The Emergency Department Approach to Syncope: Evidence-based Guidelines and Prediction Rules

Chad Kessler, MD\textsuperscript{a,b,c,d,*}, Jenny M. Tristano, MD\textsuperscript{e}, Robert De Lorenzo, MD, MSM\textsuperscript{f,g}

There are many admissions for syncope because of concern that this generally benign condition can occasionally be an ominous sign of a life-threatening disease process. Although the need for admission is obvious when a cardiac cause of syncope is diagnosed in an emergency department (ED), a large percentage of patients have undiagnosed causes of syncope after the standard evaluation. Admissions for syncope are costly\textsuperscript{1} and often return an unrevealing work-up.

\textsuperscript{a} Department of Emergency Medicine, Jesse Brown VA Hospital, 820 South Damen Avenue, MC 111, Chicago, IL 60612, USA  
\textsuperscript{b} Department of Internal Medicine, The University of Illinois School of Medicine at Chicago, 840 South Wood Street (M/C 718), Chicago, IL 60612-7315, USA  
\textsuperscript{c} Department of Emergency Medicine, The University of Illinois School of Medicine at Chicago, 808 South Wood Street, M/C 724, Chicago, IL 60612, USA  
\textsuperscript{d} Combined Internal Medicine/Emergency Medicine Residency, The University of Illinois School of Medicine at Chicago, 808 South Wood Street, M/C 724, Chicago, IL 60612, USA  
\textsuperscript{e} Departments of Internal Medicine and Emergency Medicine Residency Program, University of Illinois-Chicago, 808 South Wood Street, M/C 724, Chicago, IL 60612, USA  
\textsuperscript{f} Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814-4799, USA  
\textsuperscript{g} Department of Clinical Investigation, MCHE-CI, Brooke Army Medical Center, 3851 Roger Brooke Drive, Fort Sam Houston, TX 78234-6200, USA  
\textsuperscript{*} Corresponding author. Emergency Medicine, Jesse Brown VA Hospital, 820 South Damen Avenue, MC 111, Chicago, IL 60612.  
\textit{E-mail address: Chad.Kessler@va.gov}

doi:10.1016/j.emc.2010.03.014  
emed.theclinics.com  
0733-8627/10/$ – see front matter. Published by Elsevier Inc.
In the past two decades, many researchers have attempted to develop clinical decision criteria that emergency physicians (EPs) may use to categorize patients into high versus low risk for serious outcomes. Because syncope is a presentation with a broad differential diagnosis, these risk stratification guidelines have historically been problematic in 2 ways:

- They ensure identification of all patients who might benefit from acute intervention but increase the number of unnecessary and costly admissions.
- They decrease the number of unwarranted admissions but miss identification of at least a few patients who are predicted to have serious outcomes soon after ED presentation.

This clinical review focuses on current studies and recommendations that outline risk stratification and treatment guidelines for patients who present with syncope. It also briefly discusses the management of syncope, patient outcomes in various syncope causes, and the survival benefit accrued from acute hospitalization.

**METHODS**

Every attempt was made to include the most recent and relevant articles. To conduct a current and thorough review of the literature, OvidMEDLINE and PubMedMEDLINE searches were performed, including but not limited to the following queries: “Syncope,” “Syncope AND emergency,” “Syncope AND risk,” “Syncope AND outcomes,” “Syncope and Prognosis,” and “Syncope AND presyncope.” Articles were limited to those written in English and published after 1980. Articles were reviewed for relevance to the topic of risk stratification in the ED as well as patient disposition and outcomes. PubMed-suggested related articles and bibliographies of chosen articles were also reviewed for additional sources.

**WHAT IS SYNCOPE?**

Syncope is characterized by a sudden, transient loss of consciousness associated with an inability to maintain postural tone. The presentation is sometimes confused with other conditions that lead to loss of consciousness, such as seizure, vertigo, dizziness, drop attacks, coma, or shock and cannot be the result of trauma, ethanol, or other toxic substances. By definition, patients with syncope have regained consciousness and baseline neurologic status spontaneously, promptly, and independently, in other words, without the aid of electrical or chemical cardioversion. Syncope is most accurately categorized as a syndrome rather than a discrete medical entity. Symptom combinations vary significantly and have a broad differential diagnosis. There is variability between investigators as to whether or not “presyncope” is considered a variation of the syncope syndrome as it does not include a loss of consciousness.

