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Screening for Atrial Fibrillation and the Role of Digital Health Technologies

Edward Richardson, Angela Hall and Andrew R.J. Mitchell

Abstract

Atrial fibrillation is the commonest clinical arrhythmia and a leading cause of hospital admission, morbidity and mortality. New digital health technologies are now allowing patients and the general population to identify heart rhythm abnormalities before any encounter with a medical professional. This chapter will include an overview of the prevalence of atrial fibrillation and explore the current recommendations on methods for arrhythmia screening. We discuss different risk factors as well as physiological and structural markers for atrial fibrillation onset. We explore in detail the application of novel digital health technologies such as wearables, watches and mobile devices which may have an impact on screening detection rates. The article concludes with a discussion about how to manage patients with screen detected atrial fibrillation.

Keywords: atrial fibrillation, screening, digital health, wearables, arrhythmia, technology, cardiology, ECG, apple watch, Alivecor, Kardia, Omron HeartScan, Zenicor ECG, Miniscope, Reka e100, Zio Patch, guidelines, Holter monitor, ambulatory ECG, patient centred care, artificial intelligence, iPhone, android, apple, stroke, photoplethysmography

1. Introduction

Atrial fibrillation (AF) is increasing in prevalence with a lifetime risk of one in four people developing this common arrhythmia [1]. Its detection is of rising importance as it is a leading cause of mortality and morbidity. A recent meta-analysis showed a person with AF had an increased risk of all-cause mortality by 46%, of ischaemic heart disease by 61%, of chronic kidney disease by 64%, a 96% higher risk of a major cardiovascular event, and an 88% higher risk of sudden cardiac death. Furthermore, it more than doubled the risk of stroke and increased the risk of congestive heart failure fivefold [2]. Whilst the mechanism behind some of these are unknown, the identification of AF can be used to help reduce the risk of several of the complications, by starting anticoagulation for example. Often persons with AF can be asymptomatic and therefore it may be detected late, such as after a stroke. Around 10% of all ischaemic strokes are associated with a new diagnosis of AF and it is present in around a quarter of all patients with stroke. Screening for AF has received significant focus with a dedicated collaboration established in 2016 called AF Screen. Their aim it is to promote

discussion and research about unknown or untreated AF, as a means to reduce stroke and associated mortality [3, 4].

2. Screening

Screening for AF has received considerable attention due to the increasing numbers of patients with the arrhythmia and projections for further increases over the coming years [5]. A variety of screening methods exist from a manual pulse check to the use of novel digital screening tools [3, 6].

Public health screening has increased dramatically over the last few decades through a need and desire to address the growing burden of disease [7]. This exponential growth has been partly achievable through innovations in digital technology and an enhanced ability to detect a growing number of conditions. The rationale for screening is straightforward: detecting disease in its infancy and treating to reduce morbidity, mortality and associated healthcare and societal costs [8]. A paradigm shift has resulted in a more proactive approach whereby early detection of disease has renewed importance over the confines of diagnosis of clinically overt disease. Putting this into context, up to two-thirds of people with AF report that it disrupts their lives [9]. Medical attention may be sought early on, but it is not uncommon for the symptoms of AF to go unnoticed until there is decompensation. If AF is of the paroxysmal nature, it may go undetected unless the practitioner has the insight to investigate symptoms suggestive of an arrhythmia. However, AF can be silent, in other words exhibit no symptoms even in the persistent form and the first diagnosis may not be until there are signs of haemodynamic compromise. Unfortunately it is not uncommon for AF to also be detected when the patient presents with a thromboembolic complication such as stroke [3, 4, 10, 11].

The World Health Organisation lists criteria that should be considered when implementing screening of disease (**Table 1**) [12]. The criteria states that the condition should be an important health problem with accepted treatment. While this work is nearly 50 years old, little has changed in screening criteria. More recent updates suggest consideration of economic implications, quality assurance and informed choice alongside equity and access of screening to the entire target population [7]. This is an important consideration and one yet to achieve consensus in terms of AF screening [13].

