

# FORESIGHT

RISK MANAGEMENT FOR EMERGENCY PHYSICIANS

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## Acute Coronary Syndromes

### OBJECTIVES

*After reading this issue,  
you should be able to:*

- Explain the need for highly sensitive nursing triage criteria for patients with symptoms of possible acute coronary syndromes.
- Describe the central role of the ECG in a risk stratification approach to patients with symptoms of possible acute coronary syndromes.
- Describe clinical scenarios in which serial ECGs and cardiac biomarkers are useful.
- Explain the anatomic location of acute myocardial infarction and how it can be used to explain ECG findings.

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### INTRODUCTION

Chest pain is a high-volume and, as emergency physicians know, high-risk presentation. According to CDC statistics released in April 2002,<sup>1</sup> of the 108 million emergency department visits in the United States in the year 2000, 5.4% were for the evaluation of chest pain and related symptoms, a percentage second only to that for abdominal complaints. During that same time, the number of hospital emergency departments decreased to 3,934, which means that the average emergency department is providing care for more patients with chest pain than ever before, a number close to 1,500 per year, or four or five per day. Also of interest is that the number of women older than 45 years who presented with chest pain increased significantly but with no corresponding increase among men in the same age group.

Finally, the US population is getting older; patients 75 years old and older make up the largest emergency department population.<sup>1</sup> Coronary artery disease manifests symptomatically more frequently in an aging population, and the presenting symptoms tend to change with age. An aging population is more likely to have comorbid conditions and is less able to survive acute coronary events.

The following cases focus on two key points. The first is that chest pain is a symptom, not a diagnosis. Furthermore, “chest pain” is not necessarily pain. Rather, it is a code word for a much wider symptom complex. A more appropriate term might be “chest discomfort.” Acute coronary syndrome (ACS), too, is a broad term that may include such divergent diagnoses as unstable angina, non-ST-segment elevation myocardial infarction, and acute myocardial infarction, or AMI. The second point is this: although the ECG has a central role in the early risk stratification approach to ACS, it has a limited role in excluding the diagnosis.

**ON SIGHT - 1**

Right after Christmas, 37-year-old single mother Francine Roby had cashed in a gift certificate to a health club across the street from her office. But the first class was tough. She hurt all over afterward, but the pain in her left shoulder had bothered her throughout the class. She did much better in the second class. By the third class, she had the routine down and had even decided it might be fun. During the fourth class, the nagging left shoulder pain had returned; that time, though, it went down her arm, too. When she started to feel nauseated, she had stopped her workout and taken a quick shower. Even though the shower had made her feel a little better, she stopped at Empire Medical Center on her way home.

The emergency department triage nurse notes that Ms. Roby is a 37-year-old woman whose chief complaint is “left shoulder pain after aerobics.” She decides to note the recent shower as well, then sends Ms. Roby to the fast track area via x-ray to get shoulder films.

An intern on rotation in the emergency department examines Ms. Roby and reports her findings to Alex Meyer, MD, the emergency department attending. After performing a shoulder examination, largely for the benefit of the intern, Dr. Meyer reviews the films with Ms. Roby. He shows her that they are normal and sends her home with instructions to extend her warmup time prior to exercise, increase the amount of stretching, and take ibuprofen for the pain.

At 3:12 AM, Ms. Roby’s teenaged daughter calls 911, telling the dispatcher that her mother “looks really sick and has really bad indigestion.” On arrival, the paramedics find that Ms. Roby has a blood pressure of 110/60 and a heart rate of 122; she also is complaining of “a really weird achy feeling” in her chest. After learning that Ms. Roby has a history of insulin-dependent diabetes, the paramedics perform a

bedside glucose determination. The field ECG reveals 5 mm ST-segment elevation in I, aVL, and anterior V leads with reciprocal changes inferiorly. En route to Empire Medical Center, Ms. Roby develops ventricular fibrillation that is unresponsive to repeated attempts at defibrillation. The paramedic is performing cardiopulmonary resuscitation when they arrive; resuscitation attempts in the emergency department fail. Autopsy reveals a thrombus consistent with a recent evolving AMI in the left anterior descending coronary artery.