**WHAT IS THE PREVALENCE OF SYNCOPE IN THE ED AND IN HOSPITAL ADMISSIONS?**

Syncope is responsible for 1.2% to 1.5% of ED visits and up to 6% of hospital admissions. In 2000, an estimated 460,000 patients were hospitalized with discharge diagnoses that included syncope, 230,000 of whom had primary diagnoses of syncope. The incidence of syncope increases with advancing age. With the United States population growing older, the number of syncope admissions will increase and contribute to the growth of health care expenditures.

Of patients who present to the ED with syncope, from 39% to 50% of patients do not have the cause of syncope established after the initial ED evaluation.
This leads to syncope admission rates upwards of 60%, with most undergoing a hospital admission that is nondiagnostic.

**WHAT IS THE COST OF SYNCOPe ADMISSIONS?**

In 2005, Sun and colleagues estimated the total annual cost for syncope-related hospitalizations was $2.4 billion (95% CI, 2.2 to 2.6 billion) with a mean cost of $5,400 (95% CI, 5100 to 5600) per hospitalization. A more recent study by Alshekhlee and colleagues estimates a more modest but still significant $1.7 billion annually. These costs were similar to that of asthma, HIV, and chronic obstructive pulmonary disease–related diagnoses. It is this high cost coupled with low diagnostic yield of inpatient syncope work-ups that has largely driven the development of ED-focused clinical guidelines.

**WHAT IS THE STANDARD SYNCOPe WORK-UP IN THE ED?**

The standard syncope work-up for a patient presenting to the ED includes a detailed history, physical examination, and 12-lead ECG. These are the only level A recommendations put forth by the American College of Emergency Physicians (ACEP) updated 2007 guidelines. The history and physical examination reveals the cause of syncope in 32% to 74% of patients with an additional 1% to 11% of patients diagnosed by ECG. The most common diagnoses established by this evaluation include vasovagal syncope, orthostatic hypotension, arrhythmia, and acute coronary syndrome. The history should be detailed and include preceding events, a description of and the duration of any prodrome, events after regaining consciousness, and current medications. Past medical history should focus on the cardiac history and any family history of sudden cardiac death. Witnesses to the event should be questioned. The physical examination should include detailed vital signs, orthostatic blood pressures, abdominal and rectal examinations, and detailed neurologic and cardiac examinations. Although history and physical are helpful during syncope evaluation, a commonly encountered difficulty is patients who are often unable to provide accurate historical information.

Compared with the history and physical examination, the yield of the ECG is low. The test, however, is low risk and inexpensive and continues to be recommended in almost all patients as it contributes to decisions regarding immediate therapy and future testing. There is limited evidence to guide the use of other tests, and a complete blood cell count, blood chemistries, urine pregnancy, and other laboratory tests are ordered only if indicated by a history and physical examination. Specific tests, such as urine toxicology screens and cardiac enzymes, should be performed as directed by pertinent history and physical examination findings. Other potentially diagnostic studies include CT, MRI, stress testing, and electrophysiologic studies. These are not part of the routine initial ED syncope evaluation and should only be performed when indicated by the individual patient presentation.

**WHAT IS THE PROGNOSIS AFTER A SYNCOPe EPISODE?**

Most syncopal episodes have less ominous origins, but syncope can reflect serious conditions. Serious morbidity or mortality occurs in 4% to 6% in the period after presentation to the ED. For unknown causes of syncope, this rate approaches 30% for patients diagnosed with high-risk causes of syncope. It has long been known that patients with cardiac syncope have lower survival rates than those without syncope. It has been less clear, however, whether or not...
the syncopal episode or the cardiac history was related to the decreased survival. In 1996, Kapoor and Hanusa\textsuperscript{16} compared all-cause mortality, cardiac mortality, and other cardiovascular outcomes in patients with syncope to a matched group of patients without syncope. There were no significant differences in mortality attributed to cardiac and noncardiac comorbidities when syncope patients were compared with their nonsyncope counterparts. After successfully matching 470 pairs of patients with and without syncope, they found that the overall 1-year mortality in patients with cardiac syncope was 22\% (cardiac mortality 12\%) compared with 20\% in the matched nonsyncope group (cardiac mortality 11\%). They found no significant difference in survival rates when patients with syncope were compared with matched patients without syncope. Age, congestive heart failure, and coronary artery disease were all predictors of cardiac and overall mortality in both groups of patients, but syncope alone was not a risk factor. In the end, they concluded prognosis was primarily determined by patients’ underlying cardiac conditions. Currently, the guidelines from ACEP and the European Society of Cardiology strongly recommend admission for any potential cardiac or neurologic etiology of syncope.\textsuperscript{4,19,20,30–32}

WHAT ARE THE GUIDELINES TO RISK STRATIFY PATIENTS WITH SYNCOPE?

