

The management of unexplained collapse in service age personnel

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Abstract

Unexplained collapse is a common presentation to medical practitioners, with a wide range of differential diagnoses making assessment problematic. Without a methodical approach to the patient presenting with unexplained collapse, potentially life-threatening conditions may not be recognised, whilst benign presentations can be over-investigated. This article will review the assessment, differential diagnosis and management of unexplained collapse, whilst considering the impact in the military environment.

Introduction

Unexplained collapse is defined as transient loss of consciousness (TLoC) due to transient global cerebral hypoperfusion, characterised by rapid onset, short duration and spontaneous complete recovery (1).

Unexplained collapse accounts for 1-6% of hospital admissions per year and 1% of Emergency Department (ED) visits per year (1). The cause is unclear in many cases and often challenging to manage in the acute setting. An understanding of the likely cause, alongside an appreciation of potential mortality and morbidity following an unexplained collapse, is essential. The initial assessment following an unexplained collapse is even more difficult when the patient presents at sea in an austere or remote environment where medical staff may be relatively junior or be practising with limited skill sets and with limited equipment and investigative tools. This environment is referred to, in UK military parlance, as being Role One, with Roles Two, Three and Four describing a stepwise increase in specialist medical and surgical support facilities with enhanced investigative and treatment options available at each sequential step. Role Four capability is a tertiary and rehabilitative level of care, currently delivered via University Hospitals Birmingham NHS Foundation Trust and the Defence Medical Rehabilitation Centre Headley Court. The Role classification reflects the wide range of clinical acumen and experience of practitioners operating at Role One, as well as the limited access to investigative tools. The main aim of this article is to provide practitioners operating at Role One and further forward with a guide to aid in assessing and managing patients who present following an unexplained collapse.

Causes of collapse

There are multiple causes of an unexplained collapse and a non-exhaustive selection of important causes is outlined in Box 1.

Assessment and Management at Role 1 and forward of Role 1

As with any acute presentation, an approach that seeks to identify and initially treat any life-threatening problems, followed by a thorough history (from the patient and any witnesses) and clinical examination is vital. The currently recommended approach assesses clinical threats resulting from Catastrophic haemorrhage (<C>), Airway compromise (A), Breathing compromise (B), Circulatory compromise (C), neurological Dysfunction (D) and Environmental hazards (E). Such a <C>ABCDE approach should be the mainstay for all military clinicians when dealing with an acute medical or trauma patient. A thorough history will provide important information and may aid in appropriate examination and further investigations. The National Institute for Health and Clinical Excellence (NICE) guidelines regarding unexplained collapse (referred to as TLoC in the document) recommend some key areas that the history and assessment should focus on (Box 2) (2):

A thorough cardiovascular and neurological examination should be performed, whilst recognising the limitations that may be imposed by the practitioner's knowledge and experience, as well as the equipment available to conduct investigations. The components of the initial examination of a patient presenting with unexplained collapse can be found in Box 2. Following the history and examination, additional investigations may be required either to confirm the initial working diagnosis or, just as importantly, to exclude more

Cardiovascular (syncope)
Neurally-mediated – reflex response leading to bradycardia and vasodilatation Vasovagal syncope Carotid sinus syndrome Situational syncope, e.g. cough, micturition, post-prandial
Orthostatic hypotension – inability to maintain blood pressure whilst standing Volume depletion – Addison’s disease, diarrhoea Primary autonomic disturbance – multi-system atrophy Secondary autonomic disturbance – diabetic neuropathy
Arrhythmias – reducing cardiac output Long QT syndrome, Brugada Syndrome AV node conduction problems
Structural heart disease – inability to increase cardiac output to meet demands Aortic or mitral stenosis Acute myocardial infarction Obstructive cardiomyopathy Cardiac tamponade
Neurological Epilepsy
Metabolic Hypoxia Hypoglycaemia Hyponatraemia
Others Psychogenic syncope Ectopic pregnancy Intoxication Drug induced

Box 1: Clinical causes of collapse. (3)

