

Cardiostim EHRA Europace 2016, Nice - June 8-11, 2016

Remote Monitoring & the Smart Home of the 21st Century

Antonio Raviele, MD, FESC, FHRS

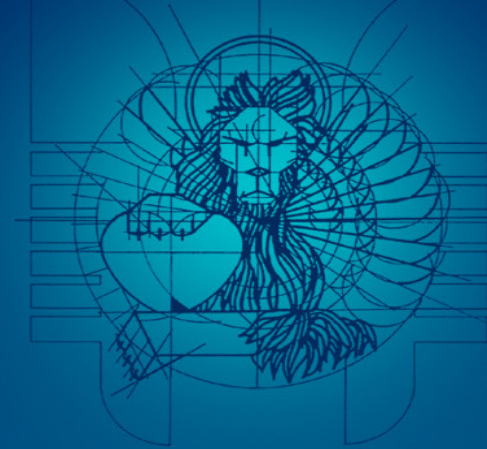
President ALFA – -Alliance to Fight Atrial fibrillation- Venezia

Syncope / Definition



- Syncope is defined as a transient loss of consciousness characterized by rapid onset, short duration, and spontaneous complete recovery, and due to transient global cerebral hypoperfusion.

Syncope / Causes



- Syncope may be the **common presentation of different conditions**, spanning from harmless, such as neurally-mediated or reflex syncope, to life-threatening, such as **cardiac arrhythmias**.

Syncope / ECG registration



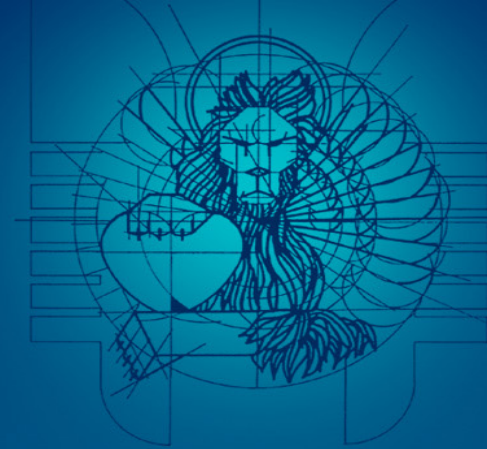
- The electrocardiogram registration during syncope allows physicians either to confirm or exclude an arrhythmia as the mechanism of syncope.

Syncope / ECG monitoring



- **Standard ECG** has limited value in diagnosing the cause of syncope when the arrhythmias are intermittent (as often occurs). In these cases, prolonged ambulatory or **remote electrocardiographic monitoring** are usually employed.

Falls / Epidemiology



- Falls are among the **most common and serious problems facing older adults** (more than 30% of people aged 65 years and over experience a fall) and are associated with considerable mortality, morbidity and reduced functioning.

Falls / Smart Home



- Smart Home health technologies are modern tools that allow to monitor human motion and may help to predict and detect falls in a home-based environment.

Recommendations for the Use of AECG Monitoring Techniques in Patients with Symptoms of Possible Arrhythmic Origin

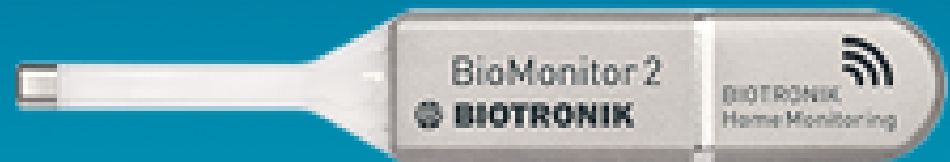
	Holter Monitoring	Event Recorders	External Loop Recorders/MCOT	Implantable Cardiac Monitors
Advantages	low cost; possibility to record asymptomatic arrhythmias	low cost; easy to use	retrospective and prospective ECG records; possibility to record asymptomatic arrhythmias automatically	retrospective and prospective ECG records; quite good ECG records; monitoring capability up to 36 months; possibility to record asymptomatic arrhythmias automatically
Limits	monitoring limited to 24–48 hours; size may prevent activities that may trigger the arrhythmias	monitoring cannot be carried out for more than 3–4 weeks; short-lasting arrhythmias are not recorded; arrhythmic triggers are not revealed; poor ECG records	monitoring cannot be carried out for more than 3–4 weeks; continual maintenance is required; devices are uncomfortable; quite poor ECG records	invasiveness; risk of local complications at the implantation site
Indications	intersymptom intervals <1 week; noncompliant patients	infrequent, fairly long-lasting, and noninvalidating symptoms; compliant patients	intersymptom intervals ≤ 4 weeks, short-lasting and/or invalidating symptoms; very compliant patients	Infrequent, short-lasting and/or invalidating symptoms; noncompliant patients

