Supplemental Material

Searching for Atrial Fibrillation Post-Stroke: A White Paper of the AF-SCREEN International Collaboration - Online Supplemental Material

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Supplemental Methods

AF-SCREEN membership, expertise and process of reaching consensus on Key Points

The AF-SCREEN collaboration was established in 2016 and now has over 150 members from a variety of professional craft groups, including physicians (cardiologists, general practitioners, internists, neurologists, and electrophysiologists), nurses and allied health professionals, epidemiologists, health economists and patient groups world-wide who have proven expertise and a research interest in the detection of unknown or undertreated atrial fibrillation. Our members come from 35 different countries. The topics and structure of the white paper were devised by the AF-SCREEN steering committee [John Camm (UK), Hugh Calkins (USA), Ben Freedman (Australia), Jeff Healey (Canada), Mårten Rosenqvist (Sweden), Renate B. Schnabel (Germany), Jiguang Wang (China)], and AF-SCREEN

members in 2017. Section work was performed in nine writing groups of co-authors with specific expertise in the field. All of them had contributed in their area with peer-reviewed original papers or reviews that had advanced the field, and were often the seminal papers. Each section brought forth specific key points of practical clinical interest with substantiating evidence.

We used a Delphi process to reach consensus on the contents of the key points.

The steering committee chose the most relevant key points for intensified discussion in the AF-SCREEN community. During the European Society of Cardiology annual conference in Munich 2018 we performed a secret voting process at the AF-SCREEN consensus meeting. During an expert discussion of AF-SCREEN members present at the meeting we refined the key points and, after circulation and further refinement in the manuscript writing group we selected nine key points for anonymous online voting by all AF-SCREEN members.

In the manuscript, we show those central key points with >85% consensus after polling of 114 members who participated. The Key points and votes are shown below. Members were asked if they agreed with the key point or did not agree. Numbers are those who agreed/total votes and percent agreement. All 9 key points selected achieved >85% agreement in the online voting by members.

Key points (agreed/total, % agreement)

1. Atrial fibrillation is a risk factor for thromboembolism and a strong marker for atrial myopathy. In cases of ischemic stroke of uncertain cause, signs of atrial myopathy should be used to inform the intensity or duration of monitoring for AF. Voting: 102/114, 89%

2. Signs of atrial myopathy without detected AF are not currently sufficient to initiate OAC. Voting: 113/114, 99%

3. The diagnosis of AF on post-stroke monitoring requires documentation by an ECG of sufficient quality to allow confirmation by a health professional with expertise in ECG rhythm interpretation. Voting: 112/114, 98%

4. The concept of ESUS has not been proven to identify stroke patients benefitting from OAC. However, there may be ESUS sub-groups (e.g. advanced age, significant atrial enlargement) that could benefit more from NOAC therapy than from aspirin. 105/114, 92%

5. Fulfilling ESUS criteria is neither an indication for NOAC treatment nor for withholding prolonged ECG monitoring. Voting: 109/114, 96%

6. Clinically diagnosed AF after stroke and TIA is associated with significantly increased risk of stroke or systemic embolism, particularly in the presence of additional stroke risk factors. Patients with recent cerebrovascular event and an episode of post-stroke AF are not included in available randomized trials, but expert consensus is that OAC therapy (either well-controlled vitamin K antagonist (VKAs) or NOACs) is generally preferred for new AF detected by ECG monitoring after stroke or TIA. Voting: 112/114, 98%

7. Patients with ischemic stroke should have continuous ECG monitoring post-stroke for at least 72 hours. Voting: 106/114, 93%

8. Cardiac imaging markers, excessive atrial ectopy and blood biomarkers including natriuretic peptides which are suggestive of atrial myopathy, increase the yield of AF, and could be used to guide the selection of patients for more intensive or prolonged post-stroke ECG monitoring. Voting: 108/114, 95%

9. The AF detection rate after cryptogenic stroke is a function of length of monitoring, the definition of duration of AF which constitutes an episode, the interval from the index stroke to the start of monitoring, the type of stroke, and patient characteristics. Voting: 108/114, 95%

Supplemental Tables

Supplemental Table 1. Detection of new AF in post-stroke subjects by external and internal devices screening method.

	No. patients	Screening method	Prior examinations	AF definition	Study population	Percent new AF	Type of study
Searching with resting ECG							
Bansil et al 2004[1]	121	Admission ECG	None	NA	Ischemic stroke	4.7	Cohort
Jabaudon et al 2004[2]	149	Serial ECG	None	NA	Ischemic stroke/TIA	6.7	Cohort
Douen et al 2008[3]	133	Serial ECG	None	NA	Stroke unit admissions, haemorrhages excluded	11.3	Retrospective cohort
Kallmünzer et al 2012[4]	271	Admission ECG	None	>30s	Ischemic stroke	9.6	Cohort
Gumbinger et al 2012[5]	312	Admission ECG	None	NA	Ischemic stroke/TIA	9.9	Cohort
Higgins et al 2013[6]	50	Serial ECG	None	NA	Ischemic stroke/TIA	8.0	RCT
Searching with intermittent ECG recorders							
Doliwa-Sobocinski et al 2012[7]	249	Thumb ECG recorder, 10 secx2/day, for 30 days	Any inpatient diagnosis, including telemetry	>10s	Ischemic stroke	6.0	Cohort
Olsson et al 2016[8]	356	Thumb ECG recorder, 10 sec x 2/day, for 14 days	Any inpatient diagnosis, including telemetry	>10s	Any stroke/TIA	7.6	Retrospective cohort

Supplemental Table 1. Detection of new AF in post-stroke subjects by external and internal devices screening method.

