Transient loss of consciousness through the eyes of a witness

Roland D. Thijs,¹ Willem A. Wagenaar,² Huub A.M. Middelkoop,³ Wouter Wieling,⁴ and J.Gert van Dijk¹

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[1] Department of Neurology and Clinical Neurophysiology, Leiden University Medical Centre, Leiden, the Netherlands
[2] Department of Experimental Psychology, Leiden University, Leiden, the Netherlands
[3] Department of Neuropsychology, Leiden University Medical Centre, Leiden, the Netherlands
[4] Department of Internal Medicine, Academic Medical Centre, Amsterdam, the Netherlands
Abstract

Objective: To assess the accuracy of eyewitness observations of transient loss of consciousness (TLOC)

Methods: Videos of a generalized tonic-clonic seizure and of reflex syncope were unexpectedly shown to 125 and 104 psychology students respectively during a lecture on an unrelated subject. Directly afterwards, the students filled in a multiple-choice questionnaire regarding muscle tone, twitches, head deviation, eye closure, gaze deviation, drooling and facial color. The consensus of experienced neurologists served as a gold standard. Even though not all items could be ascertained from the videos, the full range of questions was included to simulate clinical practice.

Results: Of all responses to the observable items on the syncope video (flaccid limbs, twitches of one shoulder, head deviation) 44% were correct, 28% erroneous and 29% concerned “I do not know” responses. The observable items on the epilepsy video (stiff limbs, twitches of all limbs, normal facial color, drooling, no head deviation) yielded 60% correct responses, 18% erroneous responses and 22% “I do not know” responses. Regarding features that were not visible on the videos, 77% of the responses were accurate (“I do not know”), while 23% erroneously provided an observation. Of all items observable on both videos muscle tone was the most accurately recalled item.

Conclusions: An eyewitness account of a single episode of TLOC should be interpreted with caution as salient features are frequently overlooked or inaccurately recalled. However, the accuracy of the eyewitness observations of TLOC differs per item; muscle tone was reported with high accuracy.
Introduction

History taking is regarded as the cornerstone in the evaluation of transient loss of consciousness (TLOC).\textsuperscript{29,53,144,171} As unconsciousness causes amnesia, an eyewitness account is needed to probe for features during the event to distinguish various causes of TLOC. Historical criteria have been identified for the differentiation between the two major causes of TLOC, i.e., syncope and epilepsy.\textsuperscript{109,223} In addition, historical features in the distinction between reflex and cardiac syncope have been studied.\textsuperscript{4,41,222}

The following details of the eyewitness account may contribute to a correct diagnosis: head turning,\textsuperscript{223} frothing at the mouth,\textsuperscript{109} long (>5 minutes) duration of unconsciousness or postictal confusion\textsuperscript{109,223} are strongly predictive of epilepsy. Observed pallor makes syncope more likely than epilepsy,\textsuperscript{109} and also favors reflex syncope over cardiac syncope.\textsuperscript{4,222} Conversely, a bluish facial color is a strong predictor for epilepsy and pleads against syncope.\textsuperscript{109,223} If, however, syncope is already likely on other grounds, facial cyanosis favors cardiac syncope over reflex syncope.\textsuperscript{222} Combined video and electroencephalogram monitoring revealed that ictal eye closure is a highly reliable indicator for psychogenic nonepileptic seizures and pleads against epilepsy.\textsuperscript{50} This probably also hold for syncope, as the eyes are opened during syncopal spells.\textsuperscript{149} Therefore, an eyewitness account of ictal eye closure may be indicative of psychogenic attacks, but the value of history taking on this subject has not been evaluated yet.

The reliability of eyewitness accounts has been studied extensively in the field of criminalology. Using various simulations, such as filmed events and staged crimes, it has been shown that mistaken identification rates can be surprisingly high and that eyewitnesses often express certainty when mistakenly identifying an innocent subject as the culprit.\textsuperscript{265} In contrast, little is known about the reliability of history taking in the medical field, as the medical interview predominantly evaluates subjective complaints and the recall of these symptoms cannot be compared with a gold standard. However, TLOC provides a unique opportunity to assess the accuracy of history taking as a video recording can be used to simulate a clinical event, serving as a gold standard. In the present study we assessed the reliability of the eyewitness account after unexpected viewing a video of either a syncopal or an epileptic attack.
Methods

Two sequential cohorts of bachelor psychology students of Leiden University were studied while attending a lecture on biopsychology: the first cohort viewed the syncope video and the second cohort the epilepsy video. The lecture was not in any way related to memory functions, taking interviews or eyewitness accounts. After the lecturer resumed the lecture after a scheduled break, a video was suddenly shown without any introduction, while the lecturer kept silent. The students thus neither knew the purpose of the experiment nor saw the questionnaire prior to watching the video. The video was only shown once.

