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REVIEW

Medicolegal relevance of the transient loss of consciousness

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Abstract

Transient and hardly traceable signs of diminished consciousness might be the only signs that are apparent and reported during the scrutinous care of intensive care unit (ICU) staff. Unfortunately, most transient loss of consciousness (TLoC) episodes occur elsewhere. This review aims to help recognize TLoC and identify situations when these conditions mean that certain legal privileges should be held. With this aim, the current literature was scoped for conceptualizing consciousness, its alterations, and loss as regarded in the legal system. This review was partly inceptive for increasing the use of unconsciousness as a defense against criminal charges. This paper tackles working ability and the legal liability of individuals suffering from TLoC. What has been most discussed is so-called syncope—a TLoC without actual focal neurological deficit which occurs due to hypoperfusion of the brain. Therefore, it is a symptom of the nervous system indicating a cardiovascular condition. Unlike stroke or transient ischemic attack (TIA), hypoperfusion affects the entire brain. The sudden loss of consciousness in everyday workplace situations can lead to dangerous situations. Likewise, as a result of avoiding these situations, being aware of the possible loss of consciousness can preclude a patient from performing the duties of occupation—or any activity.

Keywords

Disorders of consciousness; Legal liability; Syncope; Transient loss of consciousness; Working ability

1. Introduction

Disorders of consciousness (DoC) are heterogeneous groups of disorders and cover a range of consciousness states. In medical terms, consciousness is classically considered to have its "arousal" (a quantitative feature ranging from completely awake to deeply sedated or unconscious) and qualitative component—content [1]. The dictionary definition includes another part—awareness: "*Knowledge or perception of a situation or fact*" [2]. We should consider both these definitions and bear in mind that DoC is not a condition *sui generis*. The most abrupt and striking form is a transient loss of consciousness (TLoC), indicated by prompt onset, deciduous duration and complete spontaneous retrieval. Typically, a patient usually describes a blackout [3, 4]. There are many potential causes of TLoC, and its prevalence is widespread. Defining TLoC as a short, transient and reversible loss of consciousness does not infringe on its mechanisms.

For instance, some TLoCs are caused by hypoperfusion of the brain—syncope [3, 5–8]. The term syncope in Greek means a "cessation", "cutting short" or "pause". In 2001, TLoC and syncope were introduced as separate entities on two different hierarchical levels. For instance, a thalamic impairment or massive loss of function in both hemispheres can manifest as a TLoC. Loss of consciousness might indicate a carotid artery transient ischemic attack (TIA) if an obstacle to cranial blood supply exists [1]. We should leave further discussion on syncope/TIA/stroke/epilepsy well enough alone as it falls considerably under the specialty of neurology. However, it is possible to distinguish these conditions: a TIA does not meet the TLoC criteria but is a neurological deficit with a specific—focal—failure. On the other hand, a syncope is a TLoC with no focal neurological deficits. Simply put, syncopal episodes are neurological symptoms of a cardiovascular cause. Although this is true for TIAs and strokes that also reflect a cardiovascular pathology, hypoperfusion in syncope is a systemic circulatory problem concerning the entire brain. In TIA and stroke, the disruption is "focal"—it affects part of the brain caused by a regional obstruction of blood flow [1].

The National Institute for Health and Care Excellence (NICE) provides guidance on the managing of "uncomplicated fainting", including scrutinizing those considered to have an underlying cardiovascular pathology [3]. In 2009, the European Society of Cardiology (ESC) issued guidelines in the same sense. They suggested a pathway for diagnosing syncope and its proper management. They also advise carrying out investigations regarding prodromal symptoms linked to the TLoC ("red flags", specifically chest pain and palpitations) to aid in stratifying the risk. Despite advice to employ validated and standardized tools for neurobehavioral assessment, diagnostic uncertainties relative to TLoC still exist. These include differences in the interpretation of clinical and other modalities used for defining the patient's condition [9, 10], Fig. 1. Ultimately, when the cause of loss of consciousness is unrelated to cerebral hypoperfusion or remains totally unknown, the term used is TLoC [2, 11, 12].

Misinterpretations of symptoms indicating the state of consciousness may lead to false management and misleading considerations that decrease consistency and inflate diagnostic uncertainty [13, 14]. This problem may be a double-edged sword since over-appreciation of the patient's consciousness does not equal a meaningful capacity for interacting with the environment.

In order to review the available literature in the most thorough and comprehensive manner, we employed the PRISMA set of items to deliver an evidence-based minimum when reporting in systematic reviews [15–18]. After scoping the literature published from 01 January 2013 to 01 January 2023, in three databases—PubMed, Web of Science core collection, and Scopus—for "transient loss of consciousness", we found 1497 entries. The process and outcomes of our review are summarized visually in the flow diagram in Fig. 2.

After the initial search, the automation tool recorded 601 duplicates or non-English articles, and an additional 86 items were found ineligible by humans. In total, 456 entries could not be retrieved due to the publisher's limitations and similar, so at the end of the reviewing process, 354 entries were considered/consulted.

This review aims to search the existing literature to conceptualize consciousness and its alteration (loss, to be specific) as regarded in the legal system. Reviewing the literature has two main goals: to consider how states of consciousness relate to the individual's ability to interact (a feature of medicolegal relevance) and maintain legal liability. Finally, this paper intends to supply the perspective of disability and working ability and discuss special considerations in research.

2. Mode of presentation

Since TLoC is very common, it presents a tremendous economic burden to primary attending physicians and emergency medicine specialists [19]. Cases of TLoC correspond to 0.6–1.2% of visits to the emergency department (ED) [20, 21]. According to Thiruganasambandamoorthy *et al.* [22], syncope constitutes 1% to 3% of ED visits. Be as it may, they cause 1% of hospital admissions [6, 8]. Despite decreased non-COVID-related hospital admissions, they still constitute a significant proportion of hospitalizations, with an average stay of 5.5 days [20, 23, 24]. Soteriades *et al.* [20] estimated 6.2/1000 person-years in the general population have syncope [6]. Thanks to its frequency, its suddenness, and also the fact that people who experience TLoC may present both during and outside of the working hours of their attending physician, they may be transferred from the ambulance services or the emergency department to a tertiary center. Their TLoC may happen far away from the scrutiny that follows the ICU [20, 25].