Six months later, an attorney representing Francine Roby’s children files a lawsuit against Dr. Meyer, alleging medical negligence and wrongful death.

**INSIGHT - 1**

“Typical” symptoms of heart attack historically have been described based on study populations that are predominantly male. Because the symptoms that emerged from those studies are described as “typical,” all other symptoms have come to be considered “atypical.” In this model, the “typical” high-risk patient would be a 55-year-old white man who says that he feels like he has an elephant on his chest; a 37-year-old woman who describes a vague discomfort, on the other hand, would be “atypical” and would possibly be considered low risk for ACS. This can be problematic given that the number one cause of death among women in the United States is heart attack.

What is known today is that symptoms attributable to ACS are nonspecific, that they present with myriad variations of chest discomfort and shortness of breath, and that there is significant symptom overlap. In addition, patients often describe these vague symptoms of discomfort in terms that physicians and nurses might not recognize as being significant. Because of this variability, “chest discomfort” probably is a better term than “chest pain” because it refers to the full spectrum of

symptoms—pain, ache, pressure, indigestion, and so on—associated with ACS.

Good risk stratification begins in a clinical working group that puts together a thoughtful, organized approach to defining symptoms of ACS based on peer-reviewed literature. Once that symptom complex is agreed on, nurses, technicians, and physicians can be trained to respond to patients presenting with those symptoms as if they have *possible* ACS. And once a patient is identified as having possible ACS, an ECG should be done in a timely manner.<sup>2-4</sup>

A triage nurse may determine a patient’s clinical trajectory before an emergency physician has a chance to formulate an opinion about the patient’s risk for ACS. In patients with underlying ACS, time may prove to be a critical determinant of outcome. Wrong triage decisions are costly to the patient and represent malpractice risk for everyone involved with the patient’s care. Emergency nurses charged with the responsibility of initial triage need specific criteria that activate procedures, for example, getting an ECG in the time frame established by the ACC/AHA guidelines (which state that, if an ECG was not obtained in the prehospital setting, one should be obtained and reviewed by a senior physician within 10 minutes of the patient’s arrival in the emergency department<sup>3</sup>). It is important to establish that these triage criteria are followed systematically. Emergency physicians should have ultimate oversight of triage decisions, whether through protocols, triage criteria, or case-by-case assessment. Effective triage criteria should be highly sensitive at the expense of specificity in order to reduce the number of missed cases. Once a patient is identified as having possible ACS, the ECG must be completed so that the emergency physician can make a clinical judgment in the context of a risk stratification strategy as to the presence of ACS.

The key words here are “clinical judgment,” “risk stratification

strategy,” and “if the ECG reveals evidence of ischemia.”

The current state of practice assumes that the average triage nurse and the average emergency physician should be able to identify patients with symptoms of possible ACS and, if those symptoms are present, obtain an ECG in a timely manner. This successfully launches the initial triage and risk stratification. If the ECG is positive, the physician should react quickly to assess the need for reperfusion and other acute therapies. If the initial emergency department ECG is not diagnostic, the patient who has symptoms of possible ACS is still at risk based on those symptoms alone. No single, isolated ECG tracing can be used to definitively rule out ACS or underlying coronary artery disease. “Low risk” is not “no risk.”

Each emergency department may choose to implement a plan for triage of patients with symptoms suggestive of ACS. These chosen criteria, along with good clinical judgment from nurses and physicians, should identify which patients need an ECG. The criteria should be adopted by the physicians and incorporated into the facility’s ongoing competency-based nursing education program. Even with the successful implementation of such an initiative, individual emergency physicians must remain vigilant. It is always a physician’s prerogative and responsibility to redirect an initial triage decision as needed in order to protect a patient.

## HINDSIGHT - 1

Among the claims in the Roby case, the plaintiff argued that the nurse who saw Ms. Roby first failed to triage her properly, which led to her being sent to the wrong treatment area within the department, which led to a delay in diagnosis and treatment. Plaintiff’s counsel also argued that if Alex Meyer had taken a proper history he would have considered exertional angina and

ACS to be the cause of Ms. Roby’s complaints.

