Stroke prevention in atrial fibrillation: Closing the gap

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Atrial fibrillation (AF) is the most common arrhythmia seen in clinical practice, accounting for one-third of arrhythmia-related hospitalizations.[1] The prevalence of AF in the United States is 1% overall and more than 10% in people over 80 years of age, with approximately 70% of AF cases in patients between 65 and 85 years of age.[2] Moreover, the age-adjusted incidence and prevalence have increased over the last 3 decades,[3,4] resulting in a meaningful challenge to health care providers. As many as 720,000 patients, or 1.5% of all patients over the age of 65, have undiagnosed AF,[5] and the prevalence of undiagnosed AF increases to as much as 20% in higher-risk patients with 6 months of continuous monitoring.[6] The number of patients with AF is expected to increase 150% by 2050, with more than 50% of patients being octogenarians or older, reflective of the health burden of the aging population.[3,7-11] Patients with AF have a 5- to 7-fold greater risk of stroke than the general population.[12-14] Thus, the increasing prevalence of AF is expected to result in a higher incidence of stroke. The incidence of stroke in patients with AF is 5% per year, on average,[15] and AF-related strokes account for 15% of the nearly 800,000 strokes in the United States annually.[16] Patients with stroke and AF tend to have greater disability and a worse prognosis than patients with stroke without AF.[17,18]

However, very effective pharmacologic and procedure-based methods of preventing stroke in patients with AF are currently available. For patients with AF, proper use of oral anticoagulants can decrease the rate of stroke by more than two-thirds.[19,20] The American College of Cardiology (ACC)/American Heart Association (AHA)/Heart Rhythm Society AF guidelines recommend risk stratifying patients for thromboembolic stroke using the CHA_2DS_2-VASc score (class IB recommendation) and treating patients with a score of ≥ 2 with oral anticoagulants (class IA recommendation).[21] Unfortunately, underprescribing and underuse of oral anticoagulants are common, leading to unnecessary strokes.

Gaps in care of stroke prevention in AF

An abundance of data from multiple registries highlights the disturbing paradox between the availability of highly effective stroke prevention therapies and their underuse in clinical practice. There are over 15 different major registries worldwide reporting on use of oral anticoagulants in patients with AF.[22] In addition, claims-based data provide insights into nonconsented, unselected populations of patients with AF.[23] Both registry (Figure 1) and claims data have consistently demonstrated that approximately 40%-60% of patients with AF and a guideline-based indication for stroke prevention (CHA_2DS_2-VASc of ≥ 2) are not prescribed oral anticoagulants.[24-34] Of the 5 million Americans with AF, 2.5 million are not treated, and annually, 5% of these patients have a stroke. Given that two-thirds of strokes in patients with AF are preventable, there are over 50,000 preventable AF-related strokes annually in the United States.

For patients treated with warfarin therapy, the time spent within the therapeutic international normalized ratio (INR) range is low. The median times within therapeutic range in the Apixaban for Reduction in Stroke and Other Thromboembolic Events in Atrial Fibrillation (ARISTOTLE),[35] Rivaroxaban Once Daily Oral Direct Factor Xa Inhibition Compared with Vitamin

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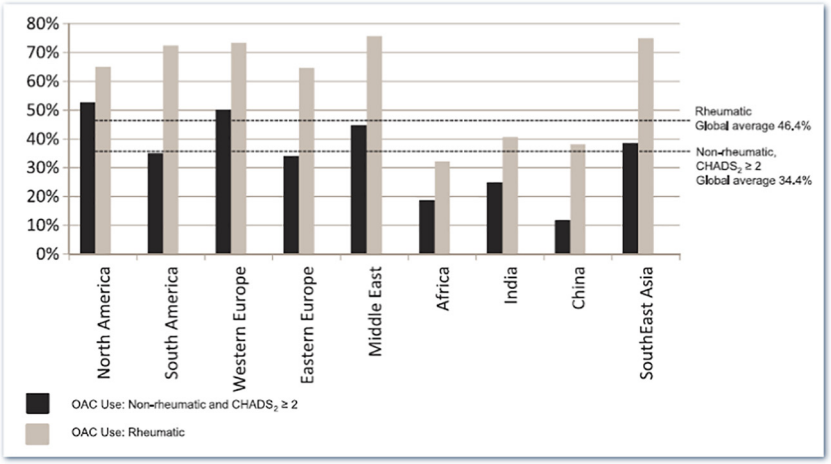
Figure 1



