Diagnosing syncope in clinical practice

Implementation of a simplified diagnostic algorithm in a multicentre prospective trial — the OESIL 2 Study (Osservatorio Epidemiologico della Sincope nel Lazio)

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Background In some patients with syncope health care is inappropriate and ineffective. In a recent observational investigation in community hospitals of the Lazio region of Italy (the OESIL study) 54·4% of patients admitted with syncope from the emergency room were discharged without a conclusive diagnosis.

Aim of the Study A simplified two-step diagnostic algorithm was developed and prospectively implemented in nine community hospitals of the Lazio region of Italy in order to improve the diagnostic performance of clinicians, thereby reducing the number of undiagnosed patients.

Study Population The study population included 195 consecutive patients (85 males and 110 females, mean age 62·5 years, range 13–95 years) presenting with a syncopal spell at the emergency room of one of the nine participating hospitals in a 2-month period.

Results The systematic implementation of the proposed diagnostic algorithm resulted in a striking reduction of undiagnosed cases. The percentage of patients discharged without a conclusive diagnosis decreased from 54·4% to 17·5%. Neurally mediated syncope was diagnosed in 35·2% of cases, cardiac syncope in 20·9% and neurological syncope in 13·8%.

Conclusions The use of specific, simplified diagnostic guidelines and algorithms results in an improvement of overall clinical performance. However, the development of such decision-making aids should carefully consider the local circumstances of daily clinical practice.

Introduction

Syncope is currently defined as a sudden and temporary loss of consciousness and of postural tone, with spontaneous recovery[1–5]. Such an event may have multiple possible causes, ranging from benign conditions to life-threatening diseases[1–5]. Furthermore, a significant percentage of emergency room visits (1–3%) and hospital admissions (2–6%) are known to be directly related to syncopal spells[1–5]. These features make syncope a major challenge for the practicing physician.

The clinical assessment and specific management of patients with syncope have significantly changed over the past two decades[1–5]. However, while newer methodologies have led to a substantial improvement in the understanding of the pathophysiology of particular forms of syncope, the diagnostic approach to such complex symptoms remains difficult and often unrewarding[4–6]. Effective care delivery can be difficult and some patients with syncope are still discharged from hospital without a conclusive diagnosis[5–8]. Consequently, in order to support clinicians and optimize the diagnostic work-up, several guidelines and diagnostic algorithms have been developed and proposed for a cost-effective management of syncope[4–6,9,10]. Owing to the wide range of possible aetiologies, these comprehensive diagnostic strategies are often difficult to implement and their real effectiveness remains unknown.

Recently, a multi-centre observational study involving 15 different community-based hospitals was performed in the Lazio region of Italy (the OESIL study, Osservatorio Epidemiologico sulla Sincope nella Regione Lazio)[11]. This investigation was sponsored by the
Italian Association of Hospital Cardiologists (A.N.M.C.O) and has enabled the collection of definite data about the number and percentage of emergency room visits and hospital admissions due to syncope in this geographic area. In particular, 781 out of 85 102 (0.9%) emergency room visits and 450 out of 33 165 (1.3%) hospital admissions were found to be related to a syncopal episode in the 2-month period of observation. Moreover, the study has gathered information about syncope management in community hospitals and has clearly shown that most patients (54.4%) are still discharged without a conclusive diagnosis, despite an extensive and costly work-up. A careful review of the data from the OESIL study has shown that, in community hospitals at least, some of the health care delivered to patients with syncope was both inappropriate and ineffective. Accordingly, in an effort to implement valid cost-effective health care, the OESIL study was provided with a second stage (the OESIL 2 study). The new investigation was planned taking into account: (1) the available evidence concerning the yield of most currently employed diagnostic procedures for syncope; (2) the complexity of the proposed guidelines and algorithms in terms of the diagnostic approach to syncope; (3) the substantial dearth of data about the real diagnostic performance of all available clinical practice guidelines for syncope. After background preparation (collection of all articles from the MEDLINE database relating to diagnostic testing for patients with syncope in the English language), a consensus group, including all active investigators of the OESIL study, was formed and a simplified diagnostic algorithm for syncope was developed to be implemented in the specific setting of community hospitals of the Lazio region of Italy [12–14].

