Review of the National Institute for Health and Care Excellence guidelines on the Management of Atrial and Ventricular Arrhythmias

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PD Lambiase[1,2], BMBCh, PhD, & E Maclean[2,3] MBBS, BSc

Affiliations:

1. Institute of Cardiovascular Sciences, University College London
2. St. Bartholomew's Hospital, London
3. William Harvey Research Institute, Queen Mary University of London

Corresponding author:
Prof Pier Lambiase
Institute of Cardiovascular Science
Rayne Building
5 University St
London WC1E 6JF
Email:p.lambiase@ucl.ac.uk
+44(0)2073 777000

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Abstract

The National Institute for Health and Care Excellence (NICE) guidelines each present a synopsis of extensive internal evidence and technology reviews, with a particular focus on clinical efficacy and cost-effectiveness within the NHS in England. This approach has delivered a novel perspective on arrhythmia management, with important distinctions from other policymakers' recommendations. For example, when compared with the ESC and AHA/HRS/ACC guidelines on Atrial Fibrillation (AF), NICE advocates unique strategies regarding arrhythmia detection, stroke and bleeding risk stratification, and rhythm control (NICE CG 196). Likewise, for patients at risk of sudden cardiac death (SCD), NICE TA314 recommends device therapy not only based on NYHA class and ECG findings, but also incorporating QALY data from analysis of key randomised controlled trials.

This review examines the NICE guidelines – together with those from the AHA/HRS/ACCand ESC –on the management of AF and ventricular arrhythmias (VA), and highlights the key common features and discrepancies between these important documents.

Abbreviations

COR: Class of recommendation

DOAC: Direct oral anticoagulant

ICER: Incremental cost-effectiveness ratio

LOE: Level of evidence

PVC: Premature ventricular contraction

VKA: Vitamin K antagonist

CMR: Cardiac MRI scan

AF: Atrial fibrillation

VA: Ventricular arrhythmias

QALY: Quality-adjusted life year

ECG: Electrocardiogram

FDA: Food and Drug Administration

AAD: Antiarrhythmic drugHCM: Hypertrophic cardiomyopathy

DCM: Dilated cardiomyopathy

ARVC: Arrhythmogenic right ventricular cardiomyopathy

NYHA: New York Heart Association

TTE: Transthoracic echocardiogram

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NDCCB: Non-dihydropyridine calcium channel blocker

Atrial Fibrillation

Atrial Fibrillation (AF) remains the most common sustained arrhythmia; an ageing population with a proliferation of predisposing co-morbidities has resulted in the global prevalence tripling over the last 50 years, affecting approximately 60 million people[1]. Whilst strategies for stroke prevention and rate control are well-established, inadequacies persist in prevention, screening, medical and interventional rhythm control. In particular, catheter ablation is accepted as a tool for improving symptoms in AF, with some preliminary evidence suggesting a survival benefit in heart failure populations, however, clinical outcomes remain suboptimal. Furthermore, technological advances and mechanistic insights have led to divergence in ablation equipment and strategies[2].

NICE published Clinical Guidelines (CG) 196 (Atrial Fibrillation: diagnosis and management) in 2021, shortly after the ESC AF guidelines (2020) and the AHA/HRS/ACC's focussed update to their 2014 recommendations (2019)[3-5]. In addition to novel cost-effectiveness and evidence reviews, NICE CG 196 incorporated data from several interventional procedure guidance (IPG) and diagnostic guidance (DG) documents – including those delineating implantable cardiac monitors (DG 41 (2020)), lead-I ECG devices (DG 35 (2019)), and the laser balloon (IPG 563 (2016))[6] – which had been published since its previous AF guidance in 2014 (CG 180).

AF detection

Although the 12 lead ECG is the accepted gold standard to confirm the diagnosis of AF, the expansion in portable or wearable heart rhythm monitoring devices (or 'Wearables'), many of which provide a single lead (lead I) ECG, is reflected in both the NICE and ESC guidelines. The NICE guidelines cite DG 35 (2019), which presents cost-effectiveness modelling of three point-of-care devices for testing symptomatic patients in the community – the Kardia Mobile app was predicted to deliver the highest quality-adjusted life year (QALY) gain at the lowest incremental cost (ICER: £1,060), however, following sensitivity analysis, there remained considerable uncertainty about cost-effectiveness, hence *no wearable device is currently recommended for this purpose*. Pulse palpation with confirmatory ECG, or a Holter monitor of appropriate duration in those with paroxysmal symptoms, remains the approach recommended by NICE, and although wearables have a role for the detection of AF in those with more sporadic symptoms, *AF treatment should not be commenced until the diagnosis has been*

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confirmed by an ECG. Smart Watches with ECG capability were included in the NICE analysis, however, significant variation in the sensitivity of these devices between trials has led other authors to advise caution before acting on ostensibly abnormal traces [7-8]. The ESC encourages inspection of abnormal wearable traces, but do not currently incorporate these devices into screening strategies, and advise that AF should not be diagnosed by photoplethysmography alone. Of note, all three policymakers define an episode of paroxysmal AF to be a minimum of 30 seconds in duration.

With regards to screening for AF, the UK's National Screening Committee (NSC) recommended against a UK-wide programme in 2019, based on uncertainties regarding the benefits of treatment in screening-positive cases, and variations in stroke risk between different AF phenotypes. The results of an updated NSC evidence review are due in 2023[9]. *Therefore, NICE currently recommends an ECG only in those patients found to have an irregular pulse, with or without symptoms. By contrast, the ESC cites evidence for the cost-effectiveness of opportunistic screening for AF*, and recommend this – by pulse palpation or ECG rhythm strip – in all those patients ≥65 years old, or with hypertension (COR: I, LOE: B)[10].

