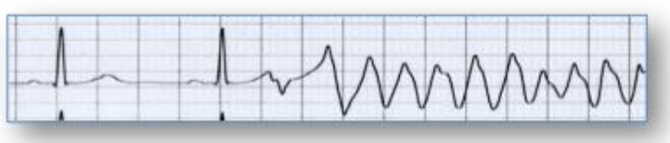
Holter Monitoring - What do all these words mean?

CM Seifer MB, FRCP(UK)



Faculty/Presenter Disclosure

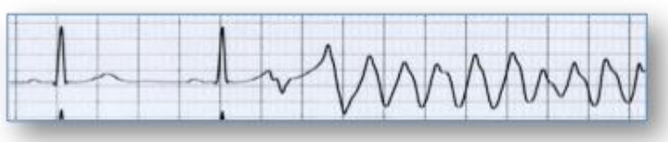
- N/A

Mitigating Potential Bias

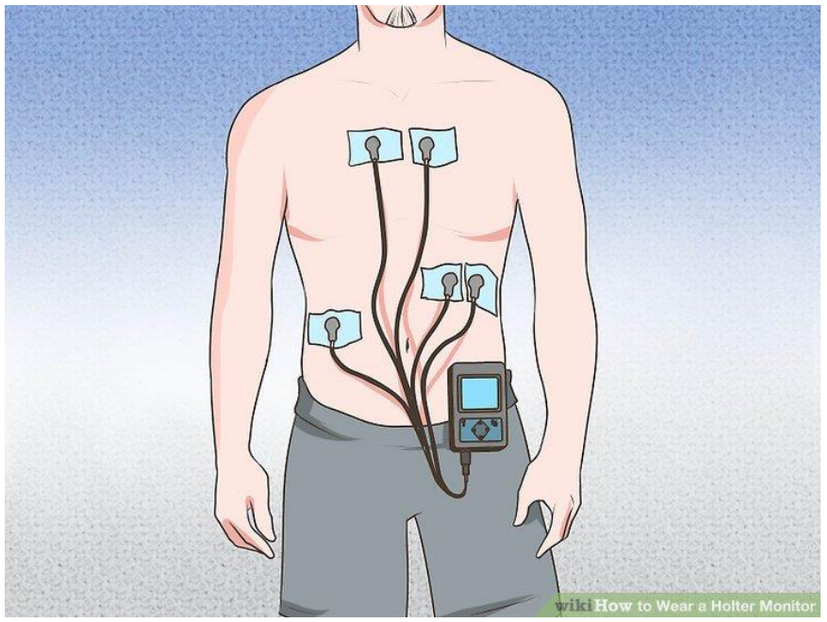
- N/A

Objectives

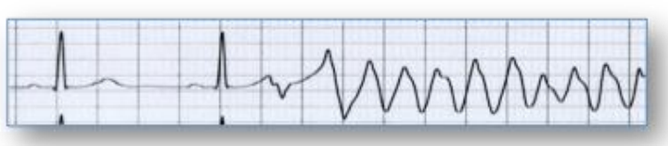
- What monitoring devices are available?
- Who should get a monitoring device?
- What information do the devices provide?
- Emerging technologies



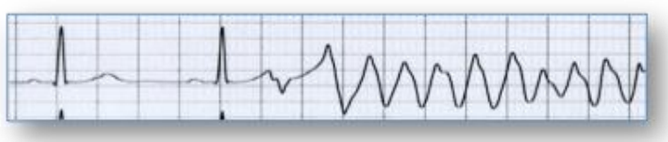
Holter Monitor



- Continuous electrocardiogram recording
- 3-5 electrodes corresponding to 2 or 3 ‘leads’
- Cardiac rhythm is recorded over 24, 48 or 72 hours