Dr. Meyer did indeed fail to assess Ms. Roby properly. They both would have been better served by a history that characterized the pain by location, nature, radiation, what made it better, and what made it worse. And if he had taken a past medical history, he would have learned about her risk factors for coronary artery disease, including insulin-dependent diabetes. The average emergency physician should have recognized that, in the context of her chief complaint and risk factors, Ms. Roby’s evaluation suggested possible ACS. If Alex Meyer had ordered an ECG and blood tests, he might have diagnosed coronary ischemia early enough to save her life.

During deposition, Dr. Meyer all but admitted culpability under tough questioning. The case settled for an amount commensurate with the age of the patient and the fact that she left three children behind.

Empire Medical Center had always considered itself a progressive and superior facility. The Roby case was a painful wakeup call. A group was formed to review the emergency department’s chest pain evaluation process and make specific recommendations for changes to reflect the current knowledge base of ACS, and to include metrics in order to show that the changes in the process were an improvement.<sup>5</sup>

- Acute coronary syndromes have a wide range of symptoms. Be an expert at recognizing them.
- Assess all patients who have symptoms suggestive of ACS thoroughly. Because of the wide spectrum of presentations, ECGs can be used as a preliminary screening instrument.
- Elicit an appropriate, focused history that includes characterization of the pain (discomfort or other symptoms) and assessment of risk factors if a patient has any symptom suggestive of ACS.
- Document not only history and physical examination findings, but also ECG interpretations, response to

therapy (especially relief of pain with nitroglycerin), and rationale for subsequent referral, as well as clinical decision-making (why did you pursue ACS as a cause of the symptoms? or gastroesophageal or musculoskeletal etiologies instead?).

## ON SIGHT - 2

When Gwen Emerson woke up at 5:00 AM with pressure in her chest and mild shortness of breath, her husband called 911 immediately. He had lost his father to cancer a few months earlier; Gwen’s mother had died at age 58 after suffering a heart attack, and Gwen had celebrated her own 58th birthday just a few months earlier.

Thirty-seven minutes later Mrs. Emerson arrives by ambulance at Whittier Hospital. On examination, she is pain free and has normal ECG results. When Matt Lowell, MD, comes into the room, Mr. Emerson pulls him aside immediately and tells him about Gwen’s family history of heart attack, expressing his fear of losing his wife and his father in the same year. Dr. Lowell briefly assures Mr. Emerson that he will “take good care of her” and suggests that he go get a cup of coffee. With some reluctance, Mr. Emerson sets out for the hospital cafeteria.

Dr. Lowell sits down to talk with Mrs. Emerson and take her history. She tells him about her family history of heart disease and confesses that she smoked a pack of cigarettes a day for about 40 years. He documents this information, and that she has no significant past medical history or complaints other than a hysterectomy 20 years earlier. Mrs. Emerson does not know whether she has high cholesterol. Dr. Lowell makes a note of this in the chart, along with a description of her symptoms, which he notes lasted less than 30 minutes and seem to have been relieved by the oxygen started in the field. He then performs an examination, which is normal. Dr. Lowell tells Mrs. Emerson that he is concerned about her symptoms and wants to order some more tests. He also asks her for

the name of their family physician so that he can call him to discuss admission. As Dr. Lowell gets up to leave the room, Mrs. Emerson tells him that she thinks the pressure sensation is coming back. Dr. Lowell asks the nurse to get another ECG.

At the desk, Dr. Lowell adds the physical examination findings to the chart and writes orders: “6:26 AM; Cardiac profile; CXR; ASA PO now; ECG now and times three every 30 minutes and with pain; Contact family doctor.” He puts the chart in the order rack for the unit clerk. Fifteen minutes later the nurse performs the second ECG.

A few minutes before 7:00 AM, Dr. Lowell gives report on his patients, including Mrs. Emerson, to his replacement, Joe Holmes, MD, then finishes his charts and goes home.