Assessment of stroke and bleeding risk

Contemporary approaches to the assessment of stroke and bleeding risk in AF patients are summarised in Table 1. The CHA_2DS_2-VASc score is an established tool for stratifying the risk of stroke, and the NICE, ESC and AHA/HRS/ACC guidelines all recommend the score as a "gatekeeper" for oral anticoagulant prescription. The ESC notes modest evidence that alternative scores which include biomarkers (such as ATRIA, or the Intermountain risk score) can improve stroke risk prediction [11]. The ABC-AF trial was subsequently published in 2021, and demonstrated that the ABC-AF score – which incorporates Age, Biomarkers and Clinical history – outperformed CHA_2DS_2-VASc for the prediction of stroke. This score may be of particular value in patients who are low-risk by conventional assessment (for example, those with a single, non-sex CHA_2DS_2-VASc score risk factor). Whether or not the ABC-AF will supersede CHA_2DS_2-VASc in future guidelines remains an open question.

Importantly, with regards to bleeding risk, *the 2021 NICE guidelines now recommend use of the ORBIT score over HAS-BLED, with analyses demonstrating higher accuracy for predicting absolute bleeding risk versus HAS-BLED and ATRIA at all levels of major bleeding risk, and in patients taking either DOACs or VKAs*. NICE acknowledges that adoption of ORBIT is a significant change in clinical practice – particularly as HAS-BLED is currently

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embedded within UK General Practice clinical records systems – but clarify that it is reasonable to use other risk assessment tools whilst the implementation of ORBIT becomes widespread. Conversely, the ESC advocates the HAS-BLED score (COR: IIa, LOE: B) to identify those at high risk of haemorrhage, with a score of ≥ 3 warranting optimisation of risk factors and regular clinical review, but not necessarily preclusion of anticoagulation. The AHA/HRS/ACC recognises that HAS-BLED can be applied to assess bleeding risk, but stop short of formally recommending its use. Intriguingly, two moderate-sized European registry studies (EORP-AF (2022) and EMIR (2023)) have since been published supporting HAS-BLED over ORBIT in the DOAC population [12-13]. Furthermore, whilst the ABC-bleeding score outperformed both HAS-BLED and ORBIT in the ARISTOTLE and RELY cohorts, this result was not replicated in meta-analysed data which found HAS-BLED superior, hence there remains justifiable divergence between policymakers [14-15].

Stroke prevention

The three guidelines concur that the DOACs (Apixaban, Rivaroxaban, Edoxaban and Dabigatran) should be recommended over warfarin in patients with non-valvular AF and an indication for anticoagulation. This reflects meta-analysed data from phase III clinical trials demonstrating a 10% reduction in all-cause mortality, 19% reduction in stroke or systemic emboli, and a similar incidence of major bleeding in patients with AF taking DOACs versus warfarin[16]. Accordingly, NICE proposes that, unless contraindicated, patients on VKAs be offered the switch to a DOAC at their next clinical appointment.

There is clear consensus over the definition of 'valvular AF' – namely moderate or severe mitral stenosis, or the presence of any metallic heart valve – however, there are important differences in the suggested thresholds at which an OAC should be recommended to patients with non-valvular AF. In this scenario, NICE recommends that an OAC be offered to all eligible patients with a CHA_2DS_2-VASc score of ≥2, and that an OAC be considered for men with a CHA_2DS_2-VASc score of 1. The NICE committee state that this guidance prioritises identifying people above a certain risk threshold rather than estimating a persons' risk of stroke in absolute terms, and that a CHA_2DS_2-VASc cut-off of ≥2 delivers high sensitivity (0.92) and adequate specificity (0.23) for stroke. By contrast, both the ESC and the AHA/HRS/ACC recommend an OAC for men with a CHA_2DS_2-VASc score of ≥2 and women with a CHA_2DS_2-VASc score ≥3 (COR: I, LOE: A (ESC) or B (AHA/HRS/ACC)). For men with a CHA_2DS_2-VASc score of ≥1, or women with a score of ≥2, there is also disparity in COR between the ESC (COR: IIa) and the AHA/HRS/ACC (COR: IIb). In those patients established on

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anticoagulation, the AHA/HRS/ACC guidelines recommend annual renal and liver function tests, the ESC suggests measurement of renal and thyroid function, electrolytes, and full blood count as part of an initial assessment, whereas NICE advocates monitoring of renal function in those patients with chronic kidney disease.

For patients with non-valvular AF and a long-term contraindication to anticoagulation (e.g. intracranial bleeding without a reversible cause), left atrial appendage occlusion (LAAO) devices can be offered as an alternative to OAC for stroke prevention. The 2014 PROTECT-AF randomised trial found that an early-generation Watchman device was non-inferior to warfarin in reducing stroke, and this is reflected in the NICE 2014 and 2021 AF guidelines, as well as in the latest ESC and AHA/HRS/ACC recommendations (COR: IIb, LOE: B) [17]. Subsequently, the Amulet IDE (2021) randomised controlled trial demonstrated that the Amplatzer Amulet occluder is non-inferior to the Watchman device for safety and stroke prevention, with superior rates of acutely successful LAA occlusion[18]. Despite evidence of an improving safety profile for LAAO devices, NICE IPG 349 still recommends that LAAOs only be implanted in centres with on-site cardiac surgery, and only following multi-disciplinary discussion[19].

Assessment of cardiac function

NICE supports transthoracic echocardiogram (TTE) in those for whom baseline assessment is important for selecting long term management strategies, such as patients undergoing rhythm control, or those with a high suspicion of valvular or structural heart disease. The ESC and AHA/HRS/ACC recommend transthoracic echocardiogram (TTE) in all patients with AF, with the ESC proposing that more than moderate left atrial dilatation by volume index (LAVI) suggests an unfavourable rhythm-control candidate. Furthermore, the ESC suggest that CMR with atrial late gadolinium enhancement (LGE) may also help guide decision-making in selected patients [20-21].

