Society of Geriatric Health Medicine (Cardiovascular branch). *Chin J Cardiac Arrhythm; DOI: 103760/cmajcnl 13859-20240130-*

00012 2024.

4. Zhang J, Johnsen SP, Guo Y and Lip GYH. Epidemiology of Atrial Fibrillation: Geographic/Ecological Risk Factors, Age, Sex, Genetics. *Card Electrophysiol Clin*. 2021;13:1-23.

5. Guo Y, Tian Y, Wang H, Si Q, Wang Y and Lip GYH. Prevalence, Incidence, and Lifetime Risk of Atrial Fibrillation in China New Insights Into the Global Burden of Atrial Fibrillation. *Chest*. 2015;147:109-119.

6. Shi S, Tang Y, Zhao Q, Yan H, Yu B, Zheng Q, Li Y, Zheng L, Yuan Y, Zhong J, Xu J, Wu Y, Xu J, Chen L, Li S, Jiang J, Wang J, Fan J, Chen M, Tang B, Li W, Wu Q, Shi B, Zhou S, Zhao X, Yin Y, Zhang Z, Zhong G, Han X, Liu F, Wu M, Gao L, Yang B, Huang H and Huang C. Prevalence and risk of atrial fibrillation in China: A national cross-sectional epidemiological study. *Lancet Reg Health West Pac*. 2022;23:100439.

7. Association CMD. *Blue Book on the prevention and treatment of atrial fibrillation in China 2018*: People's Medical Publishing House in China, People's Health Electronic Audio and Video Publishing House in China.; 2019.

8. Kotalczyk A, Guo Y, Stefil M, Wang Y and Lip GYH. Effects of the Atrial Fibrillation Better Care Pathway on Outcomes Among Clinically Complex Chinese Patients With Atrial Fibrillation With Multimorbidity and Polypharmacy: A Report From the ChiOTEAF Registry. *J Am Heart Assoc*. 2022;11:e024319.

9. Romiti GF, Proietti M, Bonini N, Ding WY, Boriani G, Huisman MV and Lip GYH. Clinical Complexity Domains, Anticoagulation, and Outcomes in Patients with Atrial Fibrillation: A Report from the GLORIA-AF Registry Phase II and III. *Thromb Haemost*. 2022;122:2030-2041.

10. Grymonprez M, Petrovic M, De Backer TL, Steurbaut S and Lahousse L. The Impact of Polypharmacy on the Effectiveness and Safety of Non-vitamin K Antagonist Oral Anticoagulants in Patients with Atrial Fibrillation. *Thromb Haemost*. 2024;124:135-148.

11. Zheng Y, Li S, Liu X, Lip GYH, Guo L and Zhu W. Effect of Oral Anticoagulants in Atrial Fibrillation Patients with Polypharmacy: A Meta-analysis. *Thromb Haemost*. 2023.

12. Guo Y, Kotalczyk A, Imberti JF, Wang Y and Lip GYH. Poor adherence to guideline-directed anticoagulation in elderly Chinese patients with atrial fibrillation: a report from the Optimal Thromboprophylaxis in Elderly Chinese Patients with Atrial Fibrillation (ChiOTEAF) registry. *Eur Heart J Qual Care Clin Outcomes*. 2023;9:169-176.

13. Gorog DA, Gue YX, Chao TF, Fauchier L, Ferreiro JL, Huber K, Konstantinidis SV, Lane DA, Marin F, Oldgren J, Potpara T, Roldan V, Rubboli A, Sibbing D, Tse HF, Vilahur G and Lip GYH. Assessment and Mitigation of Bleeding Risk in Atrial Fibrillation and Venous Thromboembolism: Executive Summary of a European and Asia-Pacific Expert Consensus Paper. *Thromb Haemost*. 2022;122:1625-1652.

14. Kim HK, Tantry US, Smith SC, Jr., Jeong MH, Park SJ, Kim MH, Lim DS, Shin ES, Park DW, Huo Y, Chen SL, Bo Z, Goto S, Kimura T, Yasuda S, Chen WJ, Chan M, Aradi D, Geisler T, Gorog DA, Sibbing D, Lip GYH, Angiolillo DJ, Gurbel PA and Jeong YH. The East Asian Paradox: An Updated Position Statement on the Challenges to the Current Antithrombotic Strategy in Patients with Cardiovascular Disease. *Thromb Haemost*. 2021;121:422-432.

15. Kang D, Yang PS, Kim D, Jang E, Yu HT, Kim TH, Sung JH, Park HN, Lee MH, Lip GY and Joung B. Racial differences in ischemic and hemorrhagic stroke: An ecological epidemiological study. *Thromb Haemost*. 2024.

16. Kang DS, Yang PS, Kim D, Jang E, Yu HT, Kim TH, Sung JH, Pak HN, Lee MH, Lip GYH and

Joung B. Racial Differences in Bleeding Risk: An Ecological Epidemiological Study Comparing Korea and United Kingdom Subjects. *Thromb Haemost*. 2024.

17. Kwon S, Lee SR, Choi EK, Lee SW, Jung JH, Han KD, Ahn HJ, Oh S and Lip GYH. Impact of Unhealthy Lifestyles on Patients with Atrial Fibrillation at Low Risk of Stroke: A Nationwide Cohort Study. *Am J Med*. 2024;137:37-46.e6.

18. Joglar JA, Chung MK, Armbruster AL, Benjamin EJ, Chyou JY, Cronin EM, Deswal A, Eckhardt LL, Goldberger ZD, Gopinathannair R, Gorenek B, Hess PL, Hlatky M, Hogan G, Ibeh C, Indik JH, Kido K, Kusumoto F, Link MS, Linta KT, Marcus GM, McCarthy PM, Patel N, Patton KK, Perez MV, Piccini JP, Russo AM, Sanders P, Streur MM, Thomas KL, Times S, Tisdale JE, Valente AM and Van Wagoner DR. 2023 ACC/AHA/ACCP/HRS Guideline for the Diagnosis and Management of Atrial Fibrillation: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation*. 2024;149:e1-e156.

19. Chung MK, Eckhardt LL, Chen LY, Ahmed HM, Gopinathannair R, Joglar JA, Noseworthy PA, Pack QR, Sanders P and Trulock KM. Lifestyle and Risk Factor Modification for Reduction of Atrial Fibrillation: A Scientific Statement From the American Heart Association. *Circulation*. 2020;141:e750-e772.

20. Nagashima K, Okumura Y, Yokoyama K, Matsumoto N, Tachibana E, Kuronuma K, Oiwa K, Matsumoto M, Kojima T, Ando H, Nomoto K, Arima K and Hirayama A. Comparison of continuous 24-h and 14-day monitoring for detection of otherwise unknown atrial fibrillation: a registry to identify Japanese concealed atrial fibrillation (REAL-AF)-based study. *Heart Vessels*. 2020;35:689-698.

21. Guo Y, Wang H, Zhang H, Liu T, Liang Z, Xia Y, Yan L, Xing Y, Shi H, Li S, Liu Y, Liu F, Feng M, Chen Y and Lip GYH. Mobile Photoplethysmographic Technology to Detect Atrial Fibrillation. *J Am Coll Cardiol*. 2019;74:2365-2375.

22. Chen Y, Wang W, Guo Y, Zhang H, Chen Y and Xie L. A Single-Center Validation of the Accuracy of a Photoplethysmography-Based Smartwatch for Screening Obstructive Sleep Apnea. *Nat Sci Sleep*. 2021;13:1533-1544.

23. Lubitz SA, Faranesh AZ, Selvaggi C, Atlas SJ, McManus DD, Singer DE, Pagoto S, McConnell MV, Pantelopoulos A and Foulkes AS. Detection of Atrial Fibrillation in a Large Population Using Wearable Devices: The Fitbit Heart Study. *Circulation*. 2022;146:1415-1424.

24. Guo Y, Zhang H and Lip GYH. Consumer-Led Screening for Atrial Fibrillation: A Report From the mAFA-II Trial Long-Term Extension Cohort. *JACC Asia*. 2022;2:737-746.

25. Babar F, Cheema AM, Ahmad Z, Sarfraz A, Sarfraz Z, Ashraff H, Tayyab H, Bajwa AM, Ali H, Sarfraz M, Shahzad A and Sabzwari SRA. Sensitivity and Specificity of Wearables for Atrial Fibrillation in Elderly Populations: A Systematic Review. *Curr Cardiol Rep*. 2023;25:761-779.

26. Pandey AK, Xu K, Zhang L, Gupta S, Eikelboom J, Cook O, McIntyre WF, Lopes RD, Crowther M, Belley-Côté EP and Whitlock RP. Lower versus Standard INR Targets in Atrial Fibrillation: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Thromb Haemost*. 2020;120:484-494.

27. Vitolo M, Imberti JF, Maisano A, Albini A, Bonini N, Valenti AC, Malavasi VL, Proietti M, Healey JS, Lip GY and Boriani G. Device-detected atrial high rate episodes and the risk of stroke/thrombo-embolism and atrial fibrillation incidence: a systematic review and meta-analysis. *Eur J Intern Med*. 2021;92:100-106.

