

The Impact of Diagnostic Tests in Evaluating Patients with Syncope

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Received November 10, 1982

We reviewed the charts of 100 patients admitted to the hospital for evaluation of syncope. The charts were examined with special attention given to the causes of syncope, the frequency and benefit of diagnostic tests, and the relative cost of these tests. In 39 patients no etiology for syncope was found, and another 18 were felt to have had a vasovagal episode. Twelve patients had arrhythmias as the cause for syncope.

Most of the patients underwent a variety of diagnostic tests including cardiac enzyme determinations, brain scans, electroencephalograms, head CAT scans, and Holter monitoring. In most instances, these tests added little useful information to the initial history and physical exam and were done at great expense to the patient.

Our data suggest that extensive neurologic testing in patients with "routine" syncope is not warranted and that the focus of hospitalization should be to rule out potentially life-threatening arrhythmias.

INTRODUCTION

Syncope, a sudden and temporary loss of consciousness, is a very common disorder, accounting for between one and two percent of medical admissions to Yale-New Haven Hospital in 1980. Wayne [1], in 1962, felt he could determine the cause for syncope in 95 percent of patients, but Silverstein and colleagues, in a more recent study, questioned this conclusion and felt that many patients with this problem never had a specific diagnosis made [2]. In a recent study, the actual frequency of diagnosis in hospitalized patients was only 10 percent [3], a number far below that expected and somewhat lower than our data would suggest. The present study was done to evaluate our ability to discover the cause of syncope in hospitalized patients and to assess whether newer, and often expensive, diagnostic tests of cardiovascular and central nervous function have increased our ability to assign a definite etiology in patients admitted with syncope. In addition, an attempt was made to compare the use of diagnostic tests in evaluating patients who defy medical diagnosis in contrast to those for whom a diagnosis is established.

Unlike a previous study [2], this analysis examined patients admitted both to general medical wards and intensive care unit beds. In addition, patients with an obvious seizure disorder as the cause for transient loss of consciousness were excluded, thus separating this study from another recent article [4].

MATERIALS AND METHODS

Patient Selection

The charts of 100 adult (>16 years of age) patients admitted to the Yale-New Haven Hospital from 1976–1978 with a chief complaint of syncope were reviewed. These charts were identified if syncope (H-ICDA number 775.5) was listed in the discharge diagnoses. The 100 charts, retrospectively reviewed, were the first 100 selected by computer from all patients admitted with syncope during this time. Based upon recent figures looking at the incidence of syncope at our hospital, this group of 100 patients represented approximately two-thirds of all patients admitted for syncope during the two-year study period. All but three of the patients were admitted to the medical service, the others being admitted to the neurology ward.

Charts were accepted for review only if syncope was the chief complaint of the patient when seen in the emergency room. Patients with other chief complaints and coincident syncope were not included in the analysis. Overall, 113 charts were examined, and thirteen were excluded for the above reasons.

Chart Review

We analyzed each chart for pertinent past medical history, especially of syncope, cardiac disease, or neurologic problems. We noted all diagnostic tests used in evaluation on this admission, the ultimate diagnosis of cause for syncope, and how that diagnosis was reached. In all cases we felt that the medical record provided adequate information.

Diagnostic Tests

Attention was directed toward those tests used in evaluating each patient. We placed special emphasis on the results of routine diagnostic tests (admission electrocardiogram, hemoglobin, hematocrit, serum glucose, electrolytes) and other and more expensive tests: exercise tolerance test, brain scan, head CAT scan, 24-hour Holter monitor cardiac monitoring, electroencephalogram, ventilation-perfusion lung scan, cardiac ultrasound, cardiac electrophysiologic testing, and serial electrocardiograms and cardiac enzymes.

Etiology for Syncope

We determined the etiology for syncope in each patient by independently reviewing the medical record for patient history and laboratory data. In all cases our retrospective review agreed with the consensus discharge diagnosis of the attending physician and housestaff caring for the patient. We attempted to assign a definite etiology for this symptom, whenever justified, by information provided in the medical record. Our criteria for etiologic diagnosis are those used in standard practice and are as follows:

1. *Vasovagal syncope*: Patients who gave a history of syncope after a typical prodrome (10–20 seconds of weakness, lightheadedness, nausea, pallor, diaphoresis, blurry vision, or other similar symptoms) in a typical situation such as emotional upset, crowded environment, personal danger or injury, or prolonged immobility or fatigue. All these patients had a rapid return to a normal baseline state and clearly no post-ictal period.

2. *Postural hypotension*: These patients had either a ten mmHg drop in systolic blood pressure or a ten beat per minute drop in pulse rate with change in posture in the appropriate setting.