Before the San Francisco Syncope Rule

The first modern syncope risk stratification rule was developed in an original article by Martin and colleagues.\textsuperscript{2} These researchers performed a prospective cohort study that identified 4 predictors of arrhythmia and mortality within the first year for patients presenting to the ED with syncope. A second prospective cohort evaluated the validity of those predictors as a clinical prediction rule that could stratify ED patients into low- and high-risk groups (Table 1). Findings in the validation study were consistent with the derivation cohort, and it was shown that an increasing number of risk factors corresponded to increasing mortality rates at 1 year.

In 2003, Italy produced the Osservatorio Epidemiologico della Sincope nel Lazio (OESIL) study, a prospective cohort study that included patients as young as 12 years, did not include presyncopal patients, and defined the primary endpoint as death from any cause within 12 months of the initial ED.\textsuperscript{33} Significant multivariate predictors were identified and a score was calculated by assigning each risk factor a value of 1. The mortality rate at 12 months increased with increasing OESIL score (see Table 1). This article was the first to make recommendations for management based on the results of risk stratification. The investigators suggested discharging patients with 0 to 1 risk factors and admitting patients with 2 to 4 risk factors. A follow-up study showed that measuring the serum troponin added little to the score’s usability and was not recommended for risk stratification.\textsuperscript{34}

Also in 2003, Sarasin and colleagues\textsuperscript{35} developed a risk score that looked at an even more specific outcome, the risk of significant arrhythmia. Again, derivation and validation cohorts were used to develop a risk score predicting arrhythmias in patients with syncope still unexplained after performing clinical history, physical examination, and 12-lead ECG. Consistent with previous studies looking at all potential for all serious outcomes, significant predictors of arrhythmia were an abnormal ECG, age greater than 65, a history of congestive heart failure, a history of myocardial infarction, and history of any type of cardiac disease. An increasing number of risk factors corresponded with an increasing risk for arrhythmia. The study focused on only those patients in whom the cause of syncope after traditional evaluation was still unknown. It answered only one question, however: whether or not the cause of syncope was likely or unlikely due to an arrhythmia.
**Table 1**

Commonalities of Syncope Risk Stratification Rules

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal ECG</td>
<td>+ 4</td>
</tr>
<tr>
<td>Age &gt;45 years</td>
<td>+ 3</td>
</tr>
<tr>
<td>History of Ventricular Arrhythmia</td>
<td>+ 3</td>
</tr>
<tr>
<td>History of CHF</td>
<td>+ 2</td>
</tr>
<tr>
<td>Systolic Blood Pressure &lt;90 mmHg at triage</td>
<td>-1</td>
</tr>
<tr>
<td>Persistent abnormal vital signs in the ED</td>
<td>-1</td>
</tr>
<tr>
<td>Volume depletion such as persistent dehydration, GI bleeding, or hematocrit&lt;30</td>
<td></td>
</tr>
<tr>
<td>Primary CNS event</td>
<td></td>
</tr>
</tbody>
</table>

**Risk Stratification of Patients with Syncope**

- Abnormal ECG
- Age >65 years
- Cardiovascular disease in clinical history
- Abnormal ECG
- Vasodilator heart failure history
- Palpitations preceding syncope
- Hematocrit <30%
- Heart Disease and/or abnormal ECG
- Signs of Conduction Disease
- Syncope during effort
- Signs and Symptoms of Acute Coronary Syndrome
- Signs of Conduction Disease
- Syncope while supine
- Palpitations preceding syncope
- Heart Disease and/or abnormal ECG
- Syncope during effort
- Syncope while supine
- Palpitations preceding syncope