Screening approaches vary and include opportunistic, and systematic that can be broken down to targeted, population and mass screening. There remains a lack of consensus regarding the optimal method with a range of studies exploring and evaluating AF screening, with some studies choosing opportunistic, some

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1. The condition should be an important health problem.
 2. There should be a treatment for the condition.
 3. Facilities for diagnosis and treatment should be available.
 4. There should be a latent stage of the disease.
 5. There should be a test or examination for the condition.
 6. The test should be acceptable to the population.
 7. The natural history of the disease should be adequately understood.
 8. There should be an agreed policy on whom to treat.
 9. The total cost of finding a case should be economically balanced in relation to medical expenditure.
 10. Case-finding should be a continuous process, not just a “once and for all” project.
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Table 1.
Principles and practice of screening for disease [12].

systematic, and others both. In all studies, older age groups are frequently targeted due to perceived cost effectiveness and anticipated positive findings. However, targeting the younger population may help address contributory lifestyle factors, reducing complications that may result. In addition to age, high risk patient groups are further targets for screening. Hypertension, diabetes and heart failure are commonly cited as chronic disease populations at higher risk of cardiovascular complications [11, 14]. As such, these patient groups have often been selected in targeted screening programmes [15–19].

Whilst the European Society of Cardiology guidelines do recommend screening asymptomatic patients for AF, the NICE and the UK National Screening Committee guidance does not [10, 20, 21]. The rationale is the lack of evidence to support it benefiting those identified by screening. This recommendation is currently under review. There are increasing numbers of studies that suggest benefit in screening. A paper in 2014 using the data from the 2004 SAFE trial, showed that of the 78–83% of those identified in the screening for AF were eligible for anticoagulation [22, 23]. Whilst there have been further papers on the cost-effectiveness of screening in AF, unfortunately several of these have continued to rely on the data from the SAFE trial [24]. An ongoing major issue is that few studies have been able to prove better health outcomes from those asymptomatic adults that were screened [25, 26]. This is at least partially due to the difficulty in proving an intervention has prevented a stroke. As such and on the recommendations of collaborations such as AF-SCREEN and the European Society of Cardiology several charities now conduct some level of screening, with most suggesting a simple pulse check [4, 27].

3. Wearable technologies

Digital health technologies have revolutionised health screening, not least within cardiology [28]. Traditional ambulatory Holter monitors (HM) connected by electrodes to the precordium, are still used regularly but have limitations. They can be used for varying lengths of time but can be inconvenient and require laborious analysis. The time and duration of wear may also be incongruent with symptoms and therefore ineffectual [29]. Modern applications can now be utilised through technological advancements, which can enable more ad-hoc monitoring. These vary from new devices to applications on mobile phones. These options can offer more advanced screening with enhanced specificity and sensitivity [29–32].

There are increasing numbers of new technologies being developed that can be used in the screening of AF. We will discuss some of the more well-known options however there will be a focus on the devices where there are published studies that demonstrate their efficacy and diagnostic accuracy. Unfortunately, there are few studies that compare results across the different devices, however, where there is sufficient evidence then we shall try and compare the technologies.

The majority of devices use a single lead, normally analogous to lead I. They do this by providing two electrodes to capture electrical signals from the fingers, thumb, wrist, or palm of each hand [33]. One of the best known is the AliveCor. It has been used in clinical practice since 2011 and there is a plethora of research where AliveCor, or Kardia as it has been more recently branded, has been the tool of choice. The AliveCor has demonstrated high sensitivity and specificity in screening studies and is U.S. Food and Drug Association (FDA) as well as Conformité Européenne (CE) approved [16, 31, 32, 34, 35]. This device creates a single lead, by providing two electrodes for 2 or more fingers of each hand. The data generated is wirelessly transmitted to a smart phone and produces a tracing. The application will notify the user if the tracing is normal or AF. The information can be securely sent to an encrypted AliveCor cloud server or a healthcare professional. The presence

of an enhanced filter provides a much smoother tracing. Studies also suggest that even elderly patients found the device easy to use and that it did not restrict activities or cause anxiety [16, 33, 36]. It has been shown to be more likely to diagnose a symptomatic underlying rhythm than an HM [37]. Limiting factors include requiring access to a smartphone and not being recommended for use in children, or those with implanted electronic devices [33, 36].

The Omron HeartScan is another single lead device, similar to the AliveCor. However, with the HeartScan one of the electrodes on the device can also be placed on the chest. It is a stand-alone device so does not require a smart phone, but it is more expensive. There is evidence to suggest that like the AliveCor, it is more likely to successfully diagnose AF, especially if symptomatic, than an HM [33, 38–40].