History Taking	Examination
<ol style="list-style-type: none"> The circumstances of the event A person’s posture immediately prior to the event Prodromal symptoms (sweating/feeling warm) Appearance and person’s colour during the event Presence of movement during the event such as limb shaking or jerking and its duration Any tongue biting How long the person was unconscious for How they felt during recovery period and how long it took to recover Weakness down one side during recovery period (2) 	<ol style="list-style-type: none"> Vital signs including heart rate, Blood pressure (lying and standing), temperature, respiratory rate, GCS. A full cardiovascular examination focussing on heart sounds to identify potential murmurs, heart rhythm, and heart rate to identify bradycardia or tachycardia. A full neurological examination to ensure return to baseline neurological status
	Initial investigations
	<ol style="list-style-type: none"> Capillary Blood glucose Urine pregnancy test – in all females. Collapse can be one of the first signs of an ectopic pregnancy 3 lead ECG trace on monitor to look for major abnormalities – when at R1 facilities with no 12-lead ECG ability 12 lead ECG if patient presents to a medical facility with this ability

Box 2: History and assessment of the collapsed patient.

RED FLAGS	
CARDIAC	NEUROLOGICAL
1. Abnormalities on ECG 2. Exercise-induced TLoC 3. Family history of sudden cardiac death age <40 4. Breathlessness 5. A heart murmur	- a bitten tongue - head turning to one side during TLoC - Unusual posturing - Prolonged limb jerking - Confusion following the event - Prodromal déjà vu

Box 3: Cardiac and Neurological red flags of the collapsed patient.

serious pathology. The range of investigations conducted may be limited due to the environment or location in which the assessment occurs.

The central issue for care at Role One and further forward is identification of patients requiring urgent referral to a higher echelon of care. Once the patient is stable, further consideration should be given to whether the patient can remain in the working environment or should be evacuated for additional investigation. This is likely to involve the individual’s parent unit or Base Port primary care facilities, but may also involve hospital admission. The ‘red flag’ features that may suggest unexplained collapse as a result of a cardiac cause, and which should prompt urgent referral for further assessment, are detailed in Box 3.

The incidence of the first presentation of epilepsy is highest in children under eleven years and adults aged over 65, although it is important to be aware of it in service-age personnel (3). It is frequently misdiagnosed, as some epilepsy disorders do not demonstrate generalised seizure activity, whilst some patients with collapse may appear to have tonic/clonic episodes (3). ‘Red flag’ signs and symptoms which may indicate epilepsy as a cause for an unexplained collapse are summarised in Box 3.

An episode of unexplained collapse may only be diagnosed as an ‘uncomplicated faint’ if no red flag features are present and there are no features suggestive of an alternative diagnosis. The ‘3 P’s’ that suggest an uncomplicated fainting episode are outlined in Box 4.

<p>Posture – prolonged standing Provoking factors – medical procedures or pain Prodromal symptoms – sweating, feeling warm, loss of hearing</p>
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Box 4: The 3 P’s of uncomplicated faints.

Emergency Department Management

As at Role One and further forward, ED patients will need to be evaluated using a <C>ABCDE approach, followed by a thorough history and examination. A twelve-lead electrocardiogram (ECG) should be performed and reviewed by an appropriately trained practitioner to assess the presence of overt cardiac abnormalities. Examples of potentially concerning ECG abnormalities are highlighted in Box 5.

<ul style="list-style-type: none"> • Ventricular Tachycardia • RBBB with ST-elevation V1-3 (Brugada pattern) • Bifascicular block • Intraventricular conduction abnormality – QRS > 120ms • Sinus bradycardia <50bpm (absence of physical training) • Prolonged or short QT interval
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Box 5: ECG changes which suggest that the underlying cause of collapse may be due to an arrhythmia. (6)

All patients should have a supine and standing blood pressure performed to assess for orthostatic hypotension. In all female patients of reproductive age, a urinary pregnancy test should be performed. Capillary blood glucose should be performed in all patients. The presence of pregnancy (positive urinary pregnancy test) or abnormally high or low blood glucose levels should increase suspicion of an underlying pathological cause for the unexplained collapse and lower the threshold for evacuation of the patient for further assessment.

Additional blood tests, including measurement of renal function, serum electrolytes and full blood count, should be taken where there is clinical concern that the collapse cannot be attributed to a simple vasovagal episode. Current clinical practice would suggest that these should be

performed in all patients presenting with a first episode of unexplained collapse.

Indications for referral or admission

Hospital admission to allow investigation of high-risk individuals will be necessary in a small number of patients. Ideally this should be via a single point of access, multi-disciplinary clinic or service, as laid out in the National Service Framework (NSF) (4). Where such services are not available, admission or referral should be via the local ED or acute medical team.