3. *Arrhythmia*: We considered a cardiac rhythm disturbance the cause of syncope if the admission or other electrocardiograms or cardiac monitoring (including 24-hour Holter monitoring) done during hospitalization demonstrated a significant arrhythmia (Table 1).

4. *Myocardial infarction*: These patients had syncope related to a history of typical ischemic chest pain in the 12 hours preceding admission with cardiac enzyme, isoenzyme, and ECG confirmation of myocardial injury.

5. *Seizures*: All these patients had a witnessed tonic or clonic event followed by a typical post-ictal period.

6. *Valvular heart disease*: These patients had exertional or post-exertional syncope and cardiac physical examination and ultrasound consistent with aortic stenosis or idiopathic hypertrophic subaortic stenosis (IHSS).

7. *Pulmonary embolus*: This patient had syncope associated with a positive ventilation-perfusion lung scan and pulmonary angiogram.

8. *Hyperventilation*: These patients had reproducible symptoms with hyperventilation identical to the syncopal episode.

9. *Unknown*: For these patients, no definitive diagnosis could be reached to explain their episode.

The assigning of patients to the other diagnostic groups was based on similar pertinent historical, laboratory, and physical exam information. These groups contained a single patient and these are listed in Table 2.

RESULTS

Patient Population

Of the 100 patients reviewed, 46 were male and 54 were female. The average age was 64 years while the median age was 69 years. The youngest patient was 19 years

TABLE 1
Arrhythmia as Cause for Syncope

Tachyarrhythmias	Number of Patients
<i>Ventricular tachycardia</i>	3
—seen on cardiac monitor in one patient	
—seen on Holter monitor in one patient	
—seen on admission ECG in one patient	
<i>Rapid atrial fibrillation</i>	1
—seen on admission ECG	
<i>Others</i>	3
—one patient with multifocal PVCs, ventricular bigeminy, and many ventricular couplets on Holter monitor	
—one patient with mitral valve prolapse and more than twenty PVCs per minute on Holter monitor	
—one patient with history of syncope from ventricular tachycardia who had discontinued antiarrhythmic therapy	
Bradyarrhythmias	Number of Patients
<i>Marked sinus bradycardia</i> (with symptoms)	4
<i>“Tachybrady” syndrome</i>	1

TABLE 2
Etiology of Syncope

Diagnosis at Time of Discharge	Number of Patients
Unknown	39
Vasovagal syncope	18
Postural hypotension	9
Tachyarrhythmia	7
Bradyarrhythmia	5
Seizure	4
Myocardial infarction	3
IHSS	2
Hyperventilation	2
Psychogenic	2
Myocarditis with ectopy	1
Hydrocephalus	1
Alcohol intoxication	1
Micturition syncope	1
Aortic stenosis	1
TIA	1
Pulmonary embolus	1
Tussive syncope	1
Pacer malfunction	1
<i>Total</i>	<u>100</u>

old while the oldest was 97 years old (Fig. 1). The mean age of patients with vasovagal syncope was 57 years. Thirty percent of patients less than 50 years of age had a vasovagal etiology (six of 20).

Etiology

The discharge diagnoses of the causes for syncope in the 100 patients are listed in Table 2. Thirty-nine patients left the hospital with no identifiable cause for their syncopal episode. Another 18 were felt to have had vasovagal syncope. Nine patients had postural hypotension related to medications or volume depletion (including gastrointestinal hemorrhage) (Table 3). Twelve patients were felt to have had an arrhythmia as a cause for syncope. Seven were tachyarrhythmias, while five had bradyarrhythmias. The characteristics of this group and criteria used for diagnosis are listed in Table 1. Four patients were felt to have had a seizure as their reason for syncope, and another three had syncope in conjunction with myocardial infarctions. Whether the syncope in the setting of MI was due to arrhythmia, vasovagal phenomenon, or other mechanisms is unknown. Another 15 patients had various causes of syncope, including IHSS, aortic stenosis, pulmonary embolus, and others, as listed in Table 2.

Previous History of Syncope

Thirty-three of the 100 patients had a previous history of syncope. The results of their evaluations are not unlike those of the full group (Table 4). Fifty-four percent of this group were discharged without an etiology for syncope while 12 percent were thought to have had vasovagal syncope (Table 4).

Diagnostic Tests

A summary of the diagnostic tests used in evaluating the 100 patients is listed in Table 5.