Syncope is associated with significant healthcare utilization because many of these patients will have recurrent syncope—the recurrence rate is approximately 35%. Nearly one-third (29%) of recurring syncopal episodes are earmarked with a physical injury [20]. In a study conducted by Jorge *et al.* [29] (2020), 12% of their participants injured themselves whilst experiencing syncope (14% injuries per fainting episode). Less than one-fifth of those were moderate or severe injuries [26–29]. In the same study, patients with $\geq$4 faints had more injuries. This was most likely because of more frequent syncope rather than more injuries per faint. Tajdini *et al.* [30] found that experiencing syncope at home, in the morning, and in an upright position or without experiencing prodromal (introductory) symptoms is associated with higher rates of injury.

The value of history-taking in the not-so-common types of TLoC has not been evaluated yet. The current TLoC definition emphasizes history-taking and assessing the facts gathered through history [31–34]; see Fig. 3. It considers TLoC as a state of apparent loss of consciousness and awareness, with loss of memory (amnesia) for the period of the event. As a rule, the "TLoC" concept is built upon history from patients and eyewitnesses [31, 35]. Items reported in that history are amnesia, a gap in memory, lack of responsiveness to speech or touch, abnormal control of movement, and transitory in duration [4, 6]. Up to 12% (mean rate of 4%) of patients presenting for syncope evaluations lack impaired cerebral perfusion or function—their condition is called "psychogenic pseudoscope" (PPS) [36–38]. It is clear in Fig. 1 that the classification and nomenclature of TLoC present a significant challenge. Aside from TLoC, there are other lengthy DoCs—like coma, minimally conscious state (MCS), and vegetative state (VS) [39, 40].

Details that should be elicited from the history should include posture, prodrome (lightheadedness, nausea, blurred vision and disorientation), signs and symptoms of heart failure, and family history of sudden death under 40 years of age. Feeling faint and a feeling of faintness are terms that are long established to describe the sudden loss of strength and other symptoms that characterize the impending or incomplete fainting spell [41]. Epidemiological studies indicate that syncope has an incidence throughout life in two weeks, first at 15–20 and another at the age >70 years [42]. Gender-dependent prevalence in the general population is 3.0% in men and 3.5% in women [6]. Some prodromal (introductory) symptoms can predict most syncopal events (82% in the study of Jorge *et al.* [29], Fig. 4, and even more, according to Reuber *et al.* [31]). These rates were lower for epilepsy (66%) and psychologic non-epileptic seizures (78%) [31]. If the patient presents after the attack, their position should be documented as syncopal attacks are uncommon in supine subjects. Usually, when the individuals become supine due to syncope, they rapidly recover consciousness [6].

Due to the abrupt and sudden onset of seizures, not preceded by symptoms such as sweating, nightshades, or blurred vision, Hoefnagels *et al.* [34] defined these as negative symptoms. Not being pale during the attack is more likely to suggest a seizure. Sweating and nausea make the probability of experiencing a seizure 0.1 times as probable. A seizure is more probable if unconsciousness lasts more than 5 minutes. As for the symptoms following the event, the most discriminatory