	No. patients	Screening method	Prior examinations	AF definition	Study population	Percent new AF	Type of study
Searching with Holter ECG							
Tonet et al 1981[9]	100	18-54h ECG	NA	NA	Stroke/TIA of suspected embolic origin, subjects with anti-arrhythmic drugs excluded	1.0	Retrospective cohort
Kessler et al 1995[10]	93	24h ECG	NA	NA	Ischemic stroke, referred for 24h ECG	0	Retrospective cohort
Schuchert et al, 1999[11]	82	72h ECG	Resting ECG	≥60s	Ischemic stroke, without carotid lesions or cardiac thrombus	6	Cohort
Jabaudon et al 2004[2]	139	24h ECG	Serial ECG	NA	Ischemic stroke/TIA	5.0	Cohort
Shafqat et al 2004[12]	210	24h ECG	Resting ECG	NA	Ischemic stroke	2.4	Retrospective cohort
Tagawa et al 2007[13]	97	24h ECG	Serial ECG	NA	Ischemic stroke	26.8	Cohort
Douen et al 2008[3]	126	Mean 5.3 days	Serial ECG	NA	Stroke unit admissions, haemorrhages excluded	2.4	Retrospective cohort
Stahrenberg et al 2010[14]	224	7 days	Admission ECG	>30s	Ischemic stroke/TIA	12.5	Cohort
Alhadramy et al 2010[15]	413	24 h	NA	≥30s	Ischemic stroke/TIA	2.5	Retrospective cohort
Rizos et al 2010[16]	120	24h ECG	Resting ECG, telemetry monitoring	≥30s	Ischemic stroke/TIA	2.5	Cohort

Supplemental Table 1. Detection of new AF in post-stroke subjects by external and internal devices screening method.

	No. patients	Screening method	Prior examinations	AF definition	Study population	Percent new AF	Type of study
Dangayach et al 2011[17]	51	48h ECGx2	NA	≥30s	Cryptogenic stroke	29.4	Cohort
Doliwa-Sobocinski et al 2012[7]	249	24h ECG	Any inpatient diagnosis, including telemetry	>10s	Ischemic stroke	2.0	Cohort
Lazzaro et al 2012[18]	133	24h ECG	Admission ECG	>30s	Ischemic stroke/TIA	6.0	Retrospective cohort
Gumbinger et al 2012[5]	192	24h ECG	Admission ECG	>30s	Ischemic stroke/TIA	1.0	Cohort
Rizos et al 2012[19]	496	NA	Admission ECG	>30s	Ischemic stroke/TIA	2.8	Cohort
Suissa et al 2013[20]	344	24h ECG	Admission ECG	NA	Ischemic stroke	2.3	Cohort
Wohlfahrt et al 2014[21]	224	7 days	Admission ECG	>30s	Ischemic stroke	12.9 (18.8 after repeat exams for 1 year)	Cohort
Manina et al 2014[22]	114	96h	Admission ECG	Any duration	Cryptogenic stroke/TIA	24.3	Cohort
Thakkar et al 2014[23]	52	24h ECG	Admission ECG	>30s	Ischemic stroke/TIA	5.8	Cohort
Tu et al 2014[24]	20	≤28 days, median 22.3 days	Resting ECG + 24h ECG	>30s	Cryptogenic stroke	5.0	Cohort
Sanak et al 2015[25]	95	21 days	Resting ECG + 24h ECG	>30s	Cryptogenic stroke <50 years	9.5	Cohort
Wachter et al 2017[26]	200	Repeated 10 day ECGs at 0, 3 and 6 months	Admission ECG	≥30s	Ischemic stroke, without ipsilateral carotid stenosis	13.5	RCT

Supplemental Table 1. Detection of new AF in post-stroke subjects by external and internal devices screening method.

	No. patients	Screening method	Prior examinations	AF definition	Study population	Percent new AF	Type of study
Inpatient Telemetry monitoring							
Bansil et al 2004[1]	121	48h	Admission ECG	NA	Ischemic stroke	4.7	Cohort
Vivanco Hidalgo et al 2009[27]	465	55h (SD 36h)	NA	>30s	Ischemic stroke/TIA	7.2	Cohort
Rizos et al 2010[16]	136	Duration of hospitalization, median 97h	Resting ECG	≥30s	Ischemic stroke/TIA	21.3	Cohort
Gumbinger et al 2012[5]	281	>72h	Admission ECG	NA	Ischemic stroke/TIA	4.6	Cohort
Kallmünzer et al 2012[4]	271	Median 75.5 hrs, standardized detection algorithm	Admission ECG	>30s	Ischemic stroke	7.3	Cohort
Lazzaro et al 2012[18]	133	Duration of hospitalization	Admission ECG	>30s	Ischemic stroke/TIA	0	Cohort
Rizos et al 2012[19]	496	Median 89 h, automated detection	Admission ECG	>30s	Ischemic stroke/TIA	7.7	Cohort
Grond et al 2013[28]	1135	72h	Admission ECG	>30s	Stroke/TIA	4.3	Cohort
Suissa et al 2013[20]	578	NA, duration of care at ward	Admission ECG	NA	Ischemic stroke	15.1	Cohort
Pagola et al 2018[29]	146	28 days, wearable textile Holter	Admission ECG+24h CEM	>120s	Cryptogenic stroke	21.9	Cohort
Event recorder /MCOT							
Barthelemy et al 2003[30]	28	Event recorder- 4 days	24h Holter	30s	Stroke or TIA	14.3	Cohort

Supplemental Table 1. Detection of new AF in post-stroke subjects by external and internal devices screening method.