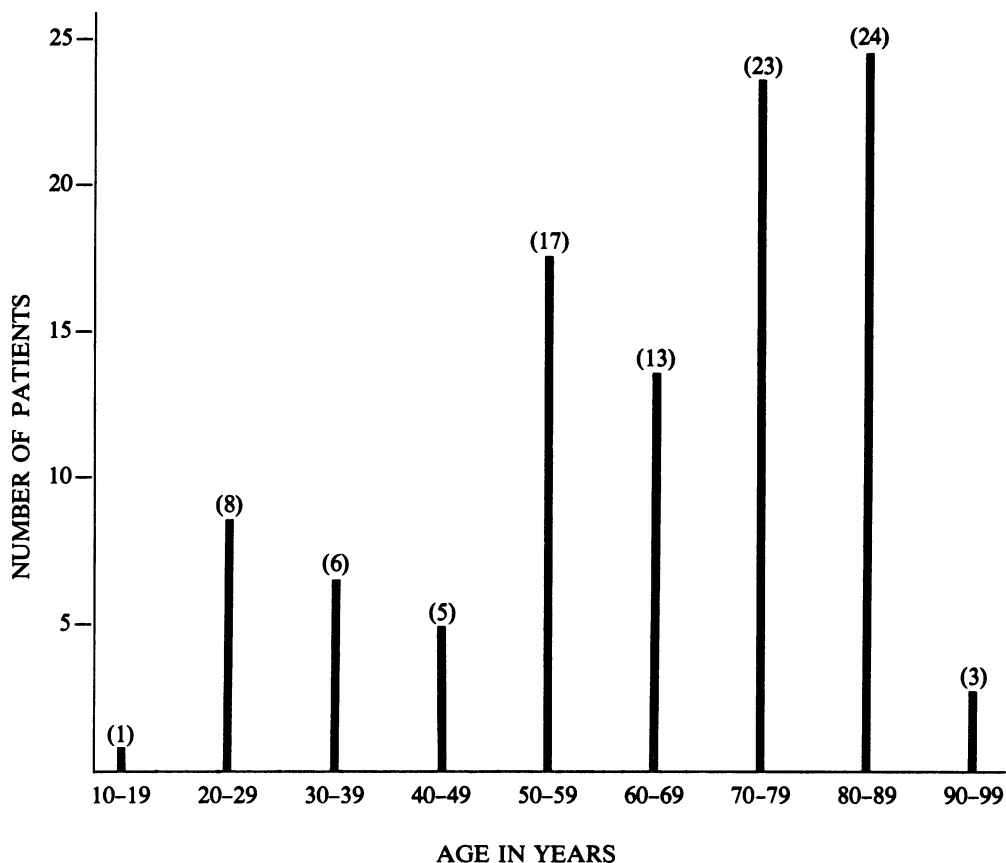


FIG. 1. Patient age.

Comparison of Patients with Known or Unknown Diagnosis

Table 6 illustrates the relative frequency of diagnostic tests performed in patients with and without a specific diagnosis. There was little difference in the relative frequencies of diagnostic tests done in the two groups although in all instances, the percentage of patients undergoing a given test in the unknown group was slightly higher.

Scope of Syncope Evaluation

Most patients admitted to the hospital for syncope underwent an extensive laboratory evaluation. The average hospital stay varied from three to seven days and

TABLE 3
Postural Hypotension as a Cause for Syncope

Medication or Clinical Problem	Number of Patients
Nitroglycerin	1
Diuretics	2
Gastrointestinal bleeding	2
Antiarrhythmic therapy	1
Postural hypotension with no clear etiology	3

TABLE 4
Etiology for Syncope in Patients
with Previous History of Syncope
(*N* = 33)

Discharge Diagnosis	Number of Patients	%
Unknown	17	51
Vasovagal	5	15
Postural hypotension	3	9
Bradyarrhythmia	2	6
Tachyarrhythmia	1	3
Pulmonary embolus	1	3
Psychogenic	1	3
Micturition	1	3
IHSS	1	3
Hyperventilation	1	3

TABLE 5
Diagnostic Tests

Test	Number of Patients Undergoing Test	Number Where Test Yielded Etiology for Syncope
"Rule out" MI (serial ECGs, enzymes, admission to CCU)	74	3
Electroencephalogram	51	1
Cardiac 24-hour Holter monitor	42	3
Brain scan	33	0
Head CAT scan	24	1
Cardiac ultrasound	21	3
Pulmonary ventilation-perfusion scan	8	1
Cardiac electrophysiologic study	7	0
Treadmill exercise stress test	5	0

TABLE 6
Comparison of Frequency of Diagnostic Tests Ordered in Patients with and without a Final Diagnosis

Test	Known Diagnosis (<i>n</i> = 61)		Unknown Diagnosis (<i>n</i> = 39)	
	Number	%	Number	%
"Rule out" MI (serial ECGs, enzymes, admission to CCU)	44	72	30	77
Electroencephalogram	27	44	24	61
Cardiac 24-hour Holter monitor	21	34	22	56
Brain scan	17	28	16	41
Head CAT scan	14	23	11	28
Cardiac ultrasound	14	23	10	26
Pulmonary ventilation-perfusion scan	5	8	3	8

often the first 48 hours are spent in a monitored cardiac or intensive care unit. Many patients also had multiple expensive investigative tests during their hospitalization.