Rate and rhythm control

Figure 1 summarises the different approaches to rate and rhythm control. Whilst there is agreement in the utility of beta blockers or calcium channel blockers as first line rate-controlling agents, NICE is the only body to support first line digoxin use in sedentary patients. By contrast, NICE does not recommend amiodarone for rate control. Of note, the ESC supports lenient rate control (<110bpm as stipulated in the RACE-II trial) regardless of heart failure

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status, with the exception of proven tachycardiomyopathy[22]. Conversely, the AHA/HRS/ACC advise caution in extrapolating the results of RACE-II, highlighting that the majority of patients in the lenient arm had heart rates <100bpm, and instead state that a target heart rate of <80bpm (at rest) is reasonable to improve symptoms as per the rate control arm of the AFFIRM trial (COR: IIa, LOE: B)[23].

Differences also exist in the prioritisation of rhythm control drugs (Figure 1) – the NICE guidelines recommend that a standard beta blocker (i.e. not sotalol) be commenced first line for all patients pursuing long-term rhythm control, whereas the ESC and AHA/HRS/ACC recommend beta-blockade alongside class Ic drugs. The ESC and AHA/HRS/ACC also recommend that Class Ic drugs be commenced in a monitored setting, whereas NICE provides a list of disqualifying co-morbidities and haemodynamic parameters for those instituting pill-in-the-pocket treatment. Amiodarone is recommended universally for rhythm control in those with significant structural heart disease.

Importantly, for acute cardioversion, the AHA/HRS/ACC recommends flecainide, propafenone, dofetilide, ibutilide (COR: I, LOE: A) and amiodarone (COR: IIa, LOE: B) for both AF and atrial flutter, whereas the ESC highlights concerns about 1:1 conduction of atrial flutter with class Ic drugs, and therefore state that both flecainide and propafenone should be avoided in this situation. Furthermore, the ESC is the only group to recommend intravenous Vernakalant for acute cardioversion of AF (COR: I, LOE: A), including in those patients with non-severe heart failure, and cite data of improved efficacy versus flecainide and amiodarone [24-25]. Notably, this drug was denied approval by the FDA in 2019, hence is still not used in the US.

In those undergoing electrical cardioversion, pre-treatment with AADs is supported (ESC – COR IIa, LOE: B), with NICE suggesting amiodarone for 1 month prior and up to 12 months following DCCV. NICE has also published a separate technology appraisal (TA197) recommending Dronedarone as an alternative to class Ic drugs or amiodarone post DCCV in those with at least one cardiovascular risk factor but no history of heart failure[26].

In AF refractory – or in patients intolerant – to anti-arrhythmic drugs, catheter ablation is well-recognised as a tool for improving symptoms. All three guidelines recommend ablation (Figure 2) in this setting for paroxysmal AF (ESC/AHA/HRS/ACC – COR: I, LOE: A), and the ESC provides a stronger recommendation of ablation in persistent AF (COR: I, LOE: A) than do the AHA/HRS/ACC, who states it 'may be reasonable' (COR: IIa, LOE: A). NICE does not discuss ablation as a first-line rhythm control option, whereas this is presented as a consideration by both ESC and AHA/HRS/ACC in paroxysmal (ESC/ AHA/HRS/ACC – COR:

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IIa, LOE: B) and persistent AF patients (ESC/AHA/HRS/ACC – COR: IIb, LOE: C). The subsequent STOP-AF First, EARLY AF and CRYO-FIRST trials add evidence to the first line cryoballoon ablation approach (Figure 3) [27-29].

The CASTLE-AF randomised controlled trial demonstrated a mortality benefit for catheter ablation of AF in patients with heart failure[2]. As such, both the ESC and AHA/HRS/ACC suggest that ablation be considered in patients with HFREF to reduce mortality and hospitalisation, with the ESC proposing a stronger class of recommendation having incorporated additional meta-analysed data (ESC – COR: IIa, LOE: B, AHA/HRS/ACC – COR: IIb, LOE: B)[30]. CASTLE-AF has a number of limitations, including a highly selected population (e.g. all participants had ICD devices), making its wider applicability debatable.

With regard to ablation technique, the FIRE and ICE randomised controlled trial demonstrated non-inferiority of cryoballoon versus point-by-point radiofrequency (RF) ablation in paroxysmal AF, with a similar safety profile[31]. Whilst meta-analyses have confirmed these efficacy data, and some trials have demonstrated cryoablation to be safer, the NICE J1 evidence review found that RF ablation delivered superior lifetime cost-effectiveness versus cryoablation, and hence recommend RF as the technique of choice. Accordingly, *NICE suggests consideration of cryoballoon or laser balloon ablation only in those patients for whom RF is unsuitable*, such as when a short procedure time – or avoidance of irrigation-related fluid overload – is a priority. In all patients undergoing catheter ablation, the ESC recommends complete pulmonary vein isolation (COR: I, LOE: A), and state that the evidence for ablation of extra-pulmonary lesions (e.g. rotors) is not well-established (ESC COR: IIb, LOE: B).

Ventricular Arrhythmias and Sudden Cardiac Death

ICD Implantation

The NICE guidance (TA314 – 'Implantable cardioverter defibrillators and cardiac resynchronisation therapy for arrhythmias and heart failure') focuses principally on the indications for ICD implantation following cost-efficacy analysis, which is based on QALY gain derived from randomised controlled trial data, including DINAMIT, IRIS and REVERSE [32-35]. As such, in patients with LVEF <35% and QRS <120ms, ICD is only recommended in those patients at high risk of sudden cardiac death, and is not recommended in those with

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NYHA class IV symptoms irrespective of QRS duration. This is a unique approach, as both the 2022 ESC and the 2017 AHA/HRS/ACC guidelines ('Management of patients with ventricular arrhythmias and the prevention of sudden cardiac death') focus on indications based only on the trial data themselves, making the utilisation of QRS duration and NYHA class criteria distinctive to NICE[36-37]. The main difference in ICD implant recommendations between the AHA/HRS/ACC and ESC is the acknowledgement of the DANISH trial criteria by the latter, hence in patients with dilated cardiomyopathy the ESC recommendation is weaker (IIa), whilst the AHA utilise 'ejection fraction of <35%', maintaining a Class I recommendation[38]. Other differences in VA management between the US, Canadian and ESC guidance have recently been extensively reviewed, excluding the NICE approach[39].