28. Kirchhof P, Toennis T, Goette A, Camm AJ, Diener HC, Becher N, Bertaglia E, Blomstrom Lundqvist C, Borlich M, Brandes A, Cabanelas N, Calvert M, Chlouverakis G, Dan GA, de Groot JR,

Dichtl W, Kravchuk B, Lubiński A, Marijon E, Merkely B, Mont L, Ozga AK, Rajappan K, Sarkozy A, Scherr D, Sznajder R, Velchev V, Wichterle D, Sehner S, Simantirakis E, Lip GYH, Vardas P, Schotten U and Zapf A. Anticoagulation with Edoxaban in Patients with Atrial High-Rate Episodes. *N Engl J Med*. 2023;389:1167-1179.

29. Becher N, Toennis T, Bertaglia E, Blomström-Lundqvist C, Brandes A, Cabanelas N, Calvert M, Camm AJ, Chlouverakis G, Dan GA, Dichtl W, Diener HC, Fierenz A, Goette A, de Groot JR, Hermans ANL, Lip GYH, Lubinski A, Marijon E, Merkely B, Mont L, Ozga AK, Rajappan K, Sarkozy A, Scherr D, Schnabel RB, Schotten U, Sehner S, Simantirakis E, Vardas P, Velchev V, Wichterle D, Zapf A and Kirchhof P. Anticoagulation with edoxaban in patients with long atrial high-rate episodes ≥24 h. *Eur Heart J*. 2024;45:837-849.

30. Imberti JF, Bonini N, Tosetti A, Mei DA, Gerra L, Malavasi VL, Mazza A, Lip GYH and Boriani G. Atrial High-Rate Episodes Detected by Cardiac Implantable Electronic Devices: Dynamic Changes in Episodes and Predictors of Incident Atrial Fibrillation. *Biology (Basel)*. 2022;11.

31. Healey JS, Lopes RD, Granger CB, Alings M, Rivard L, McIntyre WF, Atar D, Birnie DH, Boriani G, Camm AJ, Conen D, Erath JW, Gold MR, Hohnloser SH, Ip J, Kautzner J, Kutyifa V, Linde C, Mabo P, Mairesse G, Benezet Mazuecos J, Cosedis Nielsen J, Philippon F, Proietti M, Sticherling C, Wong JA, Wright DJ, Zarraga IG, Coutts SB, Kaplan A, Pombo M, Ayala-Paredes F, Xu L, Simek K, Nevills S, Mian R and Connolly SJ. Apixaban for Stroke Prevention in Subclinical Atrial Fibrillation. *N Engl J Med*. 2024;390:107-117.

32. McIntyre WF, Benz AP, Becher N, Healey JS, Granger CB, Rivard L, Camm AJ, Goette A, Zapf A, Alings M, Connolly SJ, Kirchhof P and Lopes RD. Direct Oral Anticoagulants for Stroke Prevention in Patients with Device-Detected Atrial Fibrillation: A Study-Level Meta-Analysis of the NOAH-AFNET 6 and ARTESiA Trials. *Circulation*. 2023.

33. Linz D, Gawalko M, Betz K, Hendriks JM, Lip GYH, Vinter N, Guo Y and Johnsen S. Atrial fibrillation: epidemiology, screening and digital health. *Lancet Reg Health Eur*. 2024;37:100786.

34. Guo Y, Romiti GF, Proietti M, Bonini N, Zhang H and Lip GYH. Mobile health technology integrated care in older atrial fibrillation patients: a subgroup analysis of the mAFA-II randomised clinical trial. *Age Ageing*. 2022;51.

35. Yao Y, Guo Y and Lip GYH. The Effects of Implementing a Mobile Health-Technology Supported Pathway on Atrial Fibrillation-Related Adverse Events Among Patients With Multimorbidity: The mAFA-II Randomized Clinical Trial. *JAMA Netw Open*. 2021;4:e2140071.

36. Guo Y, Corica B, Romiti GF, Proietti M, Zhang H and Lip GYH. Mobile health technology integrated care in atrial fibrillation patients with diabetes mellitus in China: A subgroup analysis of the mAFA-II cluster randomized clinical trial. *Eur J Clin Invest*. 2023:e14031.

37. Guo Y, Romiti GF, Corica B, Proietti M, Bonini N, Zhang H and Lip GY. Mobile health-technology integrated care in atrial fibrillation patients with heart failure: A report from the mAFA-II randomized clinical trial. *Eur J Intern Med*. 2022.

38. Guo Y, Romiti GF, Sagris D, Proietti M, Bonini N, Zhang H and Lip GYH. Mobile health-technology integrated care in secondary prevention atrial fibrillation patients: a post-hoc analysis from the mAFA-II randomized clinical trial. *Intern Emerg Med*. 2023;18:1041-1048.

39. Romiti GF, Pastori D, Rivera-Caravaca JM, Ding WY, Gue YX, Menichelli D, Gumprecht J, Kozieł M, Yang PS, Guo Y, Lip GYH and Proietti M. Adherence to the 'Atrial Fibrillation Better Care' Pathway in Patients with Atrial Fibrillation: Impact on Clinical Outcomes-A Systematic Review and Meta-Analysis of 285,000 Patients. *Thromb Haemost*. 2022;122:406-414.

40. Luo X, Xu W, Ming WK, Jiang X, Yuan Q, Lai H, Huang C and Zhong X. Cost-Effectiveness of Mobile Health-Based Integrated Care for Atrial Fibrillation: Model Development and Data Analysis. *J Med Internet Res*. 2022;24:e29408.
41. Camacho EM and Lip GYH. Estimating the impact of implementing an integrated care management approach with Atrial fibrillation Better Care (ABC) pathway for patients with atrial fibrillation in England from 2020-2040. *Eur Heart J Qual Care Clin Outcomes*. 2023.
42. Serna MJ, Miguel Rivera-Caravaca J, López-Gálvez R, Soler-Espejo E, Lip GYH, Marín F and Roldán V. Dynamic assessment of CHA(2)DS(2)-VASc and HAS-BLED scores for predicting ischemic stroke and major bleeding in atrial fibrillation patients. *Rev Esp Cardiol (Engl Ed)*. 2024.
43. Chao TF, Liao JN, Tuan TC, Lin YJ, Chang SL, Lo LW, Hu YF, Chung FP, Chen TJ, Lip GYH and Chen SA. Incident Co-Morbidities in Patients with Atrial Fibrillation Initially with a CHA2DS2-VASc Score of 0 (Males) or 1 (Females): Implications for Reassessment of Stroke Risk in Initially 'Low-Risk' Patients. *Thromb Haemost*. 2019;119:1162-1170.
44. Guo Y, Zhu H, Chen Y and Lip GYH. Comparing Bleeding Risk Assessment Focused on Modifiable Risk Factors Only Versus Validated Bleeding Risk Scores in Atrial Fibrillation. *Am J Med*. 2018;131:185-192.
45. Chao TF, Lip GYH, Lin YJ, Chang SL, Lo LW, Hu YF, Tuan TC, Liao JN, Chung FP, Chen TJ and Chen SA. Incident Risk Factors and Major Bleeding in Patients with Atrial Fibrillation Treated with Oral Anticoagulants: A Comparison of Baseline, Follow-up and Delta HAS-BLED Scores with an Approach Focused on Modifiable Bleeding Risk Factors. *Thromb Haemost*. 2018;118:768-777.
46. Proietti M, Romiti GF, Vitolo M, Potpara TS, Boriani G and Lip GYH. Comparison of HAS-BLED and ORBIT bleeding risk scores in atrial fibrillation patients treated with non-vitamin K antagonist oral anticoagulants: a report from the ESC-EHRA EORP-AF General Long-Term Registry. *Eur Heart J Qual Care Clin Outcomes*. 2022;8:778-786.
47. Borre ED, Goode A, Raitz G, Shah B, Lowenstern A, Chatterjee R, Sharan L, Allen LaPointe NM, Yapa R, Davis JK, Lallinger K, Schmidt R, Kosinski A, Al-Khatib SM and Sanders GD. Predicting Thromboembolic and Bleeding Event Risk in Patients with Non-Valvular Atrial Fibrillation: A Systematic Review. *Thromb Haemost*. 2018;118:2171-2187.
48. Guo Y, Lane DA, Chen Y and Lip GYH. Regular Bleeding Risk Assessment Associated with Reduction in Bleeding Outcomes: The mAFA-II Randomized Trial. *Am J Med*. 2020;133:1195-1202.e2.
49. Fong JH and Youn Y. Assessing Patterns and Stability of ADL Hierarchical Scales for Functional Disability Assessment. *Gerontologist*. 2023;63:773-782.
50. Egashira R, Sato T, Miyake A, Takeuchi M, Nakano M, Saito H, Moriguchi M, Tonari S and Hagihara K. The Japan Frailty Scale is a promising screening test for frailty and pre-frailty in Japanese elderly people. *Gene*. 2022;844:146775.
51. Long J, Cai T, Huang X, Zhou Y, Kuang J and Wu L. Reference value for the TUGT in healthy older people: A systematic review and meta-analysis. *Geriatr Nurs*. 2020;41:325-330.
52. Jia X, Wang Z, Huang F, Su C, Du W, Jiang H, Wang H, Wang J, Wang F, Su W, Xiao H, Wang Y and Zhang B. A comparison of the Mini-Mental State Examination (MMSE) with the Montreal Cognitive Assessment (MoCA) for mild cognitive impairment screening in Chinese middle-aged and older population: a cross-sectional study. *BMC Psychiatry*. 2021;21:485.
53. Shurrab M, Jackevicius CA, Austin PC, Tu K, Qiu F, Singh SM, Crystal E, Caswell J, Michael F, Andrade JG and Ko DT. Association Between Concurrent Use of Amiodarone and DOACs and Risk of