RE-LY registry.* *Reprinted with permission from Oldgren et al.[33]

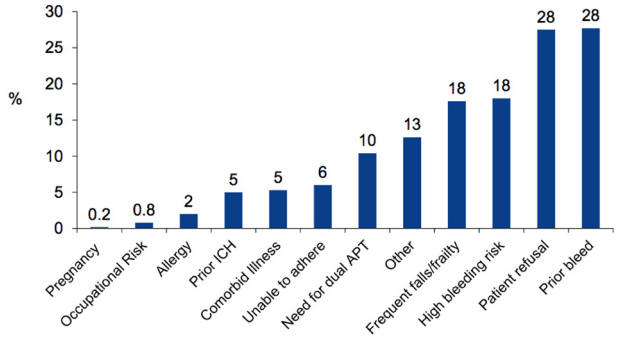
K Antagonism for Prevention of Stroke and Embolism Trial in Atrial Fibrillation (ROCKET AF),[36] Randomized Evaluation of Long-Term Anticoagulation Therapy (RE-LY),[37] and Effective Anticoagulation with Factor Xa Next Generation in Atrial Fibrillation–Thrombolysis in Myocardial Infarction 48 (ENGAGE AF-TIMI 48) trials[38] were 62%, 55%, 64%, and 68%, respectively. Outside of clinical trial settings, median time within therapeutic range varies between 54% and 68%,[39,40] and even patients with the highest time in therapeutic range have difficulty maintaining stable INR values over time.[41,42] The observed relationship between higher proportion of time in the therapeutic range and lower rates of stroke and bleeding events supports the concept that being in the therapeutic range enhances the benefits of warfarin.[43] A recent nationwide analysis of patients in the United States with a history of AF at the time of stroke found that 66% of these stroke patients were not on an oral anticoagulant and an additional 14% had subtherapeutic INR values on warfarin at the time of their stroke.[44] Similar findings were reported in an Australian study in which 85% of patients with an ischemic stroke and a history of AF were inadequately anticoagulated at the time of their stroke.[45]

There are 4 direct-acting oral anticoagulants (DOACs) approved by the US Food and Drug Administration (FDA), the European Medicines Agency, and other regulatory authorities for stroke prevention in AF: apixaban, rivaroxaban, dabigatran, and edoxaban. These agents are safer than warfarin, with more than a 50% reduction in intracranial hemorrhage relative to warfarin,[20] and they are easier to manage because they have fewer dietary and medication interactions and do not require frequent INR monitoring. There was hope in the AF treatment community that the availability of the DOACs would increase the use of oral anticoagulants. However, the availability of the DOACs has had only a modest impact on the gap in care related to stroke prevention for AF.[46] Even among patients prescribed these agents, there are ongoing challenges related to medication adherence.[47] An additional concerning global trend is the use of lower doses of the DOACs, akin to physician prescription of lower anticoagulation target ranges for warfarin, which resulted in 43% of patient time in the subtherapeutic INR range.[46]

Why are patients and providers underusing oral anticoagulants?

The Apixaban Versus Acetylsalicylic Acid (ASA) to Prevent Stroke in Atrial Fibrillation Patients Who Have Failed or Are Unsuitable for Vitamin K Antagonist Treatment (AVERROES) trial provided insight into why some patients were deemed "unsuitable for warfarin": 42% were reported to be unable to maintain therapeutic INR values, 43% were considered unlikely to monitor INR values, and 37% refused warfarin.[47] Data from the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF) found that 13% of patients were reported to have a "contraindication" to warfarin at the baseline visit, and the 4 most common reasons were prior bleeding (28%), patient refusal (28%), high risk for bleeding (18%), and frequent falls (18%) (Figure 2).[48] Similar data from the Fibrillation Registry Assessing Costs, Therapies, Adverse events and Lifestyle (FRACTAL) showed that, among patients with new-onset AF not treated with oral anticoagulation, nearly one-third were perceived to have an excess bleeding risk, and nearly one-quarter were not treated because of physician preference.[49] ORBIT-AF also showed that, in a 1-year period, 10% of patients had their warfarin discontinued without transitioning to an alternative oral anticoagulant;

Figure 2



Contraindications to warfarin in ORBIT-AF.* *Adapted with permission from O'Brien EC et al.[48]

the most common reason for warfarin discontinuation was physician preference (46%).[50] These data suggest that a major issue driving undertreatment is an overemphasis by providers on bleeding risk and an underemphasis on risk of stroke.