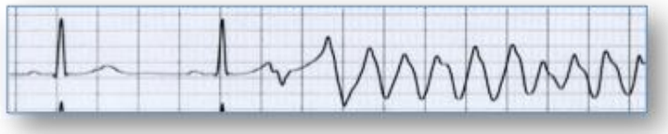


Holter Monitor

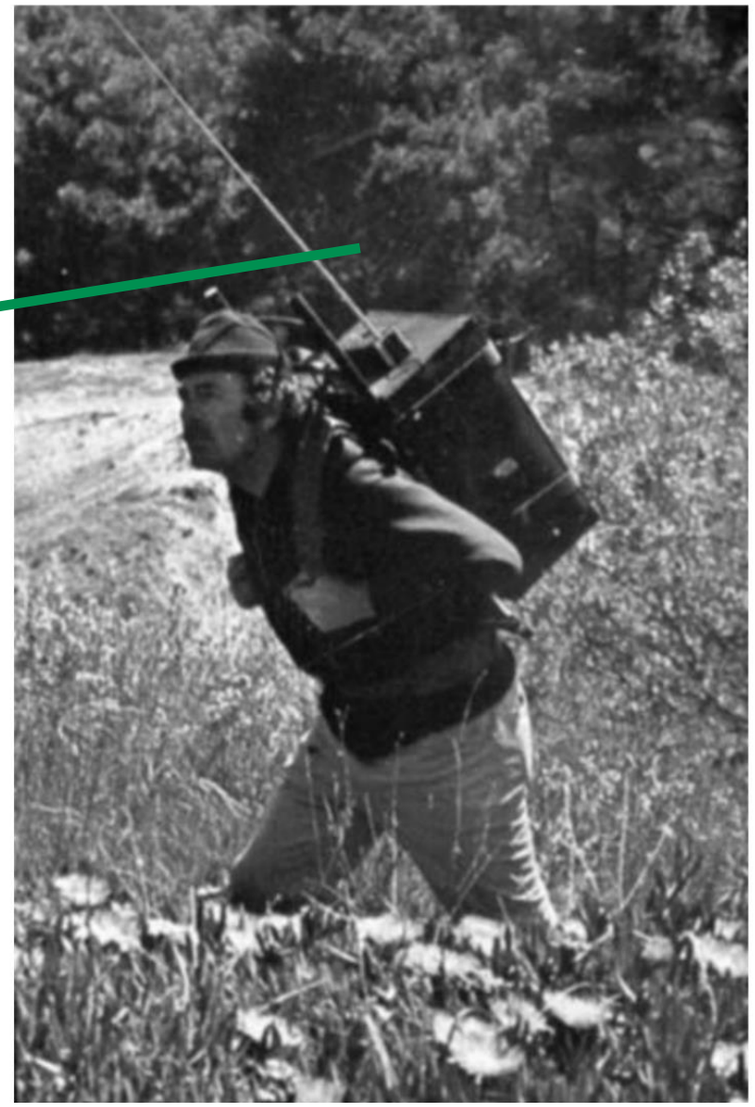


Holter Monitor

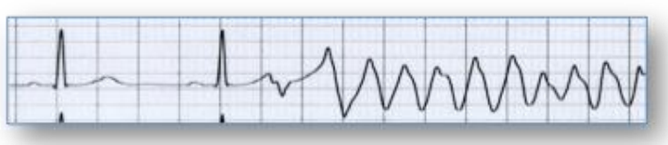
- Dr Norman J Holter
- Biophysicist
- 1940’s
- 1963 modern day Holter



85 pounds!

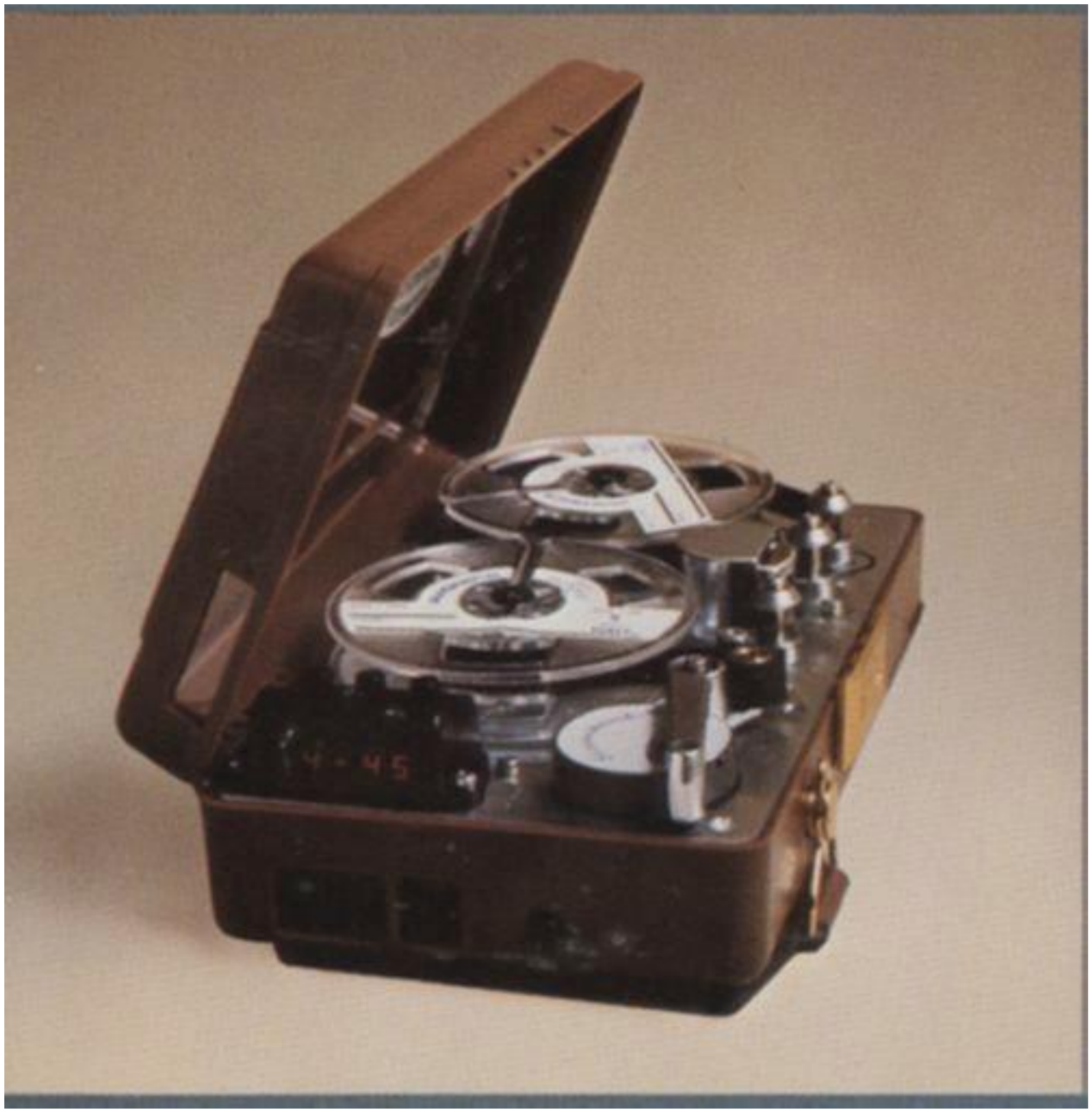


- Reel-to-reel FM tape recorder
- Large batteries
- Record and analyze ambulatory ECG data

