Should I Still Request a Holter Monitor?

Dr Iain Matthews
Consultant Cardiologist
Northumbria Healthcare
On balance...probably not

But that makes this a very short presentation, so....

I plan to run through the various ways to monitor the ambulant patient *with syncope* along with the positive and negative aspects of each
Reflex syncope
- Long history of recurrent syncope, in particular occurring before the age of 40 years
- After unpleasant sight, sound, smell, or pain
- Prolonged standing
- During meal
- Being in crowded and/or hot places
- Autonomic activation before syncope: pallor, sweating, and/or nausea/vomiting
- With head rotation or pressure on carotid sinus (as in tumours, shaving, tight collars)
- Absence of heart disease

Syncope due to OH
- While or after standing
- Prolonged standing
- Standing after exertion
- Post-prandial hypotension
- Temporal relationship with start or changes of dosage of vaso-depressive drugs or diuretics leading to hypotension
- Presence of autonomic neuropathy or parkinsonism

Cardiac syncope
- During exertion or when supine
- Sudden onset palpitation immediately followed by syncope
- Family history of unexplained sudden death at young age
- Presence of structural heart disease or coronary artery disease
- ECG findings suggesting arrhythmic syncope:
Reflex Syncope

Mixed

Vaso-depressor

Inappropriate reflex

Cardio-inhibitory

Drug-induced ANF

Low BP/Cerebral hypoperfusion

Low cardiac output

Cardiac (pulmonary)

Arrhythmia

Structural cardiac

Orthostatic Hypotension

Cardiac Syncope

Low periph. resist.

Inadequate venous return

Venous pooling

Volume depletion

Structural damage ANS

Primary auton. ANF

Secondary auton. ANF

Others
TLOC

Nontraumatic TLOC

- Syncope
  - Reflex syncope
  - Orthostatic hypotension
- Epileptic seizures
  - Generalized:
    - Tonic
    - Clonic
    - Tonic-clonic
    - Atonic
- Psychogenic
  - Psychogenic pseudosyncope (PPS)
  - Psychogenic non-epileptic seizures (PNES)

TLOC due to head trauma

- Rare causes
  - Subclavian steal syndrome
  - Vertebrobasilar TIA
  - Subarachnoid haemorrhage
  - Cyanotic breath holding spell
### Electrocardiographic monitoring

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<sup>a</sup> Class: I, IIa, IIb, III

<sup>b</sup> Level: A, B, C, D
Who should I keep in hospital?

**HISTORY**

**Major**
- New onset of chest discomfort, breathlessness, abdominal pain, or headache\(^{26, 44, 55}\)
- Syncope during exertion or when supine\(^{36}\)
- Sudden onset palpitation immediately followed by syncope\(^{36}\)

**Minor** (high-risk only if associated with structural heart disease or abnormal ECG):
- No warning symptoms or short (<10 s) prodrome\(^{36, 38, 49, 56}\)
- Family history of SCD at young age\(^{57}\)
- Syncope in the sitting position\(^{54}\)

**PAST MEDICAL HISTORY**

**Major**
- Severe structural or coronary artery disease (heart failure, low LVEF or previous myocardial infarction)\(^{26, 27, 35, 55, 59}\)
## Who should I keep in hospital?

| **ECG** |
|------------------|------------------|
| **Major**        | **Minor** (high-risk only if history consistent with arrhythmic syncope)** |
| - ECG changes consistent with acute ischaemia  | - Mobitz I second-degree AV block and 1º degree AV block with markedly prolonged PR interval  |
| - Mobitz II second- and third-degree AV block  | - Asymptomatic inappropriate mild sinus bradycardia (40-50 b.p.m.), or slow AF (40-50 b.p.m.)  |
| - Slow AF (<40 b.p.m.)                          | - Paroxysmal SVT or atrial fibrillation  |
| - Persistent sinus bradycardia (<40 b.p.m.), or repetitive sinoatrial block or sinus pauses >3 seconds in awake state and in absence of physical training | - Pre-excited QRS complex  |
| - Bundle branch block, intraventricular conduction disturbance, ventricular hypertrophy, or Q waves consistent with ischaemic heart disease or cardiomyopathy  | - Short QTc interval (≤340 ms)  |
| - Sustained and non-sustained VT  | - Atypical Brugada patterns  |
| - Dysfunction of an implantable cardiac device (pacemaker or ICD) | - Negative T waves in right precordia leads, epsilon waves suggestive of ARVC  |
| - Type 1 Brugada pattern | |
| - ST-segment elevation with type 1 morphology in leads V1-V3 (Brugada pattern)  | |
| - QTc >460 ms in repeated 12-lead ECGs indicating LQTS  | |
Electrocardiographic monitoring