The reasons for underuse of oral anticoagulation can be appropriate or inappropriate and are likely related to 3 types of barriers: patient-level barriers, provider-level barriers, and system-level barriers (Table I). Patients with AF and risk factors for stroke, including patients on oral anticoagulation and those not on oral anticoagulation, and their providers were interviewed to explore in greater detail some of these barriers.[51] The patients and providers were randomly selected from a community primary care clinic, community and academic cardiology practices, and an academic geriatrics practice. Data presented at the 2016 American Heart Association Scientific Sessions showed that nearly 4 of 5 patients said that they would follow their physician's recommendation regarding oral anticoagulation. More than half of patients not on an oral anticoagulant were told that they did not need an anticoagulant because (1) they had infrequent or minimally symptomatic AF or (2) aspirin was sufficient stroke prevention. These data suggest that the barrier to greater use of oral anticoagulation for stroke prevention with AF is at the provider and system level.

There is a difference in the perception of stroke risk and bleeding risk between patients and providers, which contributes to the provider-level barriers. In a series of interviews of patients with AF and providers who treat patients with AF, providers felt that a greater risk of stroke was needed to warrant anticoagulation with warfarin (1.25 per 100 patient-years) relative to patients (0.9 per 100 patient-years; $P = .009$).[52] Similarly, patients were willing to tolerate a higher risk of bleeding events (8.7 per 100 patient-years) than providers (5.2 per 100 patient-years; $P < .001$) to be treated with warfarin for stroke prevention.[52] Additional support for the premise that provider-level and system-level barriers are key contributors to the gap in stroke prevention care in AF comes from data in the large PINNACLE registry in the United States which demonstrated a marked and disturbing variability in practice patterns in regard to oral anticoagulant use across PINNACLE registry sites. The proportion of patients on oral anticoagulants at a PINNACLE site ranged from approximately 5% to 90%.[32]

Another issue driving undertreatment with oral anticoagulants is poor medication adherence, which may similarly be driven by patient-level, provider-level, or system-level barriers. An average of 50% of patients is nonadherent to their prescribed treatment regimens for chronic diseases, such as hypertension, dyslipidemia, and AF.[53] Nonadherence rates are similar across disease states and age groups, with the first several months of therapy characterized by the highest rates of discontinuation.[54]

Interventions to support patient management of medications have fallen short, and sustainable adherence rates have not improved.[55,56] A retrospective analysis of an insured population of patients with AF found that, during a median follow-up of 1.1 years, only 47.5% of patients prescribed a DOAC had ≥80% of days covered with a prescription, which was higher than the 40.2% seen with warfarin ($P < .001$).[57] Discontinuation rates of DOACs in the clinical trials were 21%-34%, and similar rates of DOAC discontinuation were seen in Europe with a 30% discontinuation rate at 2 years, whereas even higher discontinuation rates were seen with warfarin.[35-38] Patient-provider communication regarding medication use is poor, and opportunities to document and provide feedback on metrics for medication adherence are not readily available in electronic medical record applications.[58] Meaningful and measurable improvements in adherence require a comprehensive, multifaceted intervention in which all participants, including physicians, play an active part.

Misperception about effectiveness of aspirin contributes to underuse of oral anticoagulation

Misperceptions about the safety and efficacy of aspirin for stroke prevention in AF are prevalent in the medical community.[59] A meta-analysis of 7 clinical trials with 3,990 patients comparing aspirin alone with placebo or no treatment found a 19% (95% CI −1% to 35%) lower risk of stroke with aspirin. However, this benefit was driven by a single clinical trial, the Stroke Prevention in Atrial Fibrillation Study (SPAF I).[60] The SPAF I trial had 2 arms: patients eligible to use oral anticoagulants (group 1) and those not eligible to use oral anticoagulants (group 2). The benefit of aspirin for stroke prevention originated only from group 1, patients eligible to receive oral anticoagulants (206 aspirin patients and 211 placebo patients), in which there was an inconceivable 94% reduction in stroke from aspirin relative to placebo due to