There are some single lead devices such as the Zio Patch, which aim to provide more continuous monitoring. The Zio Patch is a single use water-resistant adhesive patch similar to a traditional HM but with a few advantages. It can record for longer, 14 days versus 7, and it has no wires, which means it is more discreet and reduces the interference. It is generally well tolerated and studies suggest it may have a higher diagnostic yield for arrhythmia [28, 33, 41–45].

Some other single lead devices are targeted more towards screening. One example, the RhythmPad^{GP}, is designed around the screening of non-symptomatic individuals in a general practice (GP) Surgery. As yet there are no studies showing its efficacy [46]. Another device that is aimed at screening is the Microlife Modified Blood Pressure (BP) monitor. It screens for AF via the detection of an irregularly irregular pulse during the inflation of an automatic blood pressure cuff. BP checks are commonly performed in the primary care setting and increasingly by people in their own homes; the design of the device monopolises on this. The evidence suggests it may even be more accurate than a pulse check [19, 47].

AF detecting devices are ever increasing in number and too numerous to detail here, however, some more well-known examples include: MyDiagnostick, the Reka e100, Miniscope M3, InstantCheck, AfibAlert, and Zenicore EKG. There are less studies associated with these but all show merit in their own way [33, 48–52].

Photoplethysmographic (PPG) technology has also shown promise and works in the same way as a pulse oximeter. Whilst PPG can be more susceptible to movement artefact, [53] they are low cost and widely available commercially including in the Apple Watch and Fitbit [54–56]. Movement artefact can be reduced with the intelligent use of accelerometers in the device [53]. The Cardio Rhythm smartphone application uses the phone's camera to detect heart rate. It has been shown to be comparable to the AliveCor in sensitivity and specificity [34, 57].

The Apple Watch initially used PPG, however the latest iteration, the Apple Watch 4, now has the ability to perform a single lead ECG. The mechanism is similar to the other single lead ECG devices. One electrode is incorporated in the back of the watch and the second in the crown at the side. The user puts one finger on the crown and is able to obtain an estimation of lead I [56, 58, 59]. Apple are currently funding a study, called the Apple Heart Study, that aims to demonstrate the ability of the Apple Watch to detect previously unknown AF by identifying pulse variability and irregularity. This has the potential to be one of the largest studies on AF identification, with over 400,000 participants, and therefore should be highly powered. Conversely, previous studies are relatively small in size. Additionally, the Apple Heart Study should help provide data for a much wider population than previous studies and therefore potentially help appraise the practicalities of screening large groups [56]. The study has released some preliminary results, which have indicated the Apple watches over all generations had a 71% positive predictive value. The data released also showed that 84% of the time during an irregular pulse notification the patient was in AF [60].

The Apple Heart Study, alongside the GARMIN AF study [61] are part of many ongoing projects; a search of clinical trials revealed frequent utilisation of modern devices within ongoing research projects. The Clinical Trials database exposed 92 trials on a recent search, where screening for AF was the primary outcome [62]. These incorporated an array of screening tools and whilst the majority focused on targeted populations, this was not exclusive. Similarly, the European Union Trials Register revealed 80 studies of a comparable nature, highlighting the ongoing interest in screening for undiagnosed AF [63].

4. Current guidelines

There are multiple different guidelines on the management of AF, in this section we have summarised the areas relating to screening as well as recommendations for anticoagulation.

4.1 European guidelines

The European Society of Cardiology (ESC) 2016 guidelines and recommendations [10] are summarised below with regards to AF screening and stroke prevention in AF:

1. Screening for AF is recommended:

- a. In elderly populations with a suggested age cut off at 65 years on an opportunistic basis.
- b. ECG screening in a more systematic manner may be considered in those at high risk of stroke or aged over 75 years of age.
- c. In Patients with a Transient Ischaemic Attack (TIA) or ischaemic stroke with a short-term ECG recording followed by ECG monitoring for at least 72 hours. There is also the suggestion that non-invasive monitors or implanted loop recorders can also be considered especially in those patients with cryptogenic stroke.
- d. Via Implantable Cardioverter Defibrillators (ICDs) and pacemakers. These should be interrogated on a regular basis for evidence of atrial high rate episodes (AHRE). This is because AHRE are associated with an increased risk of overt AF.