Implantable Loop Recorders



- The ILRs are single-lead ECG monitoring devices that are implanted subcutaneously in the left parasternal region. They have a retrospective (loop) memory that continuously records and delete the patient's ECG.
- The devices are capable of storing ECG data in response to patient activation or automatically in response to predefined arrhythmias.

Implantable Loop Recorders

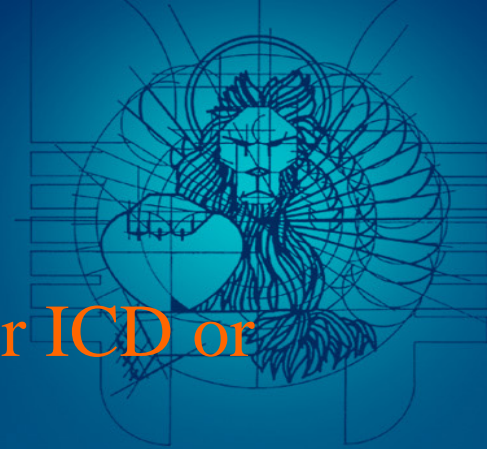


Syncope / Key points for use of ILR



- Exclude short-term high-risk patients that require immediate hospitalization or early intensive evaluation & treatment
- Include patients with a high probability of recurrence of syncope in a reasonable time period
- Be prepared to wait for a substantial time before obtaining a correlation between ECG findings & syncopal relapse

Immediate hospitaliz / evaluation



- Patients in which there is a **clear indication for ICD or pacemaker** treatment

(independently of a definite diagnosis of the cause of syncope)

- Patients with **severe structural cardiovascular** or coronary artery **disease**

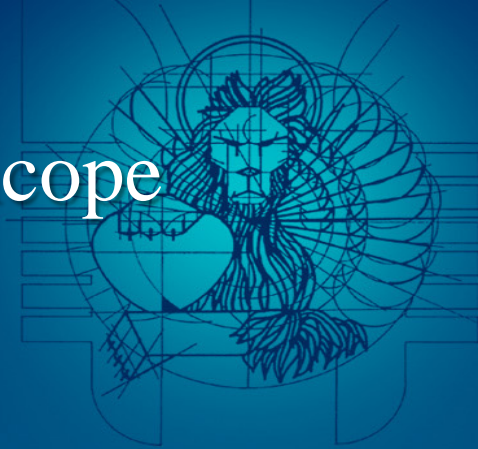
(heart failure or low ejection fraction or previous myocardial infarction)

- Patients with **important comorbidities**

(severe anaemia, electrolytic disturbance, etc)

- Patients with clinical or **ECG features** suggesting an **arrhythmic syncope**

Clinical/ECG features of arrhythmic syncope



- Syncope during exertion or supine
- Palpitations at the time of syncope
- Family history of SD
- Non-sustained VT
- Bundle branch block (QRS duration 0.12 s)
- SB (<50) or SAB in absence of negative chronotropic drugs
- Pre-excited QRS complexes
- Prolonged or short QT interval
- RBBB pattern with ST-elevation in leads V1–V3 (Brugada)
- Negative T waves & epsilon in leads V1-V3 (ARVC)

High probability of recurrence of syncope



- Number of episodes of and frequency of syncope are the strongest predictors of recurrence