Bleeding in Patients With Atrial Fibrillation. *Am J Cardiol*. 2023;186:58-65.
54. Ray WA, Chung CP, Stein CM, Smalley W, Zimmerman E, Dupont WD, Hung AM, Daugherty JR, Dickson AL and Murray KT. Risk for Bleeding-Related Hospitalizations During Use of Amiodarone With Apixaban or Rivaroxaban in Patients With Atrial Fibrillation : A Retrospective Cohort Study. *Ann Intern Med*. 2023;176:769-778.
55. Gowda RM, Khan IA, Punukollu G, Mendoza C, Wilbur SL, Vasavada BC and Sacchi TJ. Use of ibutilide for cardioversion of recent-onset atrial fibrillation and flutter in elderly. *Am J Ther*. 2004;11:95-7.
56. Valembois L, Audureau E, Takeda A, Jarzebowski W, Belmin J and Lafuente-Lafuente C. Antiarrhythmics for maintaining sinus rhythm after cardioversion of atrial fibrillation. *Cochrane Database Syst Rev*. 2019;9:Cd005049.
57. Kirchhof P, Camm AJ, Goette A, Brandes A, Eckardt L, Elvan A, Fetsch T, van Gelder IC, Haase D, Haegeli LM, Hamann F, Heidbüchel H, Hindricks G, Kautzner J, Kuck KH, Mont L, Ng GA, Rekosz J, Schoen N, Schotten U, Suling A, Taggeselle J, Themistoclakis S, Vettorazzi E, Vardas P, Wegscheider K, Willems S, Crijns H and Breithardt G. Early Rhythm-Control Therapy in Patients with Atrial Fibrillation. *N Engl J Med*. 2020;383:1305-1316.
58. Rillig A, Borof K, Breithardt G, Camm AJ, Crijns H, Goette A, Kuck KH, Metzner A, Vardas P, Vettorazzi E, Wegscheider K, Zapf A and Kirchhof P. Early Rhythm Control in Patients With Atrial Fibrillation and High Comorbidity Burden. *Circulation*. 2022;146:836-847.
59. Guo Y, Wang H, Kotalczyk A, Wang Y and Lip GYH. One-year Follow-up Results of the Optimal Thromboprophylaxis in Elderly Chinese Patients with Atrial Fibrillation (ChiOTEAF) registry. *J Arrhythm*. 2021;37:1227-1239.
60. Guo Y, Kotalczyk A, Imberti JF, Wang Y and Lip GY. Oral anticoagulation improves survival in very elderly Chinese patients with atrial fibrillation: A report from the Optimal Thromboprophylaxis in Elderly Chinese Patients with Atrial Fibrillation (ChiOTEAF) registry. *Int J Stroke*. 2022;17:661-668.
61. Kotalczyk A, Guo Y, Wang Y and Lip GY. Are low doses of non-vitamin K antagonists effective in Chinese patients with atrial fibrillation? A report from the Optimal Thromboprophylaxis in Elderly Chinese Patients with Atrial Fibrillation (ChiOTEAF) registry. *Int J Stroke*. 2021:17474930211053140.
62. Silverio A, Di Maio M, Prota C, De Angelis E, Radano I, Citro R, Carrizzo A, Ciccarelli M, Vecchione C, Capodanno D and Galasso G. Safety and efficacy of non-vitamin K antagonist oral anticoagulants in elderly patients with atrial fibrillation: systematic review and meta-analysis of 22 studies and 440 281 patients. *Eur Heart J Cardiovasc Pharmacother*. 2021;7:f20-f29.
63. Chao TF, Chiang CE, Chan YH, Liao JN, Chen TJ, Lip GYH and Chen SA. Oral anticoagulants in extremely-high-risk, very elderly (>90 years) patients with atrial fibrillation. *Heart Rhythm*. 2021;18:871-877.
64. Chan YH, Chao TF, Chen SW, Lee HF, Li PR, Yeh YH, Kuo CT, See LC and Lip GYH. Clinical outcomes in elderly atrial fibrillation patients at increased bleeding risk treated with very low dose vs. regular-dose non-vitamin K antagonist oral anticoagulants: a nationwide cohort study. *Eur Heart J Cardiovasc Pharmacother*. 2023;9:681-691.
65. Guo Y, Imberti JF, Kotalczyk A, Wang Y and Lip GYH. Atrial Fibrillation Better Care Pathway Adherent Care Improves Outcomes in Chinese Patients With Atrial Fibrillation. *JACC Asia*. 2022;2:422-429.
66. Gibson CM, Mehran R, Bode C, Halperin J, Verheugt FW, Wildgoose P, Birmingham M, Ianus J, Burton P, van Eickels M, Korjian S, Daaboul Y, Lip GY, Cohen M, Husted S, Peterson ED and Fox

KA. Prevention of Bleeding in Patients with Atrial Fibrillation Undergoing PCI. *N Engl J Med*. 2016;375:2423-2434.

67. Cannon CP, Bhatt DL, Oldgren J, Lip GYH, Ellis SG, Kimura T, Maeng M, Merkely B, Zeymer U, Gropper S, Nordaby M, Kleine E, Harper R, Manassie J, Januzzi JL, Ten Berg JM, Steg PG and Hohnloser SH. Dual Antithrombotic Therapy with Dabigatran after PCI in Atrial Fibrillation. *N Engl J Med*. 2017;377:1513-1524.

68. Lopes RD, Heizer G, Aronson R, Vora AN, Massaro T, Mehran R, Goodman SG, Windecker S, Darius H, Li J, Averkov O, Bahit MC, Berwanger O, Budaj A, Hijazi Z, Parkhomenko A, Sinnaeve P, Storey RF, Thiele H, Vinereanu D, Granger CB and Alexander JH. Antithrombotic Therapy after Acute Coronary Syndrome or PCI in Atrial Fibrillation. *N Engl J Med*. 2019;380:1509-1524.

69. Vranckx P, Valgimigli M, Eckardt L, Tijssen J, Lewalter T, Gargiulo G, Batushkin V, Campo G, Lysak Z, Vakaliuk I, Milewski K, Laeis P, Reimitz PE, Smolnik R, Zierhut W and Goette A. Edoxaban-based versus vitamin K antagonist-based antithrombotic regimen after successful coronary stenting in patients with atrial fibrillation (ENTRUST-AF PCI): a randomised, open-label, phase 3b trial. *Lancet*. 2019;394:1335-1343.

70. Galli M, Andreotti F, D'Amario D, Porto I and Crea F. Stent Thrombosis With Dual Antithrombotic Therapy in Atrial Fibrillation-ACS/PCI Trials. *J Am Coll Cardiol*. 2020;75:1727-1728.

71. Fan J, Sun Z, Yu C, Guo Y, Pei P, Yang L, Chen Y, Du H, Sun D, Pang Y, Zhang J, Gilbert S, Avery D, Chen J, Chen Z, Lyu J and Li L. Multimorbidity patterns and association with mortality in 0.5 million Chinese adults. *Chin Med J (Engl)*. 2022;135:648-657.

72. Ogawa H, An Y, Nishi H, Fukuda S, Ishigami K, Ikeda S, Doi K, Ide Y, Hamatani Y, Fujino A, Ishii M, Iguchi M, Masunaga N, Esato M, Tsuji H, Wada H, Hasegawa K, Abe M, Tsukahara T, Lip GYH and Akao M. Characteristics and clinical outcomes in atrial fibrillation patients classified using cluster analysis: the Fushimi AF Registry. *Europace*. 2021;23:1369-1379.

73. Shantsila E, Choi EK, Lane DA, Joung B and Lip GYH. Atrial fibrillation: comorbidities, lifestyle, and patient factors. *Lancet Reg Health Eur*. 2024;37:100784.

74. Chen N, Alam AB, Lutsey PL, MacLehose RF, Claxton JS, Chen LY, Chamberlain AM and Alonso A. Polypharmacy, Adverse Outcomes, and Treatment Effectiveness in Patients ≥75 With Atrial Fibrillation. *J Am Heart Assoc*. 2020;9:e015089.

75. Proietti M, Raparelli V, Olshansky B and Lip GY. Polypharmacy and major adverse events in atrial fibrillation: observations from the AFFIRM trial. *Clin Res Cardiol*. 2016;105:412-20.