**OESIL Risk Score**

- Abnormal ECG
- Age >65 years
- Cardiovascular disease in clinical history
- Abnormal ECG
- Vasodilator heart failure history
- Palpitations preceding syncope
- Hematocrit <30%
- Heart Disease and/or abnormal ECG
- Signs of Conduction Disease
- Syncope during effort
- Signs and Symptoms of Acute Coronary Syndrome
- Signs of Conduction Disease
- Syncope while supine
- Palpitations preceding syncope
- Heart Disease and/or abnormal ECG
- Syncope during effort
- Syncope while supine
- Palpitations preceding syncope

**Derivation of the SFSR**

- Vasodilator heart failure history
- Palpitations preceding syncope
- Hematocrit <30%
- Heart Disease and/or abnormal ECG
- Signs of Conduction Disease
- Syncope during effort
- Signs and Symptoms of Acute Coronary Syndrome
- Signs of Conduction Disease
- Syncope while supine
- Palpitations preceding syncope
- Heart Disease and/or abnormal ECG
- Syncope during effort
- Syncope while supine
- Palpitations preceding syncope

**Boston Syncope Criteria**

- Vasodilator heart failure history
- Palpitations preceding syncope
- Hematocrit <30%
- Heart Disease and/or abnormal ECG
- Signs of Conduction Disease
- Syncope during effort
- Signs and Symptoms of Acute Coronary Syndrome
- Signs of Conduction Disease
- Syncope while supine
- Palpitations preceding syncope
- Heart Disease and/or abnormal ECG
- Syncope during effort
- Syncope while supine
- Palpitations preceding syncope

**EGSYS Scoring System**

- Vasodilator heart failure history
- Palpitations preceding syncope
- Hematocrit <30%
- Heart Disease and/or abnormal ECG
- Signs of Conduction Disease
- Syncope during effort
- Signs and Symptoms of Acute Coronary Syndrome
- Signs of Conduction Disease
- Syncope while supine
- Palpitations preceding syncope
- Heart Disease and/or abnormal ECG
- Syncope during effort
- Syncope while supine
- Palpitations preceding syncope

---

**Derivation of the San Francisco Syncope Rule**

In a prospective cohort study by Quinn and colleagues, the goal was to derive a clinical decision rule that could be used to risk stratify patients based on potential short-term (7-day) serious outcomes and determine admission necessity. Syncopal and presyncopal events were included. Unlike previous studies that focused on death and arrhythmias as serious outcomes, the San Francisco Syncope Rule (SFSR) had several serious outcomes that were used as endpoints:

1. Death
2. Myocardial infarction
3. Arrhythmia
4. Pulmonary embolism
5. Stroke

---

*Increasing number of risk factors indicates increased risk of mortality.*
*The presence of any one of these risk factors signifies patient is high risk.*
*Patients considered at risk for serious outcomes if they fall into one of the 8 symptom categories.*
*A total point score greater than or equal to 3 is considered an indicator that admission is required.*
6. Subarachnoid hemorrhage
7. Significant hemorrhage (tied to syncope and requiring transfusion)
8. Any condition causing return to ED and hospitalization for related event, including being readmitted for the same or similar symptoms related to the initial syncopal event
9. Patients admitted who required an acute intervention during their stay that would have caused them to return if they were discharged. Acute intervention was defined as any procedure required to treat a condition related to a patient’s symptom of syncope, including pacemaker, use of vasopressors, surgery for abdominal aortic aneurysm, ruptured spleen, ectopic pregnancy, and endoscopic treatment of esophageal varices.

Through multivariate analysis, 5 predictive variables were elicited to make the San Francisco Syncope Rule (Table 2).

When applied to the derivation cohort in this study, the CHESS factors (history of Congestive heart failure, Hematocrit <30%, ECG abnormality, Shortness of breath, and Systolic blood pressure <90) were found to have a sensitivity and specificity of 96.2% (95% CI, 92% to 100%) and 61.9% (95% CI, 58% to 66%), respectively. The rule categorized 45% of cohort patients as high risk, yielding a potential 10% absolute reduction from the actual study admission rate of 55%. Including “age older than 75” as another risk factor would have achieved 100% sensitivity, identifying the 3 patients not predicted by the rule but decreasing specificity to 44%. This would have caused an additional 108 patients without serious outcomes to be classified as high risk and admitted.36

The SFSR made several contributions to syncope risk evaluation. It was the first study that derived a major clinical prediction rule based on short-term serious outcomes, with previous studies evaluating outcomes 1 year. It is currently unclear how long after ED presentation serious outcomes can be considered temporally related to the initial syncopal episode. It was also the first study to include multiple serious outcomes, recognizing that syncope may be a sentinel of other types of preventable morbidity.