At 7:17 AM the day shift nurse pages Dr. Holmes. She gives him Mrs. Emerson’s second ECG, tells him that the patient’s perception of her pressure-like discomfort is now a six on a scale of zero to 10, and asks him whether he wants to start her on some nitro. When Dr. Holmes gets to the treatment room, a nurse is performing the third ECG per Dr. Lowell’s orders. Mr. Emerson has returned to his wife’s bedside and demands to know “what’s going on and what happened to the other doctor and nurse.” As Dr. Holmes begins to explain, Mrs. Emerson develops increased discomfort, diaphoresis, and vomiting. Her blood pressure is 92/58 with a pulse rate of 132. Dr. Holmes orders a fluid bolus and repeat ECG. The radiology tech arrives to take a chest-x-ray just as the third ECG is completed at 7:32 AM. Mr. Emerson clutches his wife’s hand and refuses to leave.

Dr. Holmes retrieves and reviews Mrs. Emerson’s chart then pages the cardiologist on call. At 7:40 AM, Dr. Holmes reports the case and his findings to the cardiologist: ECG #1, normal; ECG #2, minor (<1 mm) ST segment increases in leads I and aVL and reciprocal depression in leads II, III, and aVF; ECG #3, more than 4 mm ST segment increases in leads I and aVL and reciprocal changes

consistent with acute ST-segment elevation myocardial infarction. The cardiologist asks Dr. Holmes to send Mrs. Emerson up for cardiac catheterization and says he will meet her there for direct angioplasty.

The procedure has a stormy course, plagued by a difficulty maintaining the patient’s blood pressure. At 9:56 AM Mrs. Emerson dies as a result of a malignant rhythm disturbance. Mr. Emerson is devastated.

The summons arrives 7 months later. All caregivers are named except the paramedics. Dr. Lowell is singled out by the plaintiff for exhibiting a “lackadaisical attitude” toward his patient and for “abandonment” because he “willfully” went home in the middle of Mrs. Emerson’s care.

## INSIGHT - 2

As a pathophysiologic model, the acute coronary syndrome approach has changed the thinking about a heart attack as an “event.” Rather, ACS is a continuum of illness that a patient may progress through—from asymptomatic with underlying coronary artery plaque, through plaque rupture, platelet aggregation, thrombus formation, decrease of blood flow in the culprit artery, and a mismatch between myocardial perfusion and nutritive demands distal to the lesion. Outcomes are determined by the amount of myocardium at risk, collateral circulation to the area, opening the artery, and how fast reperfusion is established.

According to the ACS model, any patient may present to an emergency department anywhere along the continuum from asymptomatic underlying coronary artery disease to sudden death. Any patient may progress along this continuum, either to a higher risk state that leads to myocardial damage and possibly death, or to a lower risk state and resolution.

The ECG has a central role in the risk stratification of patients with symptoms of possible ACS. Presence of significant ST-segment elevation in

appropriate leads (>1 mm in two or more contiguous limb leads or 2 mm in two or more contiguous precordial leads) meets the ACC/AHA Class I guidelines for reperfusion therapy by either fibrinolytic therapy or coronary angioplasty.<sup>3</sup> In the absence of a diagnostic ECG, serial or continuous ECG monitoring is required to provide the requisite information for a physician to determine adequacy of blood flow in a patient with ACS. Based on symptoms alone, it is not always clear which patients actually have ACS and which do not. When serial ECGs (or continuous 12-lead monitoring) are obtained in the emergency department, the emergency physician is more likely to identify patients with ECG evidence of ischemia and injury when compared to an initial emergency department ECG.<sup>6</sup>

## HINDSIGHT - 2

At trial, the plaintiff called on the paramedics who transported Mrs. Emerson to Whittier Hospital. Using their testimony, Mr. Emerson’s attorney suggested that there was a “carefree attitude” in the emergency department that morning. One of the paramedics testified that he heard a nurse refer to Mrs. Emerson as “a false alarm.” They followed with Mr. Emerson’s tearful testimony: not only did they call Gwen “a false alarm,” they sent him off to get a cup of coffee while she was dying. The attorney also drove home the point that Dr. Lowell left before arranging Mrs. Emerson’s disposition.

