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Evaluation of outcomes in patients with syncope discharged from the emergency department of Piacenza: a retrospective monocentric study

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Abstract

Despite being commonly encountered in the Emergency Department (ED), syncope remains a diagnostic challenge, particularly among older adults with multimorbidity and polytherapy. The real danger is to underestimate cardiac syncope, which is associated with higher morbidity and mortality. For these reasons, we conducted a retrospective study to evaluate all patients admitted to the ED of Piacenza for syncope or presyncope between 2022 and 2024. Our goal was to investigate the occurrence of Major Adverse Events (MAEs) within 30 days after discharge home. This study aims to assess the effectiveness of our ED protocol for managing syncope, which is based on the 2018 ESC guidelines, which outline three phases that minimize the risk of missed diagnoses while avoiding excessive investigations. Despite being a retrospective monocentric study, the low incidence of MAEs observed supports the protocol's effectiveness in identifying serious causes of syncope, thus allowing for safe and appropriate management of patients who are discharged home. In the future, the use of artificial intelligence could be useful to confirm the diagnosis, identify high-risk patients and decide the appropriate setting of care (discharge, observation, or admission).

Key words: syncope, emergency department, algorithms, monitoring, arrhythmias.

Introduction

Syncope is a common condition that affects approximately 30% of the general population and accounts for up to 3% of visits to Emergency Departments (ED).¹ In most cases, especially among younger patients, syncope is due to a benign cause; however, in a variable percentage ranging from 1% to 3%, it can be a symptom of a serious and potentially fatal underlying disease.²⁻⁸ According to major guidelines, syncope is defined as a Transient Loss Of Consciousness (TLOC) caused by a global cerebral hypoperfusion, characterized by a rapid onset, a short duration, and spontaneous complete recovery.² While this definition is straightforward, the complex nature of syncope arises from its multifactorial causes and varied prognoses. This complexity can make management challenging for emergency physicians, highlighting the crucial importance of accurate risk stratification,⁹ particularly among older patients with multimorbidity and polytherapy who can present with delayed or incomplete recovery.¹⁰⁻¹² The true risk lies in underestimating cardiac syncope, the form most strongly associated with morbidity and mortality. For these reasons, several risk scores have been proposed over the years, some of which have been validated. However, none has proven to be superior to clinical judgment.¹³ Among the various scores, the Canadian Syncope Risk Score (CSRS) has demonstrated the best performance, particularly in identifying patients at low risk of serious adverse events within 30 days.¹⁴

The approach to managing patients with syncope in the ED of Piacenza is based on the 2018 European Society of Cardiology (ESC) guidelines,² which outline three phases that minimize the risk of missed diagnoses while avoiding excessive investigations. In the first phase, syncope must be distinguished from other causes of TLOC. In the second phase, high-risk causes of syncope are investigated through medical history and physical examination. The medical history should include an assessment of prodromal symptoms and circumstances, as well as warning signs such as chest pain, shortness of breath, headache, and palpitations. It is important to identify triggering factors, which may include prolonged standing, physical exertion, discomfort, and environments that are hot and/or crowded. Additionally, the clinical history should pay particular attention to any pre-existing structural heart disease, the presence of a Pacemaker (PM) or an Implantable Cardioverter-Defibrillator (ICD), a family history of sudden death, and any ongoing medications. Physical examination should include testing for orthostatic hypotension, performing an electrocardiogram, and conducting additional tests as needed, such as arterial blood gas analysis¹⁵ and Point-Of-Care Ultrasonography (PoCUS).¹⁶ If syncope is suspected to be caused by occult gastrointestinal bleeding, a rectal examination should be carried out. Carotid Sinus Massage (CSM) is indicated in patients > 40 years of age with syncope of unknown origin compatible with a reflex mechanism.² In

the third phase, if the cause of syncope remains undetermined, a risk stratification is performed to determine whether the patient requires hospital admission, observation, or can be safely discharged home.