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The Future

When I speak of “full freedom” through the elimination of wires, restricted locations, electronic baggage, and radio interference I mean freedom within the limits of electronic and mechanical performance. Thus, there will always be room for improvement of the equipment, but, basically, “full freedom” means freedom to make long, continuous records of physiological phenomena as close as possible to the geographic site of occurrence. Thus the future—and this development may not be remote, in view of the present increasing interest in medical electronics—will see human beings and other animals of many types “wired for research,” with numerous little boxes piling up information about body function. Numerous physiological variables will be recorded in one over-all portable recording system and coded into one record for later study by more sophisticated analyzers than those described here.
Diagnostic yield of Holter Monitoring

• Retrospective review of all Holter monitors in a single institution between 2000-2005

• 4877 Holter studies
  – 826 were performed in patients with syncope (mean age 72 +/- 15 years)
  – 71 (8.6%) were considered to explain the syncope
  – Structural heart disease, ejection fraction and age were significant predictors of a diagnostic study (all p < 0.01)
Why is the diagnostic yield of Holter monitoring so low?

• My opinion...
  – It is over-used
  – In inappropriate situations
  – To make the ordering physician (including Cardiologists) feel better

• The only use of an OP 24 hr Holter is to gauge rate control in AF*

• If you are convinced enough you will get the answer within 24 hrs then keep them in hospital

*And some other small print Cardiological esoterica
### Electrocardiographic monitoring

#### Recommendations

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161                                                                                                                                  | IIa   | B     |
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162,166,168,201                                                                                                                       | IIa   | B     |
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175,176,181–184,202, Supplementary Data Table 5                                                                                     | I     | A     |
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174,180,187,188,195, Supplementary Data Tables 5 and 6                                                                              | I     | A     |
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184–186                                                                                                                             | IIa   | B     |
| *ILR* may be considered in patients in whom epilepsy was suspected but the treatment has proven ineffective.

137,189–191, Supplementary Data Table 7                                                                                               | IIb   | B     |
| *ILR* may be considered in patients with unexplained falls.

191–194, Supplementary Data Table 8                                                                                                  | IIb   | B     |
External loop recorders

Long battery life (up to 4 weeks)

SYNARR Flash study
• N = 395
• 10 European centre
• Enrolled within 28 days of syncopal episode
• Age 56.9 ± 18.7 years (58% female)
• 28.1% with syncope (71.9% with palpitations)

• Diagnostic yield for syncope 24.5%
• Diagnostic yield for palpitations 71.6%

Locati ET et al. SYNARR-Flash study. Europace 2016; 18(8):1265-72
# Zio XT Patch Report

## Patient #8, Patch Report

<table>
<thead>
<tr>
<th>Date of Birth</th>
<th>SEQ/SRN#</th>
<th>ECG</th>
<th>Gender</th>
<th>Primary Indication</th>
<th>Other Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/01/1987</td>
<td>12345</td>
<td></td>
<td>Male</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Patient Information

- **Physician**: Managing location
- **Physician**:
- **Location**:

### Heart Rate

- **Maximum HR**: 180 bpm (at 10/10/10 on 10/10/10)
- **Minimum HR**: 45 bpm
- **Average HR**: 92 bpm

### Patient Events

- **Number of Triggers**: 2
- **Findings during < 45 sec of Trigger**:
  - Atrial Fibrillation

### Ectopics

<table>
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<tr>
<th>Type</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supraventricular Ectopy (SVEPA)</td>
<td></td>
</tr>
<tr>
<td>Initiating</td>
<td>Rare</td>
</tr>
<tr>
<td>Coupled</td>
<td>Rare</td>
</tr>
<tr>
<td>Triplet</td>
<td>Rare</td>
</tr>
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</table>

### Atrioventricular (AV) Block

- **2nd/3rd Degree, Mobitz II, 3/4th**

### Findings

- **Heart Rate**:
  - Normal
- **Supraventricular Tachycardia (SVT)**:
  - None noted
- **Atrial Fibrillation**:
  - None noted

### Final Interpretation

1. Sinus Rhythm with variable and slowly-fast rate range with ranges over 60s.
2. Jittered Tachycardia noted with range over 50s.
3. Intermittent atrial fibrillation noted with range over 60s.
4. Possible premature atrial contractions noted with range over 60s.