Further cardiac evaluation is required in the presence of a family history of sudden cardiac death, where symptoms of a specific non-cardiac cause (e.g. seizure activity) are absent, or if the unexplained collapse is associated with chest pain or palpitations (5). European Society of Cardiology (ESC) guidance recommends referral for specialist assessment in cases where the ECG or history and examination are suggestive of a cardiac cause of the collapse (6).

Neurology follow-up should be considered in cases of suspected or proven focal neurological signs or for patients with prolonged loss of consciousness. Admission to hospital for observation and immediate investigation is based on the presence of ‘red flag’ symptoms. Such decisions will reflect on the risk-benefit analysis of individual cases, including consideration of duration and severity of symptoms and their potential to be associated with mortality or significant morbidity.

Diagnostic testing

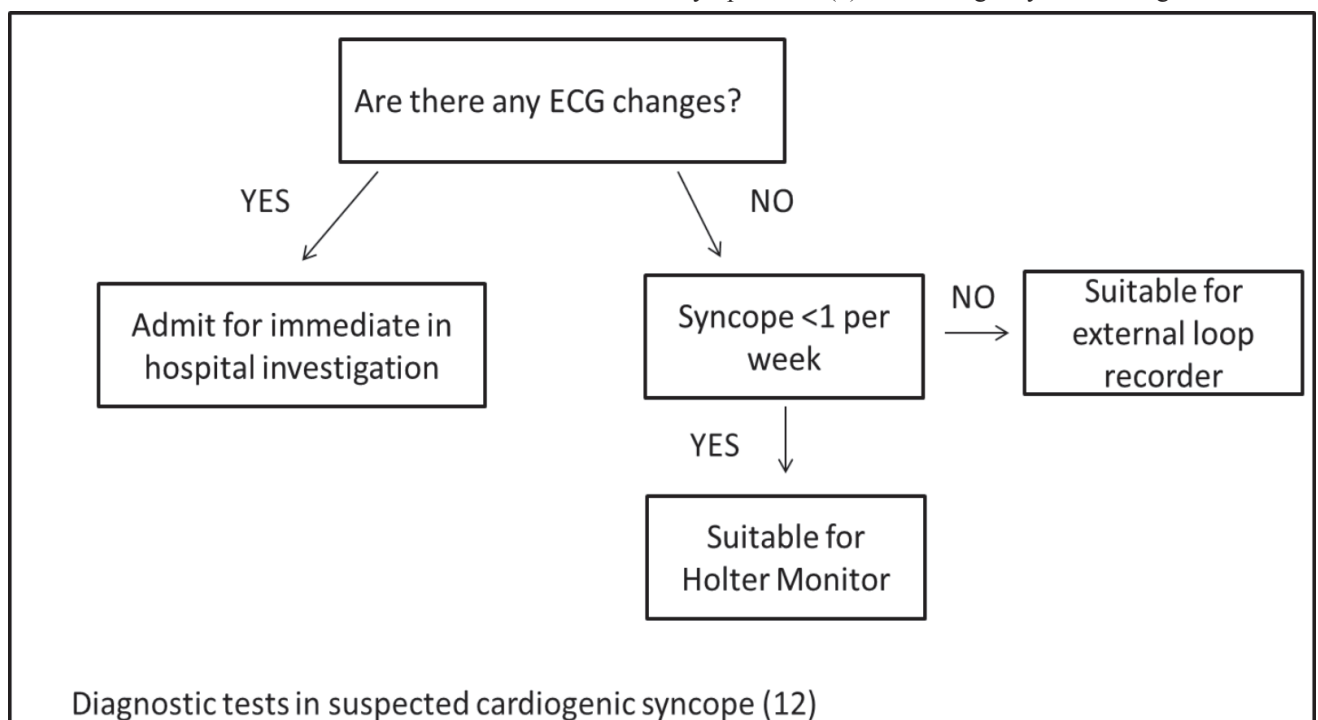
Electrocardiographic investigation

Use of Holter recorders for 24 hours or seven days (so-called 24-hour or seven-day ‘tapes’) is common practice and is of value if the patient experiences a syncopal event while the monitor is in place. Their use is usually directed towards patients who experience frequent symptoms and they are of less value in cases of isolated syncopal events. A high proportion of patients have infrequent symptoms and therefore the use of loop recorders may be more appropriate (6).