Video material
- Syncope video. This was a televised video fragment of a young woman during a tennis match. While preparing to serve, she sighs deeply, and suddenly falls to the ground with flaccid legs (Figure 1A). Once on the ground her head is turned to the left side and two twitches of the right shoulder are seen. After a few seconds she makes a purposeful movement with her left arm, indicating quick resumption of consciousness. The duration of the episode is 21 seconds.
- Epilepsy video. This home video shows a young woman lying on a bed; she suddenly starts to grunt, after which she stiffens completely. After a few seconds repetitive twitches of all limbs and the right side of her face occur. The left side of the face cannot be seen (Figure 1B). Her mother repeatedly wipes her mouth with a handkerchief because of drooling. The duration of the recording is 51 seconds. Informed consent to use the video for the present study was obtained from the patient.

Questionnaire

After viewing the video the students were informed about the experiment and asked to participate by filling in a multiple choice questionnaire (Table 1). For each video a ‘dummy question’ was included to provide an indication of the general accuracy of the observers: in the syncope video this concerned the color of billboards visible in the background, and in the epilepsy video a multiple choice question asked for the color of the patient’s trousers. All subjects were asked if they had seen a similar attack previously. In addition, the students were asked to estimate the duration of the attack in seconds or minutes. To avoid any confounding effect of being asked questions in a particular order, two different forms were distributed in equal numbers among the students: in one, the possible answers were ordered so the first was
Table 1  Questionnaire assessing the accuracy of eyewitness observations after unexpected viewing a video of either a generalized tonic-clonic seizure or reflex syncope

<table>
<thead>
<tr>
<th>Twitches</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Left side of the face</td>
<td>yes</td>
<td>no</td>
<td>I do not know</td>
</tr>
<tr>
<td>Right side of the face</td>
<td>yes</td>
<td>no</td>
<td>I do not know</td>
</tr>
<tr>
<td>Left arm</td>
<td>yes</td>
<td>no</td>
<td>I do not know</td>
</tr>
<tr>
<td>Right arm</td>
<td>yes</td>
<td>no</td>
<td>I do not know</td>
</tr>
<tr>
<td>Left leg</td>
<td>yes</td>
<td>no</td>
<td>I do not know</td>
</tr>
<tr>
<td>Right leg</td>
<td>yes</td>
<td>no</td>
<td>I do not know</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>stiff</td>
<td>flaccid</td>
<td>normal</td>
</tr>
<tr>
<td>Head position</td>
<td>midline</td>
<td>deviated</td>
<td>I do not know</td>
</tr>
<tr>
<td>Eyes</td>
<td>open</td>
<td>closed</td>
<td>I do not know</td>
</tr>
<tr>
<td>Position of the eyes</td>
<td>midline</td>
<td>to the right</td>
<td>to the left</td>
</tr>
<tr>
<td>Drooling</td>
<td>yes</td>
<td>no</td>
<td>I do not know</td>
</tr>
<tr>
<td>Facial color</td>
<td>blue</td>
<td>pale</td>
<td>normal</td>
</tr>
</tbody>
</table>

always suggestive of epilepsy (e.g. facial color: blue/pale/normal/I do not know), while the first item was suggestive of syncope in the other form (e.g. pale/blue/normal/I do not know). Of note, not all items could be judged from the videos because for instance the eyes were not visible, but the full range of questions was included. As such, our approach simulated clinical practice since eyewitnesses may be asked for details that they could not observe. As a gold standard the consensus of four experienced neurologists was used, who had seen the videos repeatedly. No consensus could be obtained regarding eye closure on the epilepsy video, as the patient’s eyes were closed in the beginning of the video and open at its end. Therefore, this item was excluded from analysis. Regarding the facial color of the patient on the syncope video, two responses were considered correct: ‘normal facial color’ and ‘I do not know’, as the patient’s face could be seen with normal color before falling, but could not be seen upon lying on the ground and the question did not stipulate when observers were supposed to attend to the color of the face. Approval of the local ethics reviewing committee was not required since the questionnaire did not compromise the physical or psychological integrity of the students in any way.
Chapter 10