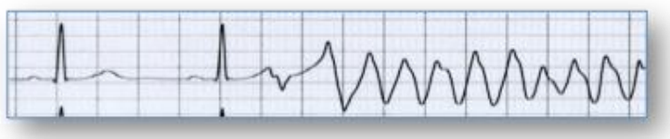


Holter 1940’s

ionics 445B Electrocardiocorder Dynamic Electrocardiography D

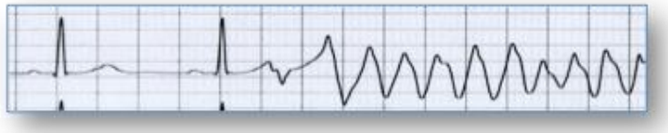


DEL MAR AVIONICS®

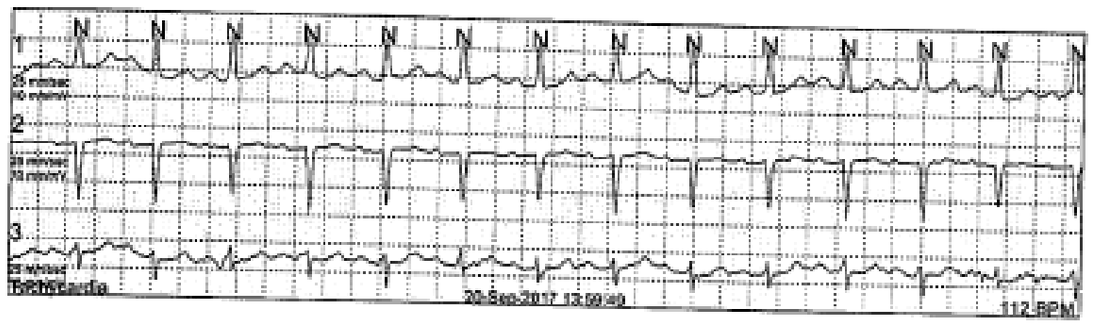


Holter Circa 1965

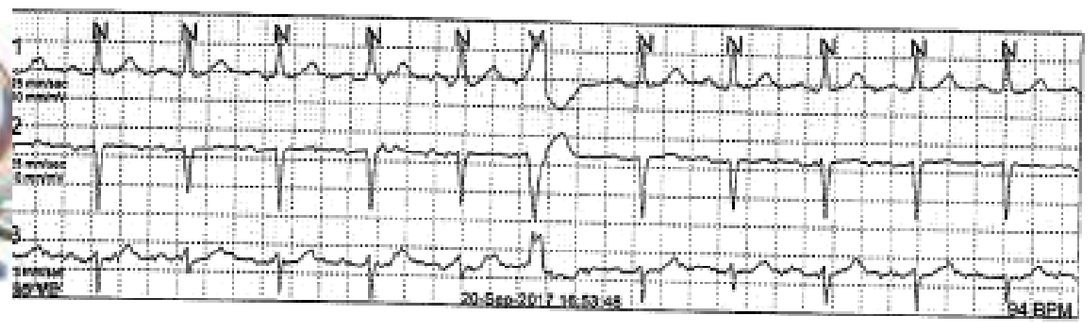
- 72 grams
- 24 hours of 2-3 channels of full-disclosure ECG

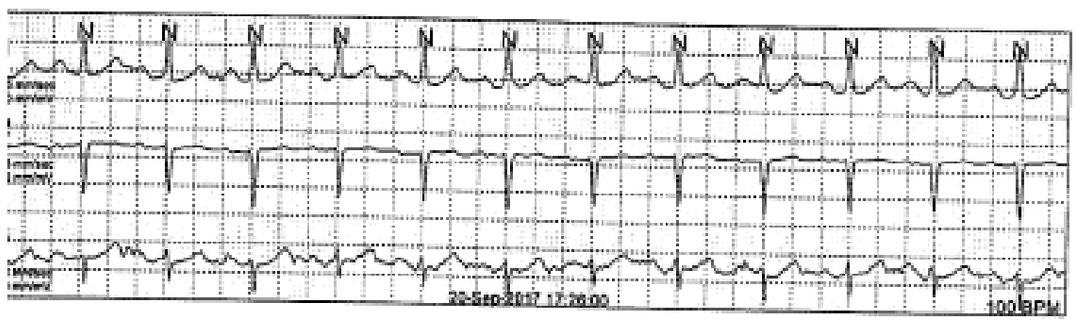


GE Company SEER Holter Circa 2016



PVC





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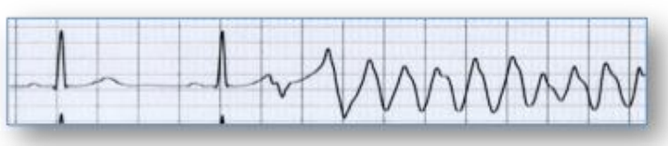

GE Company SEER Holter Circa 2016

JACC Vol. 13, No. 1
January 1989:249–58

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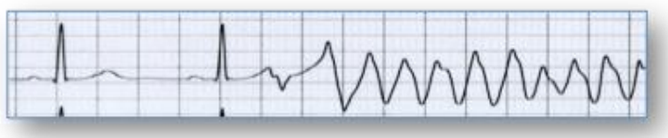
Guidelines for Ambulatory Electrocardiography

A Report of the American College of Cardiology/American Heart Association Task Force on Assessment of Diagnostic and Therapeutic Cardiovascular Procedures (Subcommittee on Ambulatory Electrocardiography)



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Vol. 34, No. 3, 1999
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PII S0735-1097(99)00354-X

ACC/AHA PRACTICE GUIDELINES

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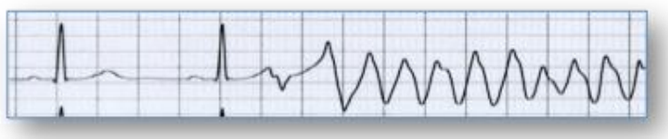
Developed in Collaboration with the North American Society for Pacing and Electrophysiology



Indications for AECG to Assess Symptoms Possibly Related to Rhythm Disturbances

Class I

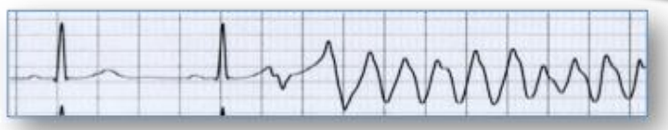
1. Patients with unexplained syncope, near syncope, or episodic dizziness in whom the cause is not obvious
2. Patients with unexplained recurrent palpitation

Class IIb

1. Patients with episodic shortness of breath, chest pain, or fatigue that is not otherwise explained
2. Patients with neurological events when transient atrial fibrillation or flutter is suspected
3. Patients with symptoms such as syncope, near syncope, episodic dizziness, or palpitation in whom a probable cause other than an arrhythmia has been identified but in whom symptoms persist despite treatment of this other cause

Class III

1. Patients with symptoms such as syncope, near syncope, episodic dizziness, or palpitation in whom other causes have been identified by history, physical examination, or laboratory tests
2. Patients with cerebrovascular accidents, without other evidence of arrhythmia