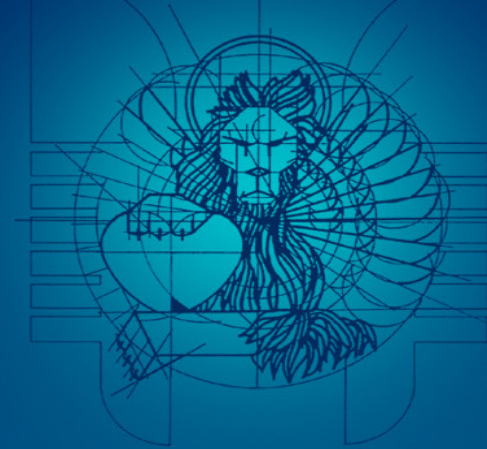
Risk of syncope recurrence

patients >40 years



No of syncopes during life	Risk of recurrence of syncope after the index episode	
	Actuarial risk 1 yr (%)	Actuarial risk 2 yrs (%)
1–2	15.4	19.7
3	36.5	41.7
4–6	37.0	43.8
7–10	37.5	43.7
>10	44.3	56.4

Syncope / Interpretation of ILR



Class I

ILR findings are diagnostic when:

- a correlation between syncope and an arrhythmia (brady- or tachyarrhythmia) is detected (*L of evidence B*)
- in the absence of such correlation, periods of Mobitz II or III degree AV block or a ventricular pause >3 s or rapid prolonged (i.e. ≥ 160 bpm for >32 beats) paroxysmal atrial or ventricular tachyarrhythmias are detected (*L of evidence C*)

Syncope / Interpretation of ILR



Class I

ILR findings exclude an arrhythmic cause when

- there is no correlation between syncope and rhythm variation (*L of evidence B*).

Syncope / Interpretation of ILR



Class III.

- ILR findings are not diagnostic and monitoring should be continued in case of:
- Pre-syncope without any relevant arrhythmias (*L of evidence C*).
- Asymptomatic arrhythmias (other than those listed above) (*L of evidence C*).
- Sinus bradycardia (in absence of syncope) (*L of evidence C*)



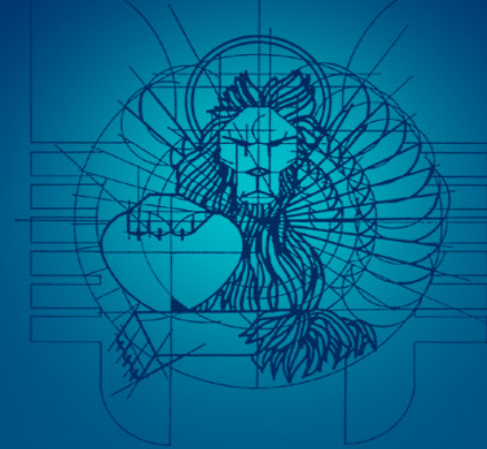
The Etiology of Syncope in Patients With Negative Tilt Table and Electrophysiological Testing

Andrew D. Krahn MD; George J. Klein, MD; Caro Norris, RN; Raymond Yee, MD

Circulation 1995; 92:1819–26.

Unexplained syncope / Late ILR

Pooled data from 11 studies



Diagnostic yield

35%
(176/506)

Moya Circulation 2001, Menozzi Circulation 2002, Brignole Circulation 2001, Krahn Circulation 1995, Khran Ciculation 1999,
Nierop PACE 2000, Boersma Europace 2004, Lombardi Europace 2005, Pierre Europace 2008

