Presenter Disclosures

Looking for AF in all the right places

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Learning objectives

- Understand the potential benefits of detecting atrial fibrillation
  - Stroke prevention, appropriate therapy for symptoms
- Review risk factors for AF
- Review the limits of screening tests for atrial fibrillation
  - ECGs
  - Standard holters
- Be aware of novel technologies for detecting atrial fibrillation
- Role of implantable loop recorders

Warfarin stroke reduction + DOAC reduction

Where should you look?

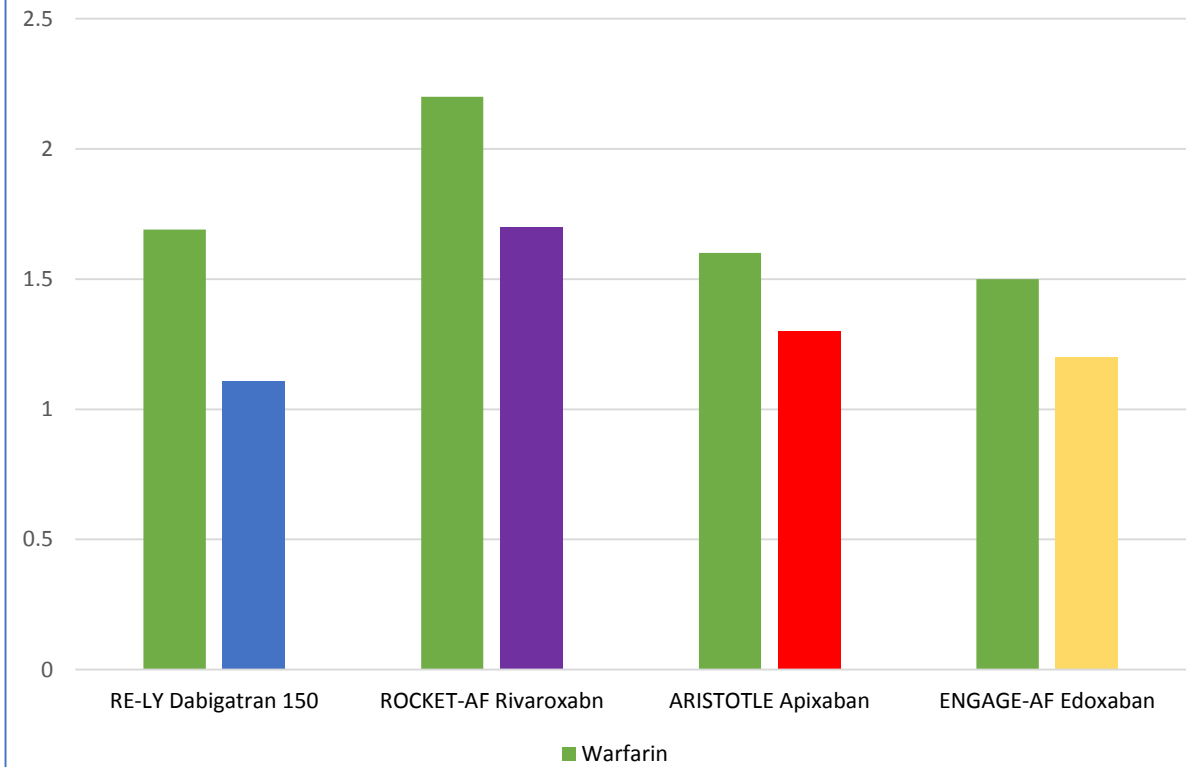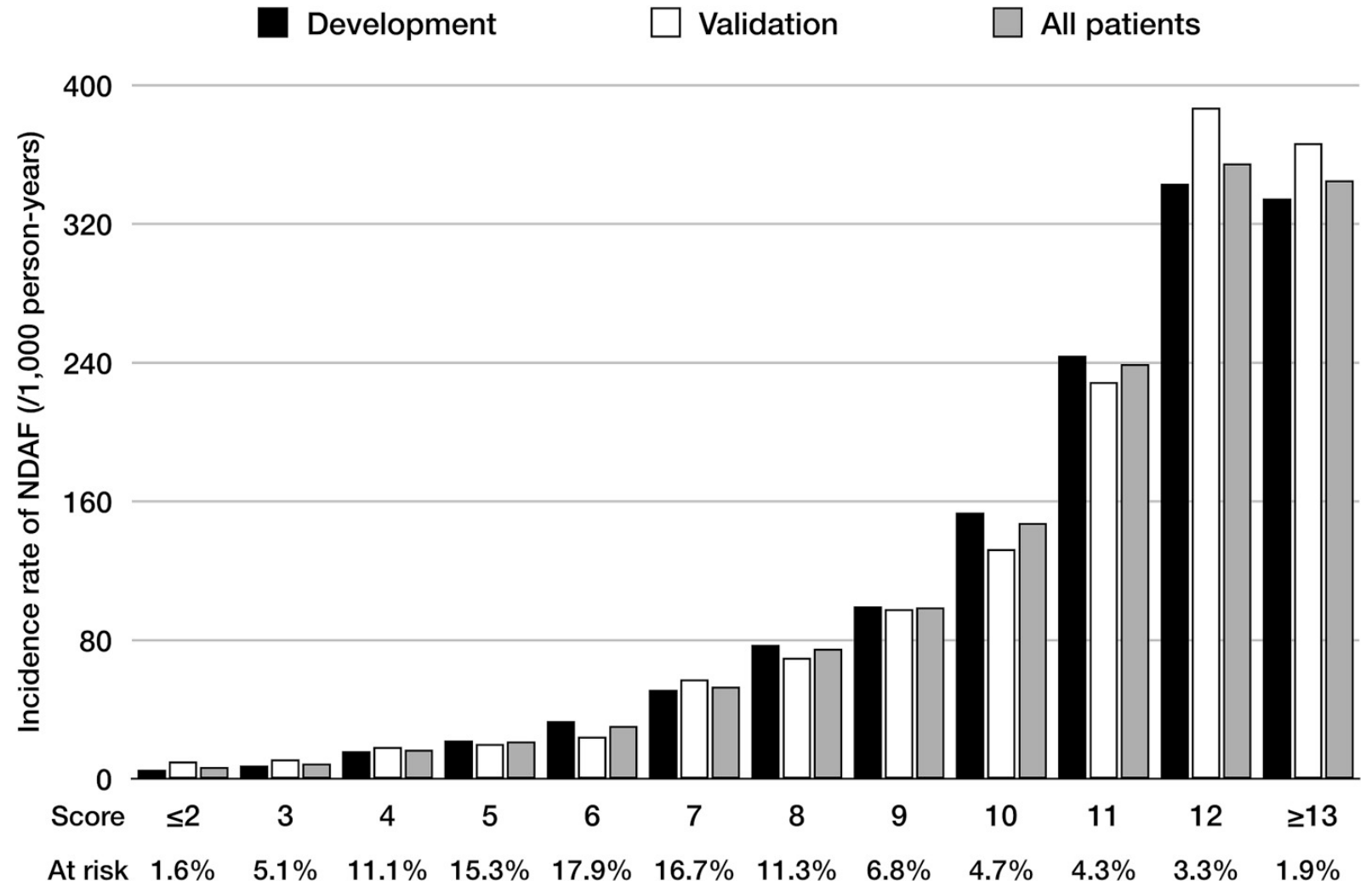- The atrium (big surprise)
- Specifically the left atrium
- Also consider whether there is structural heart disease (LVH, mitral valve disease)
- Stroke patients
  - Canadian guidelines: 2 weeks of monitoring for AF for embolic stroke or stroke/TIA of unknown origin
- Cryptogenic stroke (Embolic stroke of uncertain source – ESUS)
  - Risk factors for AF.
  - e.g. CHASE-LESS score
  - Positive correlation of embolic AF stroke with CAD, CHF, Age, severe stroke
  - Negative correlation with: Hyperlipidemia, diabetes, previous stroke