Figure 1  Drawings from frames of the video of reflex syncope (panel a) and of the video of a generalised tonic-clonic seizure (panel b), demonstrating the position of the subjects during loss of consciousness: muscle tone was flaccid on the syncope video and stiff on the epilepsy video. Of note, the eyes were not visible during the syncopal spell. Even though not all items could be ascertained from the videos, the full range of questions was included to simulate clinical practice.

(a)

(b)

Analysis

Data are presented as mean ± SD or median (25th-75th percentile). For those items observable on both videos and providing opposite observations (for example stiff muscles on the epilepsy vs. flaccid muscles on the syncope video) the percentage of correct responses was calculated after leaving out the ‘I do not know’ response. The Sign test was used to compare the estimated duration of TLOC with the true value. The Mann-Whitney U test was used to assess the influence of sex, the order of the responses to the multiple choice questions and previous experience with TLOC on the number of correct observations. Data analysis was performed
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with SPSS software, version 12.0. All tests were performed two-sided. Significance threshold was set at 5%.

Results
The results of the questionnaire for both videos are summarised in Table 2.

Syncope
104 Students evaluated the syncope video (84 women; 21±5 years), of whom 25% indicated that they had seen a similar attack previously. The mean total number of correct responses to all questioned items on the syncope video was 8 ± 2 out of 13 (range 4 to 12). Of all responses to the observable items on the syncope video (flaccid limbs, twitches of one shoulder, no twitches of the other limbs, head deviation) 44% were correct, 28% erroneous and 29% included “I do not know” responses. Of the responses to the features not visible on the syncope video, 77% correctly concerned “I do not know” responses, while 23% of the responses inaccurately provided an observation. The dummy variable (color of the billboards) was responded to with “I do not know” by 70% of the students, whereas 15% provided a correct and 15% a false observation. The estimated duration of the syncopal attack did not differ significantly from the true value (reported duration 20(10-30) seconds; true value 21 seconds).

Epilepsy
125 Students viewed the epilepsy video (95 women, 22±4 years) of whom 18% indicated that they had seen a similar attack previously. The mean total number of correct responses to all questioned items on the epilepsy video was 7 ± 1 out of 12 (range 4 to 11). Of all responses to the observable items on the epilepsy video (stiff limbs, twitches of all limbs, normal facial color, drooling, no head deviation) 60% were correct, 18% erroneous and 22% concerned “I do not know” responses. Of the responses to the features that were not visible on the epilepsy video, 78% included “I do not know” responses, while 22% of the responses inaccurately provided an observation. The dummy variable (color of the patient’s trousers) was responded to with a correct answer by 48% of the students whereas 26% provided a false observation and 26% responded with “I do not know”. The estimated duration of the epileptic seizure did
The accuracy of eyewitness observations after unexpected viewing a video of either a generalized tonic-clonic seizure or reflex syncope. The consensus of experienced neurologists served as a gold standard.

<table>
<thead>
<tr>
<th>Observable items</th>
<th>Syncope video (n=104)</th>
<th>Epilepsy video (n=125)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do not know</td>
<td>True</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>9% (9)</td>
<td>70% (73)</td>
</tr>
<tr>
<td>Twitches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- left arm</td>
<td>40% (42)</td>
<td>28% (29)</td>
</tr>
<tr>
<td>- right arm</td>
<td>43% (45)</td>
<td>32% (33)</td>
</tr>
<tr>
<td>- left leg</td>
<td>34% (35)</td>
<td>25% (26)</td>
</tr>
<tr>
<td>- right leg</td>
<td>37% (38)</td>
<td>31% (32)</td>
</tr>
<tr>
<td>Head deviation</td>
<td>11% (11)</td>
<td>76% (79)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not observable items</th>
<th>Syncope video (n=104)</th>
<th>Epilepsy video (n=125)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do not know</td>
<td>True</td>
</tr>
<tr>
<td>Gaze deviation</td>
<td>94% (98)</td>
<td>6% (6)</td>
</tr>
<tr>
<td>Twitches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- face right side</td>
<td>77% (80)</td>
<td>23% (24)</td>
</tr>
<tr>
<td>- face left side</td>
<td>79% (82)</td>
<td>21% (22)</td>
</tr>
<tr>
<td>Eye closure</td>
<td>83% (86)</td>
<td>17% (18)</td>
</tr>
<tr>
<td>Drooling</td>
<td>74% (77)</td>
<td>26% (27)</td>
</tr>
<tr>
<td>Facial color</td>
<td>53% (55)</td>
<td>47% (49)</td>
</tr>
</tbody>
</table>
not differ significantly from the true value (reported duration 60 (30-90) seconds; true value 67 seconds).