Possible NM syncope/ Early ILR

Pooled data from 11 studies



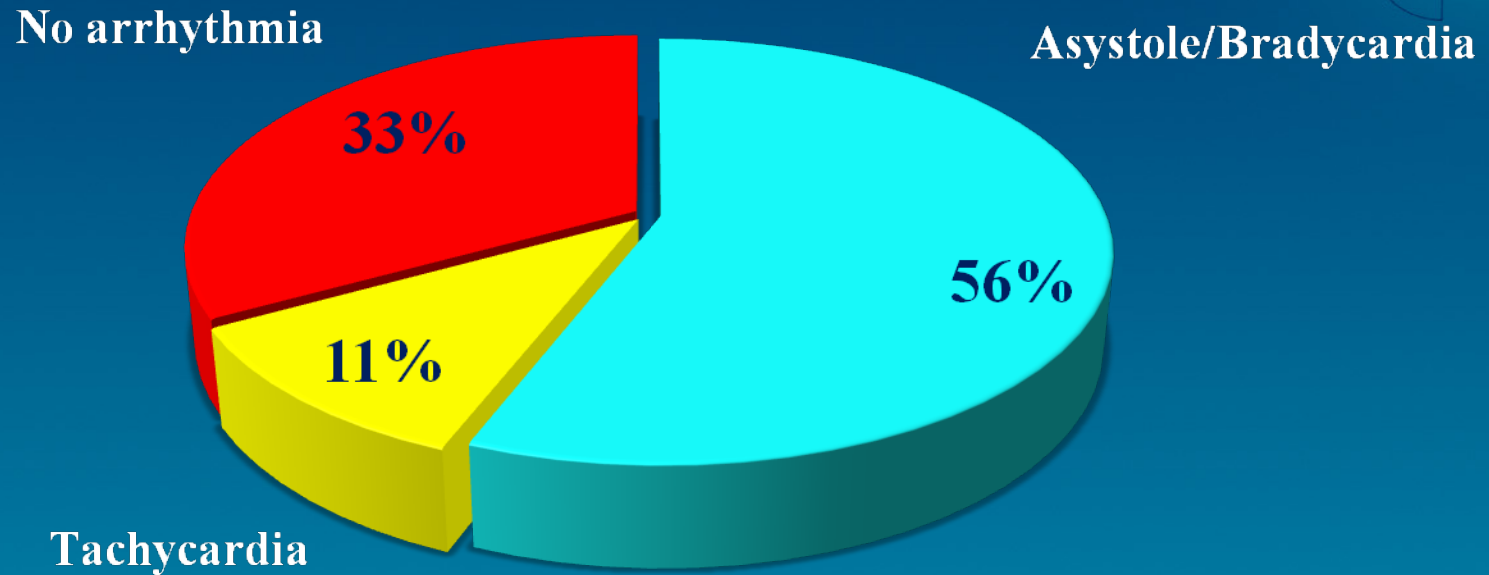
Diagnostic yield

27%
(106/392)

Moya Circulation 2001, Menozzi Circulation 2002, Brignole Circulation 2001, Krahn Circulation 1995, Khran Ciculation 1999,
Nierop PACE 2000, Boersma Europace 2004, Lombardi Europace 2005, Pierre Europace 2008