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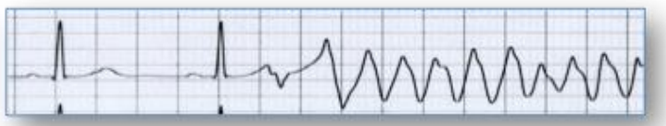
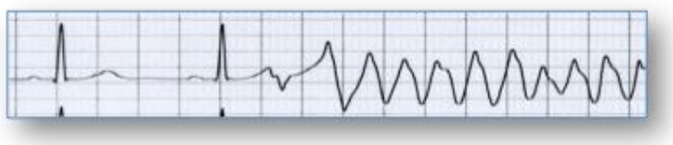
Diagnostic yield 8.6%

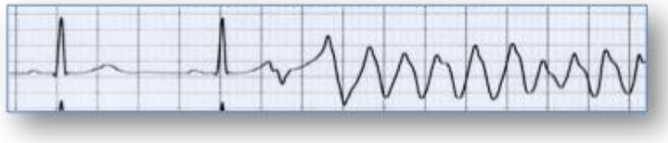


External Event Monitors

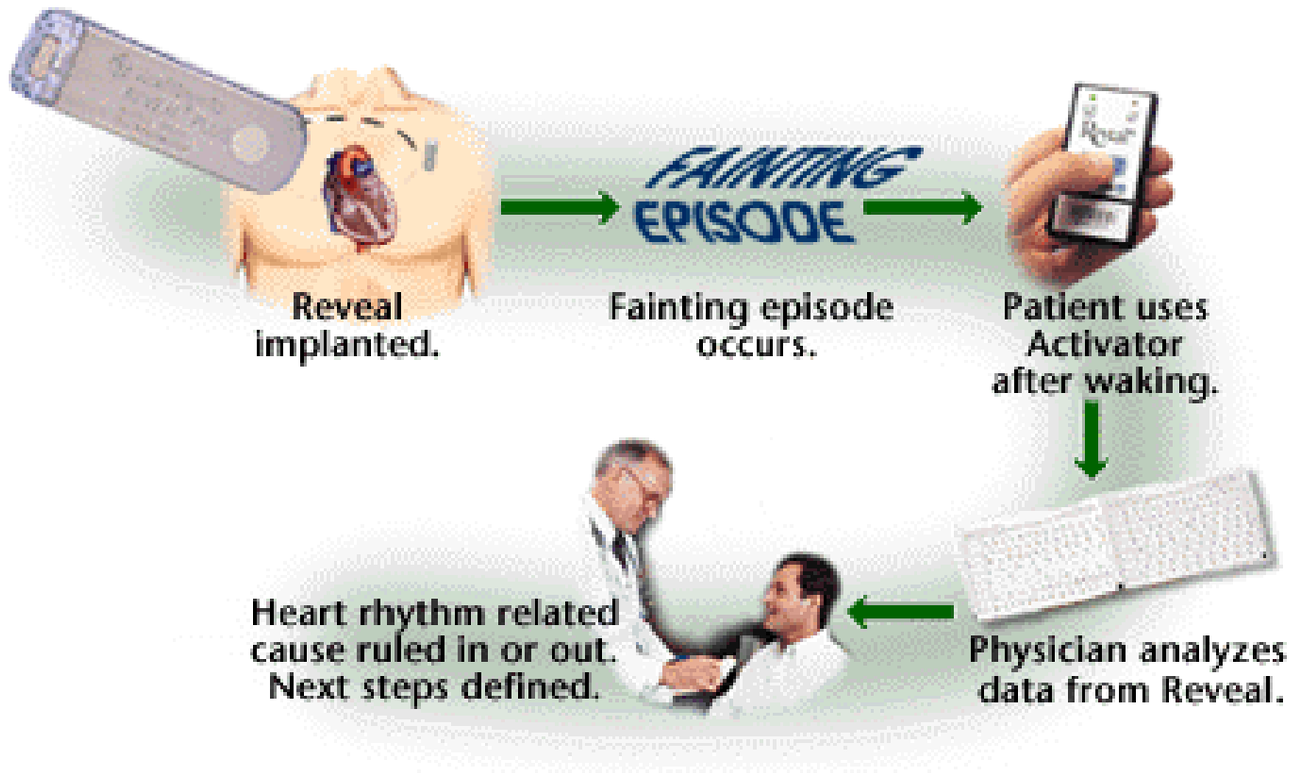
- External devices attached to patients via one to three electrodes
- They can be patient-activated or triggered automatically
- Transtelephonic
- Loop recorder