76. Hsieh HL, Kao CW, Cheng SM and Chang YC. A Web-Based Integrated Management Program for Improving Medication Adherence and Quality of Life, and Reducing Readmission in Patients With Atrial Fibrillation: Randomized Controlled Trial. *J Med Internet Res*. 2021;23:e30107.

77. Macha K, Marsch A, Siedler G, Breuer L, Strasser EF, Engelhorn T, Schwab S and Kallmünzer B. Cerebral Ischemia in Patients on Direct Oral Anticoagulants. *Stroke*. 2019;50:873-879.

78. Klijn CJ, Paciaroni M, Berge E, Korompoki E, Kõrv J, Lal A, Putaala J and Werring DJ. Antithrombotic treatment for secondary prevention of stroke and other thromboembolic events in patients with stroke or transient ischemic attack and non-valvular atrial fibrillation: A European Stroke Organisation guideline. *Eur Stroke J*. 2019;4:198-223.

79. Unverdorben M, von Heymann C, Santamaria A, Saxena M, Vanassche T, Jin J, Laeis P, Wilkins R, Chen C and Colonna P. Elderly patients with atrial fibrillation in routine clinical practice-peri-procedural management of edoxaban oral anticoagulation therapy is associated with a low risk of bleeding and thromboembolic complications: a subset analysis of the prospective, observational,

multinational EMIT-AF study. *BMC Cardiovasc Disord*. 2020;20:504.
80. Steffel J, Collins R, Antz M, Cornu P, Desteghe L, Haeusler KG, Oldgren J, Reinecke H, Roldan-Schilling V, Rowell N, Sinnaeve P, Vanassche T, Potpara T, Camm AJ and Heidbüchel H. 2021 European Heart Rhythm Association Practical Guide on the Use of Non-Vitamin K Antagonist Oral Anticoagulants in Patients with Atrial Fibrillation. *Europace*. 2021;23:1612-1676.
81. Sherwood MW, Douketis JD, Patel MR, Piccini JP, Hellkamp AS, Lokhnygina Y, Spyropoulos AC, Hankey GJ, Singer DE, Nessel CC, Mahaffey KW, Fox KA, Califf RM and Becker RC. Outcomes of temporary interruption of rivaroxaban compared with warfarin in patients with nonvalvular atrial fibrillation: results from the rivaroxaban once daily, oral, direct factor Xa inhibition compared with vitamin K antagonism for prevention of stroke and embolism trial in atrial fibrillation (ROCKET AF). *Circulation*. 2014;129:1850-9.
82. Douketis JD, Healey JS, Brueckmann M, Eikelboom JW, Ezekowitz MD, Fraessdorf M, Noack H, Oldgren J, Reilly P, Spyropoulos AC, Wallentin L and Connolly SJ. Perioperative bridging anticoagulation during dabigatran or warfarin interruption among patients who had an elective surgery or procedure. Substudy of the RE-LY trial. *Thromb Haemost*. 2015;113:625-32.
83. Godier A, Dincq AS, Martin AC, Radu A, Leblanc I, Antona M, Vasse M, Golmard JL, Mullier F and Gouin-Thibault I. Predictors of pre-procedural concentrations of direct oral anticoagulants: a prospective multicentre study. *Eur Heart J*. 2017;38:2431-2439.
84. Shaw JR, Li N, Vanassche T, Coppens M, Spyropoulos AC, Syed S, Radwi M, Duncan J, Schulman S and Douketis JD. Predictors of preprocedural direct oral anticoagulant levels in patients having an elective surgery or procedure. *Blood Adv*. 2020;4:3520-3527.
85. Villani ER, Tummolo AM, Palmer K, Gravina EM, Vetrano DL, Bernabei R, Onder G and Acampora N. Frailty and atrial fibrillation: A systematic review. *Eur J Intern Med*. 2018;56:33-38.

Acknowledgement

The study was supported by Beijing Natural Science Foundation (L232117)，National Natural Science Foundation of China (82170309).

Competing financial interests

GYHL: Consultant for Bayer/Janssen, Astellas, Merck, Sanofi, BMS/Pfizer, Biotronik, Medtronic, Portola, Boehringer Ingelheim, Microlife and Daiichi-Sankyo. Speaker for Bayer, BMS/Pfizer, Medtronic, Boehringer Ingelheim, Microlife, Roche and Daiichi-Sankyo

Other authors: None declared.

Figure 1 Risk assessment of the elderly patients with AF

* AF = atrial fibrillation; BP = blood pressure; CAD = coronary artery disease; CHA_2DS_2-VASc = Congestive heart failure, Hypertension, Age ≥75 years, Diabetes mellitus, Stroke, Vascular disease, Age 65-74 years, Sex category (female); EF = ejection fraction; HCM = hypertrophic cardiomyopathy; HF = heart failure; LV = left ventricular; LVEF = left ventricular ejection fraction; PAD = peripheral artery disease; TIA = transient ischaemic attack. ALP = alkaline phosphatase; ALT = alanine aminotransferase; AST = aspartate aminotransferase; SBP = systolic blood pressure; INR = international normalized ratio; NSAID = Non-steroidal anti-inflammatory drug; TTR = time in therapeutic range; VKA = vitamin K antagonist. CKD-EP= Chronic Kidney Disease Epidemiology Collaboration.

For the patients with a CHA_2DS_2-VASc score of low or intermediate risk at baseline, more frequent stroke risk evaluation, e.g. every 4 months, is proposed.

Figure 2 AF screening and monitoring for the elderly population

* AF = atrial fibrillation. OSA = obstructive sleep apnea.

Figure 3 An integrated care ABC pathway for the elderly population with Atrial Fibrillation

* F = female; m = male; NOAC = non-vitamin K antagonist oral anticoagulant; INR = international normalized ratio; OAC =oral anticoagulant; OSA = obstructive sleep apnea; COPD = chronic obstructive pulmonary disease.

Figure 4 Mobile health technology facilitated integrated care for the elderly patients with AF

Figure 5 Appropriate measures to reduce AF recurrence for the elderly patients receiving ablation

* Clinical recurrence of AF late recurrence or very late recurrence

Figure 6 Risk reductions in elderly patients with AF on OACs in special clinical setting (very elderly, multimorbidities, with CAD) and the increased risk of those without OACs or with underdosing of OACs

* TE and all-cause death reduced among the very elderly patients and with multimorbidities on OACs. The composite of all-cause death, TE, major bleeding and acute coronary syndrome was reduced in the elderly patients with OACs. ** For elderly patients with AF without OACs, the thromboembolic risk increased by 2.2 fold in those with CHA2DS2-VASc ≥1 in male, or ≥2 in female and by 2.5 fold in those with the underdoing of OACs. TE = thromboembolism; CAD = coronary artery disease. OACs = oral anticoagulants. Cited from Optimal Thromboprophylaxis in Elderly Chinese Patients with Atrial Fibrillation (ChiOTEAF) registry. Eur Heart J Qual Care Clin Outcomes. 2023 J Arrhythm. 2022; Int J Stroke. 2022; Int J Stroke. 2021.

Figure 7 Multimorbidity, polypharmacy and high-risk thromboembolism and bleeding in the elderly population with AF

*F = female; M = male. Cited from Optimal Thromboprophylaxis in Elderly Chinese Patients with Atrial Fibrillation (ChiOTEAF) registry. J Am Heart Assoc. 2022; J Arrhythm. 2022.

Figure 8 Periprocedural and perioperative risk assessment of the elderly population with AF

* Intervention with minor bleeding: e.g. Dental extractions (1–3 teeth), paradontal surgery, implant positioning, subgingival scalling/cleaning Cataract or glaucoma intervention Endoscopy without biopsy or resection Superficial surgery (e.g. abscess incision; small dermatologic excisions, skin biopsy) Pacemaker or ICD implantation (except complex procedures) Electrophysiological study or catheter ablation (except complex procedures) Routine elective coronary/peripheral artery intervention (except complex procedures) Intramuscular injection (e.g. vaccination)
Intervention with low-risk bleeding: e.g. Complex dental procedures Endoscopy with simple biopsy Small orthopaedic surgery (foot, hand, arthroscopy.
Intervention with high-risk interventions: e.g. Cardiac surgery Peripheral arterial revascularization surgery (e.g. aortic aneurysm repair, vascular bypass) Complex invasive cardiological interventions, including lead extraction, (epicardial) VT ablation, chronic total occlusion PCI etc. Neurosurgery Spinal or epidural anaesthesia; lumbar diagnostic puncture Complex endoscopy (e.g. multiple/large polypectomy, ERCP with sphincterotomy etc.) Abdominal surgery (incl. liver

biopsy) Thoracic surgery Major urologic surgery/biopsy (incl. kidney) Extracorporeal shockwave lithotripsy Major orthopaedic surgery. Cited from 2021 European Heart Rhythm Association Practical Guide on the Use of Non-Vitamin K Antagonist Oral Anticoagulants in Patients with Atrial Fibrillation. Europace. 2021.