Incidence of new AF according to CHASE-LESS score (1 year follow up)

CHASE-LESS Score

Predictor	Point
Coronary artery disease	1
Heart failure	1
Age (per 10 years)	1
stroke **SE**verity	
NIHSS 6–13	1
NIHSS ≥14	4
hyper**L**ipid**E**mia	-1
Sugar	-1
prior **S**troke/TIA	-1

Legend: ■ Development □ Validation ▨ All patients

Y-axis: Incidence rate of NDAF (/1,000 person-years)

Score	≤2	3	4	5	6	7	8	9	10	11	12	≥13
At risk	1.6%	5.1%	11.1%	15.3%	17.9%	16.7%	11.3%	6.8%	4.7%	4.3%	3.3%	1.9%

Symptom rhythm correlation

- For syncope – AF termination pauses are effectively treated with a pacemaker
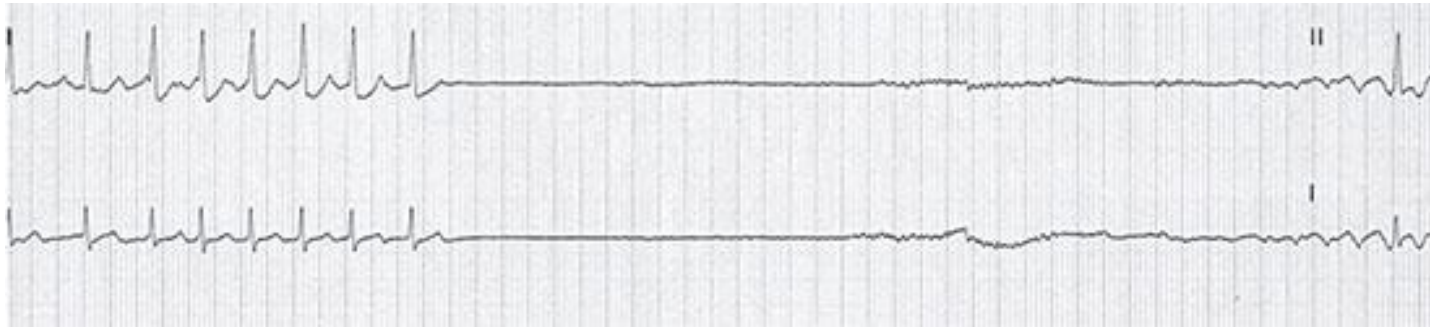

- For other AF symptoms that significantly affect quality of life
  - Earlier AF specific treatment that can improve quality of life
  - Anti-arrhythmics, ablation
  - Ablation earlier in the course of AF (ie while still paroxysmal, shorter duration) is more successful

Tools to look for atrial fibrillation

- The more severe the consequences of atrial fibrillation, the harder you should look for it

- Usually a stepwise approach using simpler and less invasive investigations first

- Can jump to more aggressive and invasive tests depending on the clinical urgency

12 lead ECG

- Completely irregular R-R intervals
- No discernible, distinct p-waves
- Cost effective to do routine ECG to screen for AF in all patients over age 65
- AF increases with age
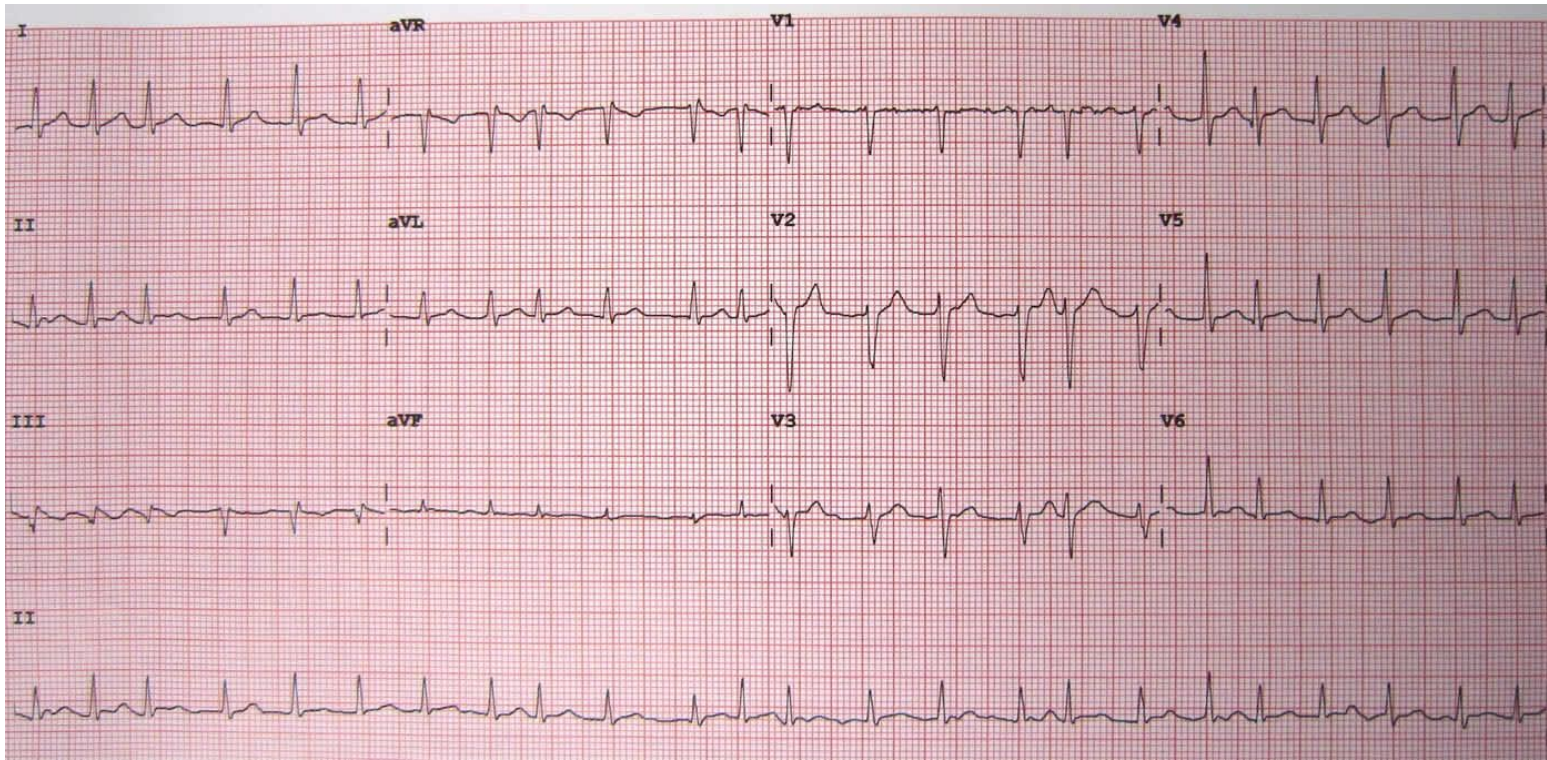
Look for AF by self monitoring pulse?