Unexplained syncope / Late ILR

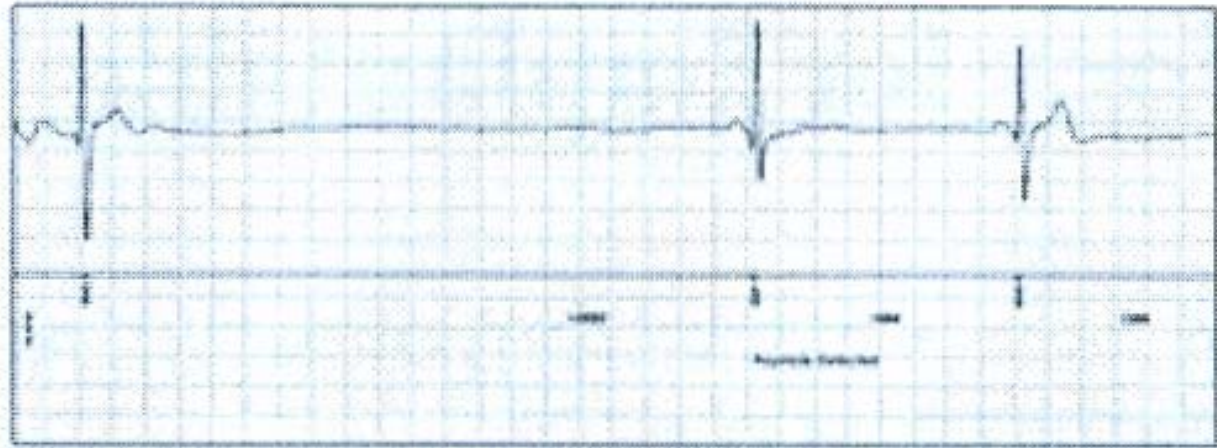
Pooled data from 11 studies



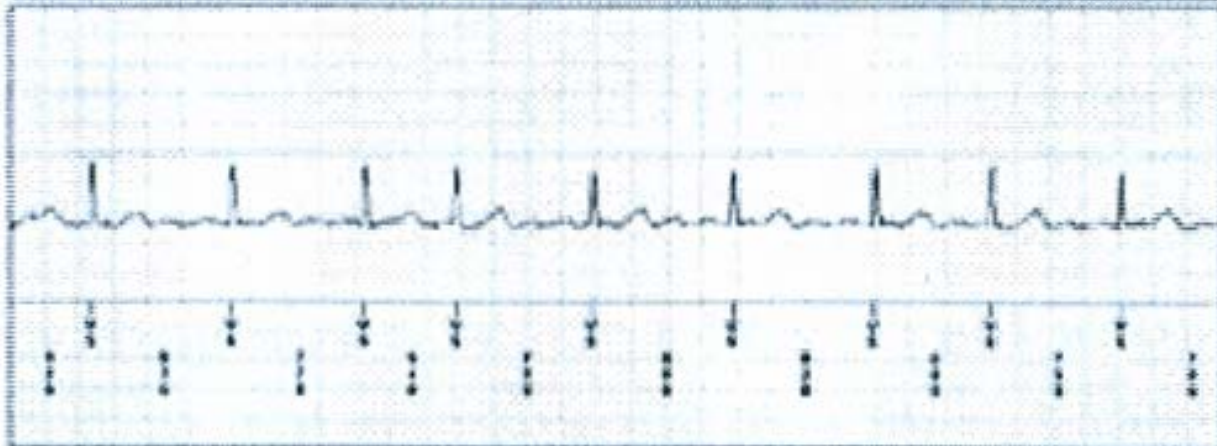
Diagnostic yield: 35% (176/506)

Moya Circulation 2001, Menozzi Circulation 2002, Brignole Circulation 2001, Krahn Circulation 1995, Khran Ciculation 1999, Nierop PACE 2000, Boersma Europace 2004, Lombardi Europace 2005, Pierre Europace 2008