Subsequently, the overall diagnostic performance of these new simplified guidelines was assessed in a prospective trial on patients with syncope presenting at the emergency rooms of community hospitals in the Lazio region of Italy.

Methods

Participating centres


Study population

All patients older than 12 years of age presenting with syncope at the emergency room of one of the nine hospitals participating in the study from the 1 April to the 31 May 1998 were considered eligible for enrolment.

Syncope was defined as a sudden and transient loss of consciousness and of postural tone with spontaneous recovery [1–3]. Patients with an already known seizure disorder and presenting a typical recurrence, with a prolonged post-ictal recovery phase, were excluded. Patients presenting with only pre-syncope or dizziness, without a clear loss of consciousness, were also excluded. The patients had to provide written informed consent to be included in the study. At the end of the scheduled 2-month period of recruitment the study population comprised 195 consecutive patients (85 males and 110 females), with a mean age of 62.5 ± 22.3 years (range 13–95 years).

Diagnostic algorithm and implementation procedures

The proposed diagnostic algorithm was developed by a consensus group, including all active investigators of the OESIL study, to consider: (1) all published guidelines on diagnosing syncope [4–6,9,10,15]; (2) the overall yield of available diagnostic procedures in patients with syncope [4–6,9,10,15,16]; (3) the estimates about the prevalence of various causes of syncope [1–6,11]; (4) the specific experience deriving from the OESIL study [11]. The diagnostic algorithm and the study protocol were both approved by the ethical committee of all participating institutions.

The diagnostic flow-chart comprised two main steps (Fig. 1).

(a) The first step. This first step (baseline evaluation) had to be performed in the emergency room by the physician on duty and included a detailed history, a complete physical examination, a 12-lead electrocardiogram with rhythm strip, an haemoglobin count and a blood glucose test (finger stick). In case a diagnostic conclusion was reached at the end of this first step, the patient was treated accordingly and no further diagnostic assessment was required. If no conclusive diagnosis could be drawn at the end of the preliminary work-up, a further evaluation was started (second step). The decision to either admit the patient to hospital or perform the diagnostic assessment on an outpatient basis was left to the emergency room physician.

(b) The second step. In the second step all further clinical and laboratory investigations had to be guided by a diagnostic hypothesis, which had to be based on the abnormalities found in the initial clinical assessment. The diagnostic algorithm allowed three main hypotheses for the syncopal spell: (1) cardiac syncope; (2) neurally mediated syncope; (3) neurological or psychiatric syncope. The diagnostic hypothesis was formulated by the emergency room physician and reviewed by the main investigator of the hospital. In case of disagreement the patient was jointly reevaluated and a consensus was reached. Neurological and psychiatric syncope were
considered together as in smaller hospitals the consultant neurologist also performs the psychiatric evaluation when necessary.

**Cardiac syncope**

If cardiac syncope was hypothesized a Doppler-echocardiographic examination was scheduled, in order to confirm or exclude the presence of structural heart disease\(^\text{[17]}\). Exercise testing and Holter monitoring were considered in cases with abnormal echocardiographic findings or in patients with a high pre-test probability of coronary artery disease or arrhythmias\(^\text{[6]}\). Further invasive cardiac tests (coronary angiography, electrophysiological study) were performed only in specific instances, when strictly indicated by abnormal findings from non-invasive testing. If the cardiac evaluation was found to be unremarkable an head-up tilt testing was then performed.