Table I. Barriers to use of oral anticoagulation for stroke prevention

Appropriateness	Reason for patient decision	Reason for provider decision	System barriers
Appropriate:	Refusal to take medication after comprehensive attempt at education	Clear high risk for bleeding based, for example, on multiple prior bleeding episodes of bleeding on OAC, von Willebrand disease, severe alcohol abuse	Lack of access to INR monitoring for patients who cannot afford NOAC
		Ongoing active bleeding	No insurance/unable to afford medication
		(Recent) Intracranial hemorrhage	Unable to afford cost of monitoring
Inappropriate:	Cost/financial concerns that can be overcome	Old age	Lack of time in clinic to discuss the issues
	Too much time involved with monitoring (warfarin)	Patient's ability to follow up and be monitored	Lack of access to anticoagulation clinic services
	Overestimate of risk/underestimate of benefit (family member of friend with bleed/stroke)	Understand risk/benefit but value avoiding bleeding more than preventing stroke	
	Concern for side effects (other than bleeding)	Cost/insurance status that can be overcome	
	Knowledge deficit/lack of understanding of net benefits	Fall risk (in absence of major trauma and/or ICH)	
	Lack of ability to reverse anticoagulation	Overestimate of risk/underestimate of benefit (patient with recent stroke or hemorrhage)	
		Knowledge deficit/do not know data	
		Racial bias (ie, risk in Asians)	
		Sex (women are higher bleeding risk)	
		Not enough time in visit	
		Think patient will not accept treatment	
		Nuisance bleeding	
		Unable to maintain therapeutic INR	
		Lack of ability to reverse anticoagulation	
Uncertain appropriateness:	Understand risk/benefit but prefer avoiding risk even when benefit outweighs risk	Substantial fall risk without prior significant trauma	
		Hepatic disease	
		Poor patient adherence to medication after attempts to improve adherence	

1 stroke in the patients taking aspirin compared with 18 strokes in the patients receiving placebo.[60]

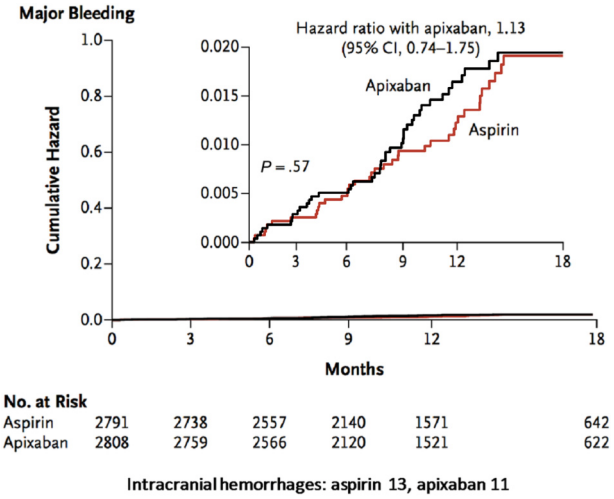
The AVERROES trial randomized patients with AF, who were felt to not be candidates for vitamin K antagonists, to apixaban versus aspirin (nearly two-thirds of those who received aspirin received 81 mg of aspirin).[47] Apixaban reduced stroke or systemic embolism with greater efficacy than aspirin (HR 0.45, 95% CI 0.32-0.62; $P < .001$).[47] Apixaban had statistically similar major bleeding events compared with aspirin (HR 1.13, 95% CI 0.74-1.75; $P = .57$), whereas there were numerically more intracranial hemorrhages with aspirin (n = 13) compared with apixaban (n = 11) (Figure 3).[47]

Nonpharmacologic options for stroke prevention

Left atrial appendage occlusion compared with dose-adjusted warfarin has been studied in 2 randomized trials.[61,62] The AMPLATZER Amulet (Abbott, Abbott Park, IL), Lariat (SentreHEART, Palo Alto, CA), WATCHMAN (Boston Scientific, Marlborough, MA), and Wavecrest (Johnson & Johnson, New Brunswick, NJ) devices all have CE Mark approval for use in Europe for left atrial appendage occlusion or closure; however, WATCHMAN is the only device with completed randomized trials. In March 2015, the FDA approved the WATCHMAN device for stroke prevention in patients with AF.[63] In February 2016, the Centers for Medicare and Medicaid Services (CMS) issued a coverage decision.[64] The CMS coverage limits use of WATCHMAN to patients with a $CHADS_2$ score ≥ 2 or CHA_2DS_2-VASc score ≥ 3 who are not suitable for long-term anticoagulation and have had a documented shared decision-making interaction with a noninterventional physician.[64] The content of a shared decision-making process and the definition of a patient not being a long-term candidate for anticoagulation are both ambiguous.