2. Stroke prevention in AF recommendations are:

- a. CHA₂DS₂-VASc Score (**Table 2**) and if the score is equal to or greater than 1 for a male or 2 for a female then oral anticoagulation can be considered. It should also be noted that female sex will only add to the score if another risk factor is present. Anticoagulation should also be continued even if the patient has surgical exclusion or occlusion of their left atrial appendage in at-risk patient groups.
- b. Oral anticoagulation is recommended in the form of a Novel Oral Anticoagulant (NOAC) unless the patient has a mechanical heart valve or moderate to severe mitral stenosis where a vitamin K antagonist (VKA) is recommended. NOACs should also be avoided in women planning a

Risk factor	Points
Congestive heart failure—signs or symptoms of or objective evidence of reduced LVEF	+1
Hypertension—on BP medication or resting BP >140/90 on a minimum of at least two occasions	+1
Age greater than or equal to 75 years old	+2
Diabetes mellitus—on hypoglycaemic agent or fasting glucose of >7 mmol/l (>125 mg/dl)	+1
Previous thromboembolism, including stroke and transient ischaemic attack	+2
Vascular disease—including peripheral artery disease, aortic plaque, or previous myocardial infarction	+1
Age between 65 and 74 years old	+1
Female sex	+1

Table 2.
CHA₂DS₂-VASc modified from ESC guidelines [10].

pregnancy or those that are already pregnant. If a VKA is used then the target International Normalised Ratio (INR) is 2.0–3.0, unless it is required to be higher for another comorbidity. Those on VKAs should have their INRs closely monitored, with the aim to keep the time in the therapeutic range as high as possible. There is also no requirement for genetic testing before the initiation of VKAs as these have been evaluated to have little or no effect on the bleeding risk.

- c. Antiplatelet monotherapy is not recommended for the prevention of stroke in patients with AF irrespective of stroke risk. Combinations of antiplatelets and oral anticoagulants should be avoided unless there is another indication for antiplatelet therapy. This is due to the increased risk of bleeding.
- d. In patients with stroke and AF immediate anticoagulation with low molecular weight heparin or heparin is not recommended
- e. Patients with hypertrophic cardiomyopathy (HCM) that develop AF should have lifelong oral anticoagulation for stroke prevention.
- f. Atrial flutter should be treated with ablation of the cavotricuspid isthmus if antiarrhythmic treatment fails, or as a potential first line treatment depending on patient preference. Anticoagulation should be treated under the same guidelines as AF.
- g. Oral anticoagulation should be interrupted in patients with severe ongoing, active bleeding, until resolution of the underlying cause.
- h. Bleeding risk scores should be considered before starting anticoagulation but with the aim of identifying modifiable risk factors than to recommend the holding of anticoagulants.

4.2 Comparison with American guidelines

The American Heart Association (AHA), American College of Cardiology (ACC), and Heart Rhythm Society (HRS) Guidelines [64] as of their 2019 update

[65, 66] are similar to the ESC guideline. In fact, the major changes in the 2019 compared to the 2014 guideline bring it closer to the ESC guidance. For example, the inclusion of Edoxaban as a NOAC.

More relevantly, the AHA/ACC/HRS guideline moved from referring to “nonvalvular AF” as the exclusion criteria for the CHA₂DS₂-VASc Score to using the narrower criteria of moderate to severe mitral stenosis or a mechanical heart valve. It is also the exclusion criteria for NOACs, as VKA should be used in these patients. This more closely aligns with the ESC guideline. The AHA/ACC/HRS guideline has also changed the classification for women within the CHA₂DS₂-VASc Score; female sex now confers no points if it is the lone risk factor. Both have the same scoring cut-offs for anticoagulation, they also both recommend NOACs over VKAs, in those eligible and similarly do not recommend aspirin in those with low CHA₂DS₂-VASc Score.

However, whilst the ESC guidance does recommend some opportunistic screening as a class I recommendation with level B evidence, the AHA/ACC/HRS guidelines are less forthcoming. Though the American guidance does suggest monitoring in those with cryptogenic stroke including the use of implantable cardiac monitors, such as loop recorders, it does not comment on more generalised screening. Both guidelines recommend interrogating the recordings of those with ICDs or pacemakers for the presence of AHREs, prompting further investigation for AF. The ESC guidance takes this further and acknowledges the recent studies demonstrating the possibilities for a more generalised approach and even recognises the potential role for the new devices mentioned above [10, 51, 64–66].

4.3 Screening after stroke

AF Screening after an ischaemic stroke or TIA is commented on in the ESC guidelines where it recognises how commonly AF is detected in stroke survivors. As mentioned above, not only does it recommend monitoring patients for at least 72 hours it also states that extensive screening should be considered. It is worth noting that the guidelines go as far as to recommend implantable loop recorders in those with “cryptogenic stroke”, where no other cause could be identified, such as carotid artery stenosis. This is a class IIa recommendation with Level B evidence.