Loop recorders have continuous ECG monitoring which selectively records either upon activation by the patient (i.e. whilst experiencing symptoms) or when the device recognises a pre-programmed arrhythmia. Implantable loop recorders (which require insertion under local anaesthesia) may be preferred over external devices for patients who have very infrequent symptoms, as they have a much greater battery life and can be left in situ for up to 36 months (6). Patients can be divided into groups according to which type of monitoring is required (Box 6).

Tilt testing

Tilt testing may be used to reproduce symptoms in those who are suspected of having neurally mediated unexplained collapse, by rapidly shifting volume in the intravascular space, leading to a reduction in venous return and cardiac output. The resultant fall in blood pressure, if compensatory mechanisms fail, will lead to the patient becoming symptomatic (6). Tilt testing may also distinguish between



Box 6: Diagnostic tests in suggested cardiogenic syncope. (12)

cardiovascular causes and epilepsy among patients who experience limb jerking during episodes of unexplained collapse.

A positive diagnosis of reflex syncope can be made in patients without structural heart disease and the induction of reflex hypotension or bradycardia when symptoms experienced during an unexplained collapse are reproduced. Orthostatic hypotension can be diagnosed if progressive hypotension is present with or without symptoms (6).

Imaging

Echocardiography is useful in determining the left ventricular ejection fraction (LVEF) as a general marker of cardiac output, cardiac chamber size, left or right ventricular hypertrophy and in identification of valvular abnormalities or pericardial effusions. Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) should be utilised more cautiously in order to prevent needless irradiation (CT) and to minimise costs for investigations that carry limited additional value in the majority of cases. They may be of value in specific cases where there is clinical suspicion of underlying pathology, such as pulmonary embolus, intracranial bleeding or intracranial space occupying lesions (6).

Managing the simple faint

One of the first steps in reducing the occurrence of vasovagal events is educating the patient about triggers for such episodes. These can include humid environments, prolonged standing and reduced fluid intake (7). This will allow patients to take control in certain circumstances to minimise these risk factors. It is important to highlight and reassure patients that there is no evidence of increased cardiovascular mortality associated with recurrent collapses occurring as a consequence of vasovagal episodes (8). Patients should be taught to become aware of pre-collapse symptoms so that they can take action to avoid the ensuing collapse. This may be as simple as advising them to sit or lie down at the onset of symptoms.

When a patient is subjected to an environment in which they are likely to experience a collapse, such as prolonged standing, it has been shown that physical treatments can be used to reduce the occurrence of simple faints. Two clinical trials have shown that simple counter pressure manoeuvres can be of use (9, 10). These trials identified that simple leg crossing or hand grip/arm tensing induced a rise in blood pressure during prodromal symptoms, which either delayed or avoided the onset of syncope (9, 10). These trials were followed by a multi-centre prospective study, which showed that the yearly rate of collapse in those patients trained in counter pressure manoeuvres was significantly lower than in the conventional group that did not use these techniques (11).

There is little evidence to support the routine use of pharmacological agents such as beta-receptor antagonists (beta-blockers) or selective serotonin reuptake inhibitors (SSRI's), unless they are specifically recommended on the advice of a specialist following appropriate assessment and investigation (12).

Influence of climate on syncope

There is limited evidence to suggest a correlation between variation in ambient temperature and the frequency of unexplained collapses (8). These data may be of relevance to military populations, as Service personnel may be required to move between geographical regions with different ambient temperatures at short notice. It is during these transition periods that personnel should be given reliable advice regarding hydration status and made aware of the risk of suffering a collapse until they are acclimatised.

Occupational considerations

Military patients who experience an episode of unexplained collapse should be investigated as outlined above and can then be broadly categorised as having vasovagal, neurological or cardiac precipitants for their symptoms. The eventual cause or correlation should then be considered in the context of the occupational and potential operational impact of such a diagnosis. During the investigative period a non-deployable medical grading should be made and restriction of duties should include 'no live weapons handling', 'no working at heights', and 'no safety-critical roles', in order to protect the individual and the Service (13).

The individual patient will also require counselling regarding unfitness to drive until the cause for collapse has been investigated. Service personnel frequently hold a driving licence for various vehicle groups, and the fitness to drive in each of these groups needs to be determined. Medical practitioners use the guidelines set out by the Driver and Vehicle Licencing Agency (DVLA) to determine ability to drive in both a Service and civilian capacity following episodes of collapse. Driving categories can be split into two groups. Group One consists of car and motorcycle driving and Group Two comprises larger goods vehicles and passenger carrying vehicles.