**Items observable on both videos**

Three items were observable on both videos but of a different nature: muscle tone was flaccid on the syncope video and stiff on the epilepsy video, head deviation was present in the syncope video and absent in the epilepsy video. Finally, twitches could not be seen on the syncope case apart from a few twitches of the right shoulder, whereas in the epilepsy case the twitches were generalized. Of these, muscle tone was the most accurately recalled item: stiff limbs were correctly reported by 99% and flaccid limbs by 77%. Next were twitches correctly reported by 83%; no twitches by 44%. Head deviation was correctly reported by 85%; no head deviation by 42%.

**Factors affecting the number of correct responses**

In neither video the total number of correct observations was affected by either sex, previous experience with similar attacks or by the order of the responses to the multiple choice questions.

**Discussion**

We assessed the accuracy of eyewitness observations after a single TLOC. Salient features of TLOC proved to be frequently overlooked or inaccurately recalled. However, the accuracy of the eyewitness observations of TLOC differed per item; muscle tone was reported with high accuracy. These findings challenge the reported diagnostic value of the eyewitness account in TLOC. The first conclusion of our study might therefore be that the diagnostic value of the eyewitness account in TLOC is overrated. While we underline that the accuracy of ‘facts’ as reported by the eyewitnesses leaves much to be desired, there is more to the diagnostic process than obtaining mere facts. Before discussing this in more detail, some differences between our study and clinical practice deserve mention. First, our study could not simulate the impact seeing a TLOC event may have on an eyewitness in real-life. Hence, our laboratory study inevitably leads to qualitatively different memories. The criminological literature on eyewitness testimony reveals that emotional stress and memory interact in a complex way: emotional arousal causes narrowing of attention, which may improve the recall of those details that are directly related to the emotion-eliciting event while retrieval of
circumstantial details is impaired.\textsuperscript{49,254} It is therefore of some importance to the accuracy of an eyewitness account whether those features relevant to the diagnosis of TLOC affect the bystander emotionally or whether they are neutral to the bystander.

Second, our study population did not consist of a cross-section of the population, but consisted of university students. Luckily, there is little evidence that intelligence affects the accuracy of eyewitness testimony: only at the low extremes of intelligence a tendency is found towards an increase of false observations.\textsuperscript{265}

Third, in our study we assessed immediate recall, whereas in clinical practice an eyewitness is often questioned hours to months after the event. Delaying recall causes a decay of the number of correct responses.\textsuperscript{69} The accuracy of eyewitness observations may therefore be lower in clinical practice than in the present study.

Fourth, the number of respondents was large, but only two incidents were shown. It is possible that videos of other attacks might have resulted in different rates of observations, but this is unlikely to affect the conclusion that eyewitness accounts are only moderately reliable.

Fifth, our study is confined to the observations of a single episode of TLOC. In clinical practice bystanders may have seen multiple events which might improve recall. However, a previous study on the accuracy of seizure descriptions by relatives of patients with epilepsy yielded similar results.\textsuperscript{204}

Finally, the multiple-choice questionnaire obviously differs in nature from a medical interview, usually characterized by a mixture of open-ended and leading questions. Ideally, the medical interview is narrative-based, allowing physicians “to build” the history with the patient rather than “take” the history from the patient.\textsuperscript{97} However, physicians often redirect the patient to specific information with narrowly constructed yes/no questions.\textsuperscript{13} It is conceivable that the latter strategy impairs the reliability of the eyewitness information by pressing witnesses to provide an answer to an unanswerable question, thus leaving out the “I do not know” response; this practice has been found to increase intrusion errors.\textsuperscript{195} Another characteristic of the medical interview is that bystanders may be interviewed repeatedly: especially in tertiary care the history is often the third or fourth recall attempt. Repeated questioning may worsen the reliability of the eyewitness account, as subjects tend to express their -confabulated- answers with more confidence on repeated questioning.\textsuperscript{195}