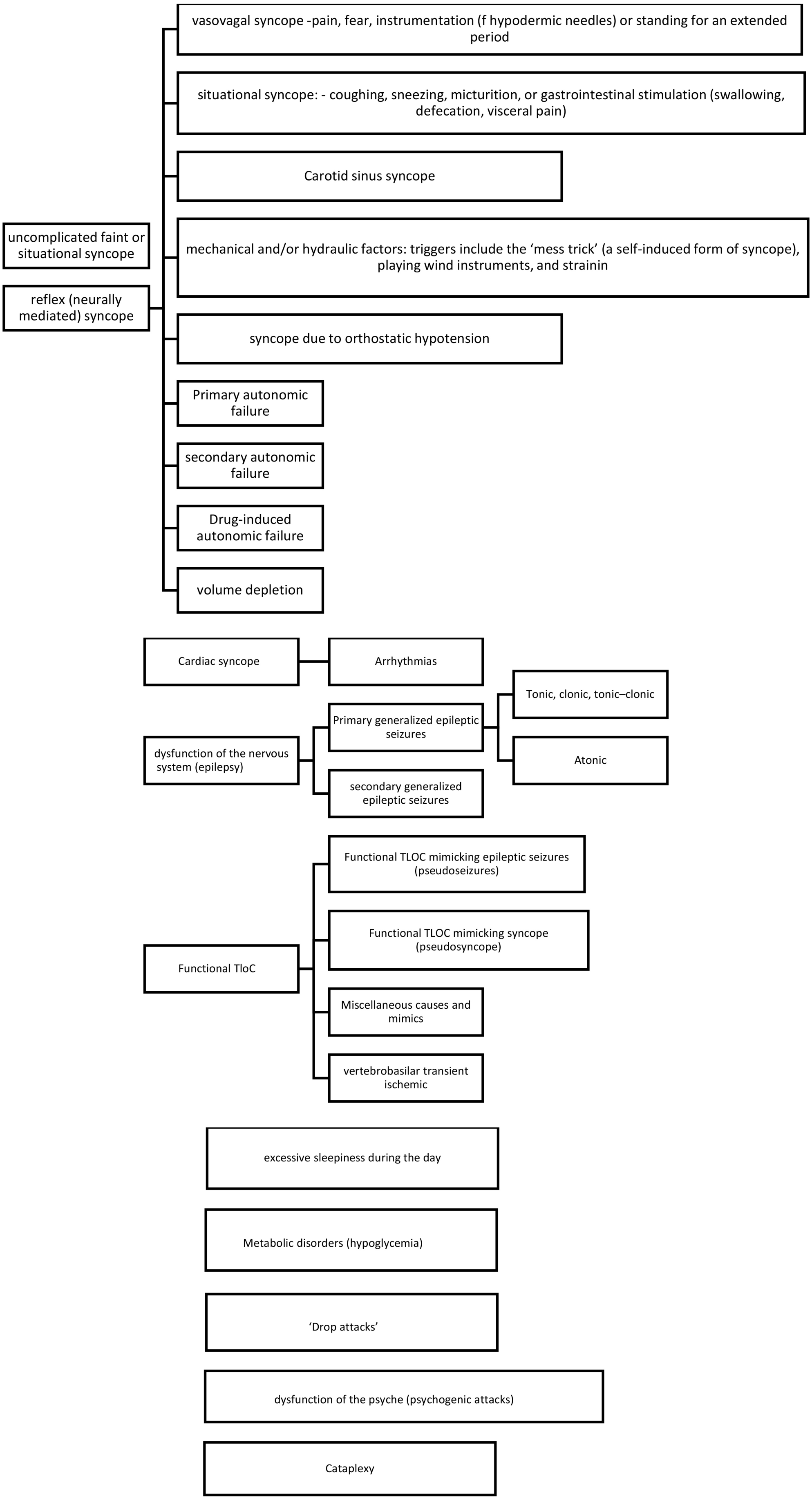

FIGURE 1. TLoC classification: lists the conditions (nontraumatic) that cause syncope in adults [1, 3, 15–17]. TLoC: transient loss of consciousness.

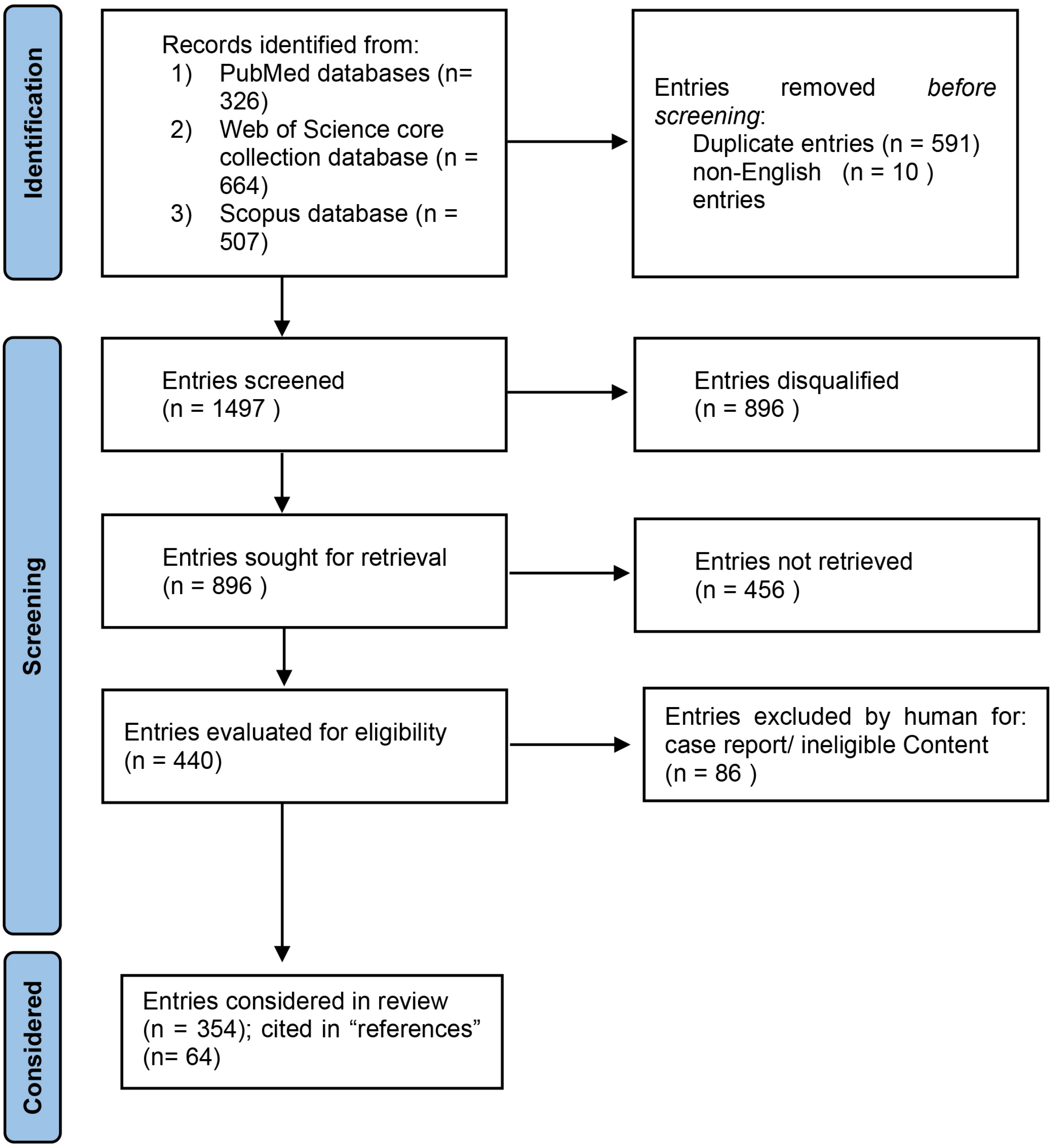

FIGURE 2. PRISMA flowchart summarizing the pathway of the studies considered.