	No. patients	Screening method	Prior examinations	AF definition	Study population	Percent new AF	Type of study
Jabaudon et al 2004[2]	88	7 days	Serial ECG, 24h ECG	NA	Ischemic stroke/TIA	5.7	Cohort
Wallman et al 2007[31]	127	Event recorder-7 days at 0, 3, and 6 months	24h ECG	30s	Ischemic stroke, w/wo frequent APB	14.2 in all patients †	Cohort
Tayal et al 2008[32]	56	MCOT-21 days	Negative stroke etiology work-up	Any Duration	Cryptogenic stroke/TIA	Any AF: 23.2 AF>30s 5	Retrospective cohort
Elijovich et al 2009[33]	20	Event recorder-30 days	Negative inpatient telemetry	NA	Cryptogenic stroke/TIA	20.0	Retrospective cohort
Gaillard et al 2010[34]	98	Transtelephonic-30 days	Negative 24h Holter	32s	Non-cardioembolic	9.2	Cohort
Bhatt et al 2011[35]	62	MCOT-28 days	24h cardiac telemetry	30s	Cryptogenic stroke/ TIA	24.2	Registry
Flint et al 2012[36]	239	30 days	Negative stroke etiology work-up	5s or 30s	Cryptogenic stroke	11.0	Cohort
Simova et al 2013[37]	36	MCOT, median 22 days	NA	≥30s	Cryptogenic stroke/TIA	8.3 (27 if <30s)	Cohort
Higgins et al 2013[6]	50	7 days	Serial ECG	>20s (or 6 beats-20s)	Ischemic stroke or TIA	8.0 (34 episodes <20s)	RCT
Kamel et al 2013[38]	20	MCOT-21 days	24h telemetry	30s	Cryptogenic stroke	0	RCT
Miller et al 2013[39]	156	MCOT-30 days	ECG (in 95%)	30s	Cryptogenic stroke or TIA	17.3	Retrospective cohort

Supplemental Table 1. Detection of new AF in post-stroke subjects by external and internal devices screening method.

	No. patients	Screening method	Prior examinations	AF definition	Study population	Percent new AF	Type of study
Gladstone et al 2014[40]	280	30 days	Negative 24h Holter	30s	Cryptogenic stroke	16.1	RCT
Sebasigari et al 2017[41]	196	30 days	NA	30s	ESUS	11.7	Retrospective cohort
Sejr et al 2019[42]	1412	48h ELR/Holter	Admission ECG	≥30s	Ischemic stroke/TIA	4.0/2.7	Cohort
Implantable devices							
Cotter et al 2013[43]	51	For AF detection: Mean 48 (0–154) days For those with NO AF detected: Mean 229 days	24h ECG	2 min	Cryptogenic stroke	25.5	Cohort
Ritter et al 2013[44]	60	Minimum 12 months	72h monitoring and 24h Holter ECG	2 min	Cryptogenic stroke	16.7	Cohort
Etgen et al 2013[45]	22	12 months	24h monitoring and 24h Holter ECG	6 min	Cryptogenic stroke	27.3	Cohort
Rojo-Martinez et al 2013[46]	101	281±212 days	24h monitoring	2 min	Cryptogenic stroke	33.7	Cohort
Mercé et al 2013[47]	14	NA	Serial ECG, Holter monitoring (length NA)	NA	Cryptogenic stroke	35.7	Cohort
Sanna et al 2014[48]	221	6 months	24h ECG	30s	Cryptogenic stroke, 24hECG negative	8.9	RCT

Supplemental Table 1. Detection of new AF in post-stroke subjects by external and internal devices screening method.

	No. patients	Screening method	Prior examinations	AF definition	Study population	Percent new AF	Type of study
Christensen et al 2014[49]	83	569±310 days	12-24h telemetry monitoring	2 min	Cryptogenic stroke	16.1	Cohort
Ziegler et al 2017[50]	1247	2 years	NA	2 min	Cryptogenic stroke	21.5	Cohort
Carrazco et al 2017[51]	100	Min 8 months	NA	NA	Cryptogenic stroke	31.0	Cohort
Makimoto et al 2017[52]	146	Median 387 (IQR 283-552) days	Resting ECG, 24h monitoring	>30s	ESUS	22.6	Cohort
Seow et al 2018[53]	71	12 months	24h ECG, 24h CEM	NA	Cryptogenic stroke	15.2	Cohort
Bettin et al 2018[54]	173	Mean 10.7 (SD 11.4) months	NA	>30s	Cryptogenic stroke	19.1	Cohort

†26% in group with frequent atrial premature beats.
*Serial monitoring with 24h ECG was used. Data given is for total.
Abbreviations: atrial fibrillation, AF; continuous ECG monitoring, CEM embolic stroke of undetermined source, ESUS; external loop recording, ELR; interquartile range, IQR randomized clinical trial, RCT; mobile cardiac outpatient telemetry, MCOT; not applicable, NA; standard deviation, SD; transient ischemic attack, TIA. NA indicates not available.

Supplemental Table 2. Odds ratios and hazard ratios for patient characteristics predictive of post-stroke AF detection from individual studies

Patient characteristics	**Cross-sectional studies** Adjusted OR (95%CI)	**Prospective studies** Adjusted HR (95%CI)
Female sex	1.06 (1-01-1.09)[55]	1.05 (1.01-1.09)[56]
		1.01 (0.95-1.07)[57]
History of hypertension	1.50 (1.45-1.55)[55]	1.24 (1.18-1.30)[56]
		1.22 (1.13-1.33)[57]
Obesity		1.05 (1.00-1.11)[56]
Prevalent heart failure	3.31 (3.16-3.48)[55]	2.05 (1.97-2.13)[56]
		2.56 (2.41-2.72)[56]
Myocardial infarction/coronary artery disease	1.11 (1.06-1.17)[55]	1.22 (1.15-1.28)[56]
	3.14 (1.35-7.28)[21]	1.10 (1.04-1.17)[57]
Valvular disease:		1.44 (1.37-1.51)[56]
Mitral stenosis	3.71 (2.84-5.87)[55]	
Other valvular disease	2.03 (1.86-2.22)[55]	
Vascular disease		0.90 (0.85-0.94)[56]
Systemic embolism		1.20 (1.11-1.29)[56]
Pacemaker or ICD implantation		1.56 (1.48-1.64)[56]
Diabetes	0.90 (0.86-0.93)[55]	0.89 (0.85-0.92)[56]
		0.93 (0.87-0.99)[57]
Thyroid disease	1.14 (1.06-1.24)[55]	0.97 (0.93-1.00)[56]
Impaired renal function	1.07 (0.97-1.18)[55]	1.12 (1.07-1.17)[56]
Liver disease	1.21 (1.00-1.48)[55]	1.05 (0.97-1.15)[56]
Anemia		1.10 (1.06-1.15)[56]
Lung disease/COPD	1.03 (0.95-1.11)[55]	1.14 (1.09-1.18)[56]
Recent (3-5 years) cancer diagnosis		0.92 (0.89-0.96)[56]
Current smoking, or recently quit	0.68 (0.64-0.72)[55]	0.92 (0.86-0.98)[56]
Alcohol index/ alcohol related diagnoses	1.30 (1.15-1.46)[55]	0.96 (0.89-1.03)[56]
Stroke characteristics		
Stroke/TIA/ Systemic embolism	1.30 (1.25-1.35)[55]	
Haemorrhagic stroke	0.71 (0.62-0.83)[55]	
Presence of any bleeding	1.24 (1.18-1.30)[55]	
Symptoms >24h	5.17 (1.76-15.49)[21]	