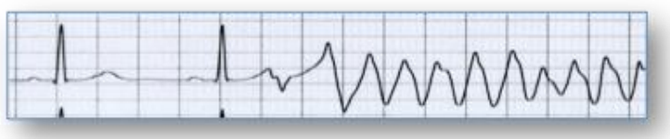

RECORD
microER
CORDIGITAL
TELEMEDICAL SOLUTIONS



Implantable Monitors

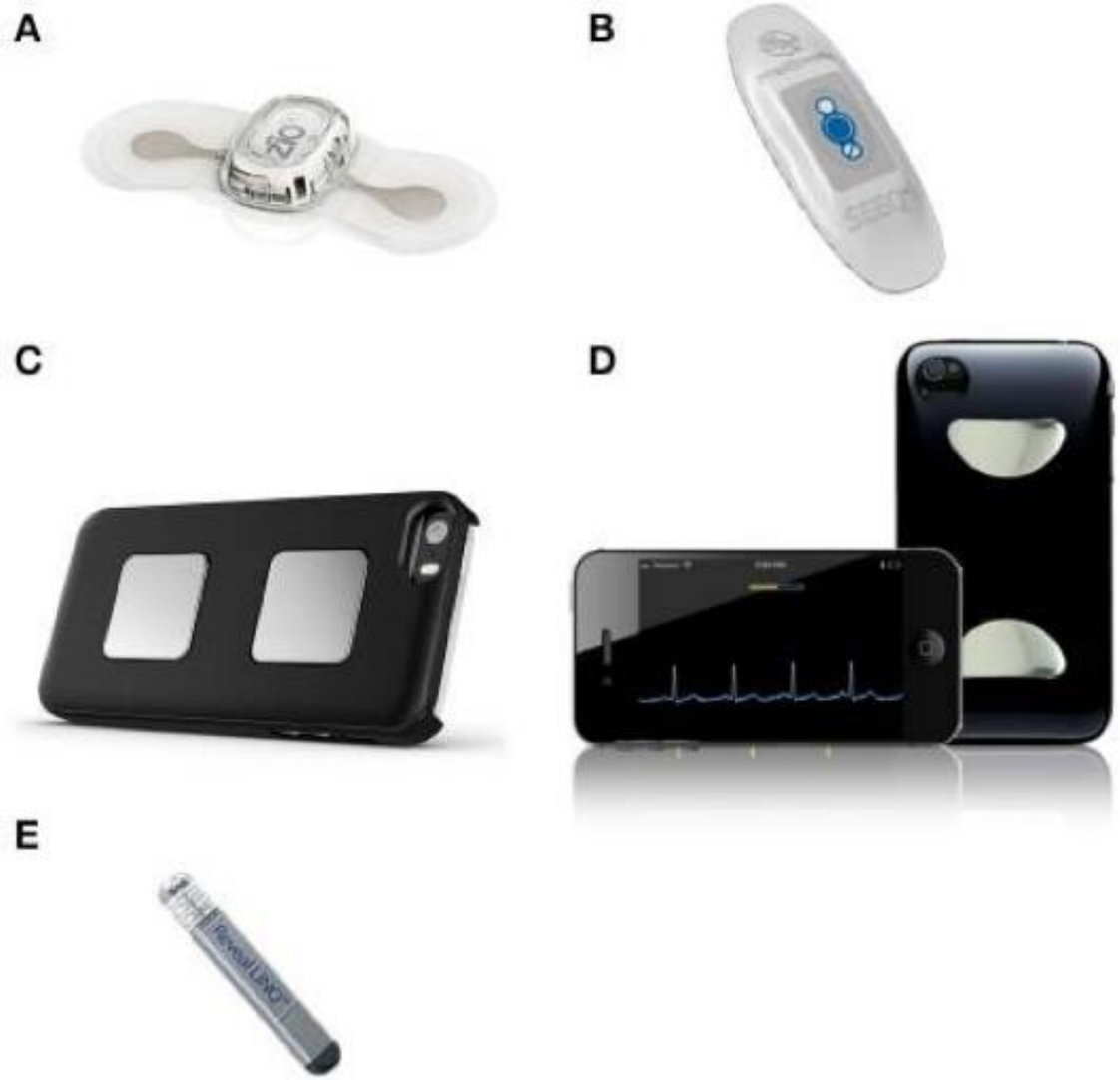


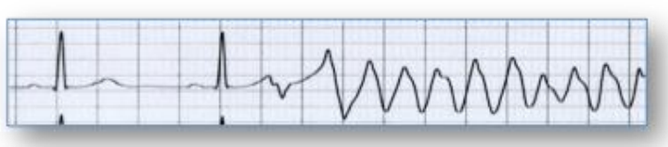
Continuous monitoring
