The syncope core management process in the emergency department

a consensus statement of the EUSEM syncope group

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Running head: Syncope core management process in European Emergency Departments

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Abstract

Background and importance: The European Society of Cardiology issued updated syncope guidelines in 2018 which included recommendations for managing syncope in the emergency department (ED) setting. However, these guidelines lack detailed process-oriented instructions regarding the fact that ED syncope patients initially present with a transient loss of consciousness (TLOC) and, thus, can have a broad spectrum of causes.

Objective(s): This study aims to establish a European consensus on the general process of the work up and care for patients with suspected syncope and provide rules for a sufficient and systematic management of the broad group of syncope (initially presenting as TLOC) patients in the ED.

Design, settings: A variety of European diagnostic and therapeutic standards for syncope patients were reviewed and summarized in three rounds of a modified Delphi process by the EUSEM syncope group. Based on a consensus statement, a detailed process path is created.

Outcome measure and analysis: The primary outcome of this work is the presentation of a process pathway for the structured management of syncope patients in European EDs.

Main results: The here presented extended event process chain (eEPC) summarizes and homogenizes the process management of European ED syncope patients. Additionally, an exemplary translation of the eEPC into a practice-based flowchart algorithm, which can be used as an example for practical use in the ED, is provided in this work.

Conclusions: Syncope patients, initially presenting with TLOC, are common and pose challenges in the ED. Despite variations in process management across Europe, the

development of a universally applicable syncope eEPC in the ED was successfully achieved. Key features of the consensus and eEPC include ruling-out life-threatening causes, distinguishing syncope from non-syncopal TLOCs, employing syncope risk stratification categories and, based on this, making informed decisions regarding admission or discharge.

Key words: Syncope, transient loss of consciousness, emergency department, guideline, extended event process chain.

Introduction

Contextualizing syncopes

Transient loss of consciousness (TLOC) is defined as a brief episode of unconsciousness with a subsequent complete recovery. The etiology can be diverse, encompassing both traumatic and non-traumatic reasons. Non-traumatic causes of TLOC can be further categorized into a) syncopes, b) epileptic reasons, c) a psychogenic origin, and d) rare causes [1]. Syncopes, defined as a decrease in blood pressure with a subsequent global cerebral hypoperfusion and loss of postural tone, only represent a subset of TLOCs and can be named as such only after a thorough prior diagnostic evaluation [1]. They can be further classified based on their etiology or the risk they carry for an underlying serious condition. The diagnostic tools used in this context are typically simple and straightforward in their application [1, 2]. However, identifying and interpreting the root causes of the occurred TLOC in an adequate, chronologically structured manner is complex and differentiating syncopes from other non-syncopal TLOCs can, thus, often be difficult. Doing so is of major relevance and a common challenge particularly in emergency departments (EDs) [3]; a setting where, by nature, the most unselected and undefined patient cohort presents.

Handling syncopes in EDs

Among all ED patients, those with syncope contribute to approximately 1-5% [1, 2, 4]. The prevalence variation, subtype distribution and differences in diagnostical/therapeutical approaches are broad in the intra-European region [4]. A major challenge for all EDs is the prompt and accurate identification of life-threatening causes for syncopes along with the capability to estimate the risk for an underlying serious medical condition precipitating syncopal event [1, 3, 5]. In 2018, the European Society of Cardiology (ESC) issued updated

guidelines on syncope [1], which, for the first time, incorporated specific recommendations on how to manage this challenging patient group in the EDs. They suggest so-called “syncope units” to be implemented for the specialized diagnosis/treatment of this patient cohort and focus on the decision-making of admission versus early discharge based on syncope risk stratification categories [1]. This implies dividing patients into a low-risk, not-low-not-high and high-risk categories. While the first cohort can be directed into ambulatory care, high-risk syncope patients are in need of intense monitoring in the ED and are admitted to the hospital. For intermediate patients, the ESC recommends further observation in the ED or a hospital syncope observation unit [1]. However, with this, the guidelines only provide detailed recommendations for patients who have already received the diagnosis of a syncope of uncertain reason. For clinical use in the ED, evidence basis or practical suggestions on how to manage patients from the very start, when they mostly present with a TLOC, are lacking [6]. Implemented management processes across Europe were yet rarely comparatively examined [4]. In addition, a recent ED syncope study has suggested an alternative strategy regarding risk-stratified admission of syncope patients than compared to the ESC guidelines [7]. Meanwhile other works have depicted and criticized that ESC syncope recommendations are yet not sufficiently established in the real-world setting [4] as well as pointed out that syncope management is overall poor in European EDs [6]. These discrepancies indicate the need for a consensus statement of European experts and the provision of a clearly structured and detailed process pathway on ED syncope management [6].

Study focus

The objective of this work is to establish a consensus statement in order to describe and homogenize the European management varieties into a universal core ED process of syncope diagnosis and initial management. This aims to create a first process pathway, based

on which syncope patient management across Europe can be better understood and subsequently improved. This core process pathway serves as a blueprint upon which, in a second step, simplified and adapted standard algorithms can be constructed for practical implementation in individual EDs. This should then take local specialties, the hospital's level of care and the diversity of national healthcare system into account but stick to the overall consensus and process description. The main difference from prior literature [1] is the emphasis placed on the fact that most ED syncope patients initially present with an unclear TLOC. Accordingly, despite the focus of this work being primarily on syncope patients, handling the symptom of TLOC in EDs will likewise be addressed.