Abbreviations: confidence interval, CI; hazard ratio, HR; odds ratio, OR; insertable cardiac monitors, ICD; chronic obstructive pulmonary disease, COPD.

Supplemental Table 3. Potential harms from monitoring for atrial fibrillation post-stroke and potential counteractions

Reason for impact	Counteraction
False positive findings	Continuous quality control and adaption of the screening program
False negative findings	Continuous quality control and adaption of the screening program, sufficient intensity of screening
Falsely high estimates of the risks of screen-detected AF	Accumulating evidence suggests high enough risk of (paroxysmal) AF to warrant treatment. Further data need to be generated, esp. for low AF burden on continuous prolonged recordings.
False estimates of treatment benefit	Risk-benefit ratios of AF treatment are high and are likely transferrable to post stroke patients. Further data need to be generated.
Diversion of limited health care resources	Continuous health economic re-evaluation of the value of a screening program

AF stands for atrial fibrillation.

Supplemental Table 4. Excerpts of guideline recommendations on post-stroke atrial fibrillation monitoring and assigned level of evidence**.**

Recommendations	Guideline	Ref.
In patients with TIA or ischemic stroke, screening for atrial fibrillation is recommended by short-term ECG recording followed by continuous ECG monitoring for at least 72 hours. (Class I Level B) In stroke patients, additional ECG monitoring by long-term noninvasive ECG monitors or implanted loop recorders should be considered to document silent atrial fibrillation.(Class IIa Level B)	ESC[58]	21,28,40,49
General supportive care and treatment of acute complications: Cardiac monitoring is recommended to screen for atrial fibrillation and other potentially serious cardiac arrhythmias that would necessitate emergency cardiac interventions. Cardiac monitoring should be performed for at least the first 24 hours (Class I; Level of Evidence B). (Revised from the previous guideline [60]) Baseline electrocardiogram assessment is recommended in patients presenting with acute ischemic stroke but should not delay initiation of intravenous rtPA (Class I; Level of Evidence B). (Revised from the previous guideline[60]) Continuous cardiac monitoring is indicated for at least the first 24 hours after stroke. [60-63] Recent studies have suggested Holter monitoring is more effective in identifying atrial fibrillation or other serious arrhythmias after stroke.[1] Outpatient event monitoring may be indicated in patients with cryptogenic stroke and suspected paroxysmal arrhythmias, especially in those patients with short hospitalizations in which monitoring was brief. The utility of prophylactic administration of medications to prevent cardiac arrhythmias among patients with stroke is not known.	AHA/Stroke[59]	18,60,61,62
It is recommended that all acute stroke and TIA patients should have a 12-lead electrocardiography (ECG). In addition, continuous ECG recording is recommended for ischemic stroke and TIA patients (Class I, Level A) It is recommended that for stroke and TIA patients seen after the acute phase, 24-hour Holter ECG monitoring should be performed when arrhythmias are suspected and no other causes of stroke are found (Class I, Level A)	ESO[64]	64
People with ischemic stroke or TIA who would be eligible for secondary prevention treatment for atrial fibrillation (anticoagulation or left atrial appendage device closure) should undergo a period of prolonged (at least 12 hours) cardiac monitoring. B People with ischemic stroke or TIA who would be eligible for secondary prevention treatment for atrial fibrillation and in whom no other cause of stroke has been found should be considered for more prolonged ECG monitoring (24 hours or longer), particularly if they have a pattern of cerebral ischemia on brain imaging suggestive of cardioembolism.	National clinical guideline for stroke (UK)[65]	
Ongoing randomized trials comparing NOACs with aspirin in ESUS patients are in progress. Prior to data from these trials, physicians might, in the meantime, consider the use of anticoagulation in parallel with continued cardiac evaluation (e.g., prolonged rhythm monitoring) after discussion and consideration of patient preference.	Antithrombotic Therapy for Atrial Fibrillation: CHEST Guideline and Expert Panel Report. (2018)[66]	

Supplemental Table 4. Excerpts of guideline recommendations on post-stroke atrial fibrillation monitoring and assigned level of evidence**.**