4.4 Guidance on atrial high rate episodes

AHREs are mentioned in both sets of guidelines. The definition of AHREs can differ but most studies have used a length of greater than 5 minutes as a cut off but some going for a cut off of 6 minutes [67]. The actual atrial rate chosen also varies with some citing 175 bpm and others up to 220 bpm [68–70]. The ESC guideline defines them as lasting 5–6 minutes or greater and a rate faster than 180 bpm [10]. Recent studies have suggested they are quite common with a 30–70% incidence in those with an implantable device [70, 71]. Whilst it is difficult to adjust for confounding factors, AHREs are associated with an elevated risk of stroke, death, and subsequent AF [67]. However, a study in 2017 showed that a temporal relationship between a stroke and an episode of AHRE was only seen in 15% of those with an implanted device [71].

Both the ESC and the AHA/ACC/HRS guidelines recommend further investigation of those patients identified to have AHRE. The AHA/ACC/HRS guideline mainly recommends further investigation to establish if true AF is present [10, 65]. The ESC guideline echoes this, however, suggests the inclusion of patient preference and accepts that rarely anticoagulation may be considered in patients without documented AF.

5. Patient centred care and the role of technology

Both the ESC and NICE recommend that patients be involved in the decision making where possible, as do the AHA/ACC/HRS guidelines to a lesser extent [10, 21, 64–66]. This can be achieved by simply informing them of the risks and benefits of different options, and ideally tailoring them to the patient but advancements in technology means that we may have other ways of individualising care.

Given the AF detecting technologies above, several papers have suggested this may be used to enable patients to self-diagnose and manage their own conditions to a greater or lesser degree depending on the estimated accuracy of the product [53, 56, 72]. This could coalesce perfectly with certain AF treatment strategies such as “pill in the pocket” cardioversion. Other ways this could be useful is in judging the effectiveness of rate or rhythm control in asymptomatic patients [33, 73]. In symptomatic individuals it may also help guide them on when to seek help [33]. Some tracings may even be able to check for complications from medications, such as QT interval monitoring on patients receiving anti-arrhythmic drug therapy [74]. The technology and software in devices such as the Zio patch or Apple watch could allow rate and rhythm monitoring over a longer period of time than would normally be possible without a device such as a loop recorder [38, 41, 48].

Furthermore certain devices, such as the AliveCor, HeartScan, or Apple watch, could be used to capture an ad-hoc single lead ECG for intermittent symptoms [53]. Considering palpitations are a common complaint in primary care and the time limitations on HMs, these devices could enable patients to obtain a reading for symptoms that may be longer than a week apart [16, 39, 73, 75]. They have also been shown to be effective in the paediatric setting [52].

Devices can also be used to provide lifestyle advice, motivation, and educational messages. These can be linked to a daily ECG tracing such as in the ongoing iHEART trial [76]. If this concept were to be expanded, personalised health promotion advice could be provided to patients. This could be extended to providing patients with reminders to take medication and therefore increase their compliance [10, 77]. It could also provide data to patients and researchers alike to establish what, if anything, seem to trigger their symptoms, fast ventricular response, or re-initiation of an episode of AF. Devices could also make it easier to target select groups and enrol them in further research [78, 79]. Additionally, this could provide insights into the demographics of AF and help further narrow down any screening attempts.

While the evidence remains unclear, the level of burden of AF could help dictate the need for anticoagulation in patients. Data gathered at a population and individual level could help personalise the requirement for anticoagulation and the risks thereof [26, 80].

The ESC guidelines recommend the use of technology to support care of patients with AF for multiple reasons. It increases coherent exchange of information between the patient and health care professionals. The guidelines also suggest that it may increase the implementation of evidence-based care, and therefore improve outcomes, by using adjuncts such as decision support software. This may help personalise care for each patient, whilst strengthening adherence to guidelines.

Artificial intelligence (AI) may help personalise care further. AI has been suggested for the diagnosis of AF since the early 1990s [81]. There has even been suggestion more recently that it can be used to predict when AF will occur up to an hour before the event in those with non-permanent AF [82, 83]. AI has many more potential benefits, from helping gather the most useful data on a patient before a consultation to outpatient monitoring and subsequent prioritisation [36, 84–87].

