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INSIDE

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Defensive Medicine Practices in Pennsylvania are Common

ABSTRACT & COMMENTARY

By Theodore C. Chan, MD, FACEP

Professor of Clinical Medicine; Medical Director, Department of Emergency Medicine, University of California San Diego Medical Center

Dr. Chan reports no relationships with companies having ties to this field of study.

Source: Studdert DM et al. Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. *JAMA* 2005; 293:2609-2617.

DEFENSIVE MEDICINE HAS BEEN DEFINED AS CLINICAL CARE that deviates from sound medical practice primarily as a result of medicolegal liability concerns. In this study, investigators conducted a mail survey in Pennsylvania of 824 physicians from six high-risk specialties including emergency medicine. (The other specialties included general surgery, orthopedics, neurosurgery, obstetrics/gynecology, and radiology.) The survey asked respondents about their frequency of defensive medicine practices, including assurance behaviors (so-called "positive" defensive medicine), which involve supplying additional services of marginal or no medical value with the aim of reducing adverse outcomes (e.g., additional tests, procedures, prescriptions), as well as avoidance behaviors (so-called "negative" defensive medicine), which involve physician efforts to distance themselves from liability risks (e.g., refusing to perform certain procedures or care for certain types of patients). The investigators also asked respondents about any specific instances of defensive medicine practices in which they had engaged recently.

Nearly all survey respondents (93%) reported practicing defensive medicine. Assurance behaviors were more frequent than avoidance behaviors. In particular, the use of imaging technology in clinically unnecessary circumstances was common and reported by 43% of all physician respondents. Of the 148 emergency physicians (EPs) surveyed, 70% reported "often" ordering more tests than medically indicated as the most common form of defensive medicine practice, a rate that was

statistically higher than all other specialties (59%). More than half of EPs who reported specific instances of defensive practices cited the use of imaging studies when not clinically necessary. Other assurance behaviors reported being used "often" by EPs included prescribing more medications than indicated (30%), unnecessarily referring to specialists (52%), and suggesting invasive procedures (19%).

Specific examples cited by EP respondents included the evaluation and hospitalization of chest pain patients, abdominal computed tomography (CT) scan for abdominal symptoms, and head CT scans for minor trauma or questionable indications. EPs were less likely to report avoidance behaviors than the other specialties, including avoiding caring for high-risk patients such as trauma patients (13% vs 39%) and avoiding certain procedures or interventions (21% vs 32%).

The investigators also collected information from each respondent on individual malpractice experiences and ability to obtain liability coverage. Interestingly, they found no correlation between level of defense medicine practice and prior individual malpractice experience or expense. In summary, the authors concluded that the prevalence of defensive medicine is widespread and has important implications for health care quality and access, as well as societal costs. ❖

COMMENTARY

There are a number of limitations to this study. First, as a survey, the results incorporated potential biases of the respondents regarding defensive medicine and the malpractice liability system in this country. Second, the survey was conducted in Pennsylvania at a time when that state was experiencing a malpractice crisis, which may have affected the physician responses. Nonetheless, this study is remarkable in demonstrating the pervasive practice of defensive medicine in response to the medicolegal liability system in this country. The irony is that defensive medicine practices—particularly assurance behaviors—ultimately may be counterproductive. As the authors pointed out: The more that physicians order tests or treatments that are only marginally or not indicated, the more likely such practices are to become the legal standard of care.

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Does a Negative CT Scan Rule Out PTE?

ABSTRACT & COMMENTARY

By David J. Pierson, MD
Editor, Critical Care Alert*; Professor of Pulmonary and Critical Care Medicine, Harborview Medical Center, University of Washington*

Source: Quiroz R, et al. Clinical validity of a negative computed tomography scan in patients with suspected pulmonary embolism: a systematic review. *JAMA* 2005; 293: 2012-2017.

In this meta-analysis, Quiroz and colleagues attempted to identify all English-language reports published since 1990 that included at least three months of follow-up in patients clinically suspected of having pulmonary thromboembolism (PTE), whose computed tomography (CT) angiograms were negative, and who did not receive anticoagulant therapy. The purpose was

to determine the incidence of subsequent episodes of PTE and thus the negative likelihood ratio (NLR) and negative predictive value (NPV) of a negative CT scan in such patients.