At the end of the first week of trial, the plaintiff released Dr. Holmes from the case. Testimony from Dr. Holmes, the cardiologist, experts, and even Dr. Lowell was cited, indicating that, after 7:17 AM when Dr. Holmes became aware of the grave nature of Mrs. Emerson’s condition, he acted within the standard of care by immediately initiating treatment and paging the cardiologist on call. The plaintiff implied that Dr. Lowell should have done this prior to leaving. Dr. Lowell’s attorney came under renewed pressure from the cardiologist’s counsel to offer

a settlement that would release him from the case and prevent his being reported to the National Practitioner Data Bank.

In closing arguments, Dr. Lowell's attorney focused on his medical judgment—that at the time he cared for Mrs. Emerson, she was not at serious risk based on facts documented in the medical record. He emphasized that the experts, the other defendants, and even the plaintiff agreed that the first ECG was normal. As he told the jury, a completely normal ECG in a patient who is pain free and has normal vital signs requires no immediate intervention other than perhaps aspirin; Dr. Lowell included aspirin in his orders, just in case, because he had a high index of suspicion. The jury reviewed Dr. Lowell's orders in his own handwriting. They were thorough and complete: he began treatment with ASA; he ordered additional serial ECGs; he got the name of the family physician; and he appropriately discussed the case with his replacement and documented their discussion before he left.

The second ECG, although not totally normal, did not meet the ACC/AHA guidelines for fibrinolytic therapy. And the third ECG, also ordered by Dr. Lowell, was performed in time to diagnose Mrs. Emerson's heart attack. This allowed Dr. Holmes to act decisively, which gave her the best chance of survival. It was actually Dr. Lowell who prepared the way for Mrs. Emerson's trip to the cath lab for angioplasty by anticipating possible complications.

Dr. Lowell's attorney reminded the jury that heart disease is the number one killer of adults in the United States. Not everyone who makes it to the emergency department alive survives. The emergency physician is typically held to the standard of, "What would a competent emergency physician have done under like or similar circumstances?"<sup>7</sup> This case had a sad outcome, but Dr. Lowell discharged his responsibilities in a manner that met this "average emergency physician" standard.

After a lengthy deliberation, the

jury returned a defense verdict for all defendants.

Matt Lowell did a number of things correctly. Patients with a history like Mrs. Emerson's require a high index of suspicion. Ordering cardiac biomarkers, performing serial ECGs in the emergency department, administering aspirin, and documenting his orders were crucial in light of the patient's symptoms. Discussing the case with Dr. Holmes and completing the documentation before he left were mandatory. But he also did some things that increased his liability risk. First, he assured Mr. Emerson of his wife's well being prematurely. And if someone else on staff could have gotten Mr. Emerson a cup of coffee, he could have stayed with his wife. Personnel changes can be difficult for patients and their families, and Dr. Lowell's decision to leave without talking to Mr. Emerson again or introducing him to Dr. Holmes was unfortunate. His actions did not come close to the criteria for abandonment, but Mr. Emerson felt abandoned nonetheless. All of this, plus a careless comment by a staff member, created an angry and bitter plaintiff.

The change of shift scenario is associated with increased risk of litigation, in particular, patients signed out across a shift change. As a result of the Emerson case, Whittier Hospital established a policy to require that patients in this situation either not be signed out or be worked up thoroughly by the incoming physician. The hospital also reviewed its chest pain pathway and developed a competency-based educational program.

The matter of the second ECG was never resolved. The record was silent on what the nurse did with the tracing and whether Dr. Lowell saw it; the first mention of it was in relation to Dr. Holmes's conversation with the cardiologist. Emergency physicians commonly order tests prior to shift change. If an ECG, x-ray, or some other diagnostic test that requires interpretation is done prior to departure, the emergency physician should document his or her clinical

impression and plan of action. The plan can be simple, such as, "Dr. Holmes agrees and will follow up." Other forms of testing that require clinical correlation can also be referred to the physician assuming care. In this case, if the second ECG had met the ACC/AHA guidelines for treatment with a fibrinolytic agent, the verdict would likely have been different.