Methods

Delphi process

The Delphi method is a procedure which can be used in various fields to develop an expert consensus based on a structured and chronological technique. Briefly, the traditional Delphi process starts with a survey on open questions about a specific topic. This is answered by the experts involved and afterwards is summarized by a facilitator and sent back to the expert group. This loop continues until a certain level of consensus is reached; modifications of the implementation are possible and were frequently provided on healthcare topics [8, 9]. In the case of this study, a modified three-step Delphi process was performed with interdisciplinary medical experts who discussed the topic of syncope management in European EDs in order to subsequently find a consensus and establish a universal process pathway. The ESC guidelines were used as a basis [1]. The methodological steps and loops of the here applied modified Delphi process are visualised in *Figure 1A*.

Firstly, different practical approaches from Ireland, France, Spain and Germany were reviewed and translated into an extended event process chain (eEPC) by a core expert group of four members (MM, KACJ, LG-CR and SL) from the respective countries (see center box) who represent the broad spectrum of minimalistic to maximalist approach in ED syncope management. These members have expertise from the medical fields of emergency medicine and cardiology. This first draft (step 1) was then reviewed by the entire European Society for Emergency Medicine (EUSEM) syncope group, consisting of ten members all authors except for SP) and revised based on the feedback (step 2). Those members were of the following specialties: emergency medicine, internal medicine, cardiology and general medicine. Finally, in a face-to-face meeting at the EUSEM 2019 Congress in Prague, a list of last discrepancies was identified, and consensus was reached via a written feedback round (step 3). Discrepancies were related to the questions of laboratory timing and types/quantities of blood values measured. The final eEPC presented in this work (*Figure 2*), thus, reflects the expert consensus of the international EUSEM syncope group; marked as "content output" in *Figure 1*.

Understanding and interpreting eEPCs

eEPCs have been frequently created in the past with the aim of better understanding and homogenizing process structures in the medical setting [10, 11]. The exact methodology of the process modelling has been described elsewhere in detail [11]. It follows a predetermined structure coded by color and shape. A legend and concrete scenarios on how process flows of eEPCs work and each sign can be read, are provided in *Figure 1B* and *C*. Briefly, a process contains of single events (red fields) and functions (green fields) [11]. As an example, an event can be a "patient with the symptom TLOC presenting in the ED" while a function can be understood as an action such as "perform triage". As indicated in *Figure 1B*, every event is

158 followed by a function (left scenario) unless the current process ends with the beginning of
159 another process/algorithm (right scenario). The second case occurs for example if a specific
160 underlying disease (e.g. “aortic valve stenosis”) has been identified for the symptom of “TLOC”
161 and a new process chain for “aortic valve stenosis” has to be subsequently started while, at
162 the same time, the current algorithm process ends. As shown in the first scenario, every
163 “function/action” has to be carried out by a responsible organizational unit, e.g. an ED
164 physicians, nurses or certain specialist doctors (here e.g. cardiology). Which organizational
165 unit is responsible for what task, highly depends on the hospital’s inner management structure
166 and are, therefore, not specified in this work. Further, “function” boxes receive input from
167 information fields, being standard operation procedures (SOPs), and give output information
168 which, in the clinical context, can be a brief written summary i.e. entered in the digital
169 documentation system.

170 Generally, eEPCs are not meant to be directly used and translated into a clinical
171 context. They intend to explain certain structures and work as a first blueprint, which can, in
172 a second step, be used to construct a modified and compatible local algorithm for the ED
173 community. The major advantage of eEPCs is their possibility to directly implement them into
174 a supporting digital tool [10, 11].

175 **Results**

176 The constructed eEPC diagram *(Figure 2 A-C)* displays the syncope management
177 process in the ED and can be separated into three major parts, starting with the “arrival and
178 triage” (*Figure 2A*), followed by “diagnostic procedures” (*Figure 2B*) and ending with “risk
179 stratification” (*Figure 2C*). This path will be explained chronologically in the following. *Figure*

3 exemplarily shows how the presented syncope eEPC can be adjusted and transformed into a practical algorithm for clinical ED use.

eEPC on syncope in the ED – Part 1 (field 1-21): Arrival and triage

The eEPC starts with a patient initially arriving in the ED with TLOC (field 1). This also includes patients who only experienced a partial TLOC since their prognosis is comparable to that of full TLOC [1]. Triage is a well-established, internationally accepted and structured process in ED care. Thus, “perform triage” (field 6) corresponds to the first “function/action” which the affected patient experiences after entry. Details and SOPs (field 9) on adequate triage have been published elsewhere and were, thus, not part of this work [12, 13]. During the Delphi process, it was registered that some European EDs may bypass the triage process if a patient comes with the Emergency Medical Service (EMS) and a strong pre-hospital suspected diagnosis (field 2 and 3). In both cases, based on output “information” from (pre)triage (field 6, 11), the process pathway continues with a risk-oriented approach by focusing on early identification/exclusion of obvious severe diseases. This, first of all, includes unrecognized trauma as a reason for TLOC (field 13). If present, the patient is transmitted to another “algorithm for traumatic TLOC” (field 14) and this specific syncope eEPC ends due to an alternative diagnosis. Secondly, a “critical assessment of shock” corresponds to the subsequent green “function” box (field 15) in patients who already received the exclusion of a traumatic TLOC. Largely, this group consists of septic (shock) patients that are in need of early identification and treatment. SOPs for “shock assessment” (field 16) are widely established and will not be presented here in detail [14]. Just as in trauma patients, the identification of shock (field 18) would lead to an end of this algorithm and the patient would

experience special care that is focused on shock management (field 20, 21). Summarizing, if both severe conditions are excluded, the responsible physicians can continue to treat this patient, according to this syncope eEPC, with the knowledge that a "non-traumatic TLOC without shock" is present (field 19). It is important to emphasize that at this point in time, the question of whether the presented patients had a syncope or another form of TLOC has not been answered yet.