The study also garnered several criticisms. First, the rule was intended to be applied to all ED patients with syncope, not just those with unexplained syncope after work-up. Theoretically, when the cause of syncope is identified, the diagnosis provides sufficient information to determine admission necessity. Age, historically considered an important factor in admission decisions, was not included as risk criterion. The investigators believed that although age could have been part of the rule, it would have been difficult to determine an appropriate cutoff, and other risk factors were found better discriminators. Lastly, because the rule did not have 100% sensitivity, it could only be used as a guideline and not as a definitive tool in directing admission decisions. The SFSR is

<table>
<thead>
<tr>
<th>Table 2</th>
<th>San Francisco Syncope Rulea</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Congestive heart failure history</td>
</tr>
<tr>
<td>H</td>
<td>Hematocrit &lt;30%</td>
</tr>
<tr>
<td>E</td>
<td>ECG abnormal (nonsinus rhythm or new changes compared with old ECG)</td>
</tr>
<tr>
<td>S</td>
<td>Shortness of breath</td>
</tr>
<tr>
<td>S</td>
<td>Systolic blood pressure &lt;90 mm Hg at triage</td>
</tr>
</tbody>
</table>

a The presence of any one of these risk factors signifies patient is high risk.

a collection of risk factors that help to determine high- and low-risk presentations, thereby augmenting physician judgment and guiding decision making.

Of the syncope risk stratification systems currently published, the SFSR has undergone the most rigorous evaluation. In the first of a series of follow-up studies by Quinn and colleagues, the SFSR was compared with the ability of physician judgment to identify patients at greater than 2% risk for a serious outcome (Table 3).

The investigators found that there was no significant difference in the sensitivities of the SFSR and physician judgment. The specificity of the SFSR at 61.9% was significantly higher compared with the specificity of physician judgment at 52%. It was predicted that the SFSR could potentially lower the study’s admission rate from 55% to 45%. Quinn and colleagues then attempted to prospectively validate the SFSR. In this study, patient follow-up continued until 30 days after the ED visit although in the original study follow-up was limited to 7 days. Validation sensitivity and specificity for predicting serious outcomes were consistent with those of the original derivation study. Application of the rule would have decreased this study’s admission rate by 7%, but the rule still did not meet 100% sensitivity. Quinn and colleagues then examined the incidence of death in consecutive ED patients presenting with syncope to determine whether or not the risk factors from SFSR could predict death up to 1 year after the initial ED visit. At 6 months, the SFSR had a sensitivity of 100% for predicting deaths possibly related to syncope and 89% sensitivity for predicting all-cause mortality. At 1 year, the rule’s sensitivity and specificity decreased for both categories.

Independent Evaluation of SFSR

In an external validation study of the San Francisco Syncope Rule performed by Sun and colleagues, the SFSR was shown less sensitive than in previous study populations. The primary outcome was all 7-day serious events, and the secondary outcome was 7-day events diagnosed only after the ED visit (see Table 3). The decision by the managing physicians to admit was 100% sensitive and 30% specific for all 7-day outcomes, but the SFSR demonstrated poor sensitivity for identifying patients with a serious event first diagnosed after the initial ED visit. It would have decreased admissions by 12% but missed 10% of patients with a 7-day serious outcome. Age greater than 60 accounted for a majority of the serious outcomes missed by the SFSR, indicating a need to re-evaluate the importance of age as a risk factor. They also made a distinction by specifically evaluating the rule’s ability to identify serious events that would be found only after the ED visit, suggesting a need to focus on predicting the risk of those short-term events. The investigators concluded that the SFSR required further validation before safe application in all patient populations.

Recently, Birnbaum and colleagues attempted to validate the ability of SFSR to identify serious outcomes within 7 days of an ED visit in another independent patient population. Again, the SFSR had decreased sensitivity compared with previously published studies and failed to identify 26% of patients with serious outcomes. The study, however, used different ECG criteria than the SFSR study and admitted more patients. A different, retrospective study of the SFSR in patients older than 65 also found similarly low sensitivity and specificity in this more at risk patient population.