A pivotal aspect in the ESC guidance is that sudden death risk stratification is no longer based on ECG and echocardiographic measures of LV function alone. Gene mutation status is becoming increasingly relevant in several diseases, and risk calculators have been developed, including for Long QT syndrome (LQTS), Brugada syndrome, hypertrophic cardiomyopathy (HCM), arrhythmogenic and lamin A/C cardiomyopathies[40]. Importantly, risk prediction based on a single parameter does not consider the potential combined effect and interactions between factors, which remains challenging to assess. For example, in patients with dilated cardiomyopathy/hypokinetic nondilated cardiomyopathy, indications for primary prevention implantable cardioverter defibrillator (ICD) implantation are recommended not to be restricted to left ventricular ejection fraction (LVEF) ≤35% alone. The clinical presentation and results of additional tests (i.e. cardiac magnetic resonance imaging, genetic testing) are important to consider – the presence of a lamin or filamin mutation in dilated cardiomyopathy, for example, is associated with an increased risk of sudden death and provides a stronger indication for ICD implantation than idiopathic DCM with a similar LVEF.

Furthermore, the ESC recommends more detailed assessment in cases of premature ventricular contractions (PVCs) or episodes of VT if the initial ECG and echocardiography are inconclusive. CMR is recommended (IIa) in this context or if the presentation is atypical (e.g. older age, right bundle branch block morphology, sustained monomorphic VT consistent with re-entry), as well as in patients with an unexplained reduced LVEF and a PVC burden of ≥10%.

Ablation of Ventricular Arrhythmias

Whilst there is no NICE guidance evaluating the role of endocardial ventricular tachycardia (VT) ablation, this has been subject to extensive appraisal by the ESC and AHA/HRS/ACC[41]. Figures 4 and 5 highlight these guideline differences and the relevant

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trials. The unique strategy undertaken by the ESC guideline has been to advise on treatment not only based on diagnosis, but also clinical presentation, for example ventricular ectopy (VE), non-sustained VT, or sustained monomorphic VT, and a full investigation of the aetiology. This constitutes an important practical utility for less experienced clinicians. The ESC guidelines strongly emphasise the role of a thorough diagnostic work-up, including CMR in VE & VT patients to fully exclude inherited and inflammatory aetiologies such as arrhythmogenic cardiomyopathies, myocarditis, and sarcoidosis, as these have critical implications for management.

Timing of Ventricular Tachycardia ablation

Three randomised trials which investigated the efficacy of early VT ablation (either as first-line treatment or after first ICD therapy) have reported their findings since the publication of the ESC guidelines in August 2022: PARTITA, SURVIVE VT and PAUSE-SCD are summarised in figure 5 [42-44]. In PARTITA (ablation after the first ICD shock versus AADs) the primary endpoint was a composite of death from any cause or hospitalization for worsening heart failure. No deaths occurred in the ablation group versus 8 deaths (33%) in the control group (p=0.004). ICD shocks were less frequent in the ablation group (9%) than in the control group (42%; p=0.039). The ablation strategy employed an extensive substrate-modification approach to ensure non-inducibility of VT as a procedural endpoint. *The fact that mortality was reduced by early VT abla*tion is a key observation not proven in previous randomised trials, including VANISH[45].

In SURVIVE VT, first line complete endocardial substrate-based catheter ablation was compared to antiarrhythmic therapy (amiodarone and beta-blockers, amiodarone alone, or sotalol and beta-blockers). After 24 months, the primary outcome – a composite of cardiovascular death, appropriate ICD shock, unplanned hospitalization for worsening heart failure, or severe treatment-related complications – occurred in 28.2% of patients in the ablation group and 46.6% of those in the AAD group. This difference was driven by a significant reduction in severe anti-arrhythmic treatment-related complications; note, amiodarone was not used in PARTITA[43].

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In the PAUSE-SCD trial, 121 cardiomyopathy patients (comprising 35% ischaemic, 30% non-ischaemic, and 35% with ARVC) were randomly assigned (1:1) to ablation plus an ICD versus conventional medical therapy plus an ICD. The primary outcome was a composite endpoint of VT recurrence, cardiovascular hospitalization, or death. At 31 months, the primary outcome occurred in 49.3% of the ablation group and 65.5% in the control group (p=0.04). The observed difference was driven by a reduction in VT recurrence in the ablation arm (p=0.02). Similar results were seen in a non-ICD registry arm receiving ablation. No differences in cardiovascular hospitalization or mortality occurred; 8.3% of patients had ablation-related complications[44].

These three early/pre-emptive VT ablation studies highlight the efficacy of ablation in reducing arrhythmic events, with PARTITA demonstrating a mortality benefit from an extensive ablation approach after a first ICD shock. Of note, there was a significant burden of complications from ablation; procedural safety will need to improve if first-line ablation is to develop widespread traction. Since AAD complications comprised the most common outcome in SURVIVE VT, this indicates that these drugs, especially amiodarone, are not an optimal alternative in a high proportion of patients. Nevertheless, the NICE BNF Arrhythmia treatment summary advocates amiodarone (in combination with a standard beta blocker) as maintenance therapy in patients who remain at high risk of VT.