Observation usually occurs in the Observation Unit (OU), although it can also take place directly within the ED clinical areas. During this time, patients undergo continuous electrocardiographic monitoring, followed by a cardiology evaluation at the end of observation. Upon discharge, some patients may be referred to a Syncope Outpatient Clinic for further diagnostic investigations. According to recent evidence, the optimal duration of monitoring is 6 hours, as collected data have shown that potential arrhythmia in intermediate to high-risk patients (according to the CSRS) typically occur within this timeframe. For low-risk patients, the monitoring duration can be reduced to 2 hours.¹⁷

The purpose of this standardized pathway is to enable safe patient discharge while simultaneously reducing unnecessary hospital admissions. Since the publication of these guidelines in 2018, a progressive reduction in hospitalization rates for syncope has been observed. In Italian EDs, admission rates have dropped from around 50%² to 20%.¹⁸

The aim of this study is to evaluate the effectiveness of this clinical method in identifying serious causes of syncope by analyzing the incidence of Major Adverse Events (MAEs) within 30 days among patients discharged home.

Material and Methods

This is a single-center, retrospective observational study that was approved by the AVEN Ethics Committee of the Area Vasta Emilia Nord (protocol number 2025/0051160). The study was conducted in the ED of Guglielmo da Saliceto Hospital in Piacenza, which serves as the hub center for a province with approximately 288,000 inhabitants.

All patients aged ≥ 18 years who presented to the ED between January 1, 2022, and December 31, 2024, were included in the study. Syncope was defined according to the ESC as “transient loss of consciousness due to transient global cerebral hypoperfusion characterized by rapid onset, short duration, and spontaneous recovery”.² Additionally, since the ESC guidelines recommend managing presyncope in the same manner as syncope, patients who presented with presyncope were also included in the analysis.

All patients who left the ED against medical advice before completing their diagnostic work-up or after refusing hospital admission were excluded.

The selection criteria for patients included those who met at least one of the following conditions: i) the primary triage complaint of “syncope/presyncope” or “altered level of consciousness”; ii) the discharge ICD-9 codes 780.2 (syncope and collapse) or 992.1 (heat syncope); iii) the triage notes or discharge diagnosis free-text fields contained the terms “syncope” or “presyncope”.

The identified cases were independently reviewed by two investigators, who excluded patients whose ED presentation was not related to syncope/presyncope (e.g., syncope reported only as past history) or whose symptoms were attributed to one of the following conditions: epilepsy, vertigo, acute alcohol intoxication, accidental fall, primary intracerebral hemorrhage, other neurological disorders (stroke, Parkinson’s disease), psychogenic pseudosyncope, concussion, hypoglycemia, carbon monoxide poisoning, or benzodiazepine intoxication. Any disagreements between the investigators were resolved through consensus.

We analyzed patients who experienced a Major Adverse Event (MAE) within 30 days of discharge from the ED. MAEs were defined according with Sun BC et al. [Sun BC et al. Standardized Reporting Guidelines for Emergency Department Syncope Risk-stratification Research, *Academic Emergency Medicine*, 2012] and included: all-cause mortality; arrhythmias (ventricular fibrillation, sustained or non-sustained symptomatic ventricular tachycardia, sinus arrest with pauses > 3 seconds, sick sinus syndrome, second-degree type II or third-degree atrioventricular block, PM or ICD malfunction with cardiac pauses, PM or ICD implantation); structural or ischemic heart disease (severe aortic stenosis [valve area less than 1 cm²], myocardial infarction, hypertrophic cardiomyopathy with left ventricular outflow tract obstruction, left atrial myxoma or thrombus with outflow tract obstruction); or other outcomes, including pulmonary embolism, aortic dissection, occult hemorrhage or anemia requiring transfusion, cardiopulmonary resuscitation.

Deaths were identified through the Data Management Center and linkage with the civil registry. As MAEs represent severe conditions requiring hospitalization, events were identified by analyzing hospital admissions that occurred within 30 days after ED discharge for syncope. For patients who died or experienced a MAE, demographic and clinical data related to the previous ED visit for syncope (medical history, physical examination, ECG findings, additional diagnostic tests, and discharge diagnosis) were collected to assess adherence to the 2018 ESC guidelines.²

The temporal distribution of total syncope presentations across the three-year period was analyzed using the Chi-square goodness-of-fit test, assuming a uniform distribution of cases as the null

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hypothesis. Trends in admission and short-stay observation rates over time were assessed using the Chi-square test for independence and the Cochran-Armitage test for linear trend. The incidence of post-discharge adverse events was compared using the Chi-square test or Fisher's exact test, as appropriate. All statistical tests were two-sided, and a p-value < 0.05 was considered statistically significant. Statistical analyses were performed using the R statistical software environment (R Core Team, version 4.3.2, Vienna, Austria).