- Maintain a high index of suspicion in all patients who have symptoms of possible ACS but normal or nonspecific initial emergency department ECGs.
- Think "progression along a continuum of disease" when evaluating possible ACS.
- Obtain ECGs liberally as circumstances warrant. Serial tracings in the emergency department are appropriate if symptoms persist or worsen in the setting of a nondiagnostic or normal initial ECG.
- Document interpretations of all ECGs ordered.
- Be vigilant at shift change. Make an extra effort to ensure proper closure with patients, their families, and coworkers.

## ON SIGHT - 3

Jane Martin was out of town having dinner with a client when she felt a familiar dull, aching sensation between her ribs. "Great time for my gallbladder to act up," she thought. Two hours later, back in her hotel room, Jane was in outright pain and nauseated. She took an antacid and lay down but began to feel worse. A little after 1:00 AM, she called her husband, and he called their family physician, Marvin Lundy, MD. Twenty minutes later, after listening to Jane's description of her symptoms, Dr. Lundy gave her two options: wait for the pain to go away, or go to a nearby emergency department. She decided to wait for the pain to go away. It didn't. A few hours later, Jane was in a cab on her way to Bowman Hospital, vomiting.

On arrival at 4:30 AM, Mrs. Martin is too weak to get out of the cab. A

nurse helps her into a wheelchair then takes her directly to a treatment room, cleans her up, and helps her into a gown. The intake nurse notes a chief complaint of epigastric pain with nausea and vomiting. Vital signs are blood pressure 110/62, pulse rate 52, respiratory rate 16, and temperature 98.4°F.

The emergency physician on duty, Brent Glassic, MD, sees Mrs. Martin 10 minutes later. She is alert and oriented but complains of feeling lightheaded when she sits up for her physical examination. Lungs are clear, heart is regular with a rate of 50, and the abdomen is completely normal. Dr. Glassic orders an ECG, CBC, amylase, urinalysis, abdominal x-ray series, and a “GI cocktail” and asks the nurse, Carla Sax, to start an IV. Mrs. Martin continues to complain of epigastric pain and vomits again.

The ECG, performed 35 minutes after Mrs. Martin arrived, shows a sinus rhythm, an occasional premature atrial contraction, a rate of 52/min, and ST-segment elevation in leads II, III, and aVF. When Dr. Glassic returns to the treatment room at 5:15 AM, Mrs. Martin tells him that she is still in pain. He diagnoses acute inferior myocardial infarction and asks Mrs. Sax to start a nitro drip and adjust as tolerated. He clears Mrs. Martin for exclusionary criteria for fibrinolytic therapy and orders a first dose to be given, along with morphine 1 mg IV slowly up to 3 mg for pain as tolerated.

The nurse, Mrs. Sax, obtains the fibrinolytic agent from the pharmacy. Another nurse, Maryanne Shay, starts the nitro drip at 10 µg/min after giving a 12.5 µg bolus at 5:20 AM. The first bolus of the fibrinolytic agent is administered at 5:27 AM, and Mrs. Sax then administers morphine 1 mg IV slowly.

When the second nurse, Mrs. Shay, asks Mrs. Martin about her pain, she does not respond. She then attempts to obtain a blood pressure. Dr. Glassic returns to the room, quickly assesses Mrs. Martin's status, and diagnoses pulseless electrical activity. Resuscitation begins at 5:38 AM, 68 minutes after arrival, and is not

successful.

Two months later Jane Martin's husband hires an attorney to file a malpractice lawsuit against Bowman Hospital and Dr. Glassic, claiming that their failure to make the correct diagnosis in a timely manner prevented his wife from receiving lifesaving care for her right ventricular infarction.

### INSIGHT - 3

In a patient with a history consistent with ACS, an ECG that meets the ACC/AHA ST segment guidelines is a sufficient trigger for the average emergency physician to start fibrinolytic therapy without waiting for a consultant. In AMI, opening the culprit artery earlier is always better than later. However, not all AMIs are the same. Infarct location has a bearing on mortality, rhythm disturbances, and the use of adjunctive therapies. Even though human anatomy has a degree of variability, an ECG can help localize the infarct-related artery.