As highlighted above, the greatest barrier in stroke prevention in AF is undertreatment with oral anticoagulation. However, left atrial appendage occlusion is an alternative form of stroke prevention in patients ineligible for oral anticoagulation. More clinical trial data are needed in this patient population, as the completed trials for WATCHMAN only included warfarin-eligible patients. The ongoing Assessment of the WATCHMAN Device in Patients Unsuitable for Oral Anticoagulation (ASAP-TOO) trial (NCT02928497) is currently recruiting patients and will address this issue, and will assess stroke prevention with

Figure 3



Major bleeding in AVERROES.* *Adapted with permission from Connolly et al.[47]

WATCHMAN among patients with AF who are ineligible for anticoagulation.

Use of devices to identify atrial fibrillation

The gaps in care of the patients diagnosed with AF who are at risk for stroke and are undertreated have been described, but patients who have undiagnosed AF are another at-risk population. The framework for implementing mass screening for AF is an important and complicated public health consideration.[65] The REVEAL-AF study found that 29% of patients with no previous diagnosis of AF and a $CHADS_2$ score ≥3 were identified as having AF within 18 months of having an implantable loop recorder.[6] The MOde Selection Trial (MOST) performed a substudy to evaluate the association between atrial high-rate episodes on pacemakers that were placed for sinus node dysfunction and stroke or death. The analysis found that patients with high-rate episodes had a 6-fold higher rate of diagnosed AF and 2-fold higher rate of stroke or death.[66] Similarly, the TRENDS trial followed over 2,800 patients with cardiac implantable electronic devices and found that patients with at least 5.5 hours of AF in a 30-day period had a 2-fold higher risk of stroke.[67] Data from the Asymptomatic Atrial Fibrillation and Stroke Evaluation in Pacemaker Patients and the Atrial Fibrillation Reduction Atrial Pacing Trial (ASSERT) were consistent with MOST and TRENDS, again showing a 6-fold higher risk of being diagnosed with symptomatic AF and a 2-fold higher risk of stroke when *subclinical AF* (defined as 6 minutes or more in a 3-month period) was identified on an implanted cardiac device.[68] Subsequent analyses from ASSERT have shown that there was no statistically significant association between AF lasting 6 minutes to 24 hours and stroke, whereas there was an association between subclinical AF lasting >24 hours and stroke (adjusted HR 3.24, 95% CI 1.51-6.95; $P = .003$).[69]

Data from cardiac implantable electronic devices can be useful to providers and help close the gaps in AF care. This was shown with the ANGELS of AF project in which providers in cardiology clinics treating patients with implantable cardioverter defibrillators were randomized to a control group that used standard clinical practices for follow-up versus centers in which providers received information about stroke risk factors and AF burden. The patients seen in the clinics in which providers received information had a marked, statistically significant increase in oral anticoagulation use relative to the controls.[70] However, there was no assessment of cardiovascular outcomes in the ANGELS of AF trial, so questions remain about the relationship of the burden of subclinical and device-detected AF and risk of stroke, and for whom anticoagulation provides greater benefit than risk. The Prevalence of Sub-Clinical Atrial Fibrillation Using an Implantable Cardiac Monitor (ASSERT-II) trial (NCT01694394), the Apixaban for the Reduction of Thrombo-Embolism in Patients With Device-Detected Sub-Clinical Atrial Fibrillation (ARTESiA) trial (NCT01938248), the Atrial Fibrillation Detected by Continuous ECG Monitoring (LOOP) trial (NCT02036450), and the Program for the Identification of "Actionable" Atrial Fibrillation in the Family Practice Setting (PIAAF-FP) trial (NCT02262351) are all ongoing clinical trials that will help to answer these important questions. Nonetheless, it should be appreciated that many of the crucial issues, such as defining the independent association of the duration and burden of AF with clinical outcomes, will not be easily answered without very large studies.