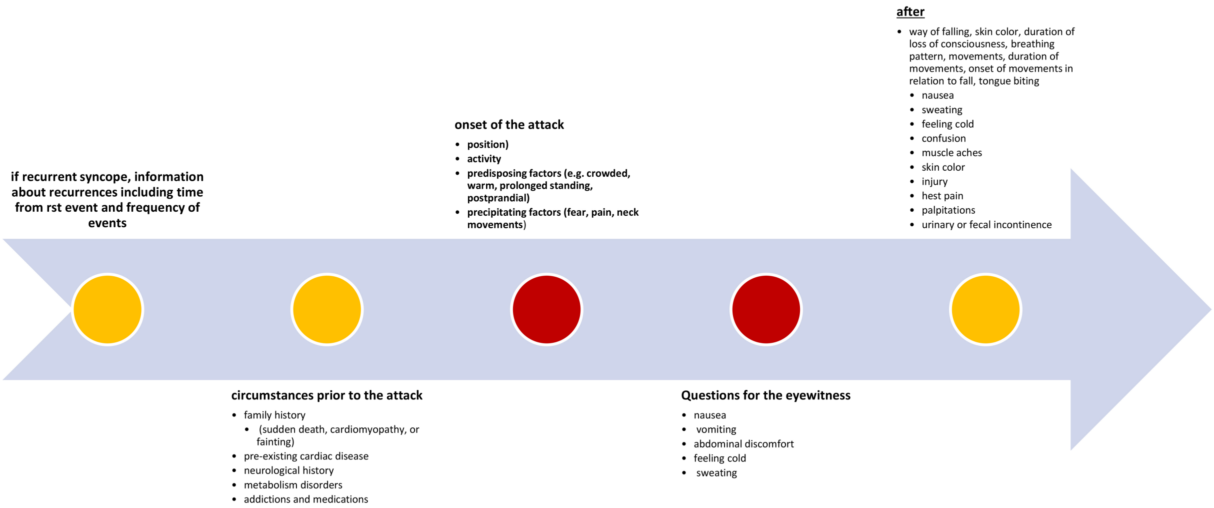

FIGURE 3. Steps to address in history-taking after TLoC [3, 26–28].

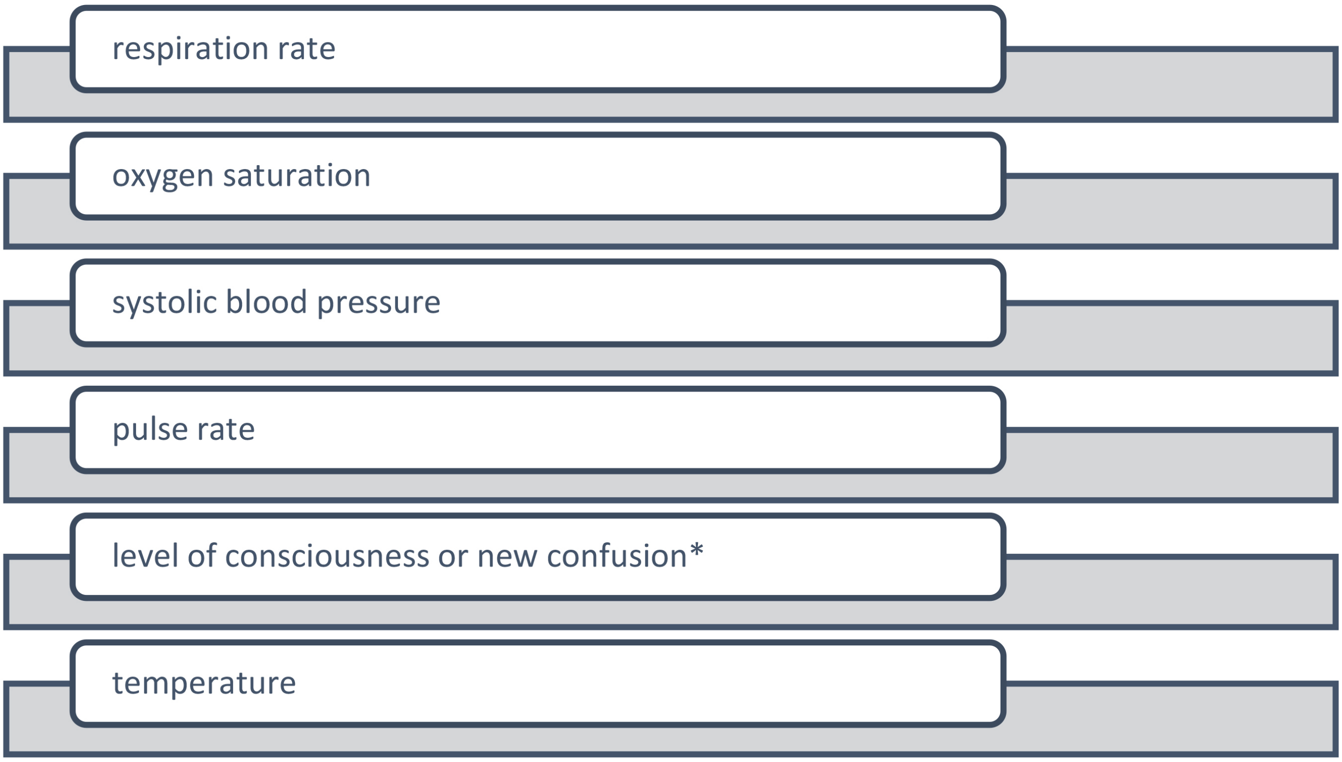

FIGURE 4. Six simple physiological parameters—components of the National Early Warning Score 2 (NEWS2) scoring system [59–61]. *Confusion, disorientation, and/or agitation of new onset, where their mental state was previously examined; this may be subtly altered. Responses to questions may retain coherence, but there is confusion, disorientation, and/or agitation. This would score 3 on the National Early Warning Score 2 (NEWS2) system.

finding was orientation. In a study, patients experiencing a seizure and eyewitnesses greatly disagreed on being oriented [34]. The event's aftermath is the point in history-taking when an eyewitness is irreplaceable in the first place because unconsciousness causes amnesia. The eyewitness will probe for features during a TLoC. Their statements will enable the healthcare professional to differentiate between syncope and epilepsy, while legal practitioners can learn about the individual's legal liability (Table 1) [35]. For the latter reason, the reliability of eyewitness accounts has been studied extensively in the field of criminology—with surprisingly high mistaken identification rates. From the medical professional's standpoint, the reliability of any eyewitness is deeply disputable.