- Recommended as reasonable by ESC for patients to self monitor pulse once daily

- But compared with intermittent ECGs in a Swedish study
  - 56% sensitivity
  - 81% specificity

- Unreliable, especially in high risk patients
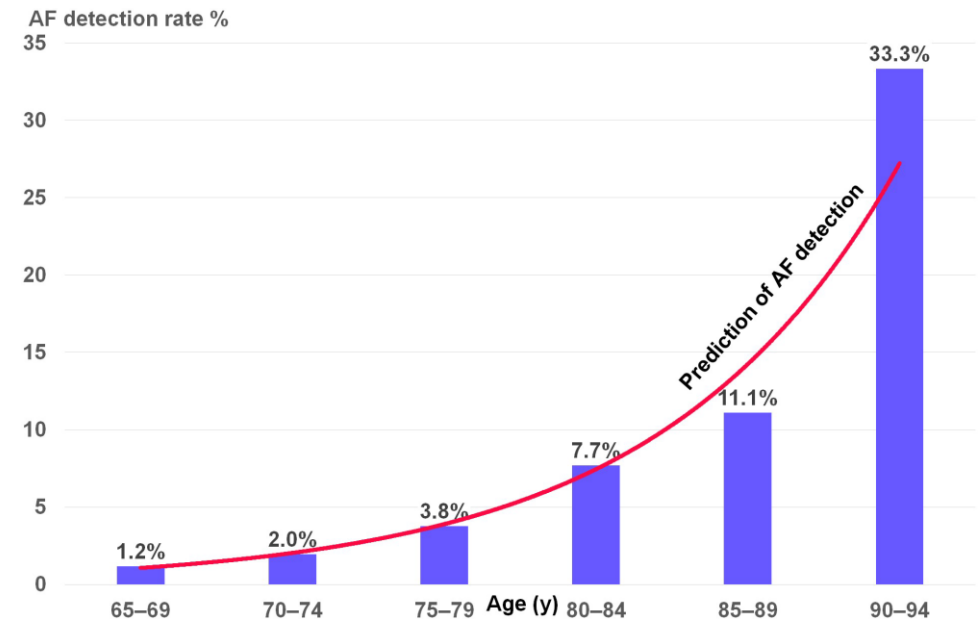
AF case finding in a Spanish population using pulse and 12-lead ECG

Table 3. Adjusted incidence of new diagnosed AF in people ≥60 years (Terres de l'Ebre, Catalonia) by age (2016–17)

Age (years)	Total N	Total new AF cases (2016–17)	Population without case finding			Population with case finding			P
			N	Total new AF cases (2016–17)	Incidence of new AF cases/1000/year (CI95%)	N	Total new AF cases (2016–17)	Incidence of new AF cases/1000/year (CI95%)	
60–69	19 958	129	10 164	24	1.2 (0.7–1.7)	9794	105	5.3 (4.4–6.5)	<0.001
70–79	15 408	286	4624	35	3.8 (2.7–5.7)	10 784	251	11.6 (10.2–13.1)	<0.001
80–89	10 181	345	2878	46	8 (5.8–10.6)	7303	299	20.4 (18.2–22.9)	<0.001
≥90	2789	134	1073	24	11.2 (7.1–16.6)	1710	110	32 (26.3–33.6)	<0.001
Total	48 336	894	18 739	129	3.4 (2.8–4.1)	29 597	765	12.9 (12–13.6)	<0.001

Other self monitoring options
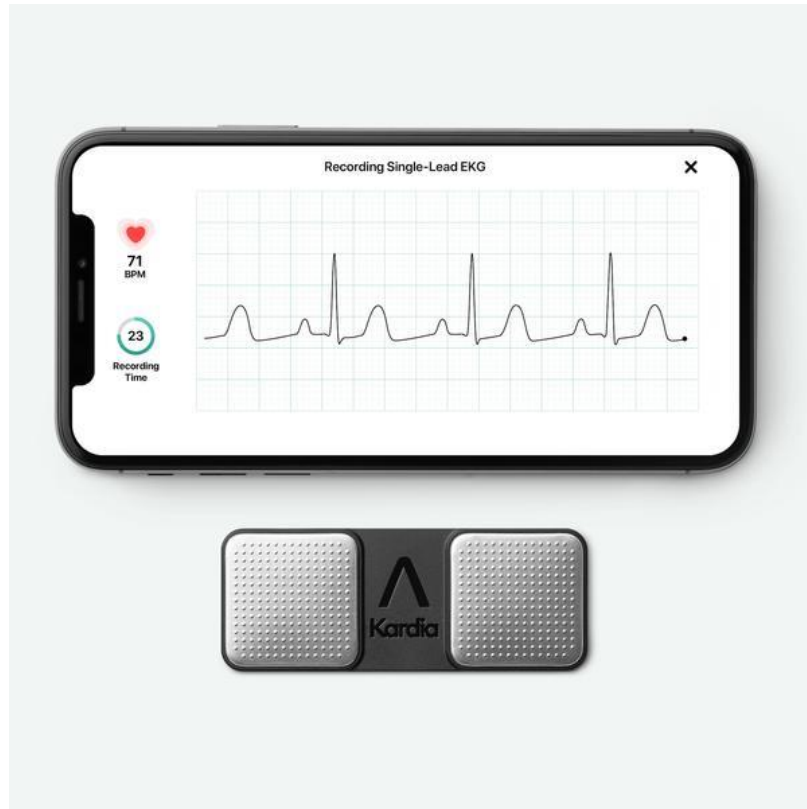
Kardia mobile ECG recorder


Watch BP with Afib detection

More effective than single ECGs for AF detection (UK study)

Table 2. The number of pulse rhythm checks and possible atrial fibrillation findings by setting