The field remains challenged to achieve successful ablation with minimal complications in these often fragile patients, as it is clear that ablation is certainly effective in reducing VA events. However, newer heart failure medications, including SGLT2 inhibitors and sacubitril-valsartan, mean that the background risk is changing. A NICE evaluation of this new evidence regarding primary and secondary VT ablation would be timely, particularly given the resource and time implications of VT ablation procedures. With the increasing utilisation of ICDs, remote monitoring is detecting more VT events, and the optimal management to avoid hospitalisations remains undefined. Technological advances in VT ablation are streamlining the procedure, hence upfront intervention may become more feasible in the future if procedural risks can be minimised.

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In 2017, NICE IPG603 supported use of the subcutaneous ICD (S-ICD) for prevention of sudden cardiac death. Subsequent data from large registry studies and recent randomised controlled trials (including EFFORTLESS, PRAETORIAN, and PAS) bolster this recommendation further; these trials are summarised in Figure 6.[46-48]. Likewise, the S-ICD is recommended by the ESC and AHA/HRS/ACC in patients with primary or secondary prevention ICD indications and no need for anti-tachycardia, brady- or cardiac resynchronisation pacing (ESC/AHA/HRS/ACC: COR: IIa, LOE: B), or in those with inadequate vascular access (AHA/HRS/ACC: COR: I, LOE: B).

The above studies showed consistent 94.0–98.6% freedom from device-related complications, with infection rates declining from 2.5% to <1.0% by improving implant technique. This included developing a method for lead placement without the need for a third (suprasternal) incision. Careful patient selection has kept the need for conversion to transvenous or cardiac re-synchronization ICD devices as low as 1–2%. The EFFORTLESS registry reported an 8.1% inappropriate shock rate at 1 year, mainly due to T-wave oversensing; this was reduced to 6.8% in S-ICD PAS, 4.8% in PRAETORIAN, and 2.9% in UNTOUCHED in patients with the latest S-ICD model and an activated SMART Pass filter that reduces T-wave oversensing[49]. The randomised PRAETORIAN trial found no difference in first shock efficacy between the S-ICD (93.8%) and TV-ICD (91.6%), and no difference between groups in the primary endpoint, with fewer device-related complications but more inappropriate shocks for the S-ICD. Whether it is safe to offer the S-ICD without defibrillation testing at the point of implant remains under investigation in the PRAETORIAN-DFT trial[50].

CONCLUSIONS

These guidelines reflect the evolving shift in both philosophy and evidence base of the management of arrhythmias, as our understanding of their natural history, genetic and socio-economic basis evolves in parallel with technological developments. Recent data support earlier ablation of both symptomatic atrial and ventricular arrhythmias, and risk stratification techniques for both stroke and sudden cardiac death continue to improve. NICE translates the evidence to ensure optimised, efficient delivery of national healthcare resources, taking a more holistic population and health economics perspective. This will need to be rigorously applied with the rapid, ever-increasing burden of arrhythmias in our ageing population and shrinking UK budgets. With the expansion of healthcare electronic records in the NHS & national BHF

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Data Science Centres, NICE is strategically positioned to evaluate its efficacy in real time over the next decade.

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Table 1: Tools for the assessment of Stroke and Bleeding risk and their inclusion in the NICE, ESC and AHA Guidelines

Stroke risk						
Risk score	***Components***			***NICE***	***ESC***	***AHA/HRS/ACC***
CHA_2DS_2VASc		Clinical feature	Points	Recommended	Recommended (I/A)	Recommended (I/B)
	C	Congestive cardiac failure	1			
	H	Hypertension	1			
	A	Age ≥ 75 years old	2			
	D	Diabetes	1			
	S	Stroke/TIA/Arterial thromboembolism	2			
	V	Vascular disease	1			
	A	Age ≥ 65 years old	1			
	Sc	Female sex	1			
ABC-AF Stroke score	Clinical features		Points	Not included in guideline	Acknowledges some evidence which suggests more accurate risk stratification than the CHA_2DS_2VASc score but not formally recommended	Not included in guideline
	Prior stroke/TIA		5.5			
	Age		0-3			
	Troponin I		0-5.75			
	NT-proBNP		0-9.75			
Bleeding risk						
Risk score	***Components***			***NICE***	***ESC***	***AHA/HRS/ACC***
HAS-BLED		Clinical features	Points	Previously recommended; superseded by ORBIT in 2021	Recommended (IIa/B)	HAS-BLED 'can be used' to estimate bleeding risk, but not formally recommended
	H	Hypertension	1			
	A	Abnormal renal/liver function	1/1			
	S	Prior stroke	1			
	B	Bleeding	1			
	L	Labile INR	1			
	E	Elderly (≥ 65 years old)	1			
	D	Drugs causing bleeding/Alcohol	1/1			

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ORBIT		Clinical features	Points	Recommended	Not included in guideline	Not included in guideline
	O	Older Age (≥ 75 years old)	1			
	R	Reduced haemoglobin (<130/120g/l)	2			
	B	Bleeding history	2			
	I	Insufficient renal function (eGFR <60)	1			
	T	Treatment with antiplatelets	1			
ABC-Bleeding	Clinical Features		Points	Not included in guideline	Acknowledges mixed evidence versus HAS-BLED; not formally recommended	Not included in guideline
	Previous bleeding		2.25			
	Age		0-8			
	Troponin I		0-10			
	GDF-15 (ng/l)		0-9.5			
	Haemoglobin		0-5.25			