**Neurologically or psychiatric syncope**

If a neurological cause was suspected from the syncopal episode, the patient could undergo an electroencephalographic examination, brain imaging (computed tomography or magnetic resonance imaging) or carotid Doppler ultrasonography. Electroencephalography was considered if seizure activity had been noted. Central nervous system imaging was performed in case of focal neurological signs, while carotid Doppler ultrasonography was allowed when a significant carotid bruit was found during physical examination. A psychiatric evaluation was requested when a clear suspicion of a psychiatric origin for the syncopal spell emerged from the initial evaluation. In the event that neurological and psychiatric assessment were found to be inconclusive the patient underwent carotid sinus massage and head-up tilt testing.

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**Final diagnosis**

During the whole work-up following the emergency room visit the patient was followed by the main investigator of the hospital, who also had the responsibility for the final diagnosis. For every patient a personal record chart was used, containing the results of the first step assessment, the diagnostic hypothesis guiding the second step and the results of all the laboratory procedures. The main investigator could also schedule further diagnostic procedures, which were not included in the original algorithm. In this case he/she had to specify in the record chart the clinical reasons leading to such behaviour. The personal records and the final diagnosis for every case were finally reviewed by the consensus group, including all main investigators from all participating hospitals. This final evaluation was intended to verify full compliance with the diagnostic algorithm and consistency of diagnosis with collected clinical and laboratory evidence.

**Undiagnosed patients — syncope of unknown origin**

Patients could be considered undiagnosed at the end of the diagnostic work-up and offered a monthly follow-up visit only if they showed: (1) a negative first step assessment, (2) no clinical or laboratory evidence of cardiac, neurological or psychiatric disease possibly causing syncope, (3) a negative carotid sinus massage and head-up tilt-testing.

**Results**

**General features of the study population**

During the 2-month study period, 195 consecutive patients with syncope as the chief complaint presented at the emergency rooms of the nine participating community hospitals, fulfilled entry criteria and were included in the investigation. There were 85 males (43.6%) and 110 females (56.4%) and the mean age was 62.5 ± 22.3 years (range 13–95 years). Of the 195 patients 63 (32.3%) had a prior history of syncope, 18 (9.2%) had a prior history of neurological disease and 57 (29.2%) had a prior history of cardiac disease. The syncopal spell was followed by major or minor injuries in 51 patients (26.1%). Of the 195 patients 132 (67.6%) were admitted to hospital from the emergency room.

**Results of the first step of the diagnostic algorithm**

For 43 of the 195 patients (22.0%) a diagnostic conclusion was achieved at the end of the first step assessment in the emergency room; 23 of these 43 patients (53.5%) were admitted to the hospital for further evaluation and treatment. The final diagnosis for these patients was the following: 22 patients (51.1%) had a neurally mediated vasovagal syncope, five patients (11.7%) a neurally mediated situational syncope, 12 patients (27.9%) a cardiac arrhythmic syncope, two patients (4.7%) a neurological syncope, one patient a psychiatric syncope (2.3%) and one patient (2.3%) a metabolic syncope.

**Results of the second step of the diagnostic algorithm**

At the end of the first step the following diagnostic hypotheses were formulated for the remaining 152 (78.0%) undiagnosed patients: (1) cardiac syncope in 53 patients (34.8%); (2) neurally mediated syncope in 52 patients (34.2%); (3) neurological or psychiatric syncope in 47 patients (31.0%).

**Suspected cardiac syncope**

Forty-one of the 53 patients with a suspected cardiac syncope were admitted to hospital (75.4%). At the end of the diagnostic work-up the final diagnosis for all these patients were the following: cardiac arrhythmic syncope in 21 cases (39.6%), cardiac non-arrhythmic haemodynamic syncope six cases (11.3%), orthostatic hypotension seven cases (13.2%), neurally mediated vasovagal syncope six cases (11.3%), neurological syncope three cases (5.6%). No final diagnosis could be reached in 10 patients (syncpe of unknown origin 18.8%).