Setting	Device type	Pulse rhythm checks	Possible AF	Detection prevalence	Detection rate
Older persons community teams	Kardia Mobile	369	53	14.3%	1 in 7
Hospital outpatient clinics	Kardia Mobile	667	67	10.0%	1 in 10
GP practices	Kardia Mobile	4,494	264	5.9%	1 in 17
Community podiatry	Kardia Mobile	767	35	4.6%	1 in 22
Fire Safe and Well	WatchBP	25	1	4.0%	1 in 25
Mental health	Kardia Mobile	1,182	45	3.8%	1 in 26
Community therapy teams	Both	404	13	3.2%	1 in 31
Community nursing teams	Both	549	14	2.6%	1 in 39
Pharmacy	Both	2,820	57	2.0%	1 in 49
Public health events	WatchBP	2,393	44	1.8%	1 in 54
Urgent Care	Kardia Mobile	391	3	0.8%	1 in 130
Prison	WatchBP	774	1	0.1%	1 in 774
Total		14,835	597	4.0%	1 in 25

AF = atrial fibrillation; GP = general practitioner.

Handheld "stick" AF detection device
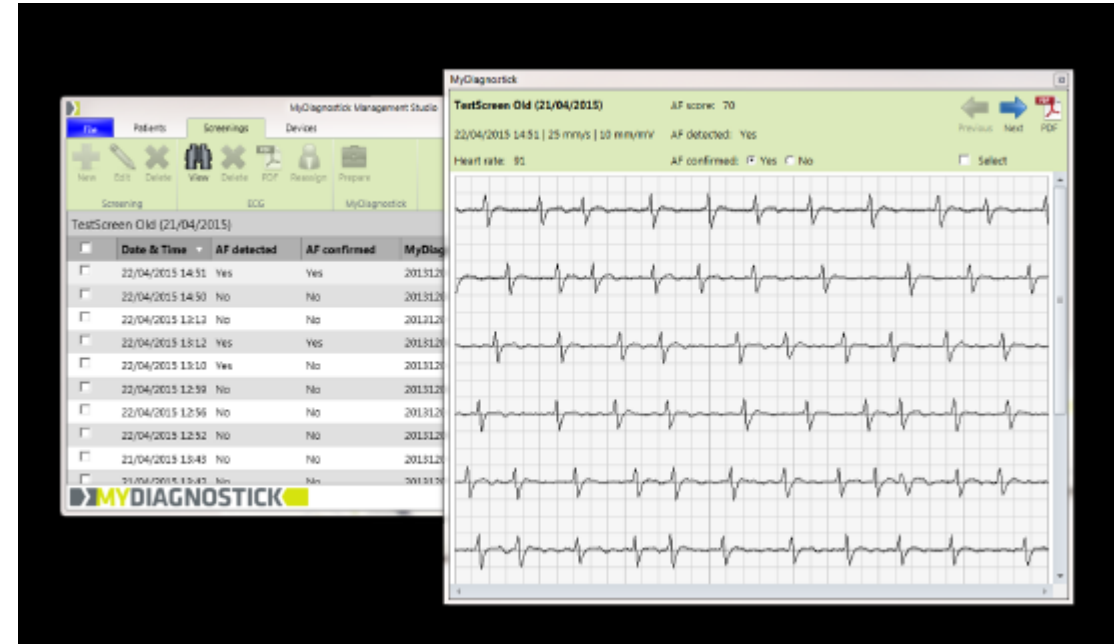
- Pt holds for 1 minute. Light turns red if AF is present
- 92% sensitivity 84% specificity for AF detection
- Less cumbersome than 12 lead ECG
- 6.4% AF detection rate in primary care in patients at moderate risk of AF

Diamantino AC , et al. Heart 2020;0:1–6.

Holter monitoring

- Longer duration is better
  - Very little benefit from a 24 hour holter to detect AF
  - Standard is now 14 days
- If only shorter holters are possible (eg from skin irritation, etc)
  - Then space holters apart widely to sample different time periods

Danish study of ILR patients vs different noninvasive monitoring strategies for AF detection

30 seconds of monitoring

- 2.3% Annual 10sec-ECGs during 3 years
- 2.2% Monthly 10sec-ECGs during 3 months / Weekly 10sec-ECGs during 3 weeks
- 2.1%
- 2.0% Daily 10sec-ECGs during 3 days

60 seconds of monitoring

- 3.0% / 2.9% Monthly 10sec-ECGs during 6 months / Weekly 10sec-ECGs during 6 weeks
- 2.6% Daily 10sec-ECGs during 6 days
- 2.3% One day with bi-daily 30sec-ECGs
- 2.2%

48 hours of monitoring

- 16.0%
- 15.0% Annual 24h-Holters during 2 years
- 14.0% Monthly 24h-Holters during 2 months / Weekly 24h-Holters during 2 weeks
- 13.0% One 48h-Holter

72 hours of monitoring

- 20.0% / 19.0% Annual 24h-Holters during 3 years
- 18.0%
- 17.0% Monthly 24h-Holters during 3 months / Weekly 24h-Holters during 3 weeks
- 16.0%
- 15.0% One 72h-Holter

144 hours of monitoring

- 24.0% Annual 48h-Holters during 3 years
- 23.0% Monthly 24h-Holters during 6 months
- 22.0% Annual 72h-Holters during 2 years / Weekly 24h-Holters during 6 weeks
- 21.0% Monthly 48h-Holters during 3 months / Monthly 72h-Holters during 2 months

168 hours of monitoring

- 25.0% Monthly 24h-Holters during 7 months
- 24.0%
- 23.0% Weekly 24h-Holters during 7 weeks
- 22.0%
- 21.0% One 7d-Holter
- 20.0%

216 hours of monitoring

- 28.0% Monthly 24h-Holters during 9 months / Annual 72h-Holters during 3 years
- 27.0%
- 26.0%
- 25.0% Weekly 24h-Holters during 9 weeks
- 24.0% Monthly 72h-Holters during 3 months

504 hours of monitoring

- 36.0% Annual 7d-Holters during 3 years
- 34.0% Monthly 72h-Holters during 7 months
- 32.0% Monthly 7d-Holters during 3 months

720 hours of monitoring

- 40.0% Monthly 72h-Holters during 10 months
- 38.0%
- 36.0%
- 34.0% One 30d-Holter

Breaking up the same total monitoring duration into smaller intervals improves AF detection