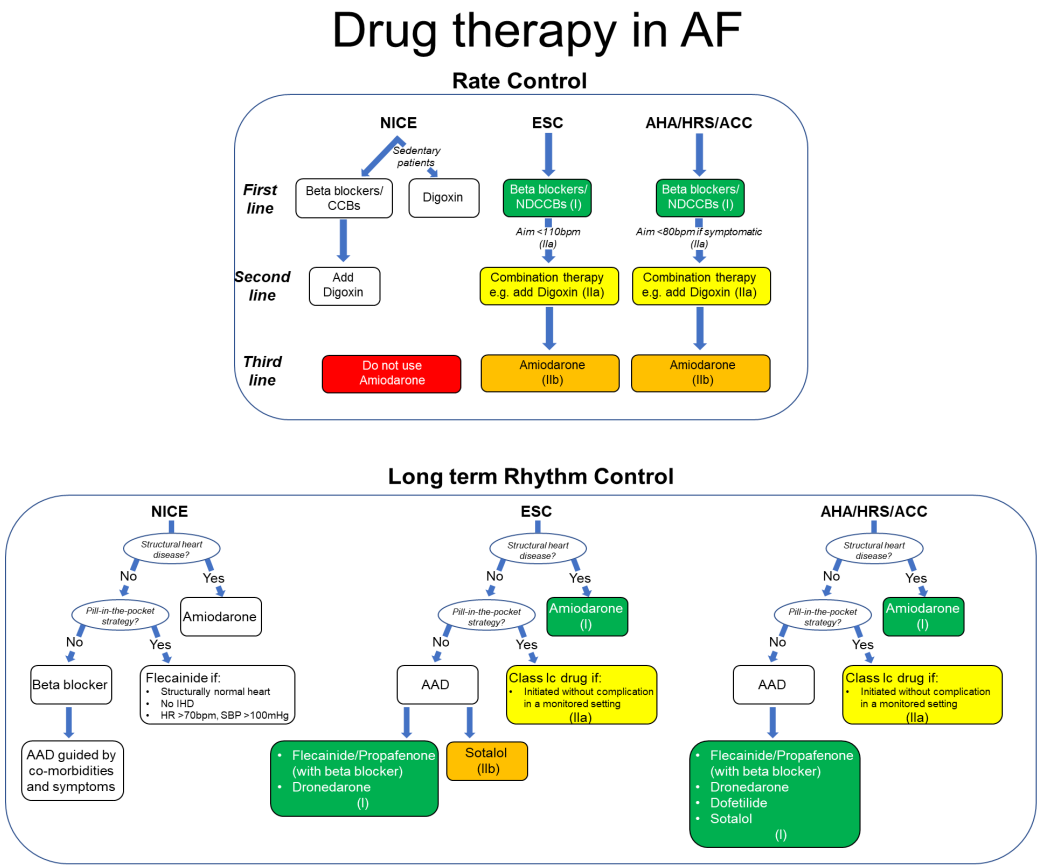

Figure 1: Flow diagram of suggested rate and rhythm control strategies for AF according to the NICE, ESC and AHA/HRS/ACC guidelines

Catheter ablation of AF

Clinical Scenario	NICE 2021	ESC 2020	AHA/HRS/ACC 2019
Paroxysmal AF: First-line treatment	*Not included in guideline*	***Should be considered (COR: IIa, LOE: B)***	***Moderate strength recommendation (COR: IIa, LOE: B)***
Persistent AF: First-line treatment	*Not included in guideline*	May be considered (COR: IIb, LOE: C)	Weak recommendation (COR: IIb, LOE: C)
Paroxysmal AF: Refractory to AADs	**Recommended**	**Recommended (COR: I, LOE: A)**	**Strong recommendation (COR: I, LOE: A)**
Persistent AF: Refractory to AADs	**Recommended**	**Recommended (COR: I, LOE: A)**	***Moderate strength recommendation (COR: IIa, LOE: A)***
Symptomatic AF in HFREF: To improve survival	**Rhythm control recommended in HF secondary to AF**	***Should be considered (COR: IIa, LOE: B)***	Weak recommendation (COR: IIb, LOE: B)