As promising as the SFSR was as a clinical prediction system, it has never been shown 100% sensitive by those who developed it or by those who have attempted external validations. It appears sensitive if applied appropriately but can only be used as a risk stratification tool and not something to replace physician judgment. Several independent researchers have been unable to validate the rule in an external independent study population.
<table>
<thead>
<tr>
<th>Study</th>
<th>System</th>
<th>Derivation Sensitivity</th>
<th>Derivation Specificity</th>
<th>Validation Sensitivity</th>
<th>Validation Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinn et al 2004</td>
<td>Derivation SFSR</td>
<td>96.2% (95% CI, 92%–100%)</td>
<td>61.9% (95% CI, 58%–66%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Quinn et al 2005</td>
<td>Physician judgment</td>
<td>94% (95% CI, 86%–94%)</td>
<td>52% (95% CI, 51%–53%)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Quinn et al 2006</td>
<td>Validation SFSR</td>
<td>—</td>
<td>—</td>
<td>98% (95% CI, 89%–100%)</td>
<td>56% (95% CI, 52%–60%)</td>
</tr>
<tr>
<td>Sun et al</td>
<td>External validation SFSR</td>
<td>—</td>
<td>—</td>
<td>89% (95% CI, 81%–97%)</td>
<td>42% (95% CI, 37%–48%)</td>
</tr>
<tr>
<td></td>
<td>All 7-day outcomes</td>
<td>—</td>
<td>—</td>
<td>69% (95% CI, 46%–92%)</td>
<td>42% (95% CI, 37%–48%)</td>
</tr>
<tr>
<td></td>
<td>Delayed 7-day outcomes</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Birnbaum et al</td>
<td>Failure to validate SFSR</td>
<td>—</td>
<td>—</td>
<td>74% (95% CI, 61%–84%)</td>
<td>57% (95% CI, 53%–61%)</td>
</tr>
<tr>
<td>Schladenhaufen et al</td>
<td>Application SFSR in Elderly</td>
<td>—</td>
<td>—</td>
<td>76.5% (95% CI, 66.7%–84.3%)</td>
<td>36.8% (95% CI, 32.2%–41.6%)</td>
</tr>
<tr>
<td></td>
<td>ED patients</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Reed et al</td>
<td>ROSE pilot high risk only</td>
<td>0.636 (P value .035)</td>
<td>0.716 (P value .035)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Reed et al</td>
<td>ROSE pilot high/medium risk</td>
<td>1.000 (P value .203)</td>
<td>0.182 (P value .203)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Grossman et al</td>
<td>Boston Syncope criteria</td>
<td>—</td>
<td>—</td>
<td>97% (95% CI, 93%–100%)</td>
<td>62% (95% CI, 56%–69%)</td>
</tr>
<tr>
<td>Del Rosso et al</td>
<td>EGSYS</td>
<td>95% (CI, 84.4–99.4)</td>
<td>61% (CI, 54.3–76.6%)</td>
<td>92% (CI, 76.9–98.2)</td>
<td>69% (CI, 62.7–75.2)</td>
</tr>
</tbody>
</table>
**Since the SFSR**

In the United Kingdom, a pilot study evaluated a particular hospital’s current departmental syncope guidelines to predict serious outcomes of syncope at various time points. The hospital’s guidelines were derived from those published by the European Society of Cardiology, the American College of Physicians, and the ACEP and were, therefore, extremely detailed, complex, and not meant for easy memorization and use. Risk stratification was performed to compare 3 scoring systems: the SFSR, the OESIL scoring system, and the hospital’s ED guidelines. The most interesting finding was that the OESIL risk factor, “age > 65,” alone performed better than the SFSR and the ED guidelines, with a sensitivity and specificity of 1.000 and 0.466, respectively (P value .002, significant).

In Boston, a prospective observational cohort study was performed to validate a decision rule created from existing published recommendations and evidence. Presyncopal events were excluded and patients were considered at risk for adverse outcomes or clinical intervention if they had any of 8 symptom categories (see Table 1). The primary outcome was any critical intervention or adverse outcome noted during the ED stay, hospitalization, or 30-day follow-up period (see Table 3). Admitting those identified by the Boston Syncope Criteria would have reduced admissions by 48% but with a sensitivity of 97%, 2 adverse outcomes would not have been identified.