10.1161/CIRCULATIONAHA.119.044407

Single patch 14 day holter, automated AF detection

A. Simultaneous ECG collections with patch-based, single lead monitor and 12-lead Holter in AF patients
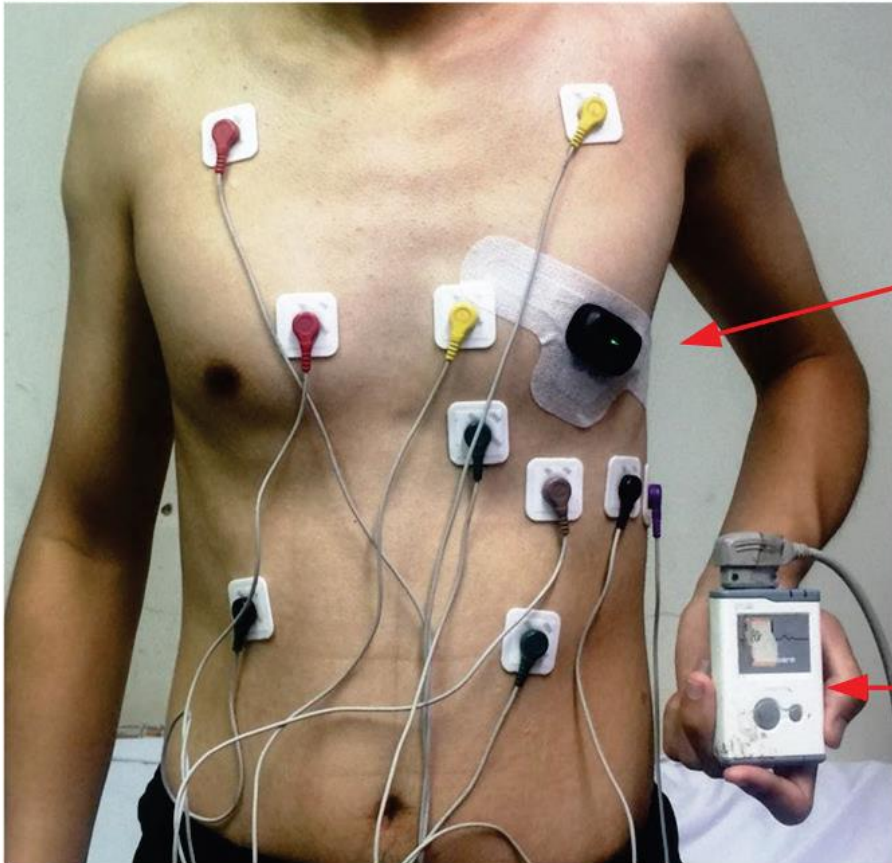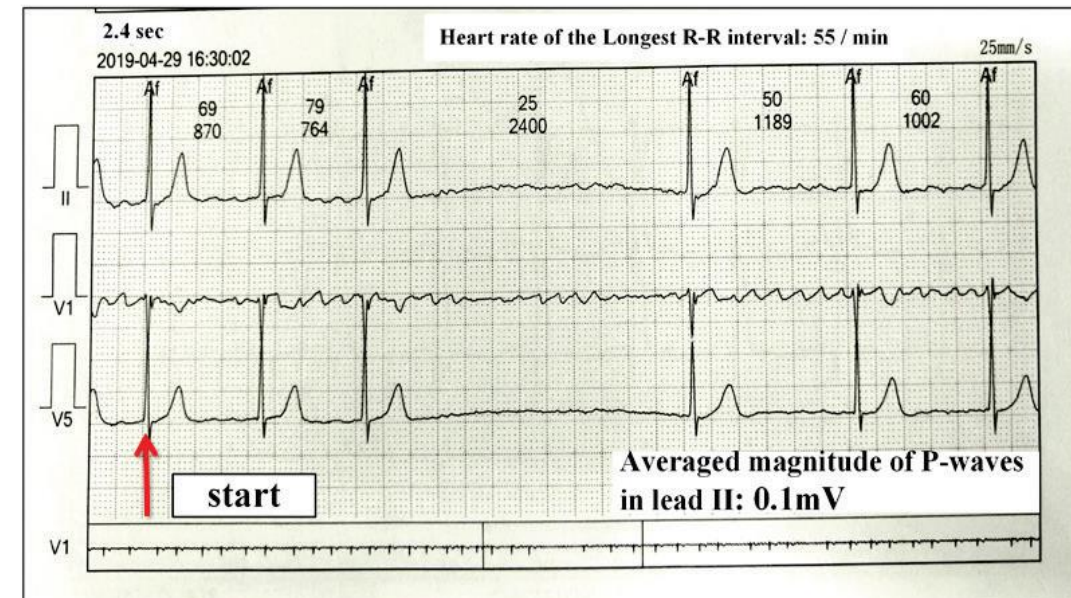
B. Collected single lead ECG with annotations

Parameters of ECG Patch:
Single lead; 250 Hz;
Modified lead;
24 hours long-term data collection;
5-day data storage;
Real-time monitoring with app;
Bluetooth or USB transmission;
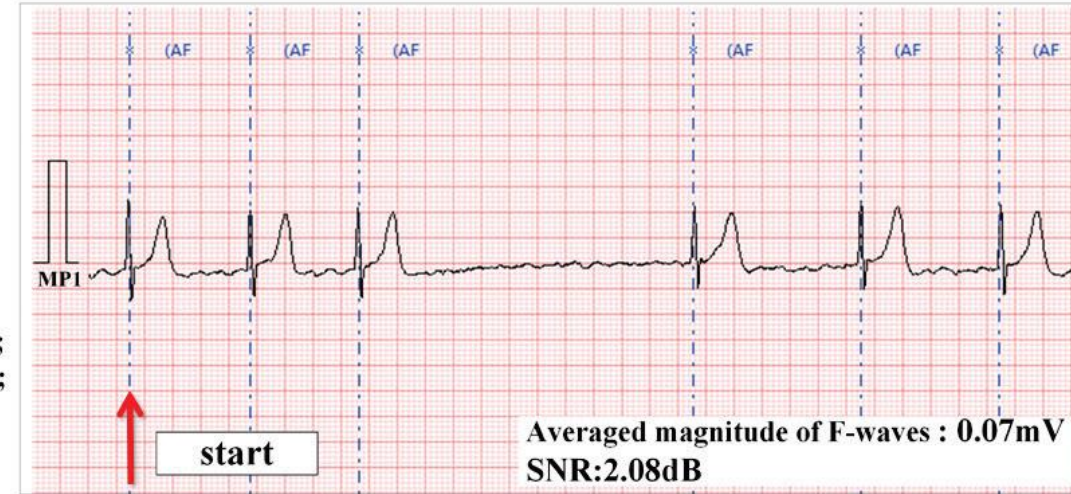
C. Clinical hard copy of standard 12-lead Holter

Parameters of Holter:
12-lead; 200 Hz;
24 hours long-term data collection;
Offline analysis with computer software;
USB transmission;