Mortality

There were three deaths among the 100 patients. In each case, the patient was over 75 years of age, had a myocardial infarction in conjunction with syncope, and died within ten days of admission. Follow-up beyond the immediate hospital period was not available for the other 97 patients.

DISCUSSION

Assigning the proper diagnosis for syncope continues to be a difficult and frustrating problem. The causes for this entity vary from benign "fainting" episodes to life-threatening brady and tachyarrhythmias. A number of previous publications have reviewed the differential diagnosis and pathophysiology of syncope [1,4-8] while others have focused on specific causes of syncope such as aortic stenosis [9], vasovagal syncope [10], pulmonary embolus [11], and others [12-15] with such a diverse group of potential causes that the physician is faced with the difficult task of deciding how aggressive to be in evaluating a patient with syncope. Prior to the modern era of coronary care units, nuclear imaging, computerized tomography, and cardiac electrophysiologic study, the major cause of syncope was felt to be vasovagal phenomenon. Indeed, in Wayne's series of 510 patients with syncope, 298 (58 percent) of the episodes were attributed to this etiology. Remarkably, only five percent were placed in an unknown category, a number far below that found in this and other recent series, all of which indicate that a third or more of patients hospitalized with syncope will not have a specific diagnosis made [2,3]. Since Wayne's study was done, the number of diagnostic tools at the physician's disposal has substantially increased, and with these new techniques it was hoped that our diagnostic accuracy would be significantly improved.

The present study was done to assess the value of "newer" diagnostic tests used in evaluating patients with syncope. A previous study confirmed that patients with syncope of unknown origin have extensive and often fruitless evaluation [3]. Our data suggest that virtually all patients hospitalized with syncope are exposed to a variety of sophisticated and expensive tests with little, if any, benefit. Many patients undergo a "battery" of tests to exclude a myocardial infarction, cardiac Holter monitoring to exclude arrhythmias, electroencephalography to look for seizures, and either a brain scan or, more recently, a head CAT scan to discover clinically unexpected neurologic diseases. Despite these studies, no diagnosis is made in between a third and a half of patients with syncope admitted to a hospital, confirming Silverstein et al.'s contention [2]. Furthermore, a significant number of the remaining patients who have "benign" or vasovagal syncope can amass a staggering hospital bill.

In reviewing the results of this analysis, as well as previous studies, a number of conclusions can be drawn:

1. In the majority of patients, the etiology for syncope will be uncovered during the initial history, physical exam, and laboratory assessment. This should include a careful history with special attention given to witnesses of the syncopal episode and their description of the event. The cardiac and neurologic exams must be thorough. Look at the tongue for trauma, suggestive evidence of a seizure disorder. A complete

drug history is essential and attention should be directed toward the possibility of gastrointestinal bleeding and other causes of postural hypotension.

2. Extensive neurologic testing in patients with syncope and a non-focal neurologic exam is often unrewarding. The routine use of electroencephalograms, CAT scans, and brain scans does not appear to add significant diagnostic information to the evaluation of the patient with a single episode of syncope and are very expensive.

3. The focus of hospitalization for patients with syncope of unknown etiology should be to exclude life-threatening brady and tachyarrhythmias. Much of the subsequent evaluation can be done in the outpatient setting.

4. Patients with a history of classic vasovagal syncope should not be hospitalized and require little, if any, further evaluation.

5. Previous studies, including this one, have been retrospective in nature. Inherent in such studies are biases in patient selection, individual differences in record keeping which may limit obtainable data, and difficulties in interpreting diagnostic and therapeutic decisions which were made months or years ago. Depending on the method of patient selection, it may be difficult to determine whether retrospectively selected patients are representative of a general patient population, or whether they represent a narrow group of patients selected by a computer or research assistant.

The prospective study of a group of patients with syncope is needed to assess the significance of the "unknown" diagnosis in patients with syncope and to extensively evaluate historical factors which might aid in deciding which patients need further diagnostic testing. Such a study is now under way at this institution.

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