Methods for shifting perspectives on stroke prevention

Providers need to be educated on how to engage patients in decision making. For situations in which there is uncertainty about the balance of risk and benefit, for example, the decision to anticoagulate patients with a CHA_2DS_2-VASc score of 1, shared decision making becomes very important. Shared decision making is different than education or informed consent, as it matches the patient's goals and preferences with the optimal treatment strategy. For providers to retain knowledge, it is critical that they engage in higher-level learning such as group, case-based discussions and that they use this knowledge on a regular basis. Social media may be an effective way to educate providers, as 24% of physicians share research on social media.[71] Ultimately, providers are overburdened with multiple medical problems and have limited time per patient. Pharmacists from the anticoagulation service and nonphysician health care providers should be able to provide support for

patient discussions to decrease the time burden on physicians. It is important to engage the patient and increase their satisfaction with their visit, as studies have shown that patient adherence is associated with satisfaction with the patient experience. Resources are available to facilitate education of providers and their patients with arrhythmias.[72]

An excellent tool is provided by www.healthdecision.org. The Michigan Anticoagulation Quality Improvement Initiative (MAQI) is a registry funded by Blue Cross Blue Shield that focuses on quality improvement. The MAQI program uses a toolkit (www.anticoagulationtookit.org) to aid with stroke prevention. The RE-LY trial dosing protocol is used for patients on warfarin, and there is a free mobile device application that provides decision support for providers.

Programs addressing oral anticoagulant undertreatment

Providers, professional societies, government agencies, and the pharmaceutical and device industries are all aligned in their desire to develop programs that address the undertreatment care gap for stroke prevention in AF. The ACC has developed the PINNACLE registry, and the AHA, in collaboration with the Heart Rhythm Society, has developed the Get With the Guidelines–AF Registry. The quality of the registry data is dependent on who is entering the data, how patients are selected, and how the data are being entered. If patients who have contraindications are excluded, then how those contraindications are interpreted will affect the results. If patients are required to provide consent, a selected population will be included. One area of focus is the use of structured data from the electronic health record, which is entered by a provider at the point of care, to automatically populate the registries.

Industry also has several initiatives in place that are designed to address the low rates of stroke prevention therapy in AF. The Assessment of an Education and Guidance Programme for Eliquis Adherence in Non-Valvular Atrial Fibrillation (AEGEAN) trial randomized patients to an education intervention to address medication adherence; however, the rates of adherence in the trial were high in the intervention and control arm at baseline, so no statistically significant difference was seen with the intervention. The IMProve treatment with AntiCoagulanTs in patients with Atrial Fibrillation (IMPACT-AF) trial is a cluster randomized study, funded by grants from various companies, in which clinics were randomized to an education intervention versus no intervention that succeeded in the goal of increasing the proportion of patients with AF at risk for stroke who are treated with an anticoagulant.[73,74] The cluster randomized education intervention trial Quantify Use of Anticoagulation to Improve Management of Atrial Fibrillation (QUANTUM-AF) is preparing to launch with randomization at the hospital level to increase the use of anticoagulation for stroke prevention in AF at the time of hospital discharge. Surescripts is developing a real-time electronic notification to be sent to patients when medications are not refilled.

Finally, federal agencies, including the FDA, are attacking the issue of undertreatment for stroke prevention. The FDA has access to the Sentinel data network, which is a claims-based system with data on 168 million patients across the United States. This is a distributed data set in which the FDA has partnered with insurance companies; the companies run data queries in their data and then share aggregate results with the FDA. The system was initially developed as a phase IV monitoring safety database; however, the FDA is working with academic and insurance industry partners to launch the IMplementation of an RCT to imProve Treatment With Oral AntiCoagulanTs in Patients With Atrial Fibrillation (IMPACT-Afib) trial (NCT03259373), which will be an education intervention claims-based trial. Patients are eligible for inclusion in the trial if they have risk factors for stroke but are not treated with an anticoagulant. Patients with AF and the providers caring for them will be randomized to receive an education intervention at baseline versus provider-only education. The primary end point is new oral anticoagulant prescription fills over the course of the first year, although patients will be followed for 2 years, and the trial is powered to potentially identify a difference in stroke or transient ischemic attack.