Averaged magnitude of F-waves : 0.07mV
SNR:2.08dB

Heart rate of the Longest R-R interval: 55 / min
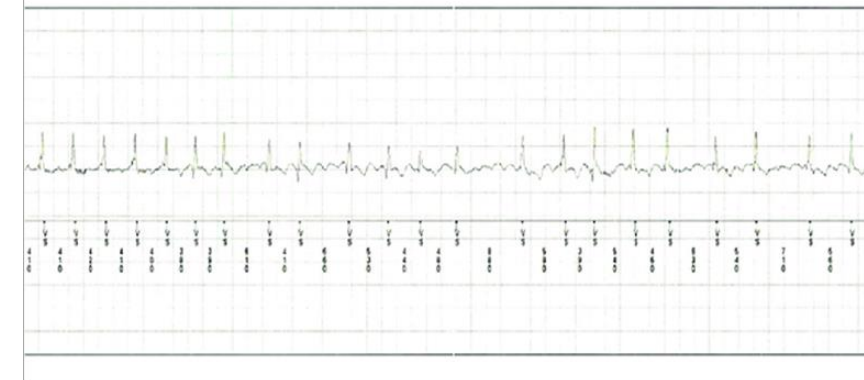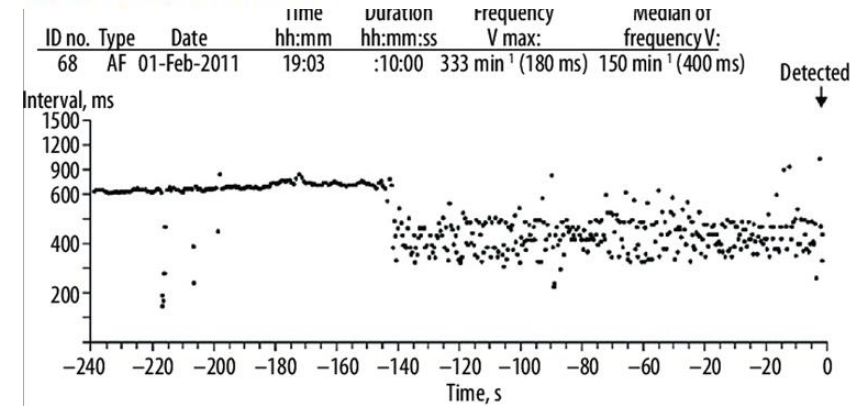
Averaged magnitude of P-waves in lead II: 0.1mV

Implantable loop recorder

- Subcutaneous, self contained rhythm recording device

- Implanted in ~20 minutes, local anaesthesia

- Battery lasts ~3 years

- Useful for detection of sporadic arrhythmias where external monitoring is not helpful or not feasible

- Often used in cases of infrequent but worrisome syncope

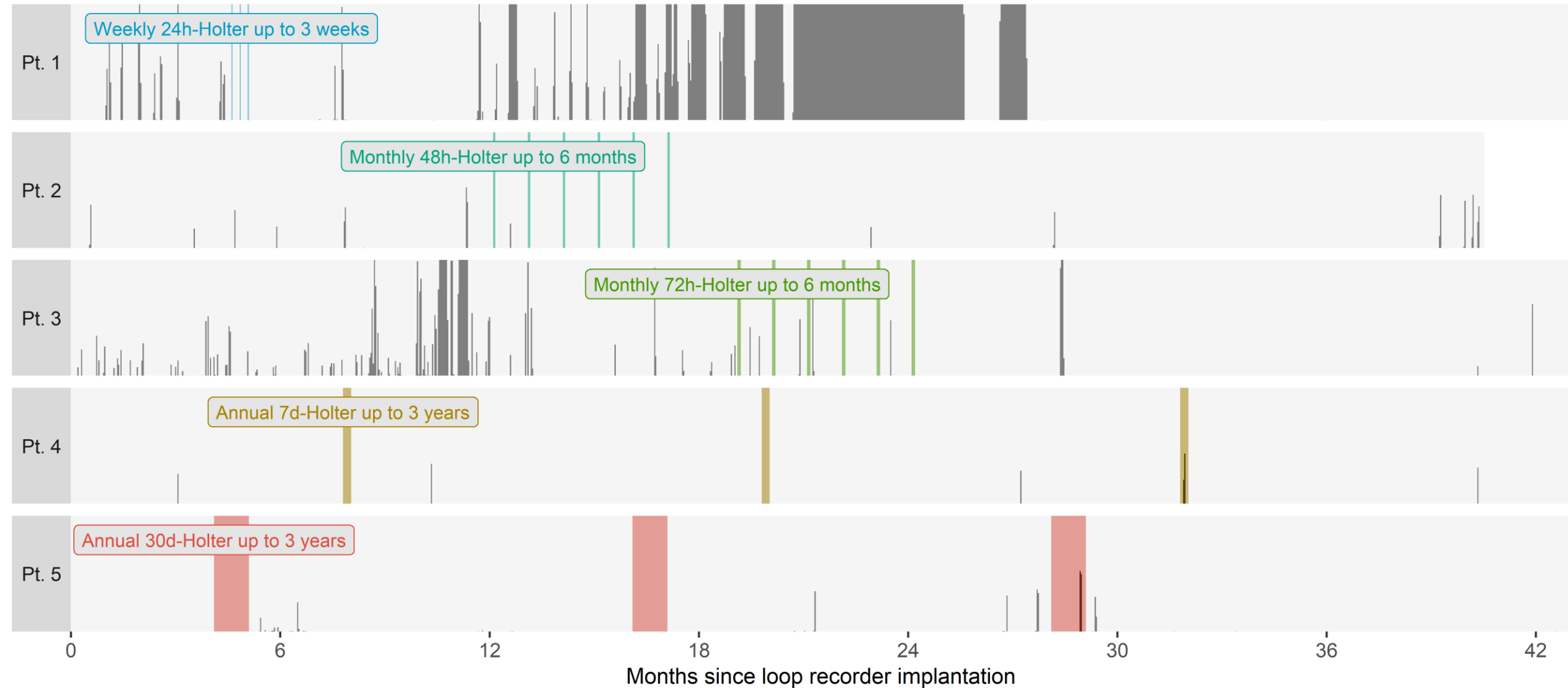- Now have AF detection algorithms that can alert for AF, even when rate is controlled