**Suspected neurally mediated syncope**

Twenty-eight of the 52 patients with a suspected neurally mediated syncope (53.8%) were admitted to hospital. At the end of the diagnostic work-up the final diagnosis for all these patients were the following: neurally mediated vasovagal syncope in 25 cases (48.0%), carotid sinus syndrome in four cases (7.6%), neurally mediated situational syncope in two cases (3.8%), neurological syncope in four cases (7.6%), psychiatric syncope two cases (3.8%), orthostatic hypotension three cases (5.7%), cardiac arrhythmic syncope two cases (3.8%). In 10 cases no diagnostic conclusion could be reached (syncpe of unknown origin 19.2%).

**Suspected neurological or psychiatric syncope**

Forty of the 47 patients with suspected neurological or psychiatric syncope were admitted to hospital (85.1%). For these patients the final diagnosis at the end of the diagnostic work-up were the following: neurological syncope 18 cases (38.2%), psychiatric syncope eight cases (17.0%), neurally mediated vasovagal syncope five cases (10.6%), orthostatic hypotension two cases (4.2%). No final diagnosis could be reached in 14 patients (syncpe of unknown origin 29.7%).

**Overall diagnostic performance**

When considering the whole study population, a conclusive diagnosis concerning the genesis of the syncopal...
Diagnosing syncope

Table 1 Relative frequencies of the aetiologies of syncope in the study population (195 patients)

<table>
<thead>
<tr>
<th>Aetiology</th>
<th>Frequency (195 patients)</th>
</tr>
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<tbody>
<tr>
<td>Neurally mediated syncope</td>
<td>69 (35.2%)</td>
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<tr>
<td>Vasovagal</td>
<td>58 (29.7%)</td>
</tr>
<tr>
<td>Situational</td>
<td>7 (3.5%)</td>
</tr>
<tr>
<td>Carotid sinus syndrome</td>
<td>4 (2.0%)</td>
</tr>
<tr>
<td>Cardiac syncope</td>
<td>41 (21.0%)</td>
</tr>
<tr>
<td>Bradyarrhythmias</td>
<td>21 (11.3%)</td>
</tr>
<tr>
<td>Tachyarrhythmias</td>
<td>14 (7.1%)</td>
</tr>
<tr>
<td>Haemodynamic</td>
<td>6 (3.0%)</td>
</tr>
<tr>
<td>Orthostatic hypotension</td>
<td>12 (6.1%)</td>
</tr>
<tr>
<td>Neurologic syncope</td>
<td>27 (13.8%)</td>
</tr>
<tr>
<td>Cerebrovascular</td>
<td>21 (10.8%)</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>6 (3.0%)</td>
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<tr>
<td>Psychiatric syncope (hypoglicemia)</td>
<td>11 (5.6%)</td>
</tr>
<tr>
<td>Metabolic syncope (hypoglicemia)</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>Syncope of unknown origin</td>
<td>34 (17.5%)</td>
</tr>
</tbody>
</table>

spell could be achieved in 161 out of 195 patients (82.5%). In 43 of 161 cases (26.8%) the diagnosis was reached with the baseline evaluation (first step), while for the remaining 118 patients (73.2%) the diagnostic conclusion required a further clinical and laboratory assessment (second step). The relative frequencies of the various aetiologies of syncope in the study population were the following (Table 1): neurally mediated vasovagal syncope 58 cases (29.7%), neurally mediated situational syncope seven cases (3.5%), carotid sinus syndrome four cases (2.0%), cardiac arrhythmic syncope 35 cases (17.9%), cardiac non-arrhythmic haemodynamic syncope six cases (3.0%), neurological syncope 27 cases (13.8%), psychiatric syncope 11 cases (5.6%), orthostatic hypotension 12 cases (6.1%), metabolic syncope one case (0.5%), syncope of unknown origin 34 cases (17.5%).

Final data review

In five cases (2.5%) from four different hospitals the final review of data showed that the diagnostic algorithm had not been correctly employed. In three cases the head-up tilt test was not performed even if a neurally mediated vasovagal syncope had been suspected, while in two cases a psychiatric evaluation was not performed even if a psychiatric disease had been hypothesized. All of these five patients remained undiagnosed. If these five cases are excluded from the overall population the diagnostic performance of the proposed algorithm improves, as undiagnosed cases decrease from 34/195 (17.5%) to 29/190 (15.2%).