Figure 2: Guideline recommendations for catheter ablation of AF

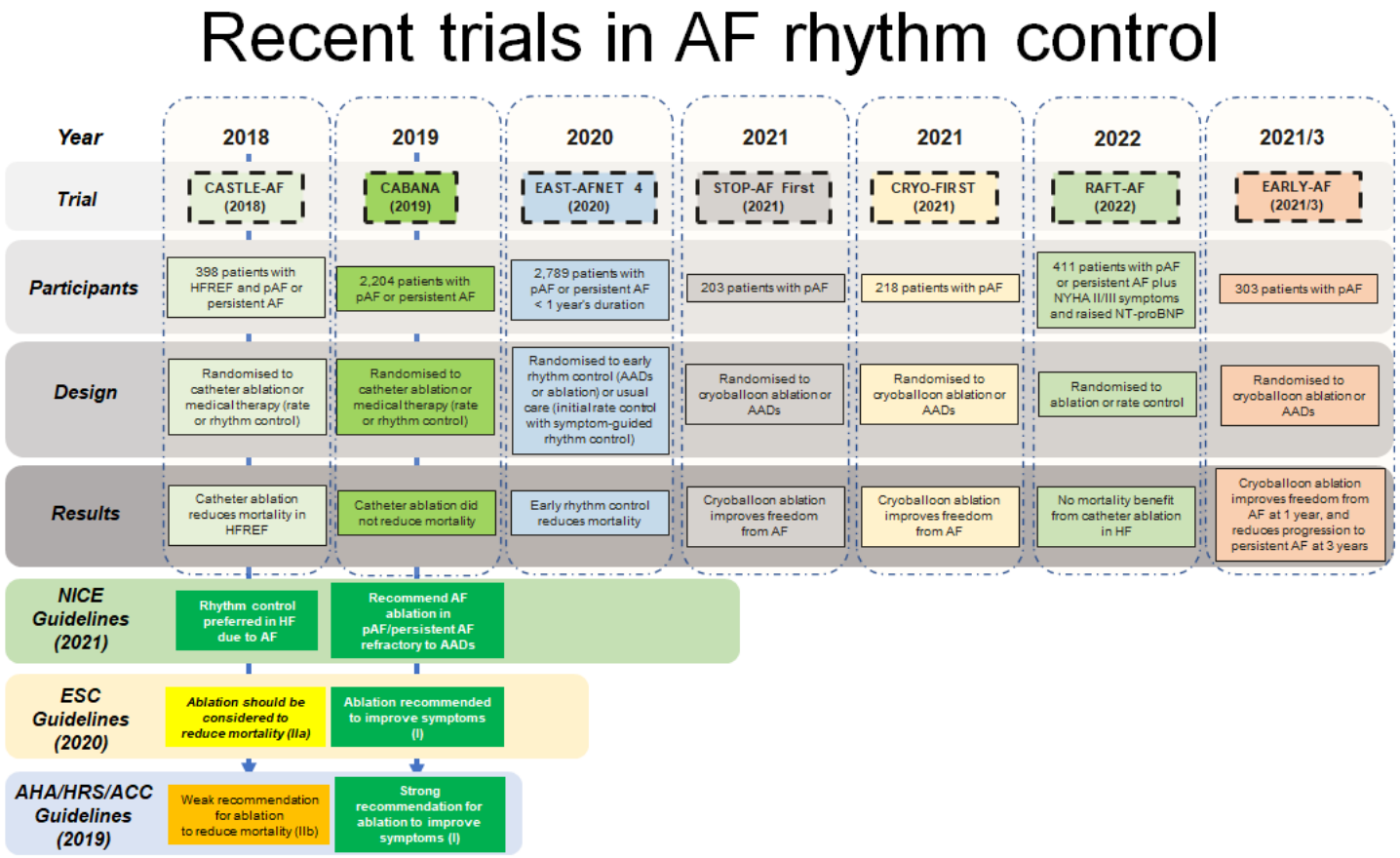

Figure 3: Summary of recent clinical trials in AF rhythm control, and their incorporation into the NICE, ESC and AHA/HRS/ACC guidelines

Catheter ablation of VT

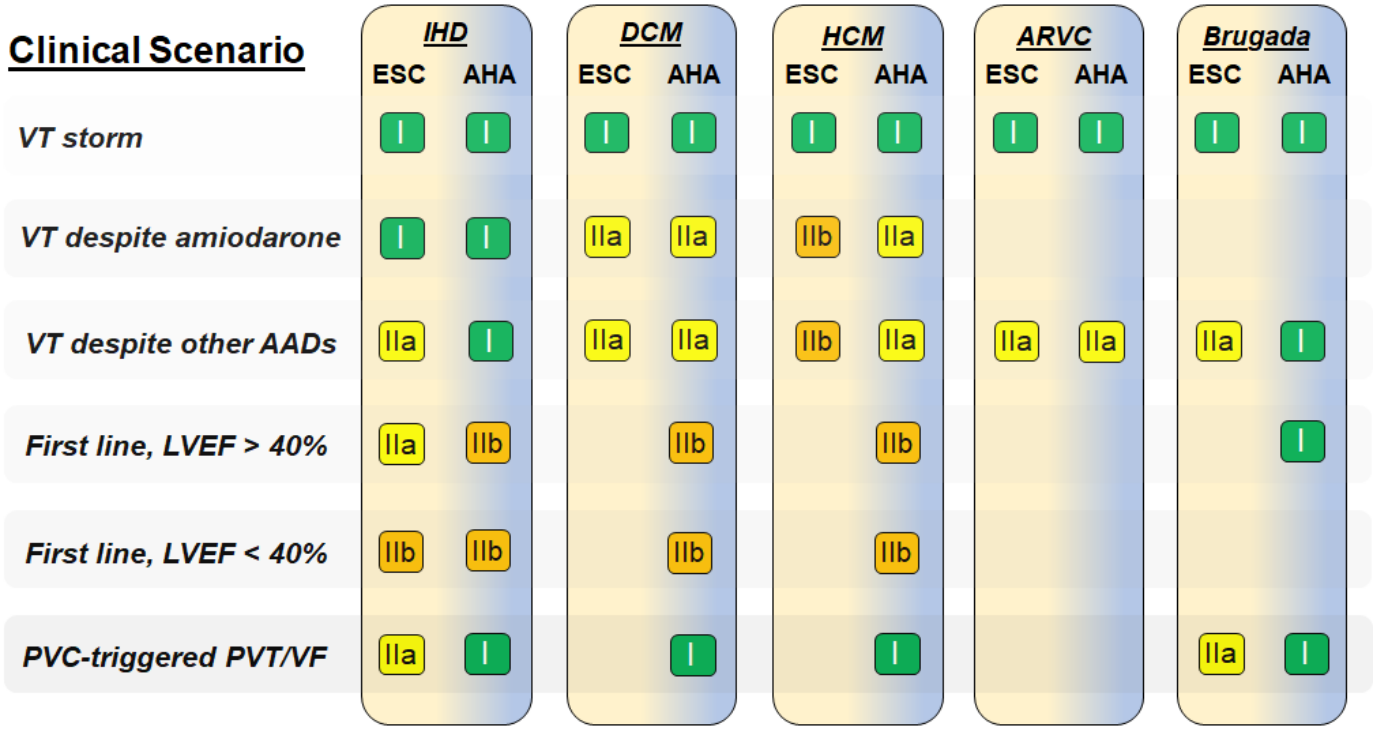

Figure 4: Guideline recommendations for catheter ablation of VT (ESC=ESC 2022, AHA=AHA/HRS/ACC 2017)