A   Medtronic REVEAL® XT

B   Reveal LINQ™

C   ST. JUDE MEDICAL SJM CONFIRM™

D   ST. JUDE MEDICAL CONFIRM Rx™ DM3500 SN: 123456

E   BioMonitor 2 BIOTRONIK Home Monitoring ⧃ BIOTRONIK
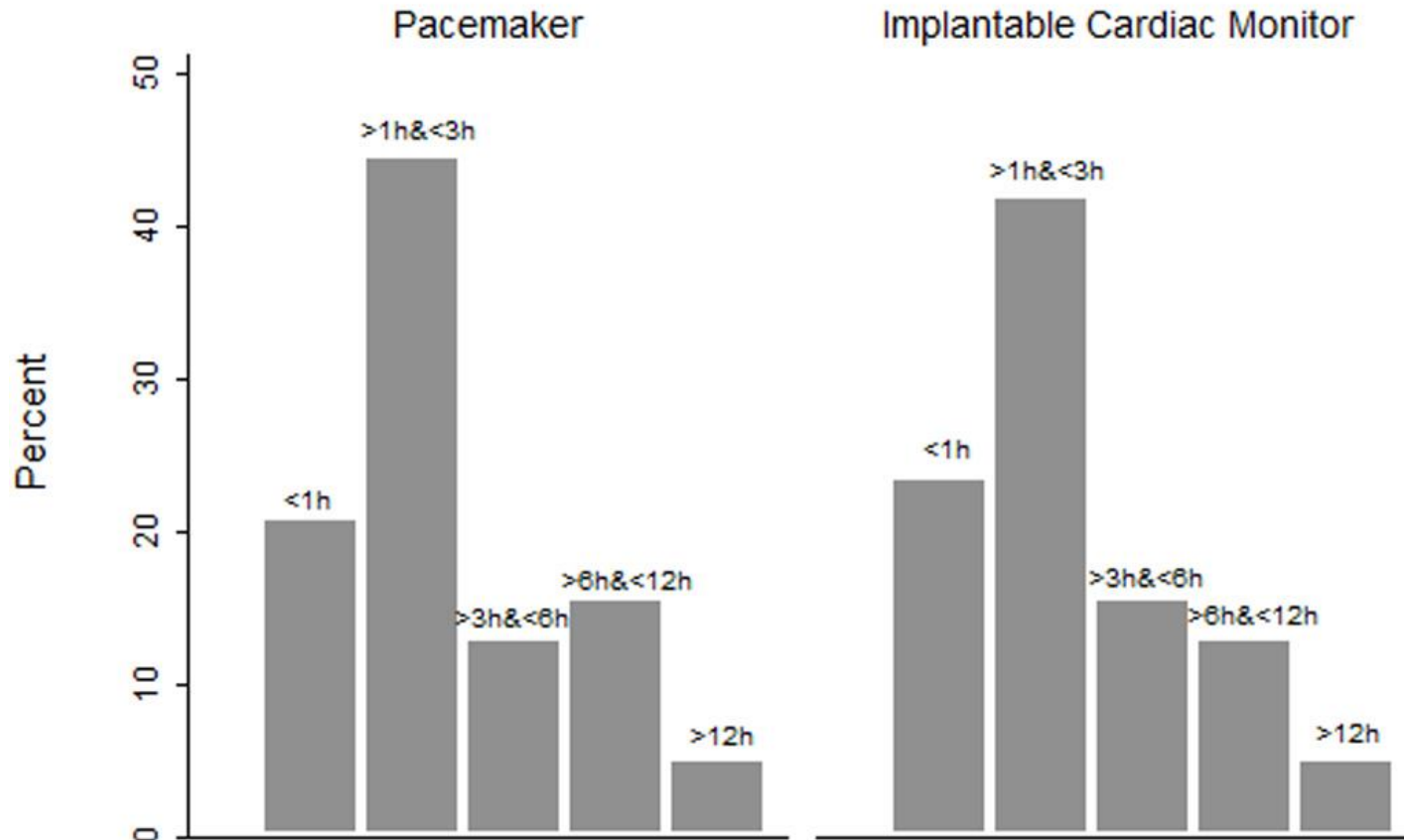

Insertion of a Reveal Linq device using a be-spoke injection tool

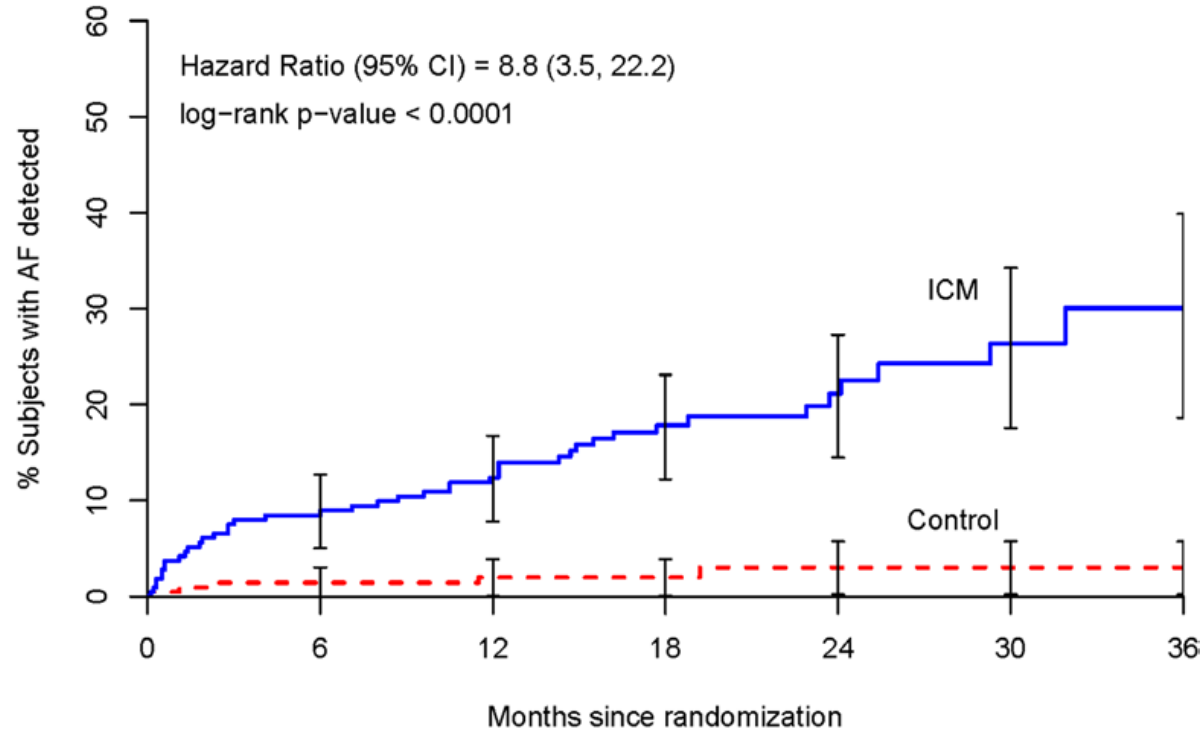ILR AF vs. external monitoring in 5 patients

ILR AF detection vs. gold standard (pacemaker)