For instance, bachelor of psychology students were shown a syncope video, and 25% were positive that they had previously seen a similar attack. Fewer students (18%) stated the same for the epilepsy seizure video. The former group's mean total number of correct responses to all question items was 8 $\pm$ 2 out of 13 (range 4–12). In addition, 44% of the responses were accurate, 28% were erroneous, and 29% answered with "I do not know".

Even the accurate diagnosis of the underlying cause is often mistaken, ineffective and waited, and misdiagnosis is common [3]. There are several "appropriate pathways" for the assessment of patients who experience TLoC to determine the correct underlying cause [43].

3. Medicolegal repercussions

Any case of medical condition or injury where law enforcement offices seek the assistance of a medical professional when investigating and understanding it (or its treatment) is considered a medicolegal case. This is a particular sort of medical case; it has legal implications for the attending physician, patient and some "third parties" (the state, the employer and so forth) [44].

3.1 Documenting transient loss of consciousness

During the TLoC episode itself, identifying the level of consciousness is pretty simple [25]. The analysis of the degree of behavioral alertness is commonly routinely performed according to the Glasgow Coma Scale (GCS). The value of this instrument, often in a modified form, has been shown to excel in routine practice in clinics worldwide [6, 25, 45]. The "peri-ictal" period and assessing the consciousness of outpatients is slightly more daunting in that context. Erroneous reporting on the state of consciousness, which may simply be inaccurate, can hinder any claim due to inaccuracies. This means the attending physician must look for signs of a loss of consciousness that may not be readily apparent to other physicians—as a rule, they are not at the scene of the event. Most certainly, the greatest challenge is diagnostic uncertainty regarding the concordance of clinical and other ("popular") modalities in defining the patient's state [46, 47]. For those patients who have unquestionably suffered a TLoC,

TABLE 1. Reflections of the eyewitness after viewing a video of either a generalized tonic-clonic seizure or reflex syncope [17, 31, 35].

Syncope				Generalized tonic-clonic seizure			
	Do not know	True	False		Do not know	True	False
Muscle tone	9%	70%	21%	Muscle tone	4%	95%	1%
Left arm twitch	40%	28%	32%	Right arm twitch	12%	79%	9%
Right arm twitch	43%	32%	25%	Left arm twitch	30%	50%	20%
Left leg twitch	34%	25%	41%	Left leg twitch	33%	44%	23%
Right leg twitch	37%	31%	33%	Right leg twitch	11%	86%	3%
Head deviation	11%	76%	13%	Head deviation	8%	38%	54%
Gaze deviation		94%	6%	Face right side	53%	42%	5%
Face right side		77%	23%	Face left side		73%	27%
Face left side		79%	21%	Facial color	35%	22%	43%
Eye closure		83%	17%	Gaze deviation		83%	17%
Drooling		74%	26%	Drooling	10%	86%	3%

their decision-making capacity is typically absent (this is also a bespoken medicolegal issue). While there are multiple tools to assess decision-making, they often concentrate on the cognitive ability to recognize and select options. Simply put, a person lacks capacity if their mind is impaired or disturbed in some way, which means they are unable to make a decision at that time [1, 48, 49]. This is a potential peril in decision-making regarding the withdrawal of life-sustaining medical therapies (LSMTs) [50, 51]. In this context, the main message should be that individuals with impaired consciousness have equal legal protection, although constitutional claims can be difficult to enforce [52].

Identifying the level of consciousness related to a particular event has great importance in the medicolegal context from the perspective of consciousness, acting ability, voluntary movement and participation of will. It is one of the fundamental starting points for systematizing events in legal proceedings. All biomarkers must meet certain criteria to constitute a surrogate endpoint or to be able to predict the outcome. Additionally, a valid biomarker should be able to convey the effect of a proposed treatment from the surrogate. Utilizing biomarkers, it should be possible to capture the impact of the treatment on the clinically relevant endpoint [53–55]. In the prehospital emergency care management of patients who experienced TLoC, integration of different procedures and solutions in the process of decision-making [21], including biomarkers, is considered as the use of tools to instantly determine the degree of illness—so-called: "early warning scores" (EWSs), in other words, point-of-care testing (POCT) [56–58].

There have been studies in recent years evaluating the National Early Warning Score 2 (NEWS2) in combination with serum levels of prehospital emergency care lactate (pLA) in the vein of their predictive capacity of TLoC. This combined score is referred to as NEWS2-L [57, 59–61]. NEWS2 is the most widely used worldwide and validated in prehospital emergency care. Finally, it has proven its usefulness in very diverse clinical settings. It is cheap and affordable as it is a system for scoring the physiological measurements routinely recorded at the patient's bedside (Fig. 4) [62]. NEWS2 is determined from simple clinical observations (respiration rate, oxygen saturation, supplemental oxygen, temperature, systolic blood pressure, heart rate and level of consciousness). Blood lactate level is an indicator of tissue perfusion and tissue oxygenation. In combination with pLA, these two obtained an AUC of 0.948 (95% CI: 0.88–1) and an OR of 86.25 (95% CI: 11.36–645.57). This is significantly higher than when the curve obtained by the NEWS2 or pLA were compared in isolation ($p = 0.018$) [57]. Similar tools already exist, like the San Francisco Syncope Rule, Evaluation of Guidelines in Syncope Study (EGSYS), or the Canadian Syncope Risk Score. They predict the risk of severe outcomes up to 30 days. The EGSYS score indicates the likelihood that syncope is due to a cardiac cause [63, 64].