Additional trials are needed to further explore ways to leverage the electronic health record for decision support, as well as monitoring and feedback of stroke prevention for AF. Best practice alerts can be used to try and change practice patterns, but such initiatives need to be studied rigorously to determine if the intervention had an impact. However, it is also important to study other metrics around best practice alerts, as additional alerts within the electronic health record could cause alert fatigue and have negative consequences for alerts outside of stroke prevention reminders.

There are currently 2 DOAC-antidotes approved and 1 in development. It is hoped that these drugs might reduce physician reluctance to prescribe DOACs to their AF patients at high risk of stroke. Idarucizumab, a humanized, monoclonal, antibody fragment that reverses the direct thrombin inhibitor dabigatran, was FDA approved in 2015. Andexanet is a recently approved modified recombinant factor Xa molecule that reverses oral direct (eg, apixaban, edoxaban, rivaroxaban) and injectable indirect (eg, enoxaparin, fondaparinux) factor Xa inhibitors. Aripazine, another potential DOAC antidote, is under investigation.

Opportunities and research priorities

Despite having data on over 70,000 patients randomized to warfarin versus DOACs,[20] there remain many unanswered questions. From the government perspective, the FDA is interested in comparative studies between the DOACs for

stroke prevention. As was discussed previously, there are ongoing comparative trials between left atrial appendage occlusion devices. The FDA is interested in addressing the gap in use of anticoagulants to prevent stroke. CMS is interested in developing meaningful quality measures related to stroke prevention with the goal of improving the quality of care that patients receive. There is the potential opportunity for CMS to develop one quality measure for undertreatment for stroke prevention, while also developing a second quality measure for overtreatment for stroke prevention. This type of initiative would be helpful to prevent unintended consequences of an undertreatment quality measure. If these quality measures were put in place, research would be needed to determine whether or not such quality measures improved the quality of care that patients with AF received. Incentives could also be developed under the medical incentive program, which is required under the Medicare Access and CHIP Reauthorization Act. Government agencies, including the National Institutes of Health, are also interested in investigating ways to decrease health inequalities related to stroke prevention in AF.

Underuse of oral anticoagulation for AF is an even bigger issue in low- and middle-income countries (RE-LY registry). The IMPACT-AF cluster randomized trial included 48 centers and 2,400 patients in Argentina, Brazil, China, India, and Romania. The intervention included targeted education focused on barriers to anticoagulation use and audit and feedback. Over 1 year, there was a 9% greater increase in oral anticoagulant use with the intervention ($P = .002$), associated with a 50% reduction in stroke. Of patients not on oral anticoagulation at baseline, at the intervention sites, nearly half were on anticoagulation at 1 year. This addresses what has been a key question about undertreatment of AF: this study suggests that about half of the gap in treatment can be closed with an intervention involving provider- and patient-targeted education with audit and feedback.[74]

Professional societies and hospitals are in key positions to improve care. For example, the ACC is working toward a global contest to improve AF care with open data access to PINNACLE. The goal is to use PINNACLE as an evidence-to-practice method to improve stroke prevention care. The ACC is also developing applications, such as AnticoagEvaluator, which can be used by providers to optimize stroke prevention care. The AHA is focused on hospital discharge care with the Get With the Guidelines–AF program, with preliminary results showing high rates of anticoagulation at participating hospitals.

Ultimately, it will be important to develop guideline uniformity in regard to indications for anticoagulation. Health care providers need to be educated on the lack of safety and efficacy with the use of aspirin for stroke prevention in AF. Finally, there are limits to the current methods for risk stratification, and new methods for risk stratification with biomarkers and imaging are needed.

Conclusion

Despite the high prevalence of AF and the development and availability of very effective treatments to prevent stroke, large gaps in stroke prevention care remain. The underuse of stroke prevention in patients with AF at risk for stroke is one of the greatest public health issues facing cardiovascular patients. Joint efforts by academia, professional societies, government agencies, and industry are needed to sufficiently address the existing gaps in stroke prevention care in AF. High-quality evidence has been generated solidifying treatment strategies to prevent stroke in AF; however, large-scale, randomized implementation trials are needed to study ways to optimize stroke prevention care in AF.

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