3 years duration



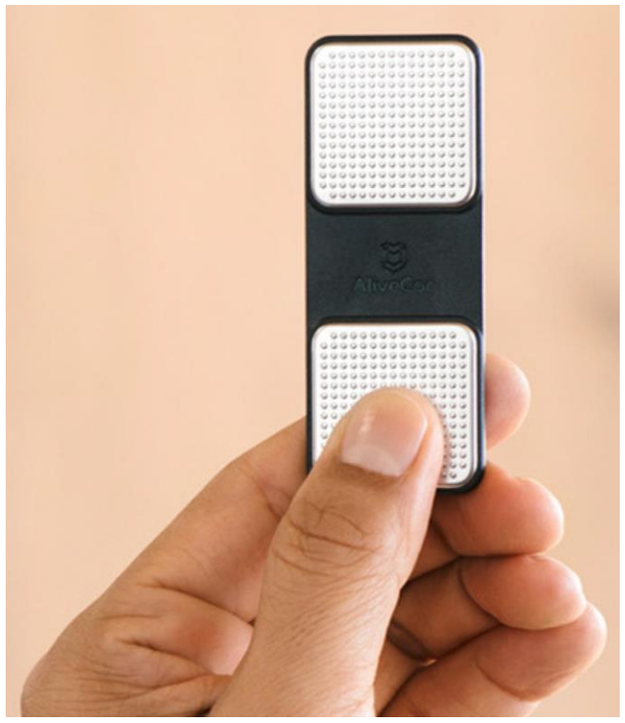
Emerging Technologies

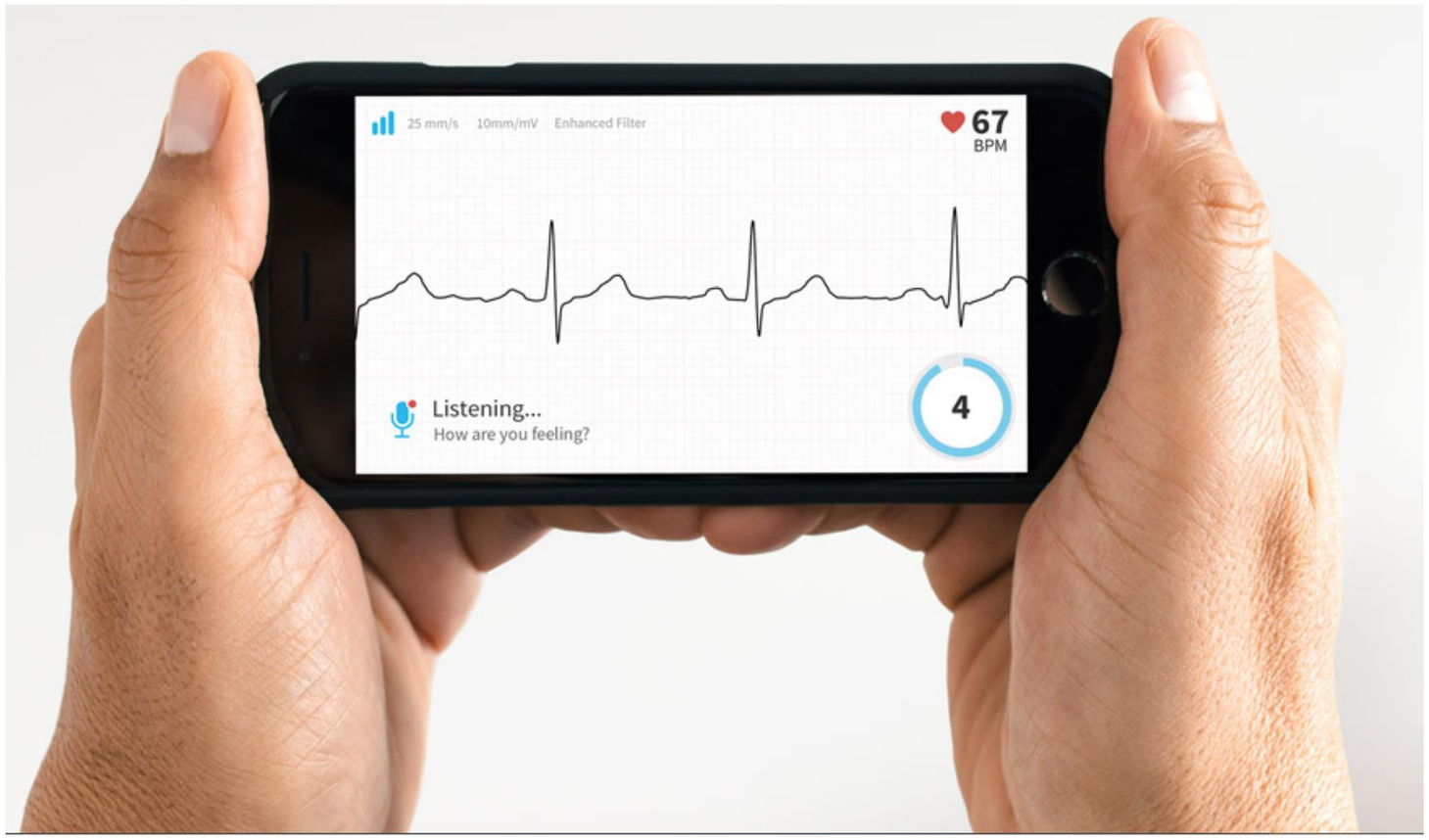
- 7 and 14 day Holters
- 30 day continuous monitors
- 3 year remote monitors