Recommendations	Guideline	Ref.
New evidence and topic expert feedback highlighted that ICMs, including loop recorders, are a cost-effective diagnostic tool for the prevention of recurrent stroke in patients with cryptogenic stroke. The guideline does not make recommendations for the use of ICMs.	Surveillance report 2014–AF: management (2014) NICE guideline CG180[67]	
Screening for atrial fibrillation in patients with ESUS: For patients with ESUS, longer term ECG monitoring (external or implantable) should be used. (GRADE quality of evidence: Moderate; GRADE strength of recommendation: Strong.) The detection of unrecognized paroxysmal AF in patients with presumed embolic stroke presenting in sinus rhythm with no history of atrial fibrillation may be important to reduce the risk of recurrent stroke. Twenty-four-hour Holter monitoring has been commonly used and is readily available, but a substantial proportion of patients with paroxysmal AF are not detected using this approach.[69,70] External rhythm recording devices can be worn for up to 30 days, but data from implanted devices show that a substantial proportion of AF occurs beyond the first 30 days following an event. Implantable loop recorders can provide up to 3 years of continuous monitoring. Whilst there is some question about the relevance of AF detected many months after the stroke to the etiology of the original event, late-detected AF does remain a significant risk factor for subsequent stroke.	National Heart Foundation of Australia and the Cardiac Society of Australia and New Zealand Stroke Foundation Clinical Guidelines for Stroke Management. Melbourne, Australia, 2017.	68 71
Patients with suspected transient ischemic attack or ischemic stroke should have a 12-lead ECG to assess cardiac rhythm and identify AF or flutter or evidence of structural heart disease (e.g. myocardial infarction, left ventricular hypertrophy) [Evidence Level B]. For patients being investigated for an acute embolic ischemic stroke or transient ischemic attack, ECG monitoring at least 24 hours is recommended as part of the initial stroke work-up to detect paroxysmal AF in patients who would be potential candidates for anticoagulant therapy [Evidence Level A]. For patients being investigated for an acute embolic ischemic stroke or TIA of undetermined source whose initial short-term ECG monitoring does not reveal atrial fibrillation but a cardioembolic mechanism is suspected, prolonged ECG monitoring for at least two weeks is recommended to improve detection of paroxysmal AF in selected patients are not already receiving anticoagulant therapy but would be potential anticoagulant candidates [Evidence Level A].	Canadian stroke best practice recommendations: Secondary prevention of stroke, sixth edition practice guidelines, update 2017.	72
ICM implantation is reasonable to optimize detection of silent AF, in patients with cryptogenic stroke in whom external ambulatory monitoring is inconclusive.	2019 AHA/ACC/HRS Focused Update of the 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation[73]	

Abbreviations: embolic stroke of undetermined source, ESUS; implantable cardiac monitor, ICM; recombinant tissue plasminogen activator, rtPA; transient ischemic attack, TIA.

Supplemental References

1. Bansil S and Karim H. Detection of atrial fibrillation in patients with acute stroke. *J Stroke Cerebrovasc Dis*. 2004;13:12-15. DOI: 10.1016/j.jstrokecerebrovasdis.2004.01.004.
2. Jabaudon D, Sztajzel J, Sievert K, Landis T and Sztajzel R. Usefulness of ambulatory 7-day ECG monitoring for the detection of atrial fibrillation and flutter after acute stroke and transient ischemic attack. *Stroke*. 2004;35:1647-1651.
3. Douen AG, Pageau N and Medic S. Serial electrocardiographic assessments significantly improve detection of atrial fibrillation 2.6-fold in patients with acute stroke. *Stroke*. 2008;39:480-482.
4. Kallmunzer B, Breuer L, Hering C, Raaz-Schrauder D, Kollmar R, Huttner HB, Schwab S and Kohrmann M. A structured reading algorithm improves telemetric detection of atrial fibrillation after acute ischemic stroke. *Stroke*. 2012;43:994-999.
5. Gumbinger C, Krumsdorf U, Veltkamp R, Hacke W and Ringleb P. Continuous monitoring versus HOLTER ECG for detection of atrial fibrillation in patients with stroke. *Eur J Neurol*. 2012;19:253-257.
6. Higgins P, MacFarlane PW, Dawson J, McInnes GT, Langhorne P and Lees KR. Noninvasive cardiac event monitoring to detect atrial fibrillation after ischemic stroke: a randomized, controlled trial. *Stroke*. 2013;44:2525-2531.
7. Doliwa Sobocinski P, Anggardh Rooth E, Frykman Kull V, von Arbin M, Wallen H and Rosenqvist M. Improved screening for silent atrial fibrillation after ischaemic stroke. *Europace*. 2012;14:1112-1116.
8. Olsson AS and Engdahl J. Detection of Atrial Fibrillation with Intermittent Handheld Electrocardiogram in Patients with Ischemic Stroke and Transient Ischemic Attack. *J Stroke Cerebrovasc Dis*. 2016;25:2648-2652.
9. Tonet JL, Frank R, Ducardonnet A, Fillette F, Fontaine G, Komajda M, Thomas D, Bousser MG and Grosgogeat Y. [Holter monitoring in patients with focal cerebral ischaemic attacks (author's transl)]. *Nouv Presse Med*. 1981;10:2491-2494.
10. Kessler DK and Kessler KM. Is ambulatory electrocardiography useful in the evaluation of patients with recent stroke? *Chest*. 1995;107:916-918.
11. Schuchert A, Behrens G and Meinertz T. Impact of long-term ECG recording on the detection of paroxysmal atrial fibrillation in patients after an acute ischemic stroke. *Pacing Clin Electrophysiol*. 1999;22:1082-1084.
12. Shafqat S, Kelly PJ and Furie KL. Holter monitoring in the diagnosis of stroke mechanism. *Inter Med J*. 2004;34:305-309.
13. Tagawa M, Takeuchi S, Chinushi M, Saeki M, Taniguchi Y, Nakamura Y, Ohno H, Kitazawa K and Aizawa Y. Evaluating patients with acute ischemic stroke with special reference to newly developed atrial fibrillation in cerebral embolism. *PACE*. 2007;30:1121-1128.
14. Stahrenberg R, Weber-Kruger M, Seegers J, Edelmann F, Lahno R, Haase B, Mende M, Wohlfahrt J, Kermer P, Vollmann D, Hasenfuss G, Groschel K and Wachter R. Enhanced detection of paroxysmal atrial fibrillation by early and prolonged continuous holter monitoring in patients with cerebral ischemia presenting in sinus rhythm. *Stroke*. 2010;41:2884-2888.
15. Alhadramy O, Jeerakathil TJ, Majumdar SR, Najjar E, Choy J and Saqqur M. Prevalence and predictors of paroxysmal atrial fibrillation on Holter monitor in patients with stroke or transient ischemic attack. *Stroke*. 2010;41:2596-2600
16. Rizos T, Rasch C, Jenetzky E, Hametner C, Kathoefer S, Reinhardt R, Hepp T, Hacke W and Veltkamp R. Detection of paroxysmal atrial fibrillation in acute stroke patients. *Cerebrovasc Dis*. 2010;30:410-417.
17. Dangayach NS, Kane K and Moonis M. Paroxysmal atrial fibrillation in cryptogenic stroke. *Ther Clin Risk Manag*. 2011;7:33-37.
18. Lazzaro MA, Krishnan K and Prabhakaran S. Detection of atrial fibrillation with concurrent holter monitoring and continuous cardiac telemetry following ischemic stroke and transient ischemic attack. *J Stroke and Cerebrovas Dis*. 2012;21:89-93.
19. Rizos T, Guntner J, Jenetzky E, Marquardt L, Reichardt C, Becker R, Reinhardt R, Hepp T, Kirchhof P, Aleynichenko E, Ringleb P, Hacke W and Veltkamp R. Continuous stroke