eEPC on syncope in the ED – Part 2 (field 22-47): Diagnostic procedures

The process of the core syncope pathway goes on with the non-traumatic, non-shock patient now receiving three "functions/actions" parallelly as indicated by the according logic operator (reverse "V"). These include the "check of vital parameters" (field 22) as explained in detail in *Table 1*. Secondly, an "ECG" is performed (field 30) and "laboratory tests" are done if appropriate in the specific setting (field 11). It was concluded in the consensus process blood draw and order varies significantly within European countries. The responsible organizational units (field 32), e.g. nurse or doctor, also differ substantially across European hospital and, thus, need to be specified locally. In many EDs, blood is drawn early by nurses, relating to field 30, although the interpretation (and additional analysis) may take place later during the process path (field 39). The SOP "lab(oratory) test in patients with TLOC" (field 31 and 40) gives an overview of the recommended laboratory values in these patients (see *Table 3*). As indicated, the absolute minimum is blood glucose and hemoglobin, but many institutions measure more variables with respect to finding a specific diagnosis (see *Table 3*). Furthermore, the "ECG" (field 26) is crucial for the recognition of typical causes of cardiogenic syncope as they go along with a high risk for sudden cardiac death [15]. In each ED, it must be clear to every involved person who is able and responsible that the interpretation must take place within 10 minutes of registration. The SOP "ECG" is displayed in *Table 2* and stands in relation

227 to the respective information provided by the ESC guidelines [16]. The result of the ECG
228 interpretation needs to be documented and signed by the responsible person (field 28).

229 After these parallel actions have been performed, a “patient with non-traumatic TLOC
230 and initial (basic) diagnostics” is present (field 34). At this stage, the emergency physician will
231 start or complete his/her history taking, physical examination and, according to the ESC
232 guidelines [1], perform or initiate a Schellong test if suitable. After this part of the process,
233 three possible outcomes are possible as indicated by the operator “XOR”.

234 The first group includes patients who are definitely identified to have a syncope as the
235 presenting symptom of another underlying disease such as a pulmonary embolism or aortic
236 dissection. This would also imply patients with a sepsis who are not in a shock. For this cohort,
237 the syncope is not the dominating reason for the ED stay. He/she is, thus, displayed to field 43
238 and subsequently receives appropriate care based on an alternative process loop (field 44),
239 resulting in the ending of this syncope ED pathway. Secondly, for patients with a syncope of a
240 certain or highly likely cause (field 46), where the syncope does represent the dominating
241 cause for arrival in the ED, as in the case of an aortic stenosis or total heart block, they are
242 likewise transferred to appropriate care and another algorithm starts (field 47). Finally, the
243 scenario presented in the center field 45 stands for patients in whom the syncopal event is
244 also predominating as a reason for the ED presentation but the exact etiology and diagnosis
245 may still be unclear. Here, the decision of clinically classifying it as a syncope of unknown origin
246 has been made. All three syncope patient cohort definitions follow the ESC guidelines [1].

247 <u>eEPC on syncope in the ED – Part 3 (field 48-61): Risk stratification</u>

248 The final part 3 of the eEPC deals with risk stratification and disposition of the patient.
249 In this phase, the risk stratification is done along the categories defined in the ESC guideline

[1] and the diagnosis of syncope is confirmed as all other differential diagnoses have been ruled out by now. Field 49 of the eEPC relates to *Table 6* of the ESC guidelines [1], where the exact risk categories are defined. The aim of syncope risk stratification is to identify features that may go along with a serious condition and would need further diagnostics/treatment. This stratification takes place based on data about the syncopal event, past medical history, physical examination and the ECG. For each category low-risk and high-risk criteria are listed as part of the ESC recommendations but will not be presented here. Neither low nor high-risk means an intermediate risk category, which automatically requires further work-up, monitoring and no direct discharge from the ED. Following the primary intention of the ESC guidelines, patients with low risk are discharged according to local practice (e.g. transfer to family physician or outpatient clinic) and the pathway ends here (fields 52, 60). Intermediate or high-risk patients require further hospital-based care and are treated according to local practice on a monitoring ward in or outside of the ED (fields 53, 54, 61). Finally, also at this stage of the pathway, a patient still may be identified to have no syncope and the diagnosis may remain unclear (field 55). Here, the patient has to undergo multiple differential diagnostic considerations and further procedures, which marks the very end of the core algorithm (field 56). These additional data can likewise lead either to the decision to follow the algorithm "discharge" (field 60) or "hospital care" (field 61).

Summary of key syncope eEPC results

In the summary, the syncope ED eEPC follows a risk-based approach which aims at, firstly, ruling out life-threatening causes for the TLOC/syncope and secondly, indicates that syncope as a diagnose can only be drawn after preliminary exclusion of non-syncope TLOCs and needs constant reevaluation since the spectrum of syncopal as well as syncopal-like events are often hard to differentiate. Thirdly, the eEPC puts emphasis on the relevance of

classifying syncopes of uncertain diagnosis via ESC risk stratification on the basis of which the main ED decision of admission versus discharge can be made. The exact reason for the syncope does not necessarily need to be found in the ED already and often remains the task of the hospital ward physicians, as in case of intermediate or high-risk patients.