Patients appear to be embracing these new technologies. For example, a recent survey by the Kings Fund [88] showed the majority of people surveyed were willing to use video consultations with their GP especially for minor ailments. The wearables market is also continuing to increase in size, with International Data Corporation's 2017 prediction that the number of wearables sold will almost double by 2021 [89, 90].

There is also an increasing body of evidence that patients having access to their clinical notes and data increases satisfaction and compliance [91, 92]. There is an appetite for patient-controlled records and data. The development of applications such as Apple Health on patients' devices has helped enable patients to keep track of everything from their own BP readings to their list of medications and allergies. Some of these are even more advanced, including GenieMD, which integrate with telemedicine consultations, check for drug interactions, and remind patients when to file for a repeat prescription [93]. Patient controlled records would empower patients and would enable them to take the relevant information with them wherever they go [94–96]. This is not a new concept, it has been used in paper form within maternity [97] and paediatrics [98] settings for a substantial period of time. Evidence shows they are effectively used [99]. Furthermore, there is a move to digitalise both of these [98, 100].

6. Review of the evidence for screening

There are two main types of screening mentioned in the studies, opportunistic and systematic. The evidence shows that an equivocal number of patients were identified with either method [22, 23, 26]. This implies that opportunistic screening is more cost effective [101]. Pulse palpation is an example of this kind of screening and is the limit recommended by the NICE guidance and even then it is under certain indications [21]. Unfortunately pulse palpation lacks specificity [102] and could therefore generate multiple false positives. The novel devices may help improve this as they have been shown to have a better specificity with most being above or around 90% and the lowest being 87%, [26] compared to 71% [101] for pulse palpation alone. Devices can either simulate lead I, use PPG, or BP cuff pulse detection. They have a good sensitivity and specificity, are generally quite easy to use, and therefore may increase the accuracy and feasibility. Whilst they may require further validation with larger studies [33] and more heterogeneous populations, some larger studies have still shown them to be cost effective and effective in potential screening scenarios.

The type of screening matters, with targeted and opportunistic screening potentially cost-effective or even cost reducing when aimed at higher risk populations. However, there is limited evidence with regards to the AF detected by these devices having any effect on clinical outcomes, as these were extrapolated from existing studies [6, 16, 32, 34, 103–111]. There is no evidence behind anticoagulation of potentially very short lived runs of AF or AHREs that can be picked up by some devices. Potential harms have not been studied in great depth, nor the cost of incidental findings in these studies [25, 26]. Despite this some of these risks can be mitigated, many devices only simulate one lead or even just pulse pattern, and therefore reduce the chance of picking up other ECG findings, such as T-wave inversion, that may then warrant further investigation.

Given the association between stroke and TIA with AF it is sensible and recommended to include screening in the work up of these patients. Current guidelines suggest the use of ILRs and external loop recorders in those with cryptogenic stroke. The novel devices that provide long term monitoring, rather than short

tracings, could be highly useful in these instances. They are less cumbersome and less invasive. The Zio Patch was reported to detect a higher number of arrhythmias than a traditional HM in one study, however, the longer monitoring period may account for this [4, 10, 26, 29, 41, 73, 111].

Those patients identified by screening may need to go on and have further ECGs depending on the method of identification. If the method did not utilise an ECG lead, then the patient will need to have a confirmatory ECG. Once AF is confirmed then rate control or anticoagulation would need to be considered via the CHA₂DS₂-VASc Score in accordance to the guidelines. In some instances, rhythm control may also be considered on an elective basis [10, 64, 65].

7. Conclusion

AF is an important, common disease, with an increasing incidence and the potential for multiple complications. It remains underdiagnosed and could potentially fit the criteria for screening, but the guidelines are divided as to whether this is recommended or not. There are multiple different novel devices that are designed to detect for AF, of which several are beginning to acquire a meaningful evidence base. Such devices might be used to increase the ease and specificity of screening for AF compared to traditional methods, they may also increase the sensitivity. There are multiple clinical trials ongoing where screening for AF is the primary outcome, which should help provide further evidence. However, there still needs to be further research before screening wide populations becomes viable. Further studies are needed comparing the different devices to each other, especially in a screening capacity. There needs to be further research into what duration of AHREs or AF increases the risk of stroke, as well as whether screening really does improve clinical outcomes.

Conflict of interest

The authors confirm that there are no conflicts of interest.

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