The use of an implantable loop recorder in the investigation of unexplained syncope in older people

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Abstract

Introduction: Reveal is a patient activated implantable loop recorder device with an 18 month battery life now available to assist in the diagnosis of suspected syncope or arrhythmias. We present our experience using this device in older subjects referred to a dedicated falls and syncope clinic in whom usual clinical assessment had not satisfactorily identified an attributable diagnosis but where we still suspected a cardiovascular cause for syncope or falls.

Methods and results: during the past 3 years 15 subjects (mean age 73 years, range 61–89 years) had Reveal implanted for symptoms of syncope alone (n=6; 40%) and unexplained falls (n=3; 20%) or symptoms of syncope and unexplained falls (n=6; 40%). Symptom duration was long (mean 48 months; range 4–200 months). Subjects had experienced significant morbidity, 6 subjects (40%) required A&E attendance or hospital admission and 4 (27%) experienced a fracture. Despite extensive and repeated investigations, which included 12-lead ECG, echocardiogram, 24-h ambulatory heart rate monitor, 24-h ambulatory blood pressure monitor, orthostatic blood pressure measurement, supine and erect carotid sinus massage, electroencephalogram, and passive and GTN head up tilt testing, the attributable diagnosis remained unexplained. Of the 15 subjects, 7 have activated the device at 4 (range 0–14) months after implantation. Bradycardia was identified in 3 and ventricular tachycardia in 1 subject. Two subjects did not activate the device during the 18 months it was in-situ. Four people had problems with device activation. This is comparable to rates noted using Reveal in younger subjects.

Conclusion: Reveal offers additional diagnostic yield in complex elderly subjects with suspected cardiovascular causes of syncope or unexplained falls which have not been previously satisfactorily diagnosed despite extensive investigations.

Keywords: syncope, implantable loop recorder, elderly, falls

Introduction

Syncope is a common occurrence accounting for approximately 6% of hospital admissions yet it remains one of the most difficult problems for a physician to attribute a cause [1]. It is defined as transient loss of consciousness and postural tone caused by reduction in cerebral blood flow. Experience from dedicated syncope clinics suggests that in older subjects presentation can be non-specific and the range of differential diagnoses is wide and includes carotid sinus syndrome, neurocardiogenic syncope, orthostatic hypotension and brady- and tachyarrhythmias [2]. In younger patients an accurate history of the preceding circumstances can often be sufficient to establish a diagnosis. This is not true for older patients where retrograde amnesia for loss of consciousness and absence of a witness account are common, and recurrent unexplained falls may be the mode of presentation [3]. Accurate diagnosis of syncope in an older patient therefore requires a high degree of clinical suspicion, thorough physical examination and carefully directed and interpreted investigations including repeated morning measurements of orthostatic blood pressure, carotid sinus massage and head up tilt testing. Despite this approach a proportion of syncopal episodes will remain undiagnosed.

Syncope that remains unexplained after initial assessment is of concern both to the clinician and to the patient. Although mortality and serious morbidity associated with syncope is generally low, it can be as high as 33% in
high risk groups such as those with ischaemic heart disease [1]. The American College of Physicians and the European Cardiac Society have recommended that patients with unexplained syncope at high risk of adverse outcomes should undergo additional cardiac investigations such as prolonged Holter monitoring or electrophysiological testing [4]. Currently the UK waiting time for electrophysiological testing is long and it is rarely carried out in older patients.

The implantable loop recorder, ILR (Reveal; Medtronic, Minneapolis, USA) offers an additional diagnostic strategy for the investigation of syncope or unexplained falls (Figure 1). The clinical usefulness and cost effectiveness of this device have previously been reported in younger patients with unexplained syncope [5, 6]. The ILR was developed to permit long term cardiac monitoring to capture the ECG during a spontaneous episode of syncope. The device measures 6.1 × 1.9 × 0.8 cm, weighs 17 g and is usually inserted under local anaesthetic into a subcutaneous pocket in the left pectoral region. The device has a battery life of approximately 18 months. Using an activation device the patient, a family member or carer ‘freezes’ the loop during or after a syncopal episode thus storing the preceding segment, which can be retrieved later using a standard pacemaker programmer [7]. The device can be programmed to retrospectively store ECG information for up to 20 min. This allows an older adult, who may have been injured or confused by a syncopal episode or fall, a sufficient ‘window’ where if the device is subsequently activated relevant information can be retrieved.