Discussion

The EUSEM syncope group of the EUSEM Research Committee has successfully constructed and approved a syncope ED process pathway on the basis of the 2018 ESC guidelines [1]. This is visualised and described in this study based on an eEPC (*Figure 2*) which is meant to enable a better understanding of overall European syncope management structures. Secondly, a simplified flowchart (*Figure 3*) shows an example of how such a universal eEPC can be used as a blueprint and be transformed into a practical algorithm for clinical use.

The current core pathway reflects the complexity of patients who arrive in the ED with syncope-compatible symptoms and who are initially classified as TLOC. Especially in emergency care, a structured diagnostic and treatment process pathway is of high relevance since increasing patient numbers, crowding and other daily burdens can cause inconsistencies and errors in the workflow [17, 18]. Also for seemingly simple and frequent symptoms, the creation of such universal process chains has shown to improve patient management quality. A prior study has presented an ED eEPC on non-traumatic abdominal pain which has been used to build digital tools for clinical appliances [10]. The hypothesis that this may also be needed for syncope patients, has been stated by European ED physicians who emphasized that this cohort is yet not sufficiently managed in the emergency setting and, generally, poorly understood [6]. Prior literature from Sayk *et al.* has provided a national ED syncope algorithm

297 [5]. In accordance with the here presented key findings, they likewise pointed out the
298 relevance of fast rule-out of serious illnesses and risk-oriented thinking. However, contrary to
299 their work, this eEPC summarizes process management structures which can universally be
300 adapted in all European EDs and are not meant to be understood as a detailed guideline for
301 action.

302 The first steps of this syncope eEPC mainly focus on diagnostic approaches that are
303 necessary to understand if the present TLOC is of syncopal cause. The uncertainty of the initial
304 presentation requires utmost attention to avoid typical bias since clinical presentation of
305 syncopal events and non-syncopal TLOC episodes can be very alike [19]. Standardized use of
306 triage (field 8) systems are, thus, of high relevance. They can promote an early identification
307 of trauma (field 13) [20, 21] and physiological shock (field 20), which in turn is often of septic
308 cause [14, 22]. Patients may have trauma following TLOC/syncope or primary head trauma as
309 a cause of TLOC. The fast and adequate differentiation of these groups and understanding the
310 interaction between trauma, TLOC/syncope and falls can be challenging. Prior studies have
311 shown that the here presented simple diagnostic tools (field 8, 26, 35) can help to identify
312 about half of the trauma cases where syncope was the etiology [23, 24]. Suggestions of
313 implementing standardised syncope pathways into trauma protocols were also made to
314 improve the affected patients' treatment quality [23]. Overall, it must be kept in mind that
315 fall-related trauma often occurs in the elderly who often additionally suffer from an altered
316 mentation or dementia [25, 26]. Therefore, conventional diagnostic methods may fail to
317 provide sufficient information for this subset of patients which is essential for the timely
318 recognition of present trauma. One work identified copeptin as a diagnostic biomarker for
319 syncope in this population; however, it has not yet been incorporated widely into routine

clinical practice and, thus, is not included among the laboratory tests suggested here (field 31, 40).

Another challenging cluster of patients resembling syncope includes those with disorders affecting the quantitative consciousness, spanning from somnolence to coma, who may falsely be classified as TLOC cases at the very beginning of the process pathway. The ESC syncope guidelines do not give sufficient information on how to differentiate coma and TLOC/syncope patients other than the duration of the ongoing altered consciousness [1]. Frequent overlaps in these two categories can especially be assumed for alcohol-intoxicated patients [27, 28], though reasons and the pathophysiology behind the occurrence of syncope in this cohort has not yet fully been understood [28, 29].

After ruling out syncope-alike causes and identifying the targeted patient cohort, the stratification into severe origins, like cardiogenic causes, or other life-threatening primary reasons such as pulmonary embolism, aortic stenosis, or dissection versus less severe etiologies get in the focus of the process pathway. The prevalence distribution and registration of serious versus less serious causes in ED syncope presentations varies immensely in Europe [4] and retrospective literature may be unreliable since low-risk syncope cases, who are sent into ambulatory care, may receive a syncope diagnose that was not specific enough while serious cases may not get coded as “syncopes” but rather according to the principle underlying illness, thus, potentially being underrepresented in routinely collected study data. For syncopes with uncertain diagnosis, applying ESC risk stratification rules [1]was perceived as highly important by consensus. In a recent prospective study by the EUSEM syncope group, the three ESC risk categories were, for the first time, also quantified amongst all presenting syncope patients in the ED [4]. Here, larger numbers of high-risk category patients were identified while admission rates were not accordingly high [4]. This supports the fact that ESC

guidelines are not yet sufficiently established in routine clinical practice and the urgent need of hospital care may often be underestimated. With the aim of counteracting this trend, structured syncope process paths are of major importance in EDs.

Lastly, also during and after definite syncope diagnosis and risk stratification, the need for constant reevaluation of the diagnosis made, is outlined in this eEPC (field 55, 56). In the aforementioned prospective European study, discrepancies between the ED discharge diagnosis and hospital discharge diagnosis of TLOC patients were reported as common [4].