Our finding of a high proportion of erroneous observations of important features of TLOC is in accordance with two previous studies on the reliability of seizure descriptions.\textsuperscript{163,204} In
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cost to those previous studies, the students in our study were unaware of the purpose of
the study, hence expectation did not confound our results. The response to the dummy
variables as well as the range of individual number of correct responses indicates that we were
able to capture the attention of the students. In the present study we did not assess the degree
of confidence the students had regarding their observations. The relation between reported
certainty and actual accuracy has been studied extensively in the field of criminology.265
Although the confidence of the witness is to some extent related to the accuracy of the
observation, this correlation is relatively weak. Accordingly, observers have little ability to
make correct discriminations between accurate and inaccurate eyewitness observations. False
observations may thus trouble the diagnostic evaluation of TLOC. In the present study we did
not assess the reliability of the bystander observation of postictal confusion, an important
feature to differentiate epilepsy from syncope.109,223 A previous study indicated that postictal
behavior together with limb movements was the most inaccurately recalled feature of
epileptic seizures.204 Nevertheless, these results should be interpreted cautiously, as this item
not only included confusion but also various other features including automatic behavior,
drowsiness, emotional response, and aggressiveness. We did not confirm the previous
findings of Loftus demonstrating a tendency of bystanders to overestimate the duration of a
viewed event.155 These differences may be explained by the fact that the interview took place
48 hours after the event in that study as compared with immediately afterwards in ours. An
accurate estimate of the duration of TLOC may thus be obtained directly after the event
whereas with delayed recall there may be some tendency to overestimate the duration of
TLOC. Of all items observable on both videos muscle tone was the most accurately recalled
item. We suggest that this discrepancy may be explained by the fact that the observation of
stiffness or flaccidity was the most distinguishing detail of both attacks whereas other items
were not perceived well enough to be accurately recalled. Recall of muscle tone may thus be
of help in the diagnosis of TLOC.
Diagnosing the cause of TLOC is complex and can have major consequences. It must be
stressed that no single historical feature is decisive for the diagnosis in TLOC and a diagnosis
can only be obtained by a combining various historical features.53 This may explain the
discrepancy between the general low accuracy of eyewitness observations as found in our
study and the high diagnostic accuracy of history taking in TLOC.251 The process of weighing
clinical features can best be explained by Haack’s crossword analogy: ‘how reasonable an
entry in a crossword is depends upon how well it is supported by the clue and any other
already intersecting entries; how reasonable, independently of the entry in question, those other entries are; and how much of the crossword has been completed.\(^96,258\) Adding to complexity, each specialty may have its own crossword strategy and weigh clinical features differently. For example, evaluation of seizure descriptions by epileptologists yielded a high sensitivity (96%), but specificity was only 50%, implicating that epileptologists rarely miss seizures but may be prone to overinterpret nonepileptic events as epileptic seizures.\(^66\)

What is the value of the eyewitness observations in the crossword of TLOC? As salient features of TLOC were frequently overlooked in the present study, the eyewitness account is unlikely to play a major role in the initial evaluation of TLOC. Other historical features such as the circumstances of the attack (e.g. pain, fear or prolonged standing as precipitants of reflex syncope) are probably less sensitive to uncertainty and hence of greater importance to diagnosis.\(^53,222,223\) Given the high proportion of “I do not know” responses, we recommend to avoid detailed closed-ended questions as this approach may press the bystander to provide an erroneous observation.\(^195\) However, if a specific observation is crucial to diagnosis, we advise to include “I do not know” in the closed-ended options, thus to ask “Do you know whether the eyes were open or closed?” rather than “Were the eyes open or closed?”. Nevertheless, a narrative based approach seems the most appropriate attitude to obtain accurate biomedical information.\(^97\) This approach encourages the patient’s narrative by focusing open-ended questions. Examples of such questions yielding important information in the initial evaluation of TLOC include: “What were you doing, where were you and what did you feel when the attack began?”\(^53\)

**Contributors**

RD Thijs was mainly responsible for data collection and analysis. All authors contributed to the interpretation of the data, and to the writing of the manuscript. JG van Dijk also provided the drawings of Figure 1

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