Since it is a way to assist in recognizing patients at high risk of adverse outcomes among those with a history of syncopal episodes, we were expected to examine the development of NEWS2-L. Biomarker considers only several standard measurements of physiological parameters and pLA (Fig. 4). This handy tool needs more comprehensive evaluation in screaming and diagnosis to stratify patients' risk after syncope. Barbic *et al.* [65] found a risk of syncope recurrence of 9.2% within the first six months in the working-age population. Following that, the risk of relapse increased by 3.5% each year up to 5 years. These data indicate consistency with the findings reported by Sumner *et al.* [66]. This biomarker alerts medical staff to deteriorating adult patients and is validated in prehospital emergency care settings, so it is less than useless in non-professional's hands.

The complexity of conditions listed in Fig. 1 explains the cause of the misdiagnosis. Even someone who is skilled requires a more elaborate diagnostic evaluation to stratify patients' risk after syncope to allow for the personalized management of different treatment options. There is a wide variant in the susceptibility of individuals to TLoC—pregnant women or soldiers standing motionless are well known examples. On the other hand, patients in heart failure rarely, if ever, experience TLoC. Thus, it does not automatically point to organic disease [4]. Even evoked and event-related potentials are used as biomarkers of consciousness state according to Pruvost-Robieux *et al.* [45]. It is also important to recognize that normal ambulatory electrocardiographic (ECG) monitoring does not exclude an arrhythmic cause for syncope. Prolonged ECG monitoring (Holter monitoring) is another tool useful in assessing unexplained syncope or where an arrhythmic etiology is suggested by history in a patient at relatively high risk of arrhythmia (*i.e.*, underlying structural heart disease or an abnormal baseline electrocardiogram) [67–69].

Bearing in mind the relevance of assessing the level of consciousness based on validated and comprehensive instruments and the need to scientifically deepen this area, aside from clinical bedside testing, several blood-based soluble protein biomarkers provide invaluable clinical information about patients and are used as diagnostic, prognostic and pharmacodynamic markers. The most commonly used blood sample matrices are serum and different types of plasma.

Traumatic disorders of consciousness might be monitored using cerebrospinal fluid and blood biomarkers [70]. Clinical symptoms of patients with a single generalized tonic-clonic seizure or syncope may be very similar, and as a differential diagnosis tool, serum neuron-specific enolase (NSE) level has been challenged [71, 72]. Biomarkers that reflect myocardial cell damage, such as cardiac troponin, and cardiac dysfunction, such as B-type natriuretic peptides, might be specific for cardiac syncope, but, because of the limitations of previous data, the role of cardiac biomarkers in the investigation of syncope is unclear [73]. In patients with vasovagal syncope, there was an increase in endothelin during the head-up tilt test, which occurred only in the case group. These patients are more likely to have an imbalance between antagonistic vasoactive biomarkers during orthostatic stress [74]. The same NSE was used to discriminate seizures from syncopal attacks, combined with S100 calcium-binding protein (S-100B) for predicting neurological outcomes in post-cardiac arrest patients [75]. This issue of similarity of seizures and syncopal attacks was tackled by the study of Martikainen *et al.* [76]. Although symptomatology such as head turning, blue face (facial cyanosis) or the absence of pallor during the event, bubbling at the mouth, tongue biting, and disorientation traditionally suggest a seizure. Ictal eye closure is a highly reliable indicator for psychogenic non-epileptic seizures and pleads against epilepsy, according to video electroencephalography (video-EEG) monitoring [34, 35, 77].

Other proteins, mediators of intercellular communication in the central nervous system (CNS) called exosomes, are emerging as potential tools for both diagnostic and therapeutic purposes. However, exosomes are just beginning to be used in model systems to understand the functional effects of cargo associated with traumatic brain injury (TBI), such as toxicity. Given the abrupt onset and complete recovery of TLoC, these biomarkers have no relevance. Studies of these molecules evaluate, in general, the cargo composition and diagnostic potential of exosomes derived from neuronal exosomes, disregarding the complex nature of TLoC [78]—more so that people can sustain TBI and still not lose consciousness. Moreover, patients with such injuries can still suffer lasting symptoms that can impact the levels of "TBI biomarkers" and the lives of these patients [79–81].

3.2 Ethical and legal considerations

TLoC may relate to the individual's ability to interact with the environment, express preferences, and ultimately, impact whether the individual claims certain moral goods. Any of these features bespeaks a medicolegal case.

After all, TLoC impacts how individuals weigh the utility of those goods. At the same time, human movements are ethically and legally interesting, thanks to their relation to voluntary control. Plan to move (willing) and self-generated actions (self-agency) imply voluntariness and power in a particular situation. Though broadly, it is handy, even from the ethical and legal point, to divide human movements into two types: intentional or voluntary and involuntary [49, 82]. Humans, for functioning, need voluntary movements, but the exact sequence in the brain remains vague.

Consciousness is hard to define, probably because it represents various overlapping concepts rather than one single and comprehensive idea [83–85]. The basic concept of consciousness has not deviated stringently from Aristotle and Thomas Aquinas. Voluntary action is somewhat more complicated, because only a mind can voluntary action. The definition of consciousness really grew from a predator perceiving a pray and "being aware" at a fairly low level to another level in which the conscious mind is fully "self-aware" [2, 86].

It is unmistakable that consciousness and voluntary action are closely related. If one is not conscious of initiating an action, then that action is not one's own action—individual's body may have made a certain movement, but it was not a deliberate movement, not something that individual did. More specifically, voluntarily movement implies awareness "from the inside" of trying to move, and therefore under normal circumstances one knows that moving is actually happening [87, 88]. This means that there is a description of the event, which the individual had in mind, under which the event seemed good to the individual; and that it was the individual's having this description in mind that caused the event. This is Davidson's theory in which he considers action, determining action as behavior caused by an agent in a special situation and omitting consciousness from the story [1, 15, 86, 89].