Results

Between 2022 and 2024, a total of 184,121 visits were recorded in the ED, of which 5,808 (3.15%) were related to syncope or presyncope (Table 1). In 2024, the number of ED visits significantly decreased following the establishment of Care and Urgency Centers (CAU) in the Emilia-Romagna Region, which are designed to manage selected minor urgent conditions. However, cases of loss of consciousness are not managed in the CAU and continue to be evaluated exclusively in the ED.

The absolute number of cases can be compared, whilst the incidence of syncope and presyncope relative to the total number of visits in 2024 is not comparable to that of previous years. Significant differences have been observed in the absolute number of cases of syncope and presyncope from 2022 to 2024 ($p = 0.0014$). However, this variation does not follow a consistent linear trend of increase or decrease ($p = 0.42$). The data show a sharp rise in cases from the first year to the second, followed by stabilization in the third year.

As reported in Table 1, among all the patients presenting with syncope, 1,202 (20.7%) were admitted to the hospital, 11 patients (0.2%) died in the ED, and 4,595 (79.1%) were discharged home. Of those discharged, 1,142 (25%) underwent a period of observation in the ED prior to discharge.

The trends in the number of syncope and presyncope episodes, hospital admissions, A&E admissions, and major adverse events at home, including death, are shown in Table 1.

A progressive, significant decline in the three-year readmission rate ($p = 0.011$) can be observed, with a highly significant linear downward trend ($p = 0.0028$). At the same time, there has been a significant increase in the length of time patients are kept under observation before being discharged home ($p < 0.0001$), with a distinctly robust linear upward trend ($p < 0.0001$).

There is no significant variation in the overall rate of post-discharge MAEs across the three-year study period ($p = 0.71$). The cumulative number of post-discharge complications was determined by combining all-cause mortality and other non-fatal major adverse events for each year. The slight 0.22% percentage decrease from 2022 to 2024 did not reach statistical significance. Among patients discharged home from the ED, 10 deaths (0.21%) and 31 MAEs (0.67%) were recorded, resulting in a total of 41 cases (0.89%).

To evaluate specific trends in mortality, data regarding post-discharge deaths were isolated and analyzed independently. Although the absolute number of deaths increased over the three-year period, the p -value remained above 0.05 (0.17). The small sample size for these specific events suggests that the observed upward trend does not reach statistical significance and is likely consistent with random variation.

The subgroup who experienced MAEs included 31 patients - 18 women and 23 men - with a mean age of 76 years (range 40-91). The details related to these patients are summarized in Table 2.

Among 31 patients who experienced a non-fatal MAE, the final diagnoses included cardiac disease in 19 patients (61.3%) (Table 3), gastrointestinal bleeding in 3 patients (9.7%), pulmonary embolism in 2 patients (6.5%), and vasovagal syncope or orthostatic hypotension in 7 patients (22.5%). In the first ED discharge, the diagnosis was syncope in 24 patients and presyncope in 7 patients. Cardiac diseases are classified into 15 arrhythmias (79%) and 4 structural diseases (21%), as reported in Table 3. Overall, these patients underwent a total of 21 invasive procedures.

Table 4 reports the causes of deaths among 10 patients discharged home. All patients were discharged with a diagnosis of syncope. In only in 2 cases the death appears to be related to a cardiac disease: the denounced causes in the death certificate were ischemic cardiopathy and cardiac insufficiency. In one case, syncope was a symptom of unrecognized sepsis. In the remaining cases, it does not seem that the deaths were related to the previous episodes of syncope; these deaths occurred after at least 7 days after the patients were discharged from the ED.

Discussion

The proportion of syncope and presyncope cases among total ED visits in Piacenza reflects the data reported in literature.¹ No significant differences have been observed in the absolute number of cases of syncope and presyncope from 2022 to 2024, even if a significant difference has been

observed in the absolute number of cases of syncope and presyncope from 2022 to 2024 ($p = 0.0014$).