Case report series would suggest that the diagnostic rate for syncope is variable. Kapoor reports that in up to 40% of older patients a cause of syncope cannot be determined [8]. Investigation by geriatricians of selected patients in a dedicated falls and syncope clinic can produce higher diagnostic rates with only 8% of syncope remaining unexplained [9]. We present our experience using this device in older subjects referred to a dedicated falls and syncope clinic in whom our usual clinical assessment had not satisfactorily identified an attributable diagnosis but where a cardiovascular cause for syncope or falls was suspected.

Methods
Consecutive subjects over the age of 60 years who had implantation of Reveal for investigation of syncope or unexplained falls were identified. Medical case notes were reviewed retrospectively.

Results
Fifteen subjects had a Reveal implanted during a 3-year period. During this same period, 1,340 new patients over 60 years old were investigated in the Cardiovascular Investigation Unit. The mean age of the 15 subjects was 73 (range 61–89) years; 13 were female. Nine were referred to the Cardiovascular Investigation Unit (regional falls and syncope service) by secondary care consultants. The remainder were referred by general practitioners. The duration of symptoms prior to assessment was long (mean 48, range 4–200 months). Presenting symptoms were syncope alone in 6 patients and unexplained falls in 3. Six subjects had both syncope and falls. Most subjects had suffered significant morbidity as a consequence of syncope; 6 subjects required A&E attendance or hospital admission; 4 experienced a fracture and 8 had sustained a soft tissue injury during events.

Initial assessment included detailed history, full physical examination, resting 12-lead ECG, repeated morning orthostatic blood pressure measurement.

Figure 1. Photograph of ILR – REVEAL.
[10–12], erect and supine carotid sinus massage, passive head up tilt in the majority of cases and GTN provocation tilt testing. A detailed description of these investigations and the rationale for their use has been previously described [11]. All subjects had at least one 24-h ECG (range 1–4). Co-morbidity was common, 7 have hypertension, 5 had a history of ischaemic heart disease and 3 had previous cerebrovascular disease. Resting ECG was abnormal in 5 people (2 old inferior infarction, 1 right bundle branch block, 1 left axis deviation and 1 first degree heart block).

Although abnormalities such as orthostatic hypotension and carotid sinus hypersensitivity were identified in 4 and 2 subjects respectively, these were not considered to be attributable diagnoses because of lack of symptom correlation. Mean duration of assessment prior to subjects being referred for Reveal was 5 months (range 1–13).

Of the 15 subjects, 7 had successfully activated the device. The details of which are shown in Table 1 and examples of the ECG recordings are shown in Figure 2. The 3 subjects with recorded significant bradycardias had subsequent dual chamber demand pacemaker insertion while the subject with ventricular tachycardia is awaiting further evaluation with electrophysiological testing. All the subjects with significant arrhythmias had a normal resting 12-lead ECG. In those subjects where sinus rhythm was recorded it was not suggestive of neurocardiogenic syncope (sinus tachycardia with subsequent sinus bradycardia).

Two subjects did not activate the device during the 18 months it was in-situ. Six people have not yet activated the device (mean duration of follow-up 5 months). Four people experienced some problems with device activation (1 subject subsequently successfully activated the device). Examples of these difficulties include not having the activator at the time of syncope, being too shocked to activate the device because of associated trauma and stiffness of the activator button. Patients received written and verbal education at the time the device was inserted and at a clinic 1 week after insertion. There were no complications related to the insertion of the device.