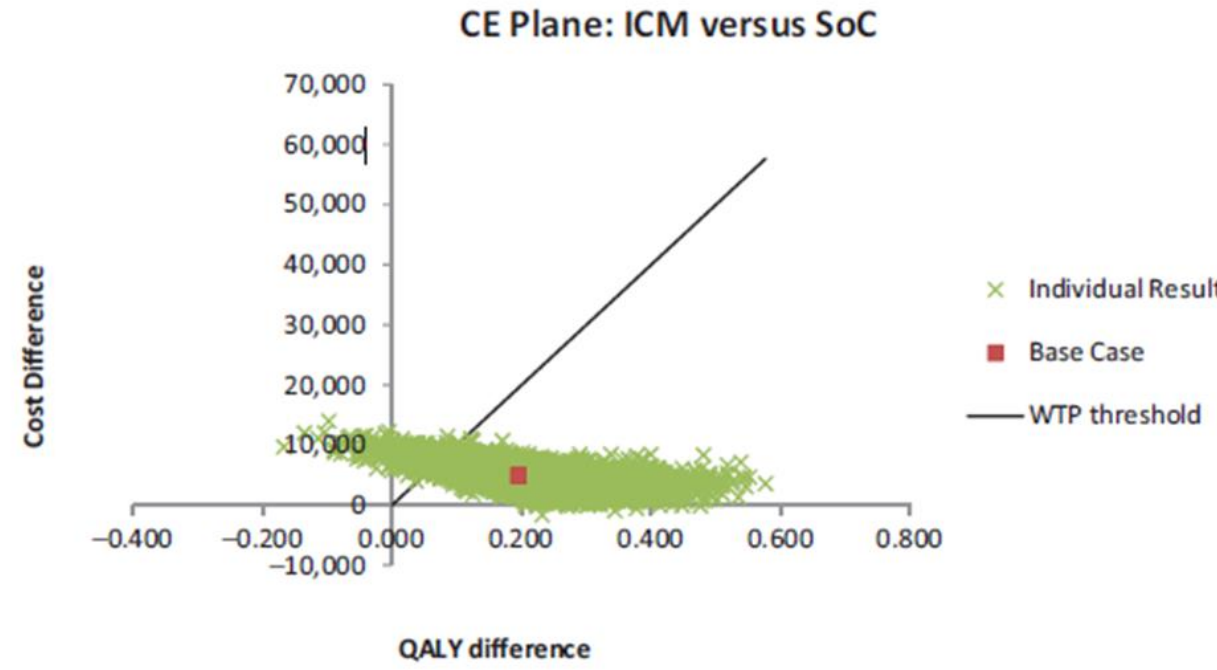
True positive AF episodes duration distribution

- Patients w/ILR upgraded to DDD pacemakers
- ILR left in until battery ran out (> 6 months)
- Good correlation of AF episodes between ILR and pacemaker

Would routine ILR after cryptogenic stroke reduce recurrent stroke?

Hazard Ratio (95% CI) = 8.8 (3.5, 22.2)
log–rank p-value < 0.0001

% Subjects with AF detected — Months since randomization

ICM

Control

at risk

	0	6	12	18	24	30	36
Control	220	194	167	114	72	36	7
ICM	221	191	173	102	57	29	8

CE Plane: ICM versus SoC

Cost Difference — QALY difference

× Individual Results
■ Base Case
— WTP threshold

- ILRs are effective at detecting AF after cryptogenic stroke
- CRYSTAL-AF substudy - Cryptogenic stroke patients who received ILR had more AF detection
  Circ Arrhythm Electrophysiol. 2016;9

- Cost effectiveness analysis suggests it would be clinically and cost effective
- Approx $28K per QALY gained
- No trial yet to prove this – need RCT evidence
  Journal of Medical Economics, 22:11, 1221-1234

Smartwatches

- Apple heart study had low detection rate of AF

- Population was very unselected (basically purchasers of apple watches)

- Poor sensitivity for automated detection

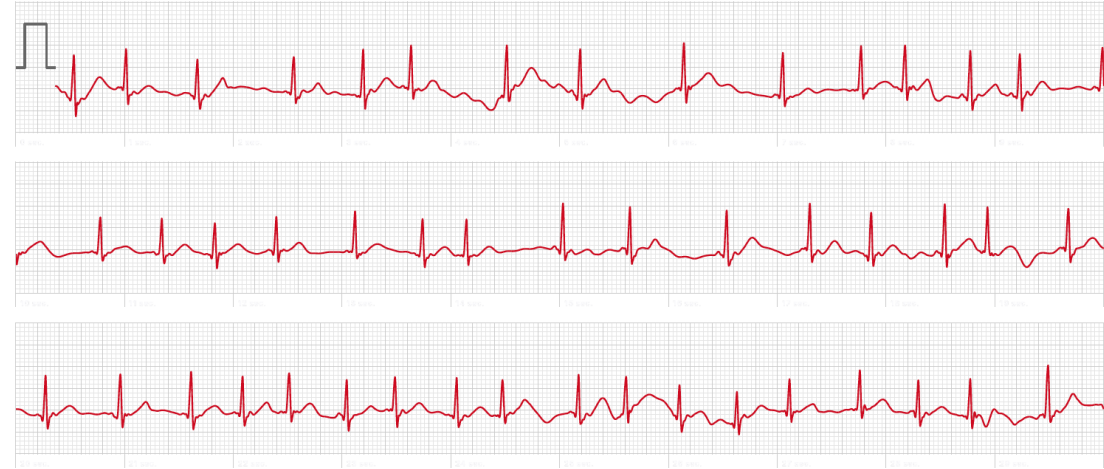- Good correlation of cardiologist PDF interpreted AF with AF on telemetry in a post CV surgery population

Atrial Fibrillation — ❤ 101 BPM Average
This ECG shows signs of AFib.

If this is an unexpected result, you should talk to your doctor.

0 mm/mV, Lead I, 513Hz, iOS 13.3.1, watchOS 5.3.1, Watch4,2 — The waveform is similar to a Lead I ECG. For more information, see Instructions for Use.

AF detected on smartwatch

Table. Rhythm Detection by the AW4 in 90 Instances of Telemetry-Confirmed AF

	AF, n (%)	SR, n (%)	Inconclusive, n (%)	No Reading, n (%)	Sensitivity, %	Specificity, %
Apple Watch notification/display	34 (38)	27 (30)	29 (32)	0 (0)	41	100
Apple Watch PDF interpretation	84 (93)	0 (0)	0 (0)	6 (7)	96	100

AF indicates atrial fibrillation; AW4, Apple Watch 4; and SR, sinus rhythm.

Rhythm was assessed with the Apple Watch 4 in 2 distinct fashions: notification/display on the watch face and offline interpretation of the PDF of the rhythm waveform stored by the Apple Heart App.

Circulation. 2020;141:702–703

Summary

- The right places to look for AF are
  - In the atrium of hearts that may have other pathologies
  - In patients who have other risk factors for AF
  - In patients in whom treatment of AF (anticoagulation, rhythm, rate control, ablation) is likely to yield benefits
- The cornerstone is ECG diagnosis
  - The longer you monitor the more likely AF is to be found
  - Look harder when there is more at stake (recurrent stroke, syncope, etc)
  - Unless AF is persistent, at least 7-14 days are recommended
  - Repeated monitoring increase detection
  - ILRs may be helpful in cryptogenic stroke
  - Poor quality evidence for smartwatches. In very selected patients may be helpful