Figure 9 Continuation, discontinuation, bridging, or resumption of anticoagulation with warfarin, with regarding to the time points in the perioperative period

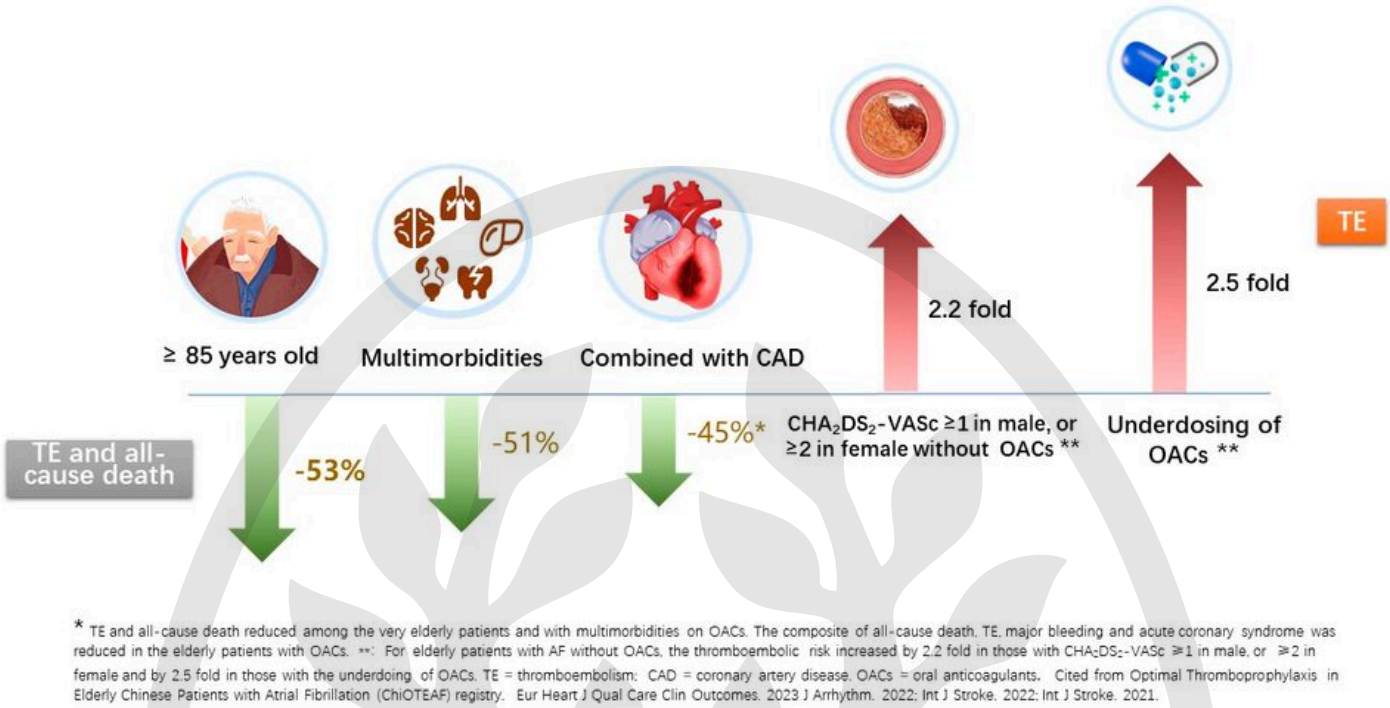
* LMWH = Low molecular weight heparin. INR = international normalized ratio. OAC = oral anticoagulant.

Figure 10 Continuation, discontinuation, bridging, or resumption of anticoagulation with NOACs, with regarding to the time points in the perioperative period

* NOAC = non-vitamin k antagonist oral anticoagulant.

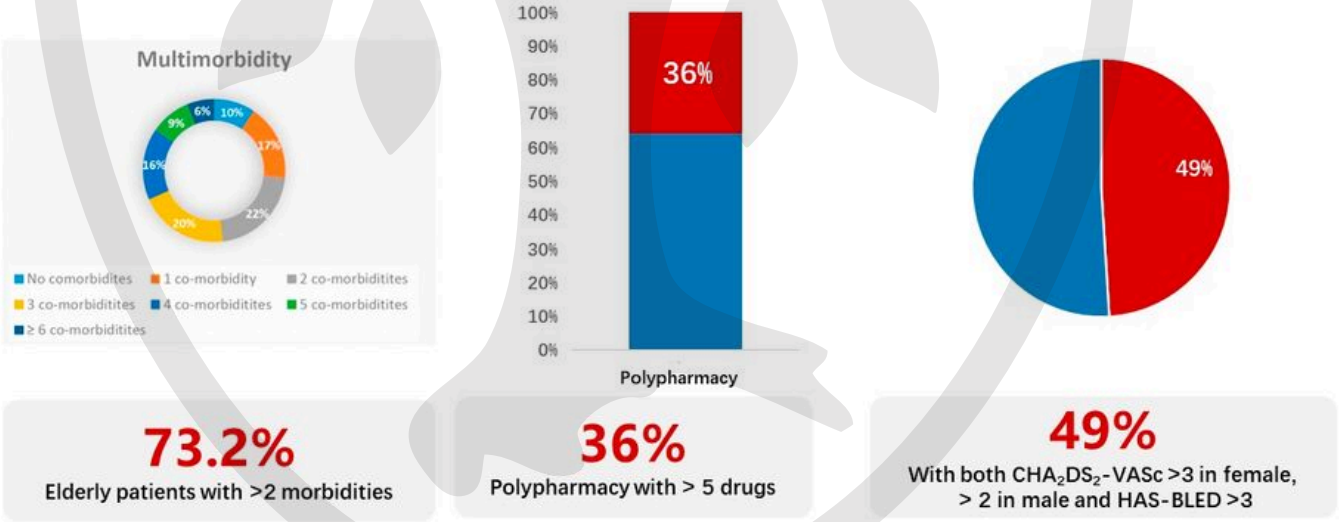
Figure 11 Management of chronic conditions in the elderly population with AF

* AF = atrial fibrillation. ARBs = angiotensin receptor blockers ; ACE inhibitors = angiotensin-converting enzyme inhibitors. NOACs = non-vitamin K oral antagonist anticoagulants.



* TE and all-cause death reduced among the very elderly patients and with multimorbidities on OACs. The composite of all-cause death, TE, major bleeding and acute coronary syndrome was reduced in the elderly patients with OACs. **: For elderly patients with AF without OACs, the thromboembolic risk increased by 2.2 fold in those with CHA_2DS_2-VASc ≥1 in male, or ≥2 in female and by 2.5 fold in those with the underdoing of OACs. TE = thromboembolism; CAD = coronary artery disease. OACs = oral anticoagulants. Cited from Optimal Thromboprophylaxis in Elderly Chinese Patients with Atrial Fibrillation (ChiOTEAF) registry. Eur Heart J Qual Care Clin Outcomes. 2023 J Arrhythm. 2022; Int J Stroke. 2022; Int J Stroke. 2021.

Figure 6 Risk reductions in elderly patients with AF on OACs in special clinical setting (very elderly, multimorbidities, with CAD) and the increased risk of those without OACs or with underdosing of OACs



* F = female; M = male. Cited from Optimal Thromboprophylaxis in Elderly Chinese Patients with Atrial Fibrillation (ChiOTEAF) registry. J Am Heart Assoc. 2022; J Arrhythm. 2022.

Figure 7 Multimorbidity, polypharmacy and high-risk thromboembolism and bleeding in the elderly population with AF

CHA_2DS_2-VASc score

Risk factors		Definition	Points
C	Congestive heart failure	Clinical HF, or objective evidence of moderate to severe LV dysfunction, or HCM	1
H	Hypertension	or on antihypertensive therapy	1
A	Age	Age 75 years or old	2
D	Diabetes mellitus	Treatment with oral hypoglycaemic drugs and/or insulin or fasting blood glucose >125 mg/dL (7mmol/l)	1
S	Stroke	Previous stroke, TIA, or thromboembolism	2
V	Vascular disease	Angiographically significant CAD, previous myocardial infarction, PAD, or aortic plaque	1
A	Age	Age 65 – 74 years	1
Sc	Sex	Female	1