The mean hospitalization rate for patients presenting with syncope or presyncope over the three-year study period is aligned with published data from Italian EDs.¹⁷ The progressive significant decline of the hospitalization rate over three years ($p = 0.011$) and the contemporary significant increased use of the observation time before discharging patients home ($p < 0.0001$) can reflect a major adherence to the guidelines, as well as the reduction in the availability of hospital beds.

Studies indicate that between 7% and 23% of patients who present to the ED with syncope experience MAEs within 7 to 30 days after their initial visit. Approximately half of these events — ranging from 3% to 14% — occur after discharge from the ED, whether during hospitalization or at home.¹⁹ A Canadian study involving 505 episodes of syncope reported a total of 49 MAEs within 30 days, including 5 deaths.²⁰ Out of these events, 12 (2.37%), which included 2 deaths, occurred at home. Another study with 293 patients presenting to the ED with syncope found that of the 82 patients discharged home, 2 (2.43%) experienced MAEs within 30 days.²¹ In the present study, the overall rate of MAEs among patients discharged home was 0.89%, and statistical analysis indicated no significant variation in the overall rate of post-discharge MAEs across the three-year study period ($p = 0.71$).

Overall, the results of this study suggest that the clinical approach recommended by the ESC guidelines and implemented in the ED of Piacenza is effective in identifying the majority of serious conditions related to syncope. This approach enables safe patient discharge while maintaining a hospitalization rate comparable to that of other EDs in Italy. The ED significantly decreased the number of traditional inpatient admissions by focusing on patient monitoring within the Short-Stay Observation Unit (OU). Although a higher percentage of patients were safely discharged home from the OU instead of being admitted to standard inpatient wards, the rates of adverse events and mortality following discharge did not significantly increase. The low incidence of pulmonary embolism and gastrointestinal bleeding and the absence of cases of aortic dissection may be attributed to the integration of bedside diagnostic tools, including PoCUS, in the patient evaluation process.

These results demonstrate a high level of clinical appropriateness: the implemented organizational strategy improved hospital resource utilization by reducing admissions while ensuring patient safety after discharge. However, this study has some limitations, including its retrospective and single-center design, as well as the potential underestimation of adverse events occurring at other

hospitals. Nevertheless, the risk of underestimation is reduced since patients who experience MAEs are all centralized at our ED, even if they initially present at peripheral hospitals. Among the 41 patients who experienced MAEs, 13 would have benefited from a period of observation that included continuous ECG monitoring and a cardiology evaluation. No procedural errors were identified in the remaining cases. Our data shows that we did not perform carotid sinus massage in 98% of the patients because our cardiologists prefer to conduct this procedure, if necessary, during a follow-up visit at the syncope outpatient clinic. These observations indicate that there was suboptimal adherence to the guidelines.

In conclusion, between 2022 and 2024, the application of a clinical approach based on the 2018 ESC guidelines for syncope management in our ED resulted in a low incidence of MAEs within 30 days from discharge. These findings support the effectiveness of the protocol in identifying serious causes of syncope and enabling a safe and appropriate management of patients discharged home. In addition, optimal adherence to the guidelines could further reduce the incidence of MAEs.

In the future, we believe that Artificial Intelligence (AI) could be useful for emergency clinicians in diagnosing and managing syncope. AI could help confirm diagnoses, identify high-risk patients, suggest the most likely etiology, and guide decision regarding the appropriate setting of care (discharge, observation, or admission).²²⁻²⁴

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Table 1. Setting care and incidence of Major Adverse Events (MAEs).

	2022	2023	2024	Total
ED visits (n)	68,740	67,876	47,505	184,121
Syncope, n (%)	1,271(1.85)	1,447 (2.13)	1,421 (2.99)	4,139 (2.24)
Presyncope, n (%)	529 (0.77)	596 (0.87)	544 (1.14)	1,669 (0.90)
Syncope and Presyncope, n (%)	1800 (2.6)	2043 (3.0)	1965 (4.1)	5808 (3.1)
Hospitalization (n)	411	420	371	1,202
Admission rate (%)	22.8	20.5	18.8	20.7
Deaths in the ED, n (%)	3 (0.17)	4 (0.19)	4 (0.2)	11 (0.19)
Discharged home from ED, n (%)	1,386 (77)	1,619 (79)	1,590 (81)	4,595 (79)
Observation, n (%)	259 (14.4)	445 (21.8)	437 (22.2)	1,142 (19.6)
Mean observation time (h:min)	6:24	8:36	8:42	
Death after discharge home, n (%)	1 (0.072)	3 (0.18)	6 (0.38)	10 (0.22)