### Discussion

Syncope in older people is an important health care issue. There is a recognised overlap between syncope and falls in older people [2]. The recently published National Service Framework for older people recognises the importance of this area and outlines the need for investigation of affected individuals by appropriate experts. Geriatricians are becoming increasingly involved in the investigation and management of syncope. Significant co-morbidity and atypical presentation often render a precise determination of the cause difficult. Despite expert guidelines on diagnostic algorithms for syncope many cases remain unexplained after extensive non-invasive testing [8, 12]. It

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**Table 1. Details of patients who activated Reveal**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Time to activation (weeks)</th>
<th>Symptom</th>
<th>Rhythm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 1</td>
<td>74</td>
<td>S</td>
<td>Sinus</td>
</tr>
<tr>
<td>Patient 2</td>
<td>65</td>
<td>S</td>
<td>Sinus pause 3 s</td>
</tr>
<tr>
<td>Patient 3</td>
<td>71</td>
<td>S&amp;F</td>
<td>Sinus</td>
</tr>
<tr>
<td>Patient 4</td>
<td>63</td>
<td>S&amp;F</td>
<td>Ventricular tachycardia</td>
</tr>
<tr>
<td>Patient 5</td>
<td>76</td>
<td>S&amp;F</td>
<td>Sinus</td>
</tr>
<tr>
<td>Patient 6</td>
<td>75</td>
<td>S</td>
<td>A-V dissociation 30 bpm</td>
</tr>
<tr>
<td>Patient 7</td>
<td>67</td>
<td>S</td>
<td>Sinus pause 6 s</td>
</tr>
</tbody>
</table>

S = syncope; F = falls.

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**Figure 2.** Examples of ECG recording illustrating ventricular arrhythmia (top) and atrioventricular conduction defect.
has been advocated that if there is suspicion of underlying cardiac disease, subjects should undergo extended Holter monitoring or should be considered for electrophysiological testing [4, 12]. Diagnostic yield from 24-h Holter monitoring remains very low; only 4% of patients have correlation of symptoms with arrhythmia. Extending monitoring to 72 h does not significantly improve the diagnostic yield. Patient activated external loop recorders have a higher diagnostic yield compared to prolonged ambulatory monitoring but do not have good rhythm-symptom correlation in more than a third of subjects [7]. An implantable loop recorder offering extended monitoring over an 18 month period which patients or carers can ‘freeze’ during or after a typical syncopal episode would appear to be an attractive diagnostic aide. The device, which costs approximately £1200, can be implanted as a day procedure under local anaesthetic via a small (2 cm) incision. The subcutaneous pocket is most often fashioned in the left pectoral region. The clinical usefulness and cost effectiveness of this device have been described previously in younger subjects with unexplained syncope [5, 6]. There is a paucity of information regarding use of Reveal in older subjects.

We describe a group of complex elderly subjects who despite extensive testing in a tertiary syncope and falls service had no attributable diagnosis of syncope prior to insertion of Reveal. In the subjects who have successfully activated the device, 4 out of 7 had a significant rhythm disturbance which was amenable to treatment. Sinus rhythm was reassuringly recorded in the remaining 3 subjects. Two subjects did not have recurrence of their symptoms during the 18 months the device was in-situ. Four patients did experience some difficulty activating the device. This would be comparable to rates that we have noted using Reveal in younger patients (unpublished data). The device appeared to be safe with no complications of device insertion being noted.

More extensive experience will be required to evaluate further Reveal in the elderly. Future research should address a number of questions. Can one be more selective in the subjects chosen for Reveal? What is the optimal timing for implantation of the device versus continued non-invasive testing? The cost effectiveness of the device in older people will also have to be evaluated.

Our initial experience would suggest that Reveal offers a valuable additional diagnostic yield in complex elderly subjects with suspected cardiovascular causes of syncope which have evaded diagnosis despite extensive previous investigation.

Key points

- Implantable loop recorders provide an additional option for the diagnosis of syncope in a selected number of elderly subjects who remain undiagnosed despite extensive cardiovascular investigation.

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References