HAS-BLED score

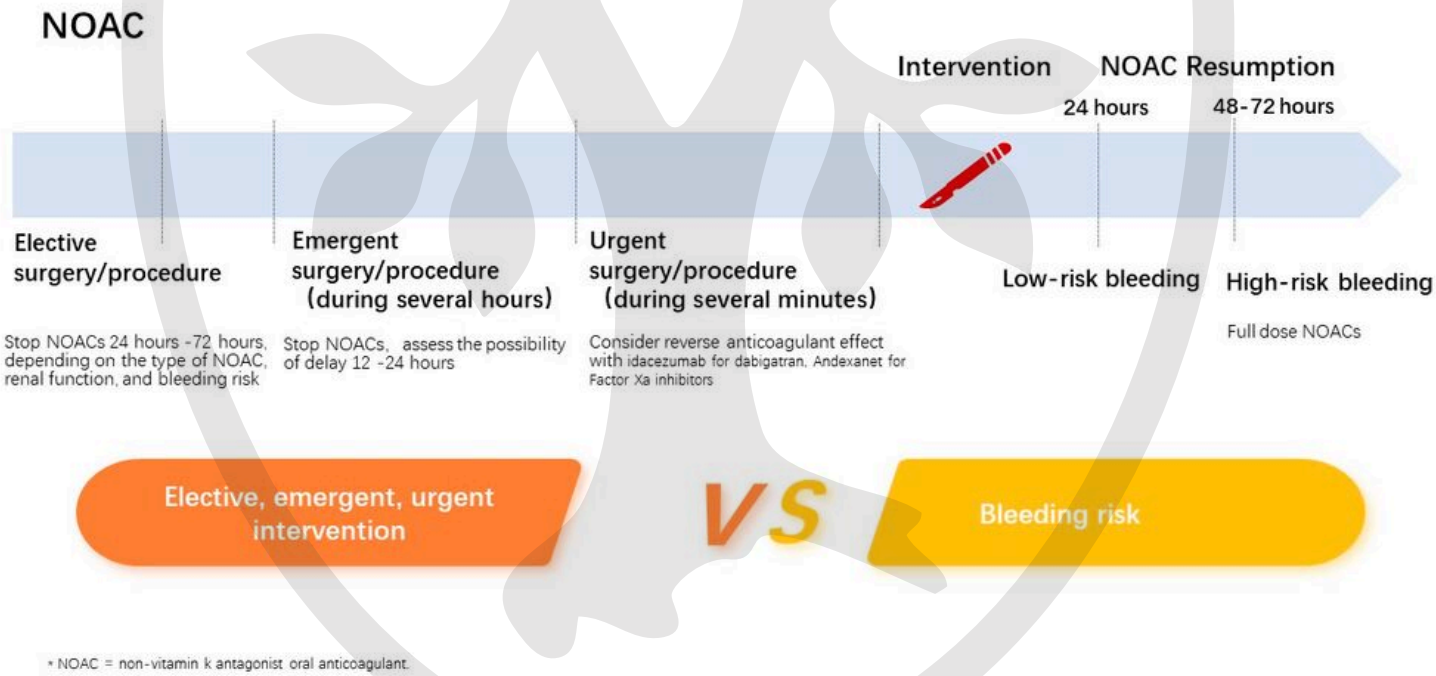
Risk factors		Definition	Points
H	Uncontrolled hypertension	SBP >160 mmHg	1
A	Abnormal renal and/or hepatic function	Dialysis, transplant, serum creatinine >200 μmol/L, cirrhosis, bilirubin > × 2 upper limit of normal, AST/ALT/ALP >3 × upper limit of normal	1 point for each
S	Stroke	Previous ischaemic or hemorrhagic stroke	1
B	Bleeding history or predisposition	Previous major haemorrhage or anaemia or severe thrombocytopenia	1
L	Labile INR	TTR <60% in patient receiving VKA	1
E	Elderly	Aged >65 years or extreme frailty	1
D	Drugs or excessive alcohol drinking	Concomitant use of antiplatelet or NSAID; and/or excessive alcohol per week	1 point for each

Geriatric General Evaluation

Items	Scores
Disability assessment	ADL scale
Frailty screening	FRAIL score
Gait abnormality and fall risk	TUGT scale
Cognitive function assessment	Mini-Cog scale
Renal function	eGFR, CKD-EP (Scr/Cys-c)
Nutritional status, diet and weight,	-
Depressive status, comorbidities, and combined with multiple drug	-

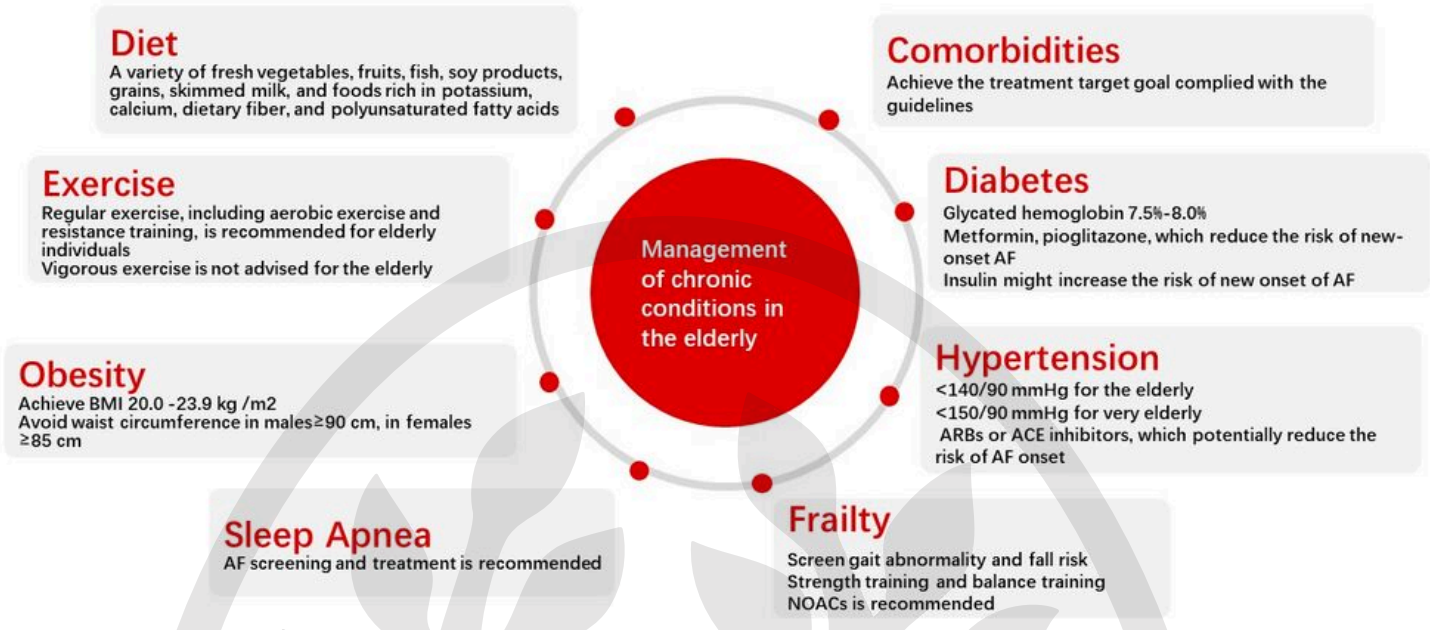
+ AF = atrial fibrillation; BP = blood pressure; CAD = coronary artery disease; CHA_2DS_2-VASc = Congestive heart failure, Hypertension, Age ≥ 75 years, Diabetes mellitus, Stroke, Vascular disease, Age 65-74 years, Sex category (female); EF = ejection fraction; HCM = hypertrophic cardiomyopathy; HF = heart failure; LV = left ventricular; LVEF = left ventricular ejection fraction; PAD = peripheral artery disease; TIA = transient ischaemic attack; ALP = alkaline phosphatase; ALT = alanine aminotransferase; AST = aspartate aminotransferase; SBP = systolic blood pressure; INR = international normalized ratio; NSAID = Non-steroidal anti-inflammatory drug; TTR = time in therapeutic range; VKA = vitamin K antagonist; CKD-EP= Chronic Kidney Disease Epidemiology Collaboration.
For the patients with a CHA_2DS_2-VASc score of low or intermediate risk at baseline, more frequent stroke risk evaluation, e.g. every 4 months, is proposed.