**Signed by Dr. Example Physician on 09/01/2023**

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PATCH-ED study

- Single centre
- \( N=86 \)
- Presenting within 6 hours of syncope
- Fitted with ambulatory patch ECG recorder (Zio patch)
- Unmatched historical group of 603 syncope patients with no obvious diagnosis in ED recruited to a prior cohort study (2007–2008) were used as a comparator
- Primary endpoint was symptomatic significant arrhythmia at 90-day follow-up.
Assessed for eligibility (n = 821)

Excluded (n = 707)

1. Clinical history of vasovagal syncope 160
2. Arrhythmia on ED ECG 39
3. Arrhythmia on pre-hospital ECG 2
4. Pulmonary Embolism 2
5. Postural hypotension 41
6. Myocardial Infarction 4
7. CT brain or clinical signs / symptoms in ED showing CVA or SAH 11
8. Evidence of haemorrhage 4
9. Other obvious underlying cause of syncope episode (e.g. GI Bleed) 122
10. Patient has pacemaker and/or ICD 22
11. Alcohol or illicit drugs 36
12. Epileptic seizure 24
13. Transient ischemic attack 6
14. Head trauma 8
15. Hypoglycemia 5
16. Previous recruitment into the study 5
17. Patient in custody or prison 1
18. Unable to consent (e.g. incapacity) 126
19. Transferred from ED 2
20. Patient died 0
21. Recruited to another study 10
22. Other reason 77

Approached for consent (n = 114)

Refused consent (n = 28)

Allocated to intervention (n = 86)

Lost to follow up (n = 0)

Discontinued intervention (n = 10)
(10 ambulatory patches not returned by patients)

90-day outcome analyzed (n = 86)
Ambulatory patch reports analyzed (n = 76)
PATCH-ED study

• Primary endpoint
  – Diagnostic yield of the patch monitor for symptomatic significant (including serious) arrhythmia was **10.5%** (95% CI 4.0 to 16.9; 9 of 86) compared with **2.0%** (95% CI 0.9 to 3.1; 12 of 603) in the comparator group

• Secondary endpoints
  – Median ambulatory patch monitor wear time was 13.6 days (IQR 11.8–14.0
  – Median time to clinical detection of symptomatic significant arrhythmia was 19 (IQR 4–30) days*

  – Patch satisfaction (based on a response rate of 55%, n=47)
    • 91% agreed the patch monitor was easy to use,
    • 72% agreed the patch monitor was comfortable to wear.
    • 82% agreed they were able to carry out normal activities,
    • 40% reported skin irritation
    • 15% reported lost adherence to the skin
PATCH – ED study

Time to first detection on ambulatory patch of all symptomatic significant arrhythmias (n=9) and all significant arrhythmias whether symptomatic or not (n=24).

![Graph showing the frequency of monitoring days for different types of arrhythmias]
NICE T-LOC guidance 2010 (updated 2014)

Offer an implantable event recorder to those with TLoC infrequently (less than once every 2 weeks)
## Pause Episode(s)

<table>
<thead>
<tr>
<th>ID#</th>
<th>Assessment</th>
<th>Type</th>
<th>Date</th>
<th>Detected Time</th>
<th>Duration</th>
<th>Max V. Rate</th>
<th>Median V. Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Appropriate</td>
<td>Pause</td>
<td>20-Feb-2019</td>
<td>03:37</td>
<td>00:00:36</td>
<td>71 bpm</td>
<td></td>
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## Brady Episode(s)

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<td>17</td>
<td>Appropriate</td>
<td>Brady</td>
<td>20-Feb-2019</td>
<td>04:18</td>
<td>00:13:27</td>
<td>Min = &lt;30 bpm</td>
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Diagnostic Yield of an ILR

- Meta-analysis in “undetermined syncope”
- 49 studies with total 4381 subjects
- Overall diagnostic yield was 43.9%
- Proportions of subjects by final diagnosis
  - Arrhythmic syncope  26.5%
  - Ventricular arrhythmias  2.7%
  - Supraventricular arrhythmia  4.9%
  - Bradyarrhythmia  18.2%
- The proportion of an analyzable ECG recording during symptoms was 89.5%
- Median time to diagnosis was 134 days.

Diagnostic yield of different ECG screening techniques for paroxysmal or silent AF

Available at: https://academic.oup.com/eurheartj/article/37/38/2893/2334964#supplementary-data.
March 2015 – June 2016
N = 148

113 (76.4%) made symptomatic recordings

Symptom-rhythm correlation was possible for all patients who submitted downloads.

Median time to diagnosis nine days (1–287 days).

Key: AF = atrial fibrillation; SVE = supraventricular ectopy; SVT = supraventricular tachycardia; VE = ventricular ectopy
Summary

• Like all syncope it boils down to history
  – If no worrying features and examination/ECG are normal then NO MONITORING AT ALL

• Then frequency of syncope...
### Electrocardiographic monitoring

#### Recommendations

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Summary

• Make friends with your Cardiology department
  – Find out what monitoring they have
  – Be explicit
    • What do you suspect?
    • The duration of monitoring you require and why
  – They will be very happy to do less Holter analysis
Questions