Limitations

The presented eEPC on ED syncope management is complex and, thus, may be seen challenging for EDs to transfer its key statements into a hospital-based syncope algorithm depending on the available expertise. Generally, providing consensus statements via a Delphi process goes along with specific limitations since the gathered results reflect opinions of the participating experts. The number of involved experts here was relatively low. Perspectives from further European emergency and cardiology physicians would be necessary to confirm the key findings displayed in this ED syncope eEPC.

Conclusions

The spectrum of syncope patients in European EDs as well as their management strategies are broad but were possible to understand and summarized into a comprehensive eEPC. The focus and challenges are especially on a) filtering syncopal TLOCs and b) stratifying them via risk category. Etiology-wise, unrecognized trauma (TLOC), early identification of sepsis, and syncope as a symptom of an underlying disease correspond to common ED challenges. Additional studies are needed to gain more detailed primary data on patients with syncope in the ED on the basis of which this syncope eEPC can be further adapted. Whether

the use of this eEPC for digital tools and the construction of location-specific algorithms may improve syncope ED care, should be of interest for future research, too.

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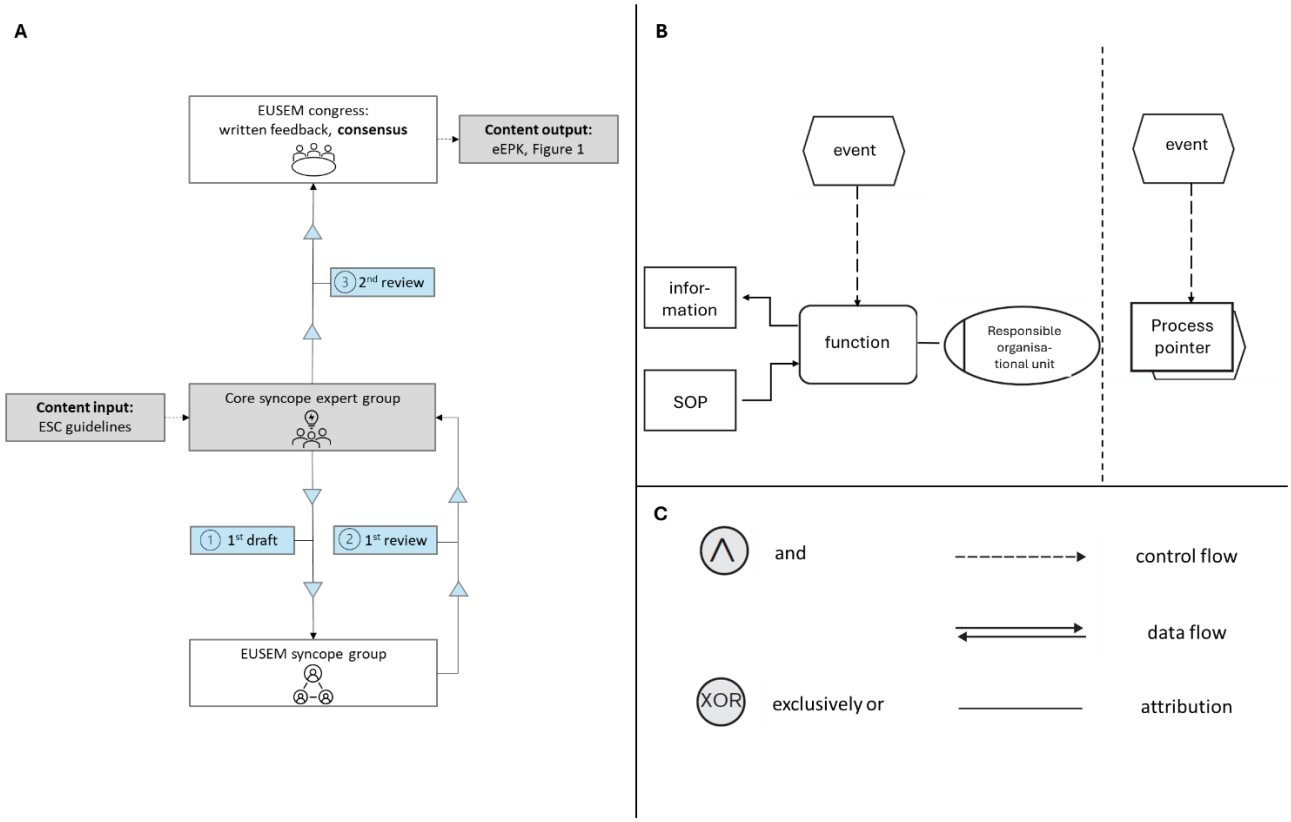
Figures and figure legends

Figure 1. Modified Delphi process (A) and eEPC legend (B, C).