The myocardium is supplied by the right coronary artery (RCA) and the left coronary artery (LCA). The bundle branches, the intraventricular septum, and a major portion of the left ventricle are generally supplied by the LCA. Therefore, a high-grade proximal LCA lesion threatens a large mass of myocardium and much of the electrical conduction system. By contrast, the RCA serves the inferior and posterior left ventricle (in 90% of the population) through the posterior descending branch. The RCA also serves the right ventricle. The right ventricle has a much smaller mass than the left ventricle.

The standard 12-lead ECG is not well suited to reveal right ventricular involvement. The physician must be aware that if there is an inferior AMI (of the left ventricle), then the posterior descending branch of the RCA is likely to be involved. If the posterior descending branch of the RCA is involved, then a more proximal lesion may be the culprit and there may also be a right ventricular infarct. If there is a

co-existing right ventricular infarct, it may not be fully appreciated on the standard 12-lead ECG. Patients with appropriate symptoms with ST-segment changes in the inferior leads may be candidates for right-sided ECGs to assess for possible right ventricular involvement. Emergency physicians should expect to find that roughly one third of all inferior STEMIs they diagnose have right ventricular involvement.

Clinically, the terms anterior, posterior, and inferior AMI really mean anterior left ventricular AMI, posterior left ventricular AMI, and inferior left ventricular AMI. Assessment of right ventricle function in patients with inferior left ventricular AMI may be important because of differences in the approach to adjunctive therapies.

The right ventricle is a low-pressure chamber, with peak right ventricular systolic pressures reaching 25 mm Hg at the most. A right ventricular infarction may compromise the ability of the right ventricle to move blood and lead to dilatation of the already thin ventricular wall; this condition manifests clinically as hypotension and jugular venous distention with clear lung fields. Agents that decrease right ventricular blood flow can cause profound hypotension. Emergency physicians should assess all patients with inferior AMI for possible right ventricle involvement. Support for the patient's blood pressure in inferior AMI and right ventricular involvement includes aggressive volume infusion. Once the diagnosis is suspected or known, agents that decrease right ventricular blood flow (nitroglycerin and morphine) should be used with extreme caution if at all.

### HINDSIGHT - 3

During deposition, Brent Glassic maintained that he saw Mrs. Martin in a timely manner when she came to the emergency department. And even though Mrs. Martin's history and symptoms were consistent with a gallbladder episode, Dr. Glassic correctly ordered an ECG and subsequently initiated fibrinolytic

therapy.

Still, the plaintiff's attorney argued that both the intake nurse and Dr. Glassic failed to take a proper history, which the plaintiff claimed led to the 35-minute delay in obtaining the ECG and allowed Mrs. Martin's condition to deteriorate. The attorney also pointed out that neither the nurses nor Dr. Glassic repeated Mrs. Martin's vital signs before administering the nitroglycerin and morphine, and that Dr. Glassic failed to administer aspirin and consult a cardiologist. Although the claim also included the omission of orthostatic vital signs, the defense expert convinced the court that these measurements are not always reliable and would not have made Mrs. Martin's true hemodynamic status more apparent.

The cardiologist on call that morning was deposed and testified that sinus bradycardia, occasional premature atrial contractions, and an initially low blood pressure should have alerted Dr. Glassic to the possibility of an inferior AMI with involvement of the proximal RCA. He also suggested that Dr. Glassic could have considered ordering a right-sided

ECG before starting either the nitro drip or the morphine.

Carla Sax testified that she did not know Mrs. Martin was lightheaded. She also thought that the nurse who was helping her, Maryanne Shay, would take vital signs before starting the nitro drip since that was the hospital's protocol. Mrs. Shay testified that she was "just helping out" when she started the nitro drip and did not realize that Dr. Glassic's verbal orders indicated "as tolerated."

The lawsuit was settled for an undisclosed amount, with Bowman Hospital and Brent Glassic sharing culpability.