unit electrocardiographic monitoring versus 24-hour Holter electrocardiography for detection of paroxysmal atrial fibrillation after stroke. *Stroke*. 2012;43:2689-2694.
20. Suissa L, Lachaud S and Mahagne MH. Optimal timing and duration of continuous electrocardiographic monitoring for detecting atrial fibrillation in stroke patients. *J Stroke Cerebrovasc Dis*. 2013;22:991-995.
21. Wohlfahrt J, Stahrenberg R, Weber-Kruger M, Groschel S, Wasser K, Edelmann F, Seegers J, Wachter R and Groschel K. Clinical predictors to identify paroxysmal atrial fibrillation after ischaemic stroke. *Eur J Neurol*. 2014;21:21-27.
22. Manina G, Agnelli G, Becattini C, Zingarini G and Paciaroni M. 96 hours ECG monitoring for patients with ischemic cryptogenic stroke or transient ischaemic attack. *Inter Emerg Med*. 2014;9:65-67.
23. Thakkar S and Bagarhatta R. Detection of paroxysmal atrial fibrillation or flutter in patients with acute ischemic stroke or transient ischemic attack by Holter monitoring. *Indian Heart J.* 2014;66:188-192.
24. Tu HT, Spence S, Kalman JM and Davis SM. Twenty-eight day Holter monitoring is poorly tolerated and insensitive for paroxysmal atrial fibrillation detection in cryptogenic stroke. *Inter Med J*. 2014;44:505-508.
25. Sanak D, Hutyra M, Kral M, Bartkova A, Zapletalova J, Fedorco M, Veverka T, Vindis D, Dornak T, Skala T, Skoloudik D, Taborsky M and Kanovsky P. Paroxysmal atrial fibrillation in young cryptogenic ischemic stroke: A 3-week ECG Holter monitoring study. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub*. 2015;159:283-287.
26. Wachter R, Groschel K, Gelbrich G, Hamann GF, Kermer P, Liman J, Seegers J, Wasser K, Schulte A, Jurries F, Messerschmid A, Behnke N, Groschel S, Uphaus T, Grings A, Ibis T, Klimpe S, Wagner-Heck M, Arnold M, Protsenko E, Heuschmann PU, Conen D, Weber-Kruger M, Find AFI and Coordinators. Holter-electrocardiogram-monitoring in patients with acute ischaemic stroke (Find-AFRANDOMISED): an open-label randomised controlled trial. *Lancet Neurol.* 2017;16:282-290.
27. Vivanco Hidalgo RM, Rodriguez Campello A, Ois Santiago A, Cuadrado Godia E, Pont Sunyer C and Roquer J. Cardiac monitoring in stroke units: importance of diagnosing atrial fibrillation in acute ischemic stroke. *Rev Esp Cardiol*. 2009;62:564-567.
28. Grond M, Jauss M, Hamann G, Stark E, Veltkamp R, Nabavi D, Horn M, Weimar C, Kohrmann M, Wachter R, Rosin L and Kirchhof P. Improved detection of silent atrial fibrillation using 72-hour Holter ECG in patients with ischemic stroke: a prospective multicenter cohort study. *Stroke*. 2013;44:3357-3364.
29. Pagola J, Juega J, Francisco-Pascual J, Moya A, Sanchis M, Bustamante A, Penalba A, Usero M, Cortijo E, Arenillas JF, Calleja AI, Sandin-Fuentes M, Rubio J, Mancha F, Escudero-Martinez I, Moniche F, de Torres R, Perez-Sanchez S, Gonzalez-Matos CE, Vega A, Pedrote AA, Arana-Rueda E, Montaner J, Molina CA and Crypto AFI. Yield of atrial fibrillation detection with Textile Wearable Holter from the acute phase of stroke: Pilot study of Crypto-AF registry. *Inter J Card*. 2018;251:45-50.
30. Barthelemy JC, Feasson-Gerard S, Garnier P, Gaspoz JM, Da Costa A, Michel D and Roche F. Automatic cardiac event recorders reveal paroxysmal atrial fibrillation after unexplained strokes or transient ischemic attacks. *Ann Noninvasive Electrocardiol*. 2003;8:194-199.
31. Wallmann D, Tuller D, Wustmann K, Meier P, Isenegger J, Arnold M, Mattle HP and Delacretaz E. Frequent atrial premature beats predict paroxysmal atrial fibrillation in stroke patients: an opportunity for a new diagnostic strategy. *Stroke*. 2007;38:2292-2294.
32. Tayal A, Tian M, Kelly K, Jones S, Wright D, Singh D, Jarouse J, Brillman J, Murali S and Gupta R. Atrial fibrillation detected by mobile cardiac outpatient telemetry in cryptogenic TIA or stroke. *Neurology*. 2008;71:1696-1701.
33. Elijovich L, Josephson SA, Fung GL and Smith WS. Intermittent atrial fibrillation may account for a large proportion of otherwise cryptogenic stroke: a study of 30-day cardiac event monitors. *J Stroke and Cerebrovas Dis*. 2009;18:185-189.
34. Gaillard N, Deltour S, Vilotijevic B, Hornych A, Crozier S, Leger A, Frank R and Samson Y. Detection of paroxysmal atrial fibrillation with transtelephonic EKG in TIA or stroke patients. *Neurology*. 2010;74:1666-1670