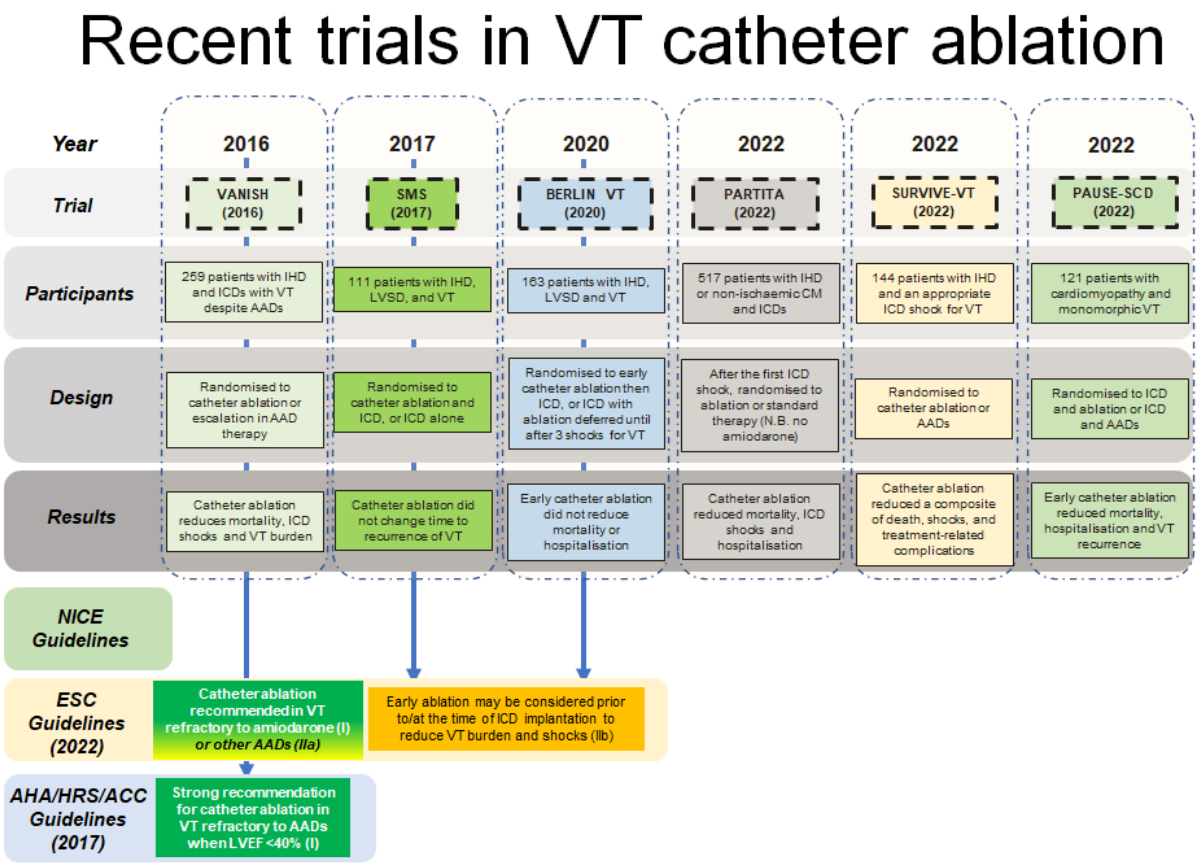

Figure 5: Summary of recent clinical trials in VT catheter ablation, and their incorporation into the ESC and AHA/HRS/ACC guidelines

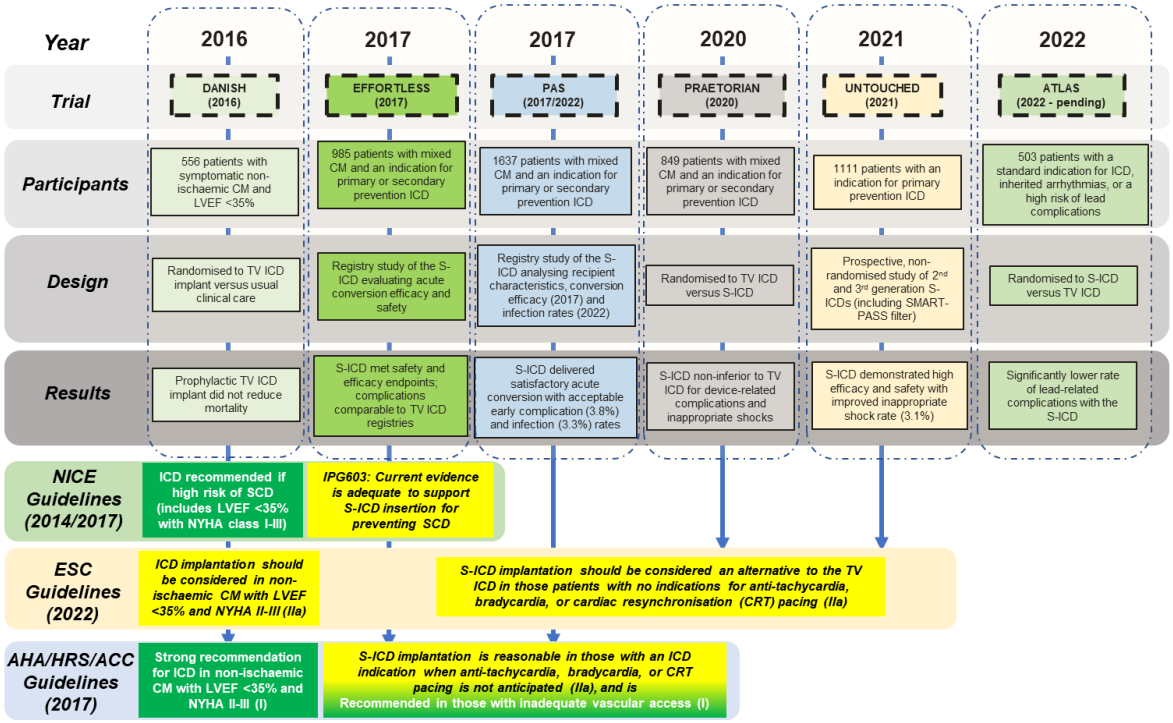

Figure 6: Summary of recent clinical trials in Transvenous and S-ICDs, and their incorporation into the NICE, ESC and AHA/HRS/ACC guidelines