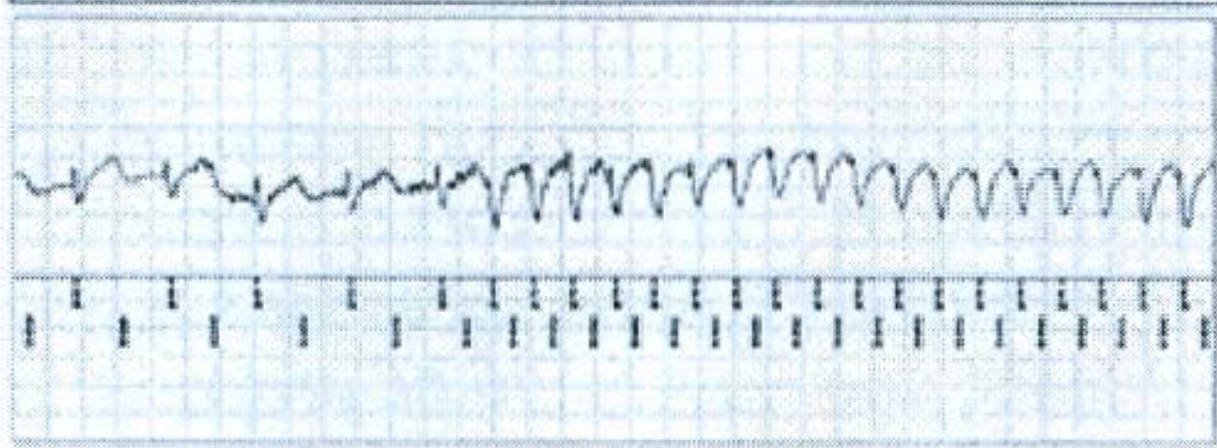
ASY

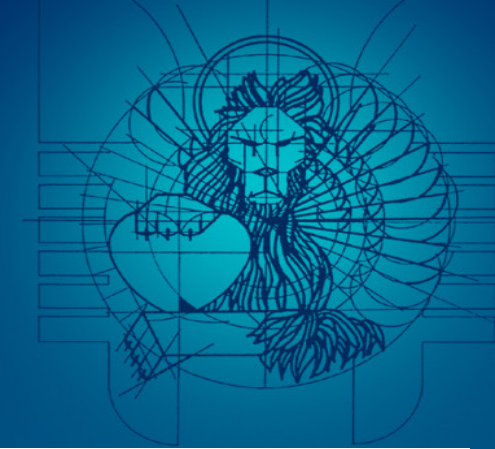


AF



FVT



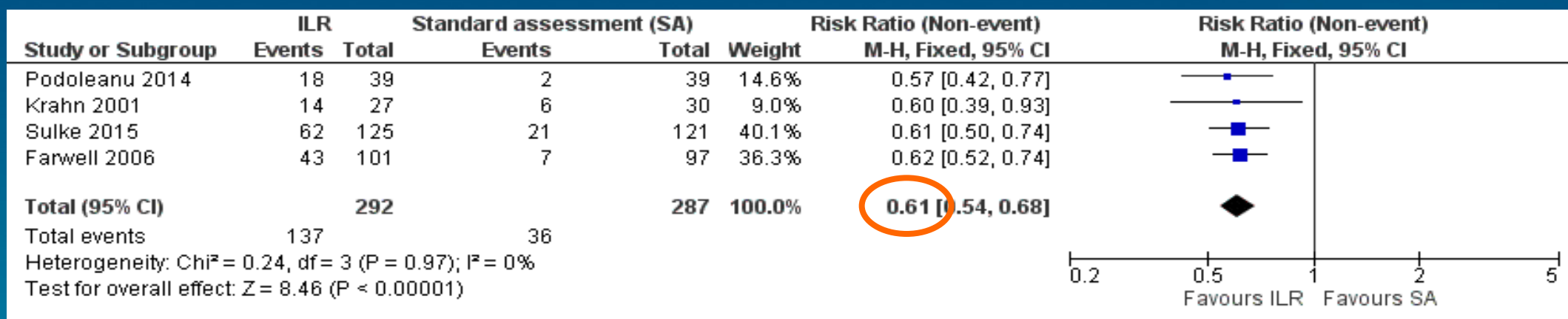


Implantable loop recorder versus conventional diagnostic workup for unexplained recurrent syncope

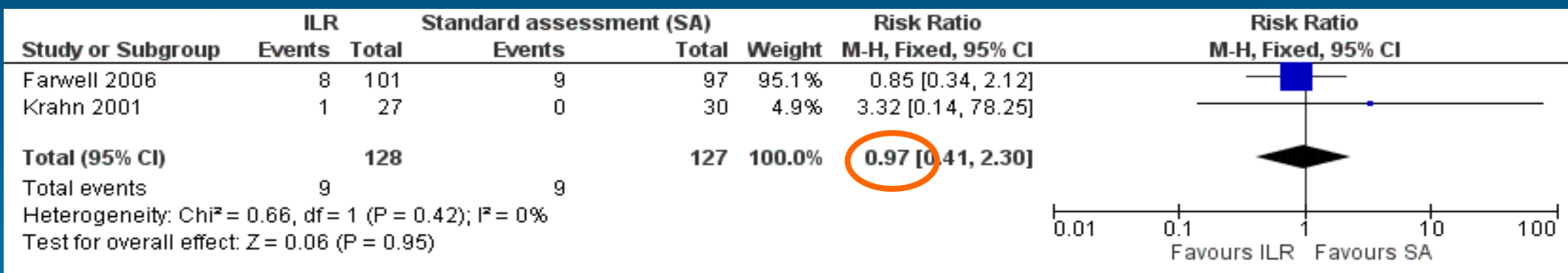
Monica Solbiati^{1,2}, Giorgio Costantino¹, Giovanni Casazza³, Franca Dipaola⁴, Andrea Galli⁵, Raffaello Furlan⁴, Nicola Montano^{1,2}, Robert Sheldon⁶

Cochrane Database of Systematic Reviews 19 APR 2016 DOI: 10.1002/14651858.CD011637.pub2

Forest plot of comparison: ILR vs standard assessment: diagnosis



Forest plot of comparison: ILR vs standard assessment: all-cause mortality





The aim of this systematic review was to compare the potential benefits and harms of ILRs with conventional diagnostic assessment in people with unexplained syncope.

Study characteristics

We searched scientific databases and found four randomised controlled trials (clinical studies where people are randomly put into one of two or more treatment groups) including 579 adults, which met our inclusion criteria. This review includes evidence identified up to April 2015.