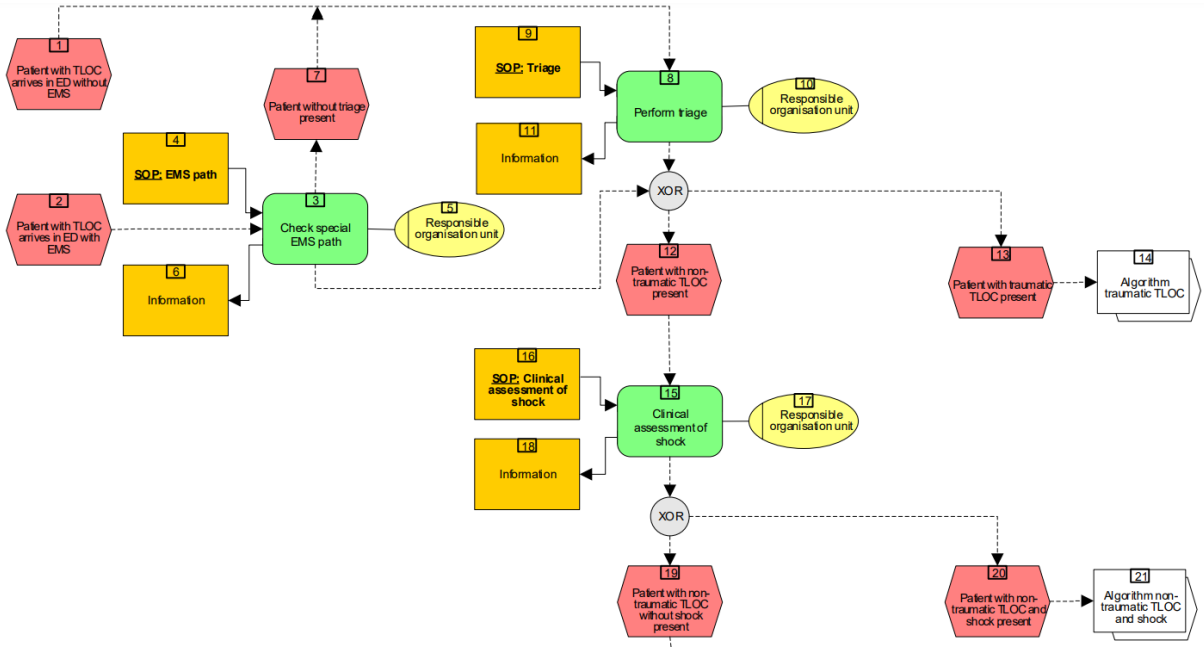


The here applied modified Delphi process is visualised in **A**, starting in the center with the core syncope expert group creating a first draft which is that transferred to the whole EUSEM syncope group for revision and finally is received back by the core syncope expert group after feedback. Written feedback and consensus was reached in a face-to-face meeting of the EUSEM syncope group on the basis of which, *Figure 2* (eEPC) was created. In **B** and **C** two scenarios are shown on how eEPCs can be built and understood (together with a legend).

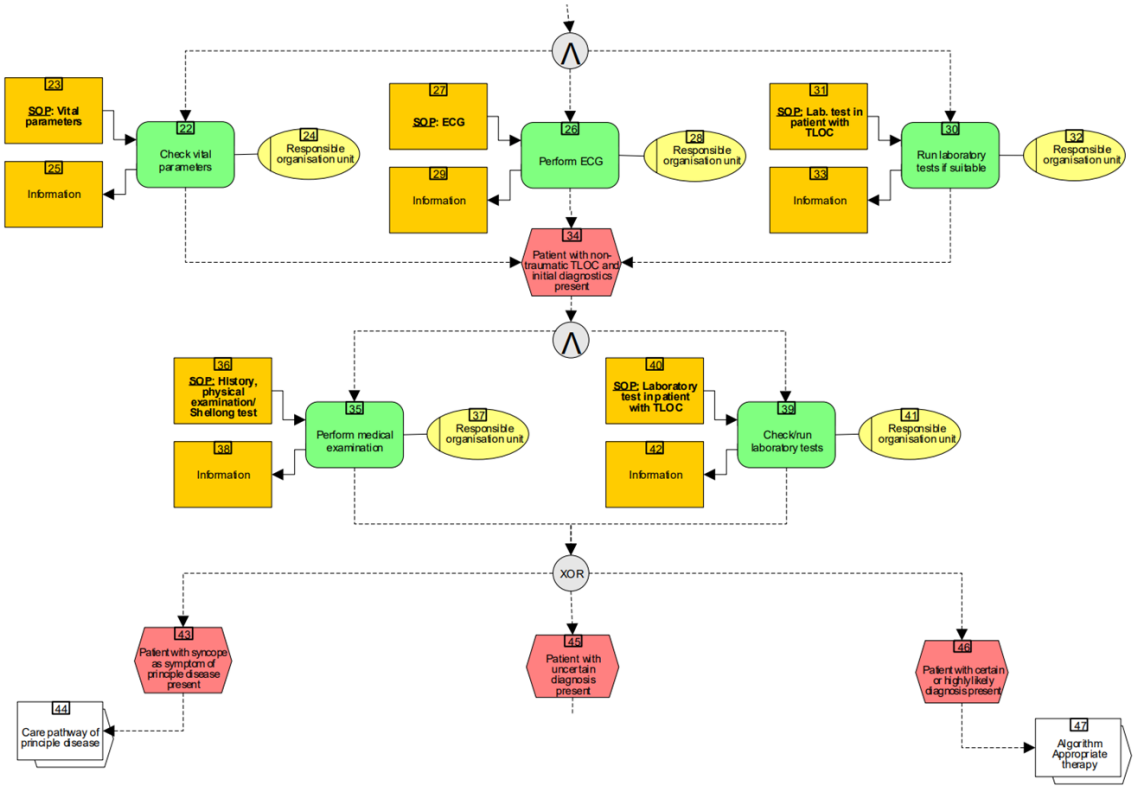
Abbreviations: **eEPC** extended event process chain.

Figure 2. Detailed eEPC of the core syncope management process in the ED context.