Again from Italy, the Evaluation of Guidelines in Syncope Study (EGSYS) study by Del Rosso and colleagues developed a diagnostic score to identify those patients presenting to the ED with syncope of a cardiac cause. A derivation cohort was used to identify independent predictors of cardiac syncope and assign point scores based on regression coefficients. The system was then validated by a separate cohort (see Table 1). A point score greater than or equal to 3 was considered the best discriminator for a diagnosis of cardiac syncope and no patients in the study with an EGSYS score less than 3 died within the first month of follow-up. The investigators concluded that a score greater than or equal to 3 indicated high risk for cardiac syncope/mortality and necessitated admission. The EGSYS rule was the first to account for different aspects of the syncope presentation increasing or decreasing the likelihood of cardiac etiology. The rule could not meet 100% sensitivity, however, for discerning cardiac syncope without having a specificity that was worse than previously published physician judgment specificities.

**WHAT ROLE DOES AGE FULFILL AS A RISK FACTOR FOR SYNCOPE?**

In 2007, Sun and colleagues specifically looked at age as a risk factor for short-term, serious events after a syncopal episode. The study included patients with syncopal or presyncopal events. The primary outcome was any serious clinical event that occurred during the 14 days after presentation to the ED. The secondary outcome was any 14-day serious clinical event that was not identified until after the initial ED evaluation. The majority of patients who experienced a primary (76%) or secondary (83%) outcome were greater than or equal to 60 years of age. They found that serious 14-day events increase with advancing age and that a majority of events happen in patients 60 and older. Sun and colleagues then described the diagnostic yield and predictive accuracy of ECG testing as a function of age. Specifically, they explored the frequency at which the initial ED ECG identified a cardiac cause of syncope and how often abnormalities correlated with patients’ risks of a 14-day cardiac event. They found ECG testing was diagnostic for a cardiac cause of syncope in 4% of all patients in the study. The ECG, however, did not identify any cardiac causes of syncope in patients younger than 40 years of age. Moreover, in patients under 40,
ECG testing was associated with a 10% frequency of incidental findings leading to additional unnecessary cardiac evaluations and hospitalizations. The investigators concluded it may be reasonable to defer ECG testing in young patients whose presentation, medical history, and physical examination are consistent with a benign cause of syncope. The ECG, however, is relatively easy to perform, inexpensive, and many to most practitioners still perform ECG on young patients.

**WHAT ARE THE EFFECTS OF ADMISSION ON PATIENT OUTCOMES IN UNDIAGNOSED SYNCOPE?**

Morag and colleagues sought to determine whether or not immediate hospitalization is beneficial to syncope patients who have a nondiagnostic ED evaluation. A nondiagnostic ED evaluation was defined as

1. History of present illness devoid of cardiopulmonary, abdominal, or focal neurologic symptoms
2. Physical examination with vital signs within a predetermined acceptable range
3. No clinical evidence of congestive heart failure
4. No new neurologic deficits
5. Normal blood glucose
6. Benign 12-lead ECG.

From a group of 45 patients greater than or equal to 50 years of age who presented to the ED with syncope and had a nondiagnostic ED evaluation, 76% (34/45) were admitted to the hospital. None of the hospitalizations established a diagnosis that was missed in the ED. Furthermore, complete follow-up at 1 month showed that 1 patient had an adverse event—a repeat syncopal episode. This yielded an overall morbidity rate of 2.2%, with no deaths occurring in this nondiagnostic group at 1 month. Although this study was limited by a small number of patients with a small number of adverse outcomes, it acknowledged that hospitalizing patients who undergo a negative ED evaluation may have no actual affect on short-term morbidity and mortality.

Recently, Constantino and colleagues assessed the short-term and long-term prognosis of patients who presented with syncope and the predictors of adverse events at 10 days and 1 year from the visit to the ED. They also compared the rate of severe outcomes in admitted and discharged patients. They did not include in their evaluation anyone who had a clinical condition primarily confirmed in the ED that would have required hospitalization independent of the syncope. Multivariate analysis showed abnormal ECG at presentation, a concomitant trauma, absence of previous symptoms preceding the syncope, and male gender were all independent risk factors for the development of severe adverse outcomes in the short term, and the rate of severe outcomes was significantly greater in admitted (14.7%) than in discharged (2.0%) patients. One-year mortality was also greater in those admitted compared with those discharged. Risk factors affecting long-term prognosis included age greater than 65, coexistence of neoplasms at presentation, cerebrovascular disease, structural heart disease, and ventricular arrhythmias.