As an alternative theory of action, Geach's axiomatic idea of a "mental act" is gladly used by cognitive scientists. A mental act is not necessarily an action: rather, it is called an act because of its connection with actualization—it is happening which occurs in a mind [90, 91]. Every act is the "actualization" of some "potentiality" of a "substance" [92]. The perpetrator of a mental act is the mind, and sensation, perception, judging, imagining, supposing, deciding, and feeling an emotion are all prerogatives for such acts [93]. A mental act precludes an attitude to act, or to operate components of animal behavior [94]. Finally, consciousness is also behavior controlled by the brain [95]. Capacity for voluntary action is gradually developed throughout infancy to reach a plateau hand-in-glove with a well-functioning motor system that permits well-controlled fluid movement [49].

The requirement for a voluntary act (a conduct which is performed consciously) is an explicit prerequisite for committing a crime without doing a criminal act: a person is not guilty of an offence unless criminal liability is based upon conduct that includes a voluntary act [55]. In other words, unconsciousness prevents a defendant from acting [58, 82]. This discussion merely provides an outline of the overwhelming complexity of theories of movement, intending to help in understanding the role of consciousness in acts and action. In psychology, the process of progressing from incompetence to competence (or the "conscious competence") in a skill is more complicated [86]. In the medicolegal context, this opens up a series of questions, like the following: What is the explanation for this necessary connection between emotion/sensation and knowledge of emotion/sensation? Why is it a metaphysical impossibility to have the one without the other, and what is the role of consciousness in this link [2, 96, 97]? To better illustrate the connection of emotion/sensation and movement, Keller and Heckhausen recorded electroencephalographs (EEGs) while participants performed a simple mental task of overcounting, coupled with electromyography (EMG) of the finger in real-time to detect when participants moved. They showed no difference in onset times whether the movement was self-initiated or unconsciously performed, but the amplitude of the readiness potential was greater during self-initiated movements [98]. The interpretation of this finding was that this was due to the increased resources required for the conscious experience of deciding to act. Cognitive processes may contribute to the management of resources in simple voluntary actions, but were directed elsewhere unconsciously performed movements [55, 99].

The practical relevance of these deliberations is an ongoing action-perception cycle as seen in everyday life; the interplay of consciousness, activity, knowledge; and the interaction of the human body with our environment [2, 86]. Beyond everything, if we should be accounted responsible for our actions, it appears evident that we must be able to choose between different actions and have free will [82]. The most apparent feature of everyday life, likely most frequently scrutinized by the physician, is the ability to drive. Driving a motor vehicle and suddenly experiencing incapacitation can result in injury or death for the driver, passengers or onlookers. In the social context, driving is considered a privilege, and regulations aim to balance that privilege and the potential to harm others (Table 2). With the availability of new data on the clinical outcomes of patients with TLoC, driving regulations have evolved in many countries. Driver with TLoC history is considered "high-risk driving behavior". Relative to cultural and social mentality, legislation of the individual country will find different levels of that balance. Attempts have been made to quantify the potential risk of harm associated with various categories of incapacitated drivers. In this way, driving regulations would be more objective. These attempts rely on outdated scientific data and may not accurately reflect vehicle changes and the modern driving environment [100].

Just alike, structural or electrical heart disease manifesting in syncope are often considered disqualifiers for military service or [101].

3.3 Disability and risk of injuries

Fainting suddenly in everyday workplace situations can raise a dangerous situation. Also, as a result of avoiding these situations, being aware of the possible loss of consciousness can preclude the patient from performing the duties of occupation—or any activity (for instance, fear of motor vehicle crash [102]). Ultimately, these influence working ability, making it challenging to execute work tasks and retain employment [65]. Determining whether or not individuals with TLoC are eligible for disability benefits on account of unemployment is still unfortunately left to individual assessments to help ease the financial burden. There are copious examples in the literature of attempts to prove that the symptoms of TLoC episodes are severe enough for individuals to qualify for the benefits [3, 20, 27].

Red flags, or prodromal symptoms of TLoC, may indicate that the person is about to faint. Those are valid, as individuals may notice the color of incarnate, for instance. After the episode, individuals may feel exhausted, confused, and still nauseous. Depending on whether or not TLoC caused an individual to fall, contingent on the impact of the fall, they may even have concussions or broken bones. A medical history of previous syncopal episodes was found to be an additional predictive factor of getting injured. Nevertheless, as loss of consciousness equals the loss of muscle tone and, ergo, posture, episodes of TLoC usually lead to a risk of falls [3, 6, 28].

Most likely, due to more frequent syncope and fewer injuries per faint. Tajdini *et al.* [30] found the mentioned finding (experiencing syncope in the morning, at home, while standing, or without experiencing prodromal (introductory) symptoms is associated with higher injury rates) [30], Fig. 5. According to the evidence, recurrent syncope does not predict the risk of adverse outcomes related to structural heart disease [11, 103]. Whatsoever, Jorge *et al.* [29], while analyzing 102 injuries associated with the 710 faints (14%), identified 19% of which as moderate or severe injuries, without age, sex, nor the presence of prodromal (introductory) symptoms associated with injury-free survival. Patients with $\geq$4 faints in the prior year had more injuries than those with decreased number of faints (relative risk 2.97, $p < 0.0001$). Probably due to more frequent syncope and not more injuries per episode. According to Jorge *et al.* [29] Injury severity did not associate with age, sex, or prior-year syncope frequency.

4. Conclusions

Warning score systems considering only the standard measurement of physiological parameters, like NEWS2 (and NEWS2-L), should be implemented routinely to assist in legal or post-hospital clinical procedures. This should also increase patients' and families' quality of life, as they should be alert to the consequences of recurrent syncope—increasing the likelihood of being injured. In the legal context, this biomarker could indicate the future requirement for a voluntary act (conduct that is performed consciously), which is an explicit precondition for committing a particular action. In particular, the bluntest voluntary act, driving, is assessed based on old assumptions

TABLE 2. TLoC types that should be regulated as per medical fitness to drive; depending on the social and cultural environment.