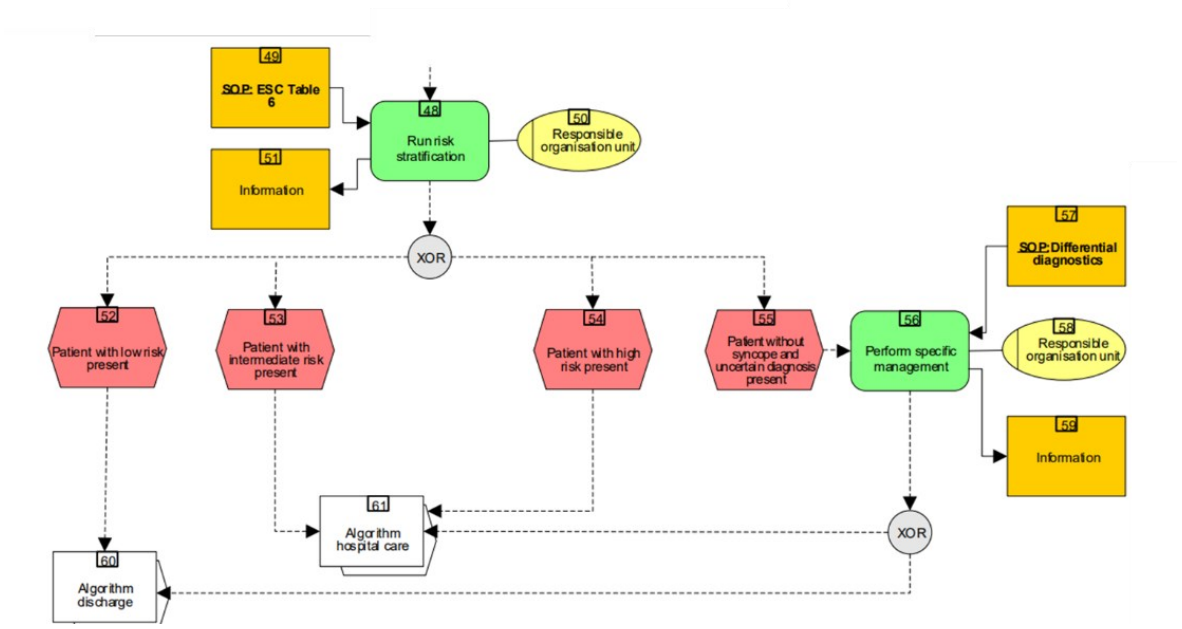
A. Part 1 (field 1-21): Arrival and triage



B. Part 2 (field 22-47): Diagnostic procedures



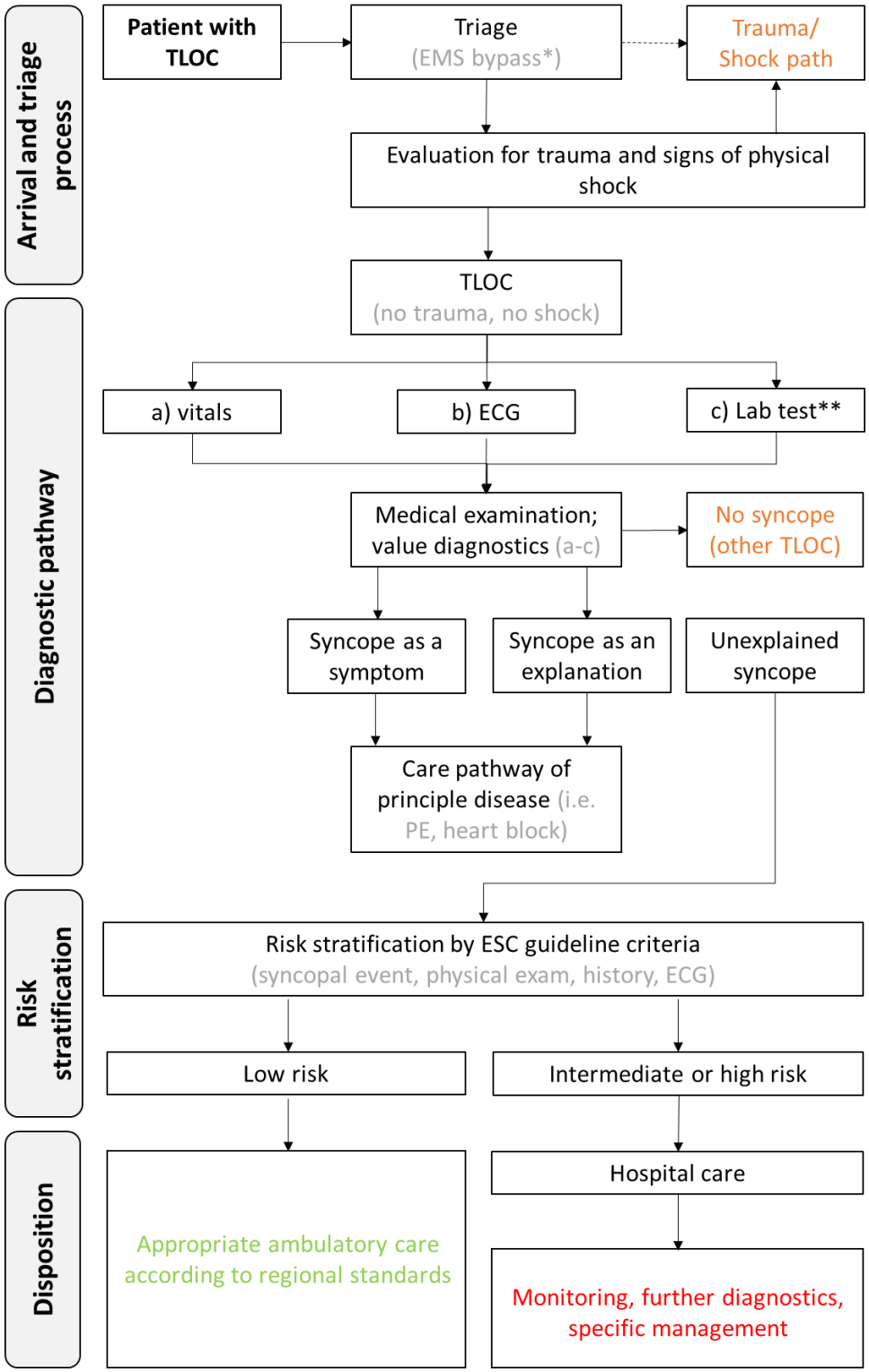
C. Part 3 (field 48-61): Risk stratification