In straightforward cases of reflex vasovagal collapse, which is unlikely to occur while sitting or lying and is benign in nature, the driver does not need to notify the DVLA and no driving restrictions will be put in place. Presentations of unexplained collapse with a high probability of reflex vasovagal collapse lead to no restrictions on Group One drivers, whilst those with Group Two licences can drive three months after the event. Should a single episode of collapse have no clinical pointers to cardiovascular or neurological causes and investigations reveal no abnormalities, a Group One licence will be revoked for six months and a Group

Two licence for one year. In those clinical cases where more than one episode of collapse is seen without reliable prodromal symptoms, Group One licences are revoked for twelve months and Group Two licences for ten years. If there are any questions regarding ability to drive following episodes of collapse, the DVLA should be informed so that a decision can be made on an individual basis (14).

General naval service

'Vasovagal collapse' is a common condition, and most people experience it infrequently. However, where it is affecting an individual Service person's function within the unit or role, referral to the Regional Occupational Health Team (ROHT) is required. In cases of unexplained loss of consciousness or altered awareness, a thorough specialist assessment and trial of treatment (where indicated) should be the norm. If all investigation is normal, a deployable grading can be awarded, provided six months have elapsed since the last episode of collapse and the individual is thought to be at low risk of recurrence (13). In those personnel who experience recurrent episodes of collapse, but where no cause can be found, grading can be according to functional role, but an individual must remain downgraded for twelve months following the last episode of collapse (13).

The purpose of ROHT referral is to determine suitability for continued employment, and whether restriction of roles by way of permanent downgrade is appropriate, or whether medical discharge from the Service is warranted. Patients from some specific branches of the Royal Navy such as Service divers, aircrew and submariners require more thorough occupational health involvement as detailed below.

Aircrew

Following unexplained collapse in aircrew, the individual should be considered unfit for flying for a period of up to 28 days; further investigation and assessment before a formal medical category assessment and downgrading must take place. If downgrading is required and lasts for more than six months, the patient needs to be referred to an air station Consultant in Occupational/Aviation Medicine (ConsOM(Av)) for a medical category review. On returning to fitness and before flying duties commence their case must be reviewed by a ConsOM(Av).

If aircrew suffer a single episode of fainting, it is compatible with an early return to unrestricted duties (A1, L1). Should the individual have infrequent but recurrent episodes of collapse with triggers unrelated to flying duties as well as well recognised warning symptoms, this is also compatible

with an early unrestricted return to duties (A1, L1). Individuals in whom there is any doubt about the nature or cause for collapse are 'unfit for service outside base areas', 'unfit weapons handling' and 'unfit flying/controlling' for up to twelve months. If after this time there is no recurrence of collapse, and with the recommendation of ConsOM(Av), the individual may be upgraded to (A1, L2) (15).

Service and sports divers

Routine medical examinations are required for Service divers as well as Service sports divers. Past medical history needs to be taken into account to determine the individual's fitness for immersion and pressure exposure. A relevant medical condition such as recurrent, unprovoked loss of consciousness of unknown aetiology or recurrent episodes of fainting may lead to a diver being declared permanently medically unfit for diving. All such patients require referral to Senior Medical Officer (Diving Medicine) (SMO(DM)) to be individually assessed (16).

Continued fitness for submarine service

In patients of the submarine cadre who suffer unexplained collapse, especially if it is of a recurring nature or requires hospitalisation, the MO should question their continued fitness to serve in submarines. Cases must be dealt with on an individual basis overseen by the ROHT. Once concerns are raised about a qualified submariner's fitness for further service, their medical notes and relevant case history should be passed to the SMO (Submarines) who will make the final decision (17).

Conclusion

Unexplained collapse is a common presenting complaint in adults and is likely to be encountered among the Naval Service population. The diagnosis remains primarily clinical, supported by ECG, blood tests, and further investigation depending upon the circumstances leading to the collapse. In remote environments, a thorough history and examination will allow the medical practitioner to make a decision as to whether the patient needs emergency evacuation for further investigation or whether the patient can remain deployed. Once in the secondary care environment, further investigations, such as ECG and blood tests, can be performed and risk stratification can be employed to determine those patients at high risk of further morbidity and mortality. Treatment options will depend upon the eventual diagnosis or underlying cause. The likely outcome is a referral to the ROHT to determine the highest possible medical category in which a Service person can be employed.

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