- Suspect inferior AMI in patients with symptoms of ACS who exhibit sinus bradycardia and mild to moderate hypotension, especially if premature atrial contractions are present.
- Pay attention to symptoms such as lightheadedness.
- Obtain serial vital signs before administering nitrates and morphine to patients with acute inferior STEMI.
- Agents that diminish right ventricular flow (nitrates and morphine) can have significant adverse effects in the setting of right ventricular infarction.

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1. Which of the following statements is correct?
  - A. a single ECG may be used to exclude the diagnosis of ACS in most cases
  - B. by taking a good history, the emergency physician can exclude the presence of ACS without testing
  - C. patients with AMI represent a fairly homogenous population and tend to present with similar complaints
  - D. slightly more women die of breast cancer than heart attack in the United States
  - E. there is evidence that gender bias has a role in physicians' assessment of ACS symptoms in women
2. Which of the following statements is incorrect?
  - A. emergency physicians must maintain a high index of suspicion when evaluating patients who have symptoms of possible ACS and normal initial ECGs
  - B. good risk stratification of patients with possible ACS begins with good triage
  - C. triage criteria should be developed to guide nurses' decision-making
  - D. triage criteria must be highly specific to prevent ordering ECGs for patients who do not really need them
  - E. use of triage protocols for patients with chest discomfort favors undertriage
3. The ECG has a central role in risk stratification of patients with symptoms of possible ACS. Which of the following statements best characterizes the initial emergency department ECG:
  - A. if totally normal, ACS can be ruled out
  - B. if totally normal, both occult underlying coronary artery disease and ACS may be present
  - C. if totally normal, occult underlying coronary artery disease may be present, but ACS can be ruled out
  - D. only those ECGs that suggest ACS should be shown to the emergency physician
  - E. should not be performed before the emergency physician sees the patient because doing so would commit the physician to a cardiac workup
4. In most cases, which of the following is required for the initiation of a fibrinolytic agent in a patient with symptoms of ACS:
  - A. AMI with cardiogenic shock
  - B. appropriate ST-segment depression in contiguous leads (ACC/AHA guidelines)
  - C. appropriate ST-segment elevation in contiguous leads (ACC/AHA guidelines)
  - D. at least one positive cardiac biomarker
  - E. cardiology consultation
5. Serial ECGs:
  - A. are of little use in the emergency department
  - B. are of most value in patients who have a low risk profile for ACS
  - C. are required in patients who are likely to be discharged from the emergency department in less than 1 hour
  - D. might increase the yield in patients with marginal ECG evidence of ischemia or injury
  - E. should be obtained only if a patient has ongoing chest discomfort
6. Which of the following statements regarding patients with inferior AMI is correct?
  - A. agents that diminish right ventricular flow (nitrates and morphine) have little hemodynamic effect on patients with right ventricular infarct
  - B. AMI can be ruled out on the basis of a single nondiagnostic ECG
  - C. may exhibit sinus bradycardia, premature atrial contractions, and mild to moderate hypotension
  - D. right-sided ECG is not helpful in identifying right ventricular infarction
  - E. usually progress to cardiogenic shock
7. Which of the following statements is incorrect?
  - A. at shift change, it is unnecessary to inform patients that their care will be assumed by someone else
  - B. extra attention is needed when a new physician assumes care of an existing emergency department patient
  - C. many treatment errors can potentially occur during change of shift
  - D. shift change is associated with increased risk of litigation
  - E. shift changes are difficult on patients and their families
8. Which of the following statements regarding inferior wall AMI is correct?
  - A. agents that diminish right ventricular flow (nitrates and morphine) can have significant adverse effects in the setting of right ventricular infarction
  - B. hypotension due to right ventricular infarct usually requires treatment with pressors
  - C. inferior AMI should be suspected in patients with symptoms of ACS who exhibit sinus tachycardia and mild to moderate hypertension
  - D. symptoms of lightheadedness are common and are of no significance
  - E. the physician should not rely on information gathered from serial vital signs obtained prior to administration of nitro drip and morphine in patients with acute inferior STEMI

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**A N S W E R S**

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Record your answers here:

Question	A	B	C	D	E
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Answers from Issue 53, February 2002

1-E, 2-C, 3-D, 4-E, 5-E, 6-C, 7-A, 8-D