Figure 1 Risk assessment of the elderly patients with AF



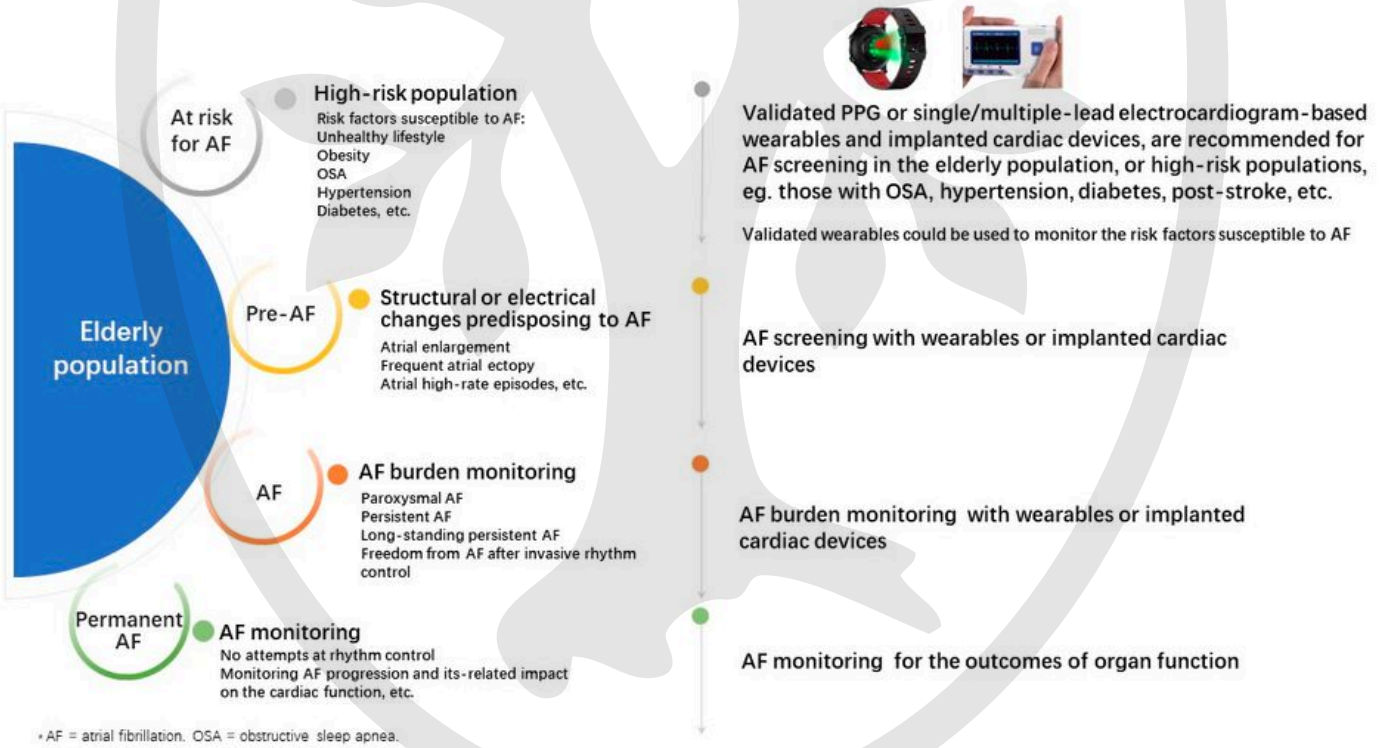
+ NOAC = non-vitamin k antagonist oral anticoagulant.

Figure 10 Continuation, discontinuation, bridging, or resumption of anticoagulation with NOACs, with regarding to the time points in the perioperative period



* AF = atrial fibrillation. ARBs = angiotensin receptor blockers ; ACE inhibitors = angiotensin-converting enzyme inhibitors. NOACs = non-vitamin K oral antagonist coagulants.

Figure 11 Management of chronic conditions in the elderly population with AF



* AF = atrial fibrillation. OSA = obstructive sleep apnea.

Figure 2 AF screening and monitoring for the elderly population

Integrated care: ABC Pathway for the elderly population with AF

A Avoid stroke with anticoagulation

- CHA_2DS_2-VASc ≥ 2 (m), 3 (f) , NOACs (preferred) or warfarin (INR 2.0-3.0)
- CHA_2DS_2-VASc =1 (male), 2 (f), could benefit from the modification of risk factors.

•Antiplatelet is not recommended as an alternatives of OACs.

B Better symptom management

Patient-centered and symptom-directed decisions for rate or rhythm control

- Rhythm/rate control with drugs
- Rhythm/rate control with invasive procedures

C Cardiovascular risk and comorbidity management

- Lifestyle modification: diets, physical activity, weight control
- OSA, hypertension, diabetes mellitus, heart failure, cardiac ischemia, COPD, pulmonary hypertension, chronic kidney/liver disease, cancer, etc.
- Address any psychological morbidity,

• F = female; m = male; NOAC = non-vitamin K antagonist oral anticoagulant; INR = international normalized ratio; OAC =oral anticoagulant; OSA = obstructive sleep apnea; COPD = chronic obstructive pulmonary disease.

Figure 3 An integrated care ABC pathway for the elderly population with Atrial Fibrillation

Mobile health technology facilitated ABC pathway

	Composite outcome of stroke or thromboembolism, all-cause death, and rehospitalization (HR, 95% CI)		Rehospitalisations (HR, 95% CI)
Aged ≥ 75 years	-42%	0.58 (0.35-0.97)	0.47 (0.24-0.91)
Aged ≥ 65 years	-61%	0.39 (0.22-0.67)	0.32 (0.17-0.60)
Higher risk of thromboembolic recurrence	-62%	0.38 (0.18-0.80)	0.35 (0.10-1.26)
Multimorbidity	-63%	0.37 (0.26-0.53)	0.42 (0.27-0.64)
Diabetes mellitus	-64%	0.36 (0.18-0.73)	0.25 (0.11-0.60)

• ABC = Atrial fibrillation Better Care; HR = hazard ratio; CI = confidence interval

Figure 4 Mobile health technology facilitated integrated care for the elderly patients with AF

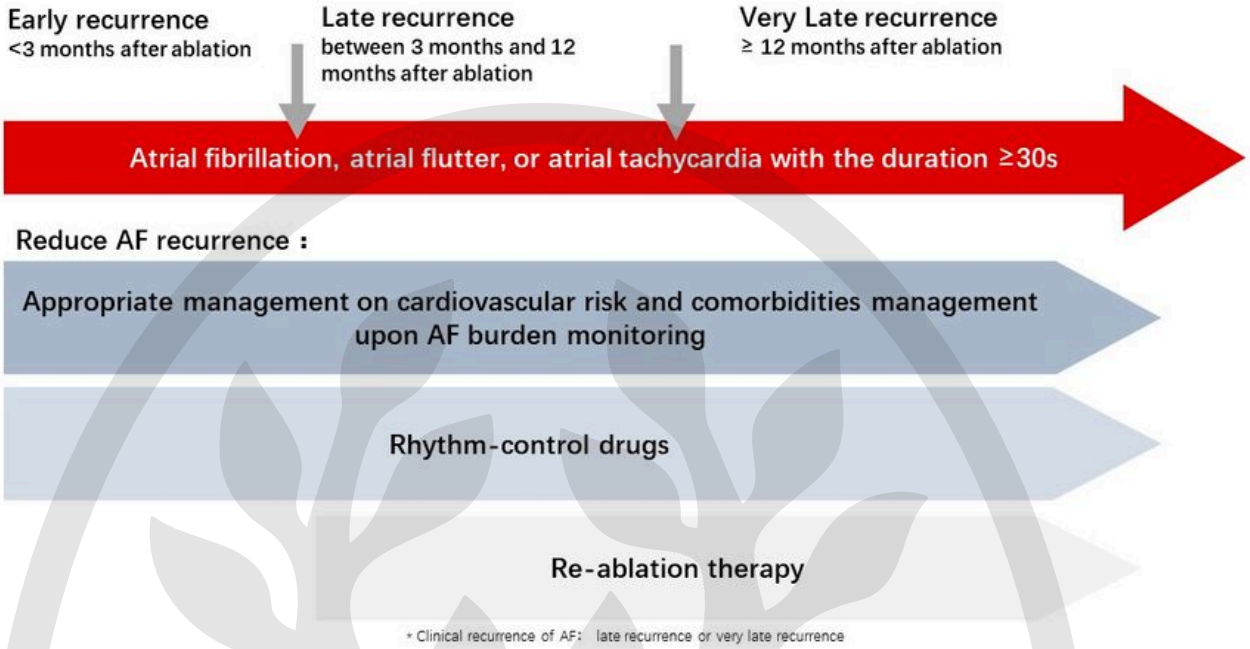
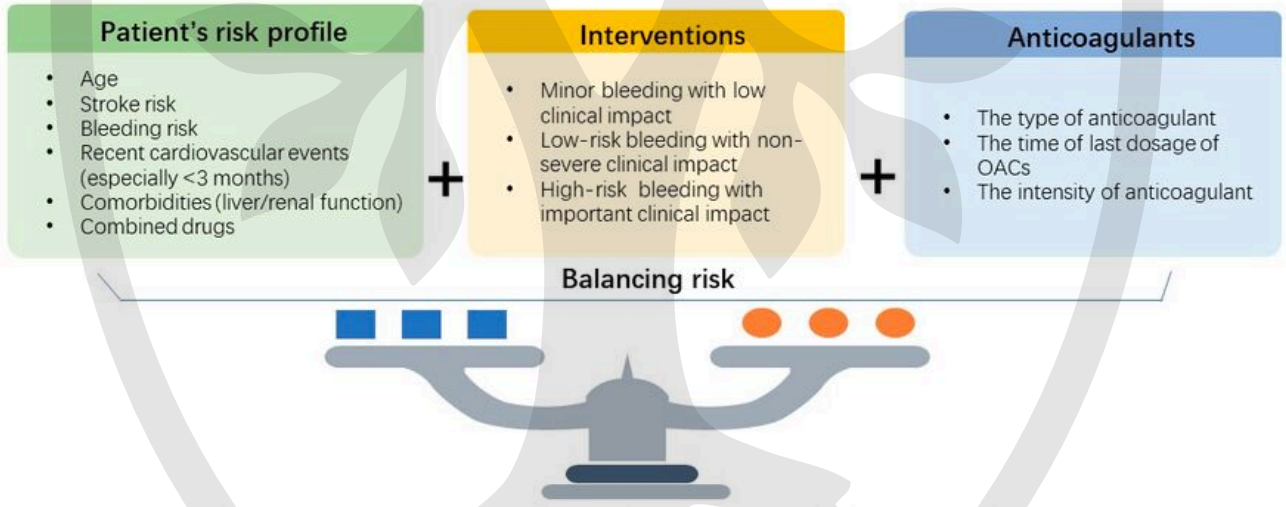