TLoC types	Driving restrictions apply to:
Single episode of typical vasovagal syncope	Non-commercial drivers
Single episode of unexplained syncope or atypical vasovagal syncope	Non-commercial drivers
Syncope with a reversible cause	
Syncope with a diagnosed and treated cause	Non-commercial drivers
Recurrent typical vasovagal syncope	Non-commercial drivers
Recurrent situational syncope with an avoidable trigger	
Recurrent atypical vasovagal or recurrent unexplained syncope	Non-commercial drivers
Single episode of typical vasovagal syncope	Commercial drivers
Syncope with a diagnosed and treated cause	Professional driver/carriers
Single or recurrent unexplained, single or recurrent atypical vasovagal, or recurrent typical vasovagal syncope	Professional carriers

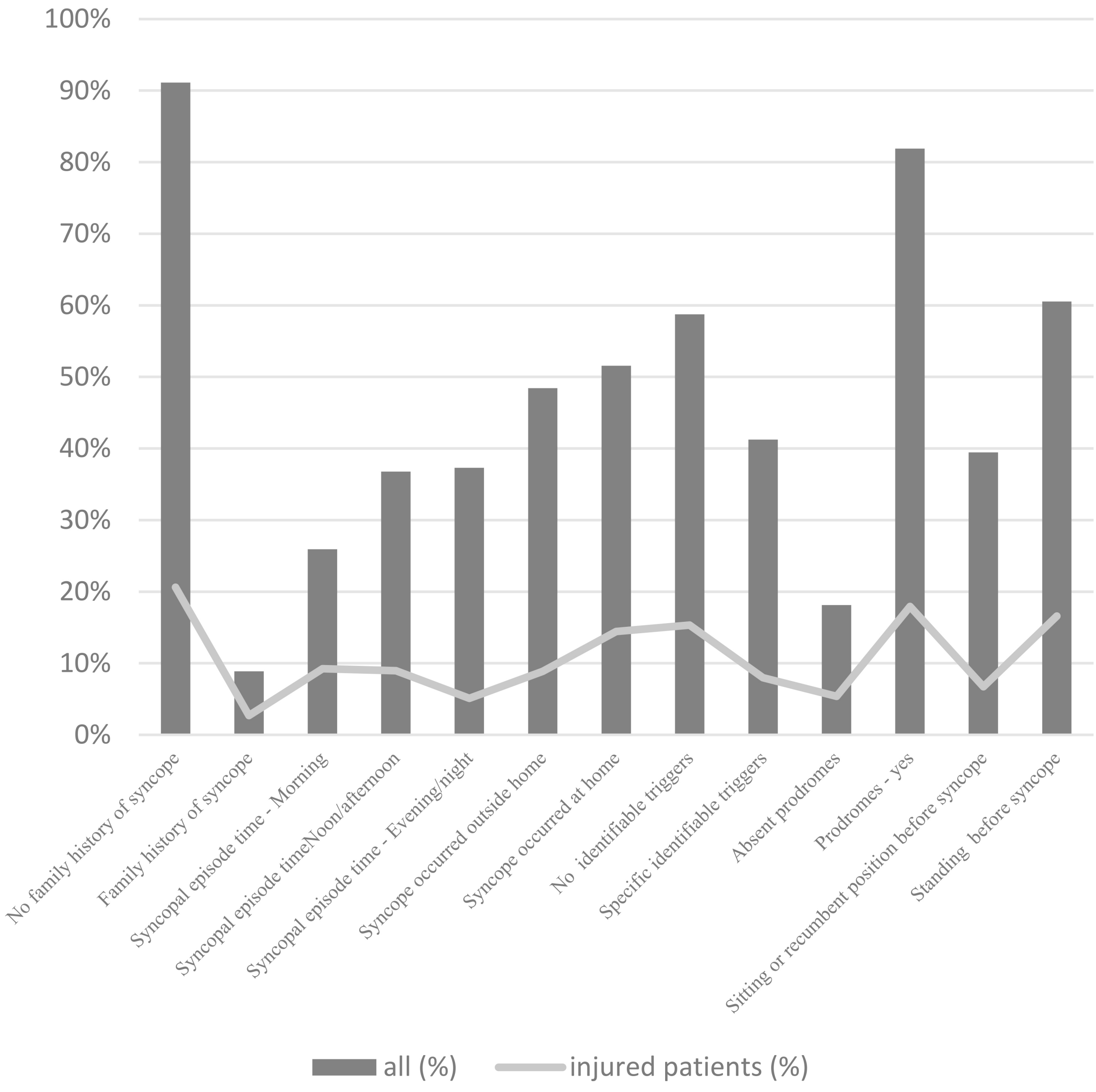

FIGURE 5. Periictal characteristics of patients with TLoC-related injuries [29]. Bars—all patients; line—injured patients [29].

and can hardly reflect the reality of modern driving. In this way, the development of driverless technologies may also influence the assessment of a patient's driving ability.

Assessment of the risk for each case, amended with a combined assessment of the medical records, may be in order. Considering consciousness' fundamental role in acting and free will, involving TLoC in processing capability or legal liability seems reasonably expected. In such deliberations, the existence of valid documentation is mandatory. Unfortunately, that remains the only tool for individuals when claiming (or denying) legal liability. Since there are a series of medical tests for diagnosing TLoC, currently, there is no *post hoc* biomarker.

AVAILABILITY OF DATA AND MATERIALS

Available on request.

AUTHOR CONTRIBUTIONS

IS—designed the research study, and performed the statistical analysis. IS and MP—wrote the manuscript and checked the language. LL—supervised the initial submission and all the revisions. At the final stage, all the authors carefully proofread the paper and approved its publication. All authors collected data and prepared the initial draft of this manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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