Of 22 studies identified through PubMed, MEDLINE, EMBASE, the Cochrane Database, and other sources, 15 studies (3500 patients) met the researchers' criteria for inclusion in the meta-analysis. Twelve of these studies used single-slice CT, two used multidetector-row CT, and one used electron-beam CT. Among the 3500 patients in the included studies, there were 36 episodes of PTE and six additional instances of deep venous thrombosis during the 3 to 12 months of follow-up. Fifteen deaths were attributed to PTE.

The overall NLR of VTE after a negative CT angiogram was 0.07 (95% confidence interval [CI], 0.05-0.11), and the NPV was 99.1% (95% CI, 98.7-99.5%). There was no difference between single-slice CT (NLR, 0.08; 95% CI, 0.05-0.13) and multidetector-row CT (NLR, 0.15; 95% CI, 0.05-0.43) regarding ruling out PTE in the included studies. The authors concluded that the clinical validity of using CT to rule out PTE is similar to that of conventional pulmonary angiography. ❖

COMMENTARY

The results of this study suggested that clinical outcome is not affected adversely if anticoagulant therapy is withheld based upon a negative CT scan. The overall NPV for this test compares favorably with the NPVs previously reported for conventional pulmonary angiography, and is superior to those reported for negative- or low-probability ventilation-perfusion scans.

The principal limitation of CT scanning, which has delayed acceptance of this test as a gold standard for excluding PTE, is its questionable ability to detect isolated peripheral emboli. The clinical importance of this limitation is uncertain, however, particularly in the evaluation of patients who are ill enough to be admitted to the intensive care unit (ICU). In the absence of severe co-morbidities such as obstructive lung disease or advanced congestive heart failure, it is doubtful whether subsegmental PTE in the absence of more central clots would explain acute life-threatening illness. Although the present study found no difference in the performance of single-slice vs multiple-detector CT scanners, it is likely that the latest machines are better able to detect small peripheral emboli than their predecessors of 10 or 15 years ago.

We now can regard CT scanning as a second (and more readily available) gold standard in ruling out all but the tiniest pulmonary emboli—provided that equipment of relatively recent manufacture has been used, and the study is judged technically adequate by the interpreting radiologist. For ICU patients, there remains a role for ventilation-perfusion scanning in those few patients suspected of having PTE who cannot be given IV contrast material and who do not have serious concomitant cardiopulmonary disease. However, in most instances, a CT angiogram is the procedure of choice. If it is negative, PTE can be excluded confidently enough to obviate the need for anticoagulation.

Gum Elastic Bougie is Useful Adjunct For Difficult Airways

ABSTRACT & COMMENTARY

By Jacob W. Ufberg, MD
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Source: Jabre P, et al. Use of gum elastic bougie for prehospital difficult intubation. *Am J Emerg Med* 2005;23:552-555.

The gum elastic bougie (GEB) is an established tool that has gained increased usage during difficult endotracheal intubation scenarios during the last several years. The GEB is a 60-cm tracheal tube introducer with a smoothly angled tip. If the glottis is not visualized fully during direct laryngoscopy, the GEB may be passed blindly (or with partial visualization) behind the epiglottis. The operator confirms tracheal placement through "clicks" felt as the tip of the bougie passes over the tracheal rings, and feels the progress of the GEB become difficult as it reaches the carina. After placement of the GEB, the tracheal tube is passed over the GEB during direct laryngoscopy.

The authors of this study attempted to assess the effectiveness of the GEB in prehospital cases of difficult endotracheal intubation. This study was performed in the suburbs of Paris, where the emergency medical service (EMS) response systems are quite different than in the United States. The EMS system involved consisted of five mobile intensive care units (MICUs), which responded to about 10,000 calls per year at the time of the study. The MICU is composed of a driver, a nurse anesthetist, and either a senior emergency physician (in > 90% of MICUs) or a senior anesthesiologist. Field intubations in this system always are performed or supervised by a physician.