The presented eEPC shows the detailed process chain of syncope patients presenting in the ED. It is, for visualisation and explanatory reasons, separated into three parts here, starting with **A** (triage and arrival), continuing with **B** (diagnostic procedures) and ending with **C** (risk stratification). The color codes can be understood as shown in the legend of *Figure 1B* and *C*.

Abbreviations: ED emergency department; **eEPC** extended event process chain; **SOP** standard operation procedures.

Figure 3. Explanatory flowchart algorithm, on the basis of the syncope eEPC, for practical use in the ED context.



This flowchart shows an example of how the syncope ED eEPC *(Figure 2)* can be transferred into an algorithm for practical use in the ED.

*some EDs bypass triage if patient arrives via EMS; **add after medical examination if not done before or if parameters are missing.

Abbreviations: **ECG** electrocardiography; **ED** emergency department; **EMS** emergency medical service; **lab** laboratory; **TLOC** transient loss of consciousness.

Tables and table legends

Table 1. SOP Vital parameters and triage (*Figure 2,* field 9 and 23)

SOP	**Vital parameters and triage** (Figure 2, field 23)
①	Check available vital signs from triage.
②	Determine blood pressure, heart rate, peripheral oxygen saturation, respiratory rate and body temperature.
③	Perform adequate documentation as usual in the specific setting.

The presented steps give details on the SOP "vital parameters and triage" which corresponds to field 23 and 1 of *Figure 2*.

Abbreviations: **SOP** standard operation procedure.

576 **Table 2.** SOP Perform ECG (*Figure 2*, field 26)

SOP Perform ECG (*Figure 2*, field 26)	
①	Perform and interpret ECG (only a normal ECG corresponds to a low risk)
Major high risk features	**Minor high risk features** (only if history is consistent with arrhythmogenic syncope)
Signs of acute ischemia (see 4th universal definition of acute myocardial infraction of reference[6])	Mobitz I second degree AV-block
Mobitz II second and third degree AV-block	AV-block I with markedly prolonged PR-interval
Slow atrial fibrillation (HR < 40/min)	Asymptomatic bradycardia (HR 40-50/min)
Persistent sinus bradycardia (HR < 40/min) or repetitive sinoatrial block or sinus pauses (> 3 sec.) in awake state and in absence of physical training	Paroxysmal supraventricular tachycardia or atrial fibrillation
Bundle branch block, intraventricular conduction disturbances, ventricular hypertrophy, signs of ischemic heart disease or cardiomyopathy	Pre-excited QRS-complex
Sustained and non-sustained ventricular tachycardia	Short QTc-interval (< 340mS)
Dysfunction of a pacemaker or ICD	Atypical Brugada patterns

	Type 1 Brugada pattern (ST-elevation V1-V3)	Negative T-waves in right precordial leads, epsilon waves suggestive of arrhythmogenic right ventricular cardiomyopathy
	QTc > 460mS suggesting long QT-syndrome (consistently in repeated 12-lead ECGs)	
②	Perform expert ECG interpretation within 10min of registration	
③	Documentation of ECG report according local standards	

The presented steps give details on the SOP "perform ECG" which corresponds to field 26 of *Figure 2*.

Abbreviations: **AV** atrioventricular; **ECG** electrocardiography; **HR** heart rate; **ICD** implantable cardioverter defibrillator; **sec** seconds; **min.** minutes; **mS** milliseconds; **SOP** standard operation procedure.

592 **Table 3.** SOP Laboratory testing (*Figure 2*, field 31 and 40)

SOP	Laboratory testing	
①	**Minimal laboratory tests** if recommended in the specific setting: a) Blood glucose b) Hemoglobin	
additional tests	**Typical additional tests** at the discretion of the attending physician: a) Full blood cell count b) Electrolytes c) CK, Lipase, AST, LDH d) Lactate e) C-reactive protein f) Coagulation (if patient is on anticoagulant therapy)	
	Specific additional tests depending on suspected diagnoses:	
	a) Serial cardiac troponin, copeptin	Fast-rule out of myocardial infarction [30-33]
	b) D-dimer	Pulmonary embolism, aortic dissection [34]

593

594 The presented steps give details on the SOP "laboratory testing" which corresponds to fields
595 31 and 40 of *Figure 2*.

596 **Abbreviations**: **CK** creatine kinase, **AST** aspartate aminotransferase, **LDH** lactate
597 dehydrogenase.