The study was helpful in that it showed risk factors affecting short-term prognosis were significantly different than risk factors affecting long-term prognosis. It also illustrated that there was a significant difference in short-term outcomes between admitted and discharged patients, with admitted patients having a worse short-term prognosis. In other words, hospital admission after syncope did not significantly improve long-term prognosis.
SUMMARY

The evaluation and disposition of syncope presenting to the ED is a complex and costly problem. As the size and average age of the population increases, its share of resources will parallel in growth. Currently at minimum, every patient with syncope receives a thorough interview, physical examination, and ECG. It has been demonstrated, however, that it is not the isolated syncopal episode but the underlying cause that has the impact on future prognosis. With the number of possible serious and elusive causes, the additional work-up continues to be variable but significant in time and monetary expense.

As yet, there is still no single set of rules or guidelines that the EP can completely rely on. All current prediction rules (1) sacrifice risk stratification of a few patients to decrease overall admission rates, thereby missing patients with potentially serious outcomes, or (2) recognize all patients with potential for serious outcomes but require a large number of unnecessary admissions as a result of the decreased specificity (see Table 3). The relatively high sensitivity and simplicity of the SFSR has made it one of the most referenced clinical prediction rules. Lack of sufficient sensitivity, however, and an inability to validate the rule in an independent patient population continues to limit its clinical usefulness. There have been attempts to derive other clinical prediction rules. These recent studies continue to have problems creating a set of guidelines that sufficiently balance the concern for patient safety with cost reduction. The most interesting conclusion derived from the many studies is that physicians were highly sensitive and tended to admit patients that eventually developed a serious outcome, including those missed by the risk stratification systems. This increased sensitivity, however, came at the price of many excessive admissions (low specificity).

There are many studies about syncope, most of which focus on sorting patients into categories of high versus low risk for serious outcomes. There are certain criteria that are consistently present in every stratification system derived:

- Abnormal ECG, whatever the definition may be
- History of structural or arrhythmic heart disease, often clinically represented by shortness of breath or other symptoms of heart failure
- Persistently abnormal vital signs in the ED
- Older age, especially in combination with any of the other criteria.

Those with high risk should be admitted and undergo further immediate work-up. Those who look well and do not have any of the complaints are usually low risk and can likely be safely discharged with appropriate follow-up. Even low risk does not signify no risk. To that effect, these studies have not really developed rules but have ascertained specific factors that can guide decision making. An absolute clinical decision rule to direct syncope admissions is not currently feasible, and no rule should ever override physician judgment.

There are many questions that still need to be answered. The optimal follow-up interval must be determined. It is still unclear for how long an episode of syncope can truly be considered an indicator of future morbidity and mortality. After a certain length of time, other aspects of patients' interval health status likely develop a stronger predictive relationship than a previous syncopal episode. It is not ever certain what constitutes appropriate follow-up. Is a primary care physician check for symptom resolution and routine cardiac risk stratification sufficient or should follow-up patients undergo more in-depth evaluation? It should also be clarified as to whether or not “presyncope” should be included or studied as its own unique presentation. Future studies might try to determine if presyncope and syncope convey the same concern for prognosis.
A question for EPs is what disposition is appropriate to patients without a specified cause of syncope after ED evaluation. It is these patients that provide the most difficulty during clinical decision making. Future research should attempt to address the following questions. For those patients with no definite syncopal cause after ED work-up, does hospitalization affect short- or long-term outcomes? Does hospitalization affect outcomes in those with a specific syncope diagnosis? Is there a way to stratify risk for patients with an undiagnosed cause? Addressing these questions may help determine what a clinical decision rule must accomplish to achieve maximal sensitivity and specificity. Moreover, the answer to these questions may lie outside of a clinical prediction rule.

ACKNOWLEDGMENTS

The authors would very much like to thank Dr James Quinn for taking the time to review and critique this article.

REFERENCES