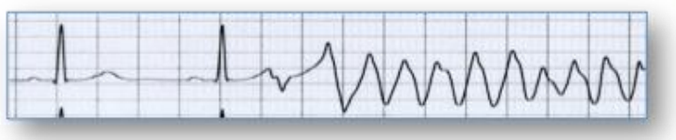




Smartphone ECG

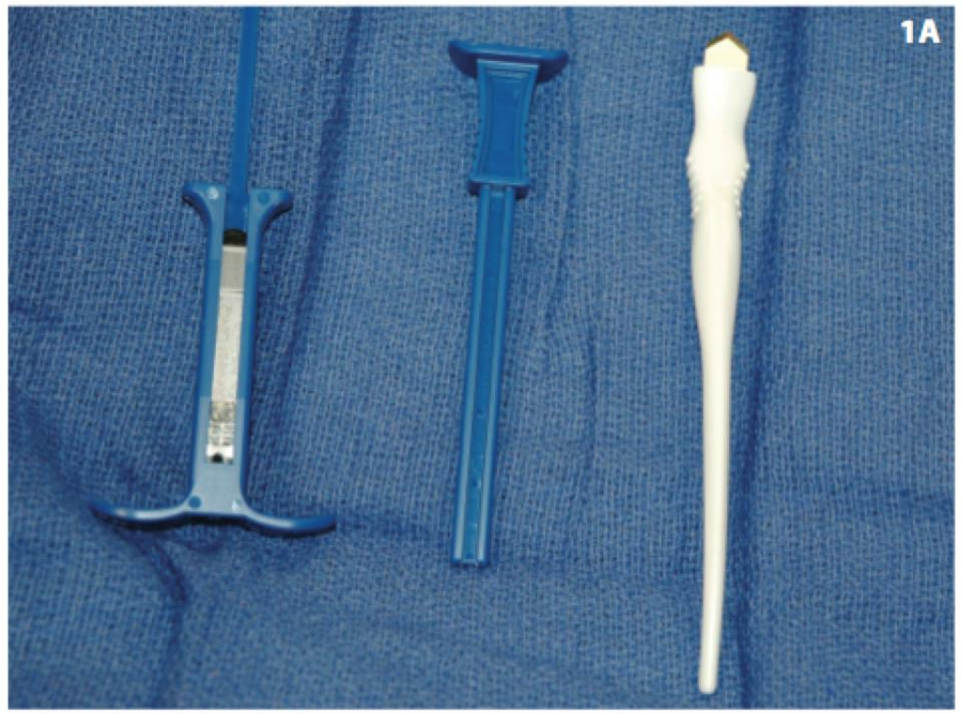






AliveCor Inc, San Francisco,

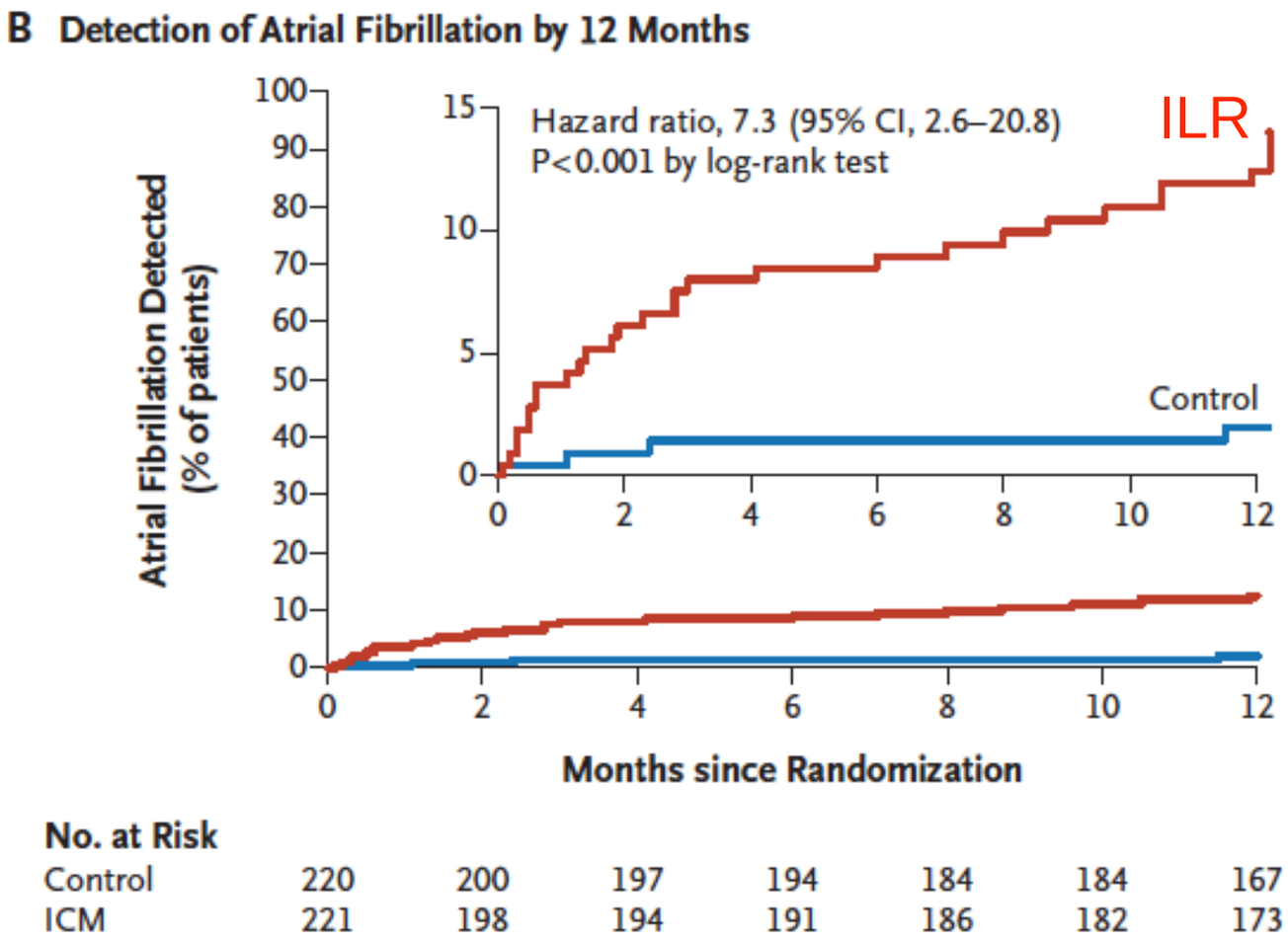
Implantable Loop Recorder (ILR)