Key results

All-cause mortality (death from any cause) was no different in people who received the ILR. Loop recorders do not seem to change quality of life, although people with ILR had a significantly higher rate of diagnosis compared to participants in the standard assessment group. Moreover, data seem to show a trend towards a reduction in syncope recurrences after diagnosis in people implanted with ILR. Finally, costs were higher in the group of participants in which the ILR was implanted but the cost per diagnosis and the cost to diagnose an arrhythmia were much lower for participants randomised to ILR implant.

Quality of the evidence

There was low quality evidence that ILR does not change mortality if compared to a standard diagnostic assessment of people with syncope. There was moderate quality evidence that ILR increases the rate of diagnosis if compared to a standard diagnostic assessment. Future research is needed in order to clarify if ILRs can improve quality of life and reduce syncope recurrences and costs.

All the included studies were funded: two of them by scientific societies, the remaining were partially supported by the ILR's manufacturers.

Indications for the use of diagnostic implantable and external ECG loop recorders

Task Force members: Michele Brignole (Chairperson), Lavagna, Italy; Panos Vardas (Co-chairperson), Herakleion, Greece; Ellen Hoffman, Munich, Germany; Heikki Huikuri, Oulu, Finland; Angel Moya, Barcelona, Spain; Renato Ricci, Rome, Italy; Neil Sulke, Eastbourne, UK; Wouter Wieling, Amsterdam, The Netherlands

Europace 2009; 11: 671-87

Syncope / Indications for ILRs



Class I

- Early phase of evaluation of patients with recurrent syncope of uncertain origin who have:
 - absence of high-risk criteria that require immediate hospitalization or intensive evaluation,
 - a likely recurrence within battery longevity of the device (*L of evidence A*)
- High-risk patients in whom a comprehensive evaluation did not demonstrate a cause of syncope or lead to specific treatment (*L of evidence B*)

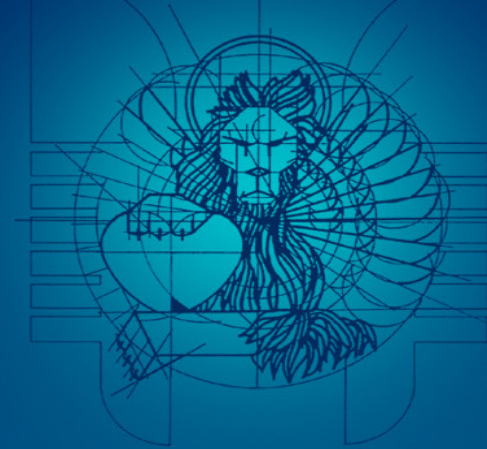
Syncope / Indications for ILRs



Class II A

- To assess the contribution of bradycardia before embarking on cardiac pacing in patients with suspected or certain neurally mediated syncope presenting with frequent or traumatic syncopal episodes (*L of evidence B*)

Syncope / Indications for ILRs



Class II B

- In patients with T-LOC of uncertain syncopal origin in order to definitely exclude an arrhythmic mechanism (*L of evidence C*)

Issues



- Remote ECG monitoring
to assess the cause of syncope
- Smart home monitoring
to predict and detect falls

Does smart home technology prevent falls in community-dwelling older adults: a literature review

Eva Pietrzak

Centre for Military and Veterans' Health, University of Queensland, Queensland, Australia

Cristina Cotea

Centre for Military and Veterans' Health, University of Queensland, Queensland, Australia

Stephen Pullman

Centre for Military and Veterans' Health, University of Queensland, Queensland, Australia

Inform Prim Care 2014; 21: 105-112



Results Nine papers fulfilled the inclusion criteria. The following outcomes were observed: (1) older adults' attitudes towards fall detectors and smart home technology are generally positive; (2) privacy concerns and intrusiveness of technology were perceived as less important to participants than their perception of health needs and (3) unfriendly and age-inappropriate design of the interface may be one of the deciding factors in not using the technology.

Conclusion So far, there is little evidence that using smart home technology may assist in fall prevention or detection, but there are some indications that it may increase older adults' confidence and sense of security, thus possibly enabling aging in place.