In four cases (2.0%) from four different hospitals the investigators performed further laboratory diagnostic procedures without strictly adhering to the diagnostic algorithm; however, such patients remained undiagnosed.

Discussion

Syncope represents a common and challenging symptom complex for the practicing physician. The possible causes of such frequent events are known to be multiple, while the costs of resolving the aetiology of the single episode may become enormous when the available highly technological approaches are used[6–9]. Moreover, in patients with syncope the extensive employment of complex diagnostic laboratory procedures does not represent in itself a guarantee of clinical success. In fact, relevant percentages of patients with syncopal spells remain undiagnosed despite prolonged and costly work-up[4–6,11]. However, these management strategies appear to have a degree of complexity that eventually makes them impractical for implementation in daily clinical practice. This constitutes a major limitation to both application and dissemination of such guidelines, which should be not only valid and reliable, but also practical to use[19].

Several investigations, including the OESIL study, have clearly shown that current clinical practice results in suboptimal care for patients with syncope[4–6,11]. Surprisingly, most physicians are aware of available information on this issue from the medical literature, including decision-making aids, clinical practice guidelines and algorithms. However, such knowledge does not modify their usual clinical behaviour, while a poor compliance with published strategies and protocols is evident[11]. Considering all such issues and following the frustrating results of the OESIL study (54% of patients with syncope discharged without a conclusive diagnosis), a simplified diagnostic algorithm for syncope was developed and prospectively implemented in the community-based hospitals.

The use of this new simple two-step approach for syncope determined a substantial improvement in overall diagnostic performance, with the percentage of undiagnosed cases decreasing from 54.4% to 17.5% in the same clinical setting of community hospitals in the Lazio region of Italy. Moreover, the diagnostic algorithm was shown to be practical and easily employable, as it was not correctly implemented in only five cases (2.5%). Another point of interest is that the distribution of the specific causes of syncope in the population of the OESIL 2 study was found to be similar to that already noted in previous experiences and reported by most authors[4–6]. Neurally mediated syncope was shown to represent the most common form of syncope in unselected patients presenting to emergency departments (35.2%), followed by cardiac syncope (20.9%) and neurological syncope (13.8%).

The main finding of this clinical study is represented by the clear evidence that the prospective implementation of a simplified diagnostic guideline for the evaluation of patients with syncope is associated with a striking reduction of undiagnosed cases (OESIL 2 study, 17.5%), when compared with what can be defined as a non-guided extensive diagnostic approach (OESIL study, 54%). The clinical behaviour of the same physicians in the same hospitals were substantially different.
only a few months apart (OESIL study October–November 1997, OESIL 2 study April–May 1998). This observation may have several possible explanations. First of all, the diagnostic algorithm developed for the OESIL 2 study was proposed to physicians by a credible source (Italian Association of Hospital Cardiologists, A.N.M.C.O.) and targeted to an audience which had already been made receptive to change by a recent experience on the same clinical issue (the OESIL study). These two factors are known to have a significant impact on clinical practice and to encourage innovation in patient care[12]. Furthermore, the simplified two-step diagnostic algorithm had been developed with particular care in the specific practice circumstances of the Italian community-based hospitals. This element has particular relevance, as local factors are known to affect practice behaviour, while all guidelines need to be adapted to the evidence and practice [13].

Furthermore, the real impact on health outcomes and on quality of care should be considered in the development of the diagnostic algorithm implemented in this investigation. However, even if the results of the present investigation can be taken as encouraging, a non-negligible percentage of patients with syncope still remains undiagnosed (17-5%). Specific efforts should therefore be undertaken to further reduce the number of patients discharged without a conclusive diagnosis, while careful monitoring is warranted to maintain the standards of care which have been achieved with noticeable difficulty.

References


Appendix

OESIL Study Investigators