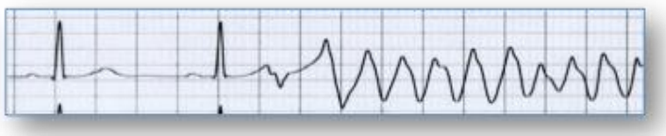
- 3 grams
- 3 year battery life

Medtronic Inc, Frindley MI

Searching for AF In Cryptogenic Stroke

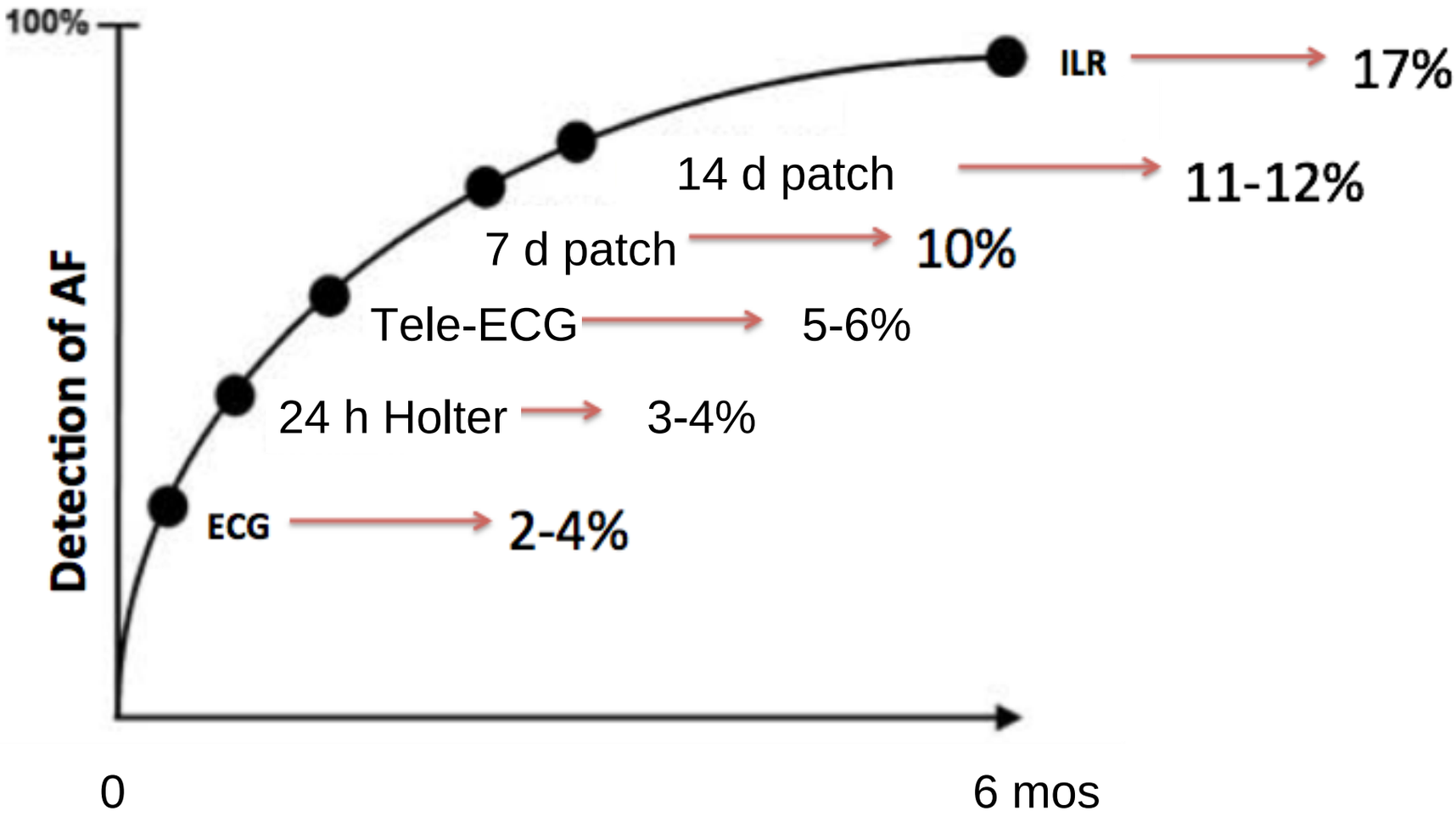


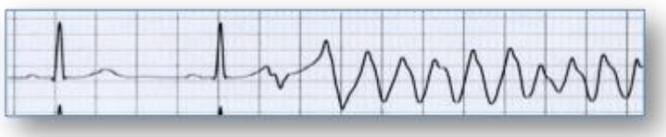
Cryptogenic Stroke: Cause unknown after echo, ECG, CT/MRI



Sanna T, *et al*., *NEJM* 2014;371(13)

AF Detection After Stroke



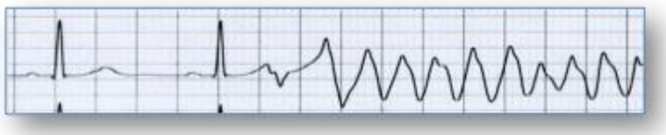


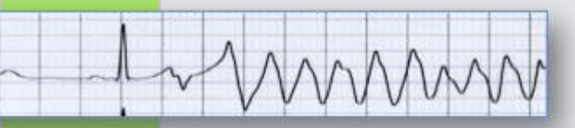
Slide Courtesy of AD Krah

Older Adults with Unexplained Syncope

Table 1. Characteristics of Individuals with Tachyarrhythmia and Bradyarrhythmia Diagnosed Using an Implantable Loop Recorder

Age	Baseline ECG	Months to First Syncope	Activation	Rhythm
Individuals with bradyarrhythmia				
88	Sinus bradycardia	10	Automatic	Marked sinus bradycardia
83	LAFB, right BBB	1	Automatic	Sinus bradycardia, sinus pause
87	1° AVB	11	Automatic	Sinus bradycardia, sinus pause
86	Sinus rhythm, inferior QWMI	1	Individual	Sinus pause
78	Sinus rhythm	1	Automatic	Sinus pause
81	LVH	21	Automatic	Sinus pause
86	Sinus rhythm, anterior QWMI	22	Individual	Sinus pause
86	1° AVB	1	Individual	2°AVB type 1
86	1°AVB	1	Individual	Junctional bradycardia
84	Sinus bradycardia	3	Individual	Junctional bradycardia
77	1° AVB	7	Automatic	CHB
80	1° AVB, LAFB	10	Individual	CHB
Individuals with tachyarrhythmia				
82	LAFB	1	Automatic	AF with RVR
86	1° AVB, LAFB	1	Individual	AF with RVR
75	1° AVB	2	Automatic	AF with RVR
87	Sinus bradycardia, LAFB	2	Individual	AF with RVR
86	AF, right BBB	3[a]	Automatic	AF with RVR
78	Sinus rhythm	4	Individual	AF with RVR
85	LAFB	4[a]	Automatic	AF with RVR
81	Sinus rhythm, LPFB	7	Individual	AF with RVR
90	Sinus rhythm, premature ventricular complexes	14	Automatic	AF with RVR
77	AF with controlled ventricular rate	14	Automatic	AF with RVR
81	Sinus bradycardia	14[a]	Automatic	AF with RVR
75	Sinus rhythm	16	Individual	AF with RVR
82	Sinus rhythm, left BBB	20[a]	Automatic	AF with RVR



	APPROPRIATE USE		INAPPROPRIATE USE
	To assess ventricular rate control in permanent atrial fibrillation or atrial flutter		Routine screening for atrial fibrillation or atrial flutter
	*To evaluate for atrial fibrillation or atrial flutter in patients with cryptogenic stroke, particularly in the absence of other risk factors for stroke		To evaluate for atrial fibrillation or atrial flutter in patients with stroke due to known atrial fibrillation or atrial flutter, or another identifiable cause for neurological event, or if there is another indication for anticoagulation
	To screen for ventricular ectopy in patients with hypertrophic cardiomyopathy or arrhythmogenic right ventricular cardiomyopathy; Consider in patients with other inheritable arrhythmia syndromes for risk assessment		Patients whom already have an indication for an ICD
	Patients with congenital or some cases of acquired complete heart block to assess for permanent pacemaker		Patients whom already have an indication for or pacemaker
	Patients with cardiomyopathy suspected to be induced by very frequent ventricular ectopy		
	Unexplained syncope or pre-syncope suspected to be due to a cardiac arrhythmia and anticipated to occur during duration of monitoring		Rare or infrequent syncope or pre- syncope, or if other causes are present to explain syncope or pre-syncope (eg vasovagal)
	Unexplained symptomatic palpitations anticipated to occur during monitoring		Unexplained palpitations occurring infrequently
			To evaluate for symptomatic or asymptomatic coronary artery disease.
			Assessment or routine follow up for ICD or pacemaker malfunction when device interrogation, ECG, or other available data are sufficient to establish an underlying cause or diagnosis

Today's Challenges In Ambulatory ECG

- Establishing Cost-Efficacy
- Demonstrating benefit of AF screening
- Integrating new technologies
- Harnessing the power of consumer technology