Non-fatal post-discharge MAEs, n (%)	14 (1.01)	11 (0.68)	6 (0.38)	31 (0.67)	
Overall post-discharge MAEs, n (%)	15 (1.08)	14 (0.86)	12 (0.76)	41 (0.89)	

Table 2. Characteristics of patients experiencing Major Adverse Events (MAEs) within 30 days of ED presentation for syncope. PM, pacemaker; ICD, implantable cardioverter-defibrillator; ECG, electrocardiogram; PoCUS, point-of-care ultrasound.

Patient characteristics	n	%
Age (mean, y.o.)	76	
Female	18	44
Male	23	56
Past history		
- Structural cardiopathy	7	17
- PM / ICD	6	14
- Parkinson disease	1	2
- Dementia	9	22
- Malignancy	5	12
- End-stage disease	7	17
Abnormal ECG	5	12
Orthostatic hypotension test		
- Positive	11	27
- Negative	11	27
- Not done	19	46
PoCUS		
- Diagnostic	1	2
- Not diagnostic	24	58
- Not done	16	39
Observation		
- Done	14	34
- Not done	27	66

Carotid sinus massage		
- Positive	0	0
- Negative	1	2
- Not done	40	98
Cardiologic evaluation		
- Done	11	27
- Not done	30	73
Final diagnosis at discharge from ED		
- Syncope of defined etiology	23	56
- Syncope of undefined etiology	18	44
Adherence to the protocol		
- Yes	32	78
- No	9	22

Table 3. Classification of cardiac diseases and procedures.

Cardiac disease	N = 19
Arrhythmia:	15
- Advanced atrio-ventricular block / sick sinus syndrome	6 / 1
- Supraventricular paroxysmal tachycardia / atrial fibrillation	2 / 1
- Ventricular pre-excitation	1
- Malfunctioning PM	2
Structural disease:	4
- Acute coronary syndrome	2
- Patent Foramen Ovale (PFO)	1
- Post-ischemic dilated cardiopathy	1
Procedure:	21
- Coronarography	5
- PM / ICD implantation	7 / 1
- PM correction	2
- Catheter ablation	5

- PFO correction	1
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Table 4. Characteristics of 10 patients dead at home after being discharged from the emergency department. Pt, patient. F, female. M, male. OU, Observation Unit.

	Cause of death	Days after discharge	Year of death	Age	Sex	OU
Pt 1	Ischemic cardiopathy	1	2024	80	F	Yes
Pt 2	Sepsis	4	2024	82	M	No
Pt 3	Parkinson disease	9	2023	86	F	No
Pt 4	Pharyngeal carcinoma	9	2023	86	M	Yes
Pt 5	Alcoholic hepatitis	10	2024	82	M	No
Pt 6	Pulmonary carcinoma	15	2023	81	M	No
Pt 7	Airways obstruction	15	2022	62	F	No
Pt 8	Chronic obstructive lung disease	26	2024	72	M	Yes
Pt 9	Cardiac insufficiency	26	2024	88	F	No
Pt 10	Pulmonary fibrosis	29	2024	82	F	No

Contribution: Francesca Burlon and Andrea Vercelli designed the study and collected the data; Francesca Burlon wrote the manuscript with the help of Andrea Vercelli and Erika Poggiali. Erika Poggiali supervised the findings of this work and critically revised the manuscript. Maria Giulia Bolognesi and Daniela Aschieri helped supervised the project. All authors discussed the results and contributed to the final manuscript.

Conflict of interest: the authors declared no potential conflicts of interest with respect to the research, authorship, or publication of this article.

Ethics approval and consent to participate: the AVEN Ethics Committee of the Area Vasta Emilia Nord, protocol number 2025/0051160. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No animal studies were performed in this study.

Availability of data and materials: data are available upon reasonable request to Erika Poggiali, E.Poggiali@ausl.cp.itr

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