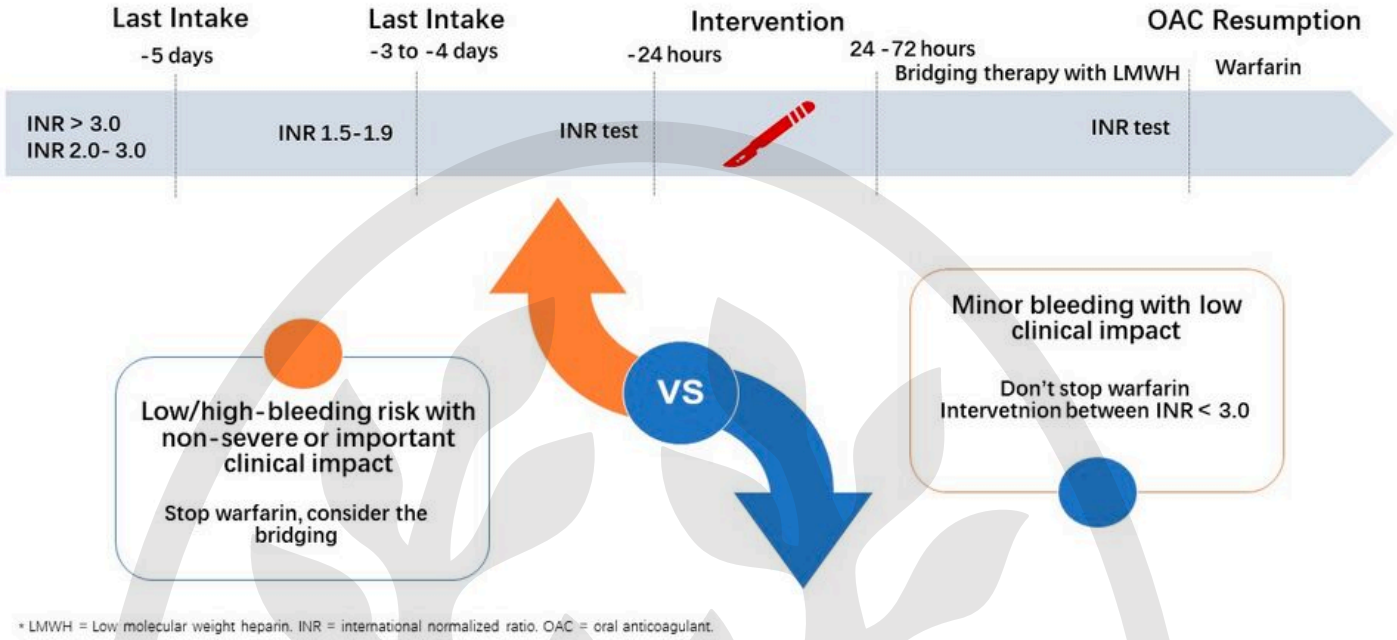
Figure 5 Appropriate measures to reduce AF recurrence for the elderly patients receiving ablation



* Intervention with minor bleeding: e.g. Dental extractions (1–3 teeth), paradontal surgery, implant positioning, subgingival scalling/cleaning Cataract or glaucoma intervention Endoscopy without biopsy or resection Superficial surgery (e.g. abscess incision; small dermatologic excisions, skin biopsy) Pacemaker or ICD implantation (except complex procedures) Electrophysiological study or catheter ablation (except complex procedures) Routine elective coronary/peripheral artery intervention (except complex procedures) Intramuscular injection (e.g. vaccination)
Intervention with low-risk bleeding: e.g. Complex dental procedures Endoscopy with simple biopsy Small orthopaedic surgery (foot, hand, arthroscopy.
Intervention with high-risk interventions: e.g. Cardiac surgery Peripheral arterial revascularization surgery (e.g. aortic aneurysm repair, vascular bypass) Complex invasive cardiological interventions, including lead extraction, (epicardial) VT ablation, chronic total occlusion PCI etc. Neurosurgery Spinal or epidural anaesthesia; lumbar diagnostic puncture Complex endoscopy (e.g. multiple/large polypectomy, ERCP with sphincterotomy etc.) Abdominal surgery (incl. liver biopsy) Thoracic surgery Major urologic surgery/biopsy (incl. kidney) Extracorporeal shockwave lithotripsy Major orthopaedic surgery. Cited from 2021 European Heart Rhythm Association Practical Guide on the Use of Non-Vitamin K Antagonist Oral Anticoagulants in Patients with Atrial Fibrillation. Europace. 2021.

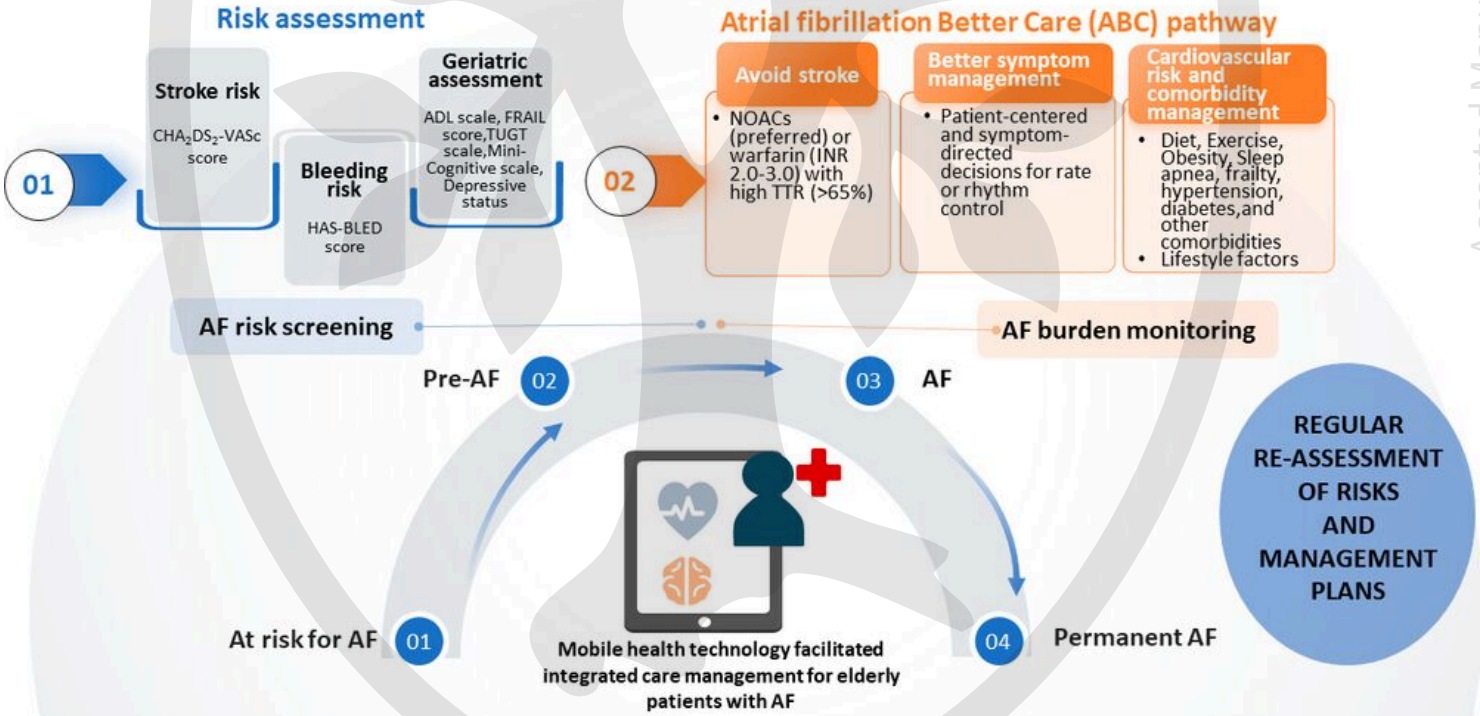
Figure 8 Periprocedural and perioperative risk assessment of the elderly population with AF

Warfarin



* LMWH = Low molecular weight heparin. INR = international normalized ratio. OAC = oral anticoagulant.

Figure 9 Continuation, discontinuation, bridging, or resumption of anticoagulation with warfarin, with regarding to the time points in the perioperative period



Chinese expert consensus guidelines on the diagnosis and treatment of Atrial Fibrillation in the Elderly

* AF = Atrial fibrillation; CHA2DS2-VASc = Congestive heart failure, Hypertension, Age ≥75 years, Diabetes mellitus, Stroke, Vascular disease, Age 65-74 years, Sex category (female); ADL scale = Activities Daily Living; TUGT scale = Timed Up and Go Test.