35. Bhatt A, Majid A, Razak A, Kassab M, Hussain S and Safdar A. Predictors of occult paroxysmal atrial fibrillation in cryptogenic strokes detected by long-term noninvasive cardiac monitoring. *Stroke research and treatment*. 2011; Vol. 2011: Article ID 172074,p. 5.
36. Flint AC, Banki NM, Ren X, Rao VA and Go AS. Detection of paroxysmal atrial fibrillation by 30-day event monitoring in cryptogenic ischemic stroke: the Stroke and Monitoring for PAF in Real Time (SMART) Registry. *Stroke*. 2012;43:2788-2790.
37. Simova I, Mateev H, Katova T, Haralanov L and Dimitrov N. Telemonitoring boosts atrial fibrillation detection in cyptogenic stroke patients-preliminary findings. *Cardiol Angiol*. 2013;1:47-57.
38. Kamel H, Navi BB, Elijovich L, Josephson SA, Yee AH, Fung G, Johnston SC and Smith WS. Pilot randomized trial of outpatient cardiac monitoring after cryptogenic stroke. *Stroke*. 2013;44:528-530.
39. Miller DJ, Khan MA, Schultz LR, Simpson JR, Katramados AM, Russman AN and Mitsias PD. Outpatient cardiac telemetry detects a high rate of atrial fibrillation in cryptogenic stroke. *J Neurol Scienc*. 2013;324:57-61.
40. Gladstone DJ, Spring M, Dorian P, Panzov V, Thorpe KE, Hall J, Vaid H, O'Donnell M, Laupacis A, Cote R, Sharma M, Blakely JA, Shuaib A, Hachinski V, Coutts SB, Sahlas DJ, Teal P, Yip S, Spence JD, Buck B, Verreault S, Casaubon LK, Penn A, Selchen D, Jin A, Howse D, Mehdiratta M, Boyle K, Aviv R, Kapral MK, Mamdani M, Investigators E and Coordinators. Atrial fibrillation in patients with cryptogenic stroke. *New Engl J Med*. 2014;370:2467-2477.
41. Sebasigari D, Merkler A, Guo Y, Gialdini G, Kummer B, Hemendinger M, Song C, Chu A, Cutting S, Silver B, Elkind MSV, Kamel H, Furie KL and Yaghi S. Biomarkers of Atrial Cardiopathy and Atrial Fibrillation Detection on Mobile Outpatient Continuous Telemetry After Embolic Stroke of Undetermined Source*. J Stroke Cerebrovasc Dis*. 2017;26:1249-1253.
42. Sejr MH, May O, Damgaard D, Sandal BF and Nielsen JCJH. External continuous ECG versus loop recording for atrial fibrillation detection in patients who had a stroke. *Heart*. 2019;105:848-854.
43. Cotter PE, Martin PJ, Ring L, Warburton EA, Belham M and Pugh PJ. Incidence of atrial fibrillation detected by implantable loop recorders in unexplained stroke. *Neurology*. 2013;80:1546-1550.
44. Ritter MA, Kochhäuser S, Duning T, Reinke F, Pott C, Dechering DG, Eckardt L and Ringelstein EB. Occult atrial fibrillation in cryptogenic stroke: detection by 7-day electrocardiogram versus implantable cardiac monitors. *Stroke*. 2013;44:1449-1452.
45. Etgen T, Hochreiter M, Mundel M and Freudenberger T. Insertable cardiac event recorder in detection of atrial fibrillation after cryptogenic stroke: an audit report. *Stroke*. 2013;44:2007-2009.
46. Rojo-Martinez E, Sandín-Fuentes M, Calleja-Sanz AI, Cortijo-García E, García-Bermejo P, Ruiz-Piñero M, Rubio-Sanz J and Arenillas-Lara JF. High performance of an implantable Holter monitor in the detection of concealed paroxysmal atrial fibrillation in patients with cryptogenic stroke and a suspected embolic mechanism. *Revista de neurologia*. 2013;57:251-257.
47. Merce J, Garcia M, Ustrell X, Pellise A, de Castro R and Bardaji A. Implantable loop recorder: a new tool in the diagnosis of cryptogenic stroke. Revista espanola de cardiologia. 2013;66:665-666.
48. Sanna T, Diener HC, Passman RS, Di Lazzaro V, Bernstein RA, Morillo CA, Rymer MM, Thijs V, Rogers T, Beckers F, Lindborg K, Brachmann J and Investigators CA. Cryptogenic stroke and underlying atrial fibrillation. *New Engl J Med*. 2014;370:2478-2486.
49. Christensen L, Krieger D, Højberg S, Pedersen O, Karlsen F, Jacobsen M, Worck R, Nielsen H, Aegidius K and Jeppesen L. Paroxysmal atrial fibrillation occurs often in cryptogenic ischaemic stroke. Final results from the SURPRISE study. *Euro J Neuro*. 2014;21:884-889.

50. Ziegler PD, Rogers JD, Ferreira SW, Nichols AJ, Richards M, Koehler JL and Sarkar S. Long-term detection of atrial fibrillation with insertable cardiac monitors in a real-world cryptogenic stroke population. *Inter J Card*. 2017;244:175-179.
51. Carrazco C, Golyan D, Kahen M, Black K, Libman RB and Katz JM. Prevalence and Risk Factors for Paroxysmal Atrial Fibrillation and Flutter Detection after Cryptogenic Ischemic Stroke. *J Stroke Cerebrovasc Dis*. 2018;27:203-209.
52. Makimoto H, Kurt M, Gliem M, Lee JI, Schmidt J, Muller P, Clasen L, Brinkmeyer C, Shin DI, Jander S, Kelm M and Furnkranz A. High Incidence of Atrial Fibrillation After Embolic Stroke of Undetermined Source in Posterior Cerebral Artery Territory. *JAHA*. 2017; 29;6(12).
53. Seow S-C, How A-K, Chan S-P, Teoh H-L, Lim T-W, Singh D, Yeo W-T and Kojodjojo P. High Incidence of Occult Atrial Fibrillation in Asian Patients with Cryptogenic Stroke. *J Stroke Cerebrovasc Dis*. 2018;27(8):2182-2186.
54. Bettin M, Dechering D, Kochhauser S, Bode N, Eckardt L, Frommeyer G and Reinke F. Extended ECG monitoring with an implantable loop recorder in patients with cryptogenic stroke: time schedule, reasons for explantation and incidental findings (results from the TRACK-AF trial). *Clin Res Cardiol*. 2019;108:309-314.
55. Friberg L, Rosenqvist M, Lindgren A, Terent A, Norrving B and Asplund K. High prevalence of atrial fibrillation among patients with ischemic stroke. *Stroke*. 2014;45:2599-605.
56. Bisson A, Bodin A, Clementy N, Babuty D, Lip GYH and Fauchier L. Prediction of Incident Atrial Fibrillation According to Gender in Patients With Ischemic Stroke From a Nationwide Cohort. *Am J Cardiol*. 2018;121:437-444.
57. Fauchier L, Clementy N, Pelade C, Collignon C, Nicolle E and Lip GY. Patients With Ischemic Stroke and Incident Atrial Fibrillation: A Nationwide Cohort Study. *Stroke*. 2015;46:2432-2437.
58. Kirchhof P, Benussi S, Kotecha D, Ahlsson A, Atar D, Casadei B, Castella M, Diener H-C, Heidbuchel H, Hendriks J, Hindricks G, Manolis AS, Oldgren J, Popescu BA, Schotten U, Van Putte B, Vardas P and Group ESCSD. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. *Europ Heart J*. 2016;37:2893-2962.
59. Jauch EC, Saver JL, Adams Jr HP, Bruno A, Connors J, Demaerschalk BM, Khatri P, McMullan Jr PW, Qureshi AI and Rosenfield K. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2013;44:870-947.
60. Adams HP, Jr., del Zoppo G, Alberts MJ, Bhatt DL, Brass L, Furlan A, Grubb RL, Higashida RT, Jauch EC, Kidwell C, Lyden PD, Mor-genstern LB, Qureshi AI, Rosenwasser RH, Scott PA and Wijdicks EF. Guidelines for the early management of adults with ischem-ic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups: the American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists. *Stroke*. 2007;38:1655-1711.
61. Christensen H, Fogh Christensen A and Boysen G. Abnormalities on ECG and telemetry predict stroke outcome at 3 months. *J Neurolog Scien*. 2005;234:99-103.
62. Cavallini A, Micieli G, Marcheselli S and Quaglini S. Role of monitoring in management of acute ischemic stroke patients. *Stroke*. 2003;34:2599-2603.
63. Sulter G, Elting JW, Langedijk M, Maurits NM and De Keyser J. Admitting acute ischemic stroke patients to a stroke care monitoring unit versus a conventional stroke unit: a randomized pilot study. *Stroke*. 2003;34:101-104.
64. The European Stroke Organisation Executive C and the ESOWC. Guidelines for Management of Ischaemic Stroke and Transient Ischaemic Attack 2008. *Cerebrovasc Dis*. 2008;25:457-507.
65. Physicians RCo. National clinical guideline for stroke- Prepared by the *Intercollegia te Stroke Working Party 2016*. 2016; Fifth Edition:99-100.

66. Lip GYH, Banerjee A, Boriani G, Chiang CE, Fargo R, Freedman B, Lane DA, Ruff CT, Turakhia M, Werring D, Patel S and Moores L. Antithrombotic Therapy for Atrial Fibrillation: CHEST Guideline and Expert Panel Report. *Chest*. 2018;154:1121-1201.
67. Excellence NIfHaC. Surveillance report 2017 – Atrial fibrillation: management (2014) NICE guideline CG180. *Surveillance report*. 2017:4.
68. Brieger D, Amerena J, Attia J, Bajorek B, Chan KH, Connell C, Freedman B, Ferguson C, Hall T, Haqqani H, Hendriks J, Hespe C, Hung J, Kalman JM, Sanders P, Worthington J, Yan TD and Zwar N. National Heart Foundation of Australia and the Cardiac Society of Australia and New Zealand: Australian Clinical Guidelines for the Diagnosis and Management of Atrial Fibrillation 2018. *Heart, lung & circulation*. 2018;27:1209-1266.
69. Afzal MR, Gunda S, Waheed S, Sehar N, Maybrook RJ, Dawn B and Lakkireddy D. Role of outpatient cardiac rhythm monitoring in cryptogenic stroke: a systematic review and meta-analysis. *Pacing and Clinical Electrophysiology*. 2015;38:1236-1245.
70. Kamel H, Navi BB, Elijovich L, Josephson SA, Yee AH, Fung G, Johnston SC and Smith WS. Pilot randomized trial of outpatient cardiac monitoring after cryptogenic stroke. *Stroke*. 2013;44:528-530.
71. Stroke Foundation- Clinical Guidelines for Stroke Management 2017. 2017;15. 10.2018
72. Wein T, Lindsay MP, Cote R, Foley N, Berlingieri J, Bhogal S, Bourgoin A, Buck BH, Cox J, Davidson D, Dowlatshahi D, Douketis J, Falconer J, Field T, Gioia L, Gubitz G, Habert J, Jaspers S, Lum C, McNamara Morse D, Pageau P, Rafay M, Rodgerson A, Semchuk B, Sharma M, Shoamanesh A, Tamayo A, Smitko E and Gladstone DJ. Canadian stroke best practice recommendations: Secondary prevention of stroke, sixth edition practice guidelines, update 2017. *Inter J Stroke*. 2018;13:420-443.
73. January CT, Wann LS, Calkins H, Chen LY, Cigarroa JE, Cleveland JC, Jr., Ellinor PT, Ezekowitz MD, Field ME, Furie KL, Heidenreich PA, Murray KT, Shea JB, Tracy CM and Yancy CW. 2019 AHA/ACC/HRS Focused Update of the 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation. *Circulation*. 2019: DOI: https://doi.org/10.1016/j.jacc.2019.01.011.

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