Forty-five intubators (23 EPs, five anesthesiologists, and 17 nurse anesthetists) participated in this study. A senior anesthesiologist always was on call to respond to the scene in cases of difficult or impossible intubation. All participants initially were trained in GEB usage with classroom and mannequin didactics. After training, all MICUs were equipped with GEBs, and GEB was used as the firstline alternative technique in cases of difficult intubation (defined by more than two failed attempts under direct laryngoscopy with optimal head positioning and external laryngeal manipulation). If two attempts with GEB assistance failed, the operators used another method based upon preference and experience. A senior anesthesiologist was called if GEB-assisted intubation failed, or if a difficult ventilation scenario arose.

Patients were enrolled into the study if tracheal access was not achieved after two direct laryngoscopy attempts, and data forms were completed immediately after the airway management process. Data collected included Cormack and Leane laryngeal view classification (grade 1, whole larynx visible; grade 2, partial view of vocal cords; grade 3, only epiglottis visible; grade 4, no part of larynx visible), clinical characteristics, a validated intubation difficulty score, patient height and weight, history of ENT disease, objective cervical mobility, cervical immobilization, history of maxillofacial disease, clinical risk factors for difficult intubation (e.g., morbid obesity, reduced cervical mobility, upper airway distortion, or maxillofacial trauma), and success or failure of GEB-assisted intubation.

During the study period, 1442 patients required prehospital intubation. Of these, 640 were cardiac arrest victims, and 802 had cardiac activity. Of the 802 with cardiac activity, 95% received paralytic agents before intubation. Forty-three patients (3%) required GEB-assisted intubation. These patients had a median Cormack and Leane score of 4, and high median scores for difficulty of intubation. GEB assistance allowed rapid (rapid was not defined in the study) intubation of 33 of the 41 (80%) failed intubations, 24 with one attempt and 9 requiring two attempts using GEB assistance. Seven patients were intubated after GEB failure (intubating LMA [1], retrograde intubation [1], blind nasal intubation [1], senior anesthesiologist rescue using direct laryngoscopy [4]), and one patient required cricothyroidotomy. Most failed GEB-assisted intubations occurred in patients with ENT malignancies. No complications associated with GEB use were encountered.

The authors mentioned several factors that may have contributed to this success rate, which is lower than in previous studies performed in operating rooms and EDs. Some previous studies excluded anticipated difficult airways, while the patients in this study were selected for their difficulty. Also, the environmental conditions of prehospital intubation often are much more difficult than those in the hospital. Almost half of the patients in this study were intubated while supine on the ground. ❖

COMMENTARY

American EMS systems do not include physicians on-scene, and the performance of European physicians using this device cannot be assumed to correlate to American paramedics with far less training and experience than the operators in this study.

That being said, this study did highlight the utility of the GEB as a simple, inexpensive device that can be a handy addition to our difficulty airway armamentarium. Many physicians, myself included, consider this the first line of defense after direct laryngoscopy has failed. The GEB can be used effectively with very little training, and the reported success rates are high.

One interesting aspect is the study's high success rate despite the median laryngeal view score being a 4 (no part of larynx visible). Traditionally, the bougie has been most useful for patients in whom at least the epiglottis is visible. Twenty-seven of the 41 patients enrolled had a grade 4 airway upon initial laryngoscopy, so evidently the GEB also may be useful for blind intubation.

Special Feature

The Use of Chest CT for the Diagnosis of PE

By Esther Chen, MD
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Several recent studies have significantly expanded the evidence for the central role of computed tomography (CT) in the evaluation of the patient with suspected pulmonary embolism (PE). We review these studies below and summarize the current understanding of the advantages and disadvantages of CT.

CT Technique

The current 16-detector row CT scanner allows imaging of the entire thorax with 1-mm collimation within a single breath hold in fewer than 10 seconds,[1] compared

with a SDCT, which scans with 2-5 mm collimation in a 32-second breath hold or during shallow respirations.[2,3] The reduced acquisition time of MDCT diminishes motion artifacts, particularly important in dyspneic patients. Unfortunately, even with the 10-second breath hold, severely dyspneic patients often have large respiratory movements that can cause respiratory motion artifact, contributing to a low, but significant number of nondiagnostic studies (about 9-10% in several recent trials).[2-4]

Moreover, MDCT scanners have significantly improved the detection of small peripheral emboli because they provide high spatial resolution data that can be reformatted for two- and three-dimensional visualization. MDCT allows visualization of clot in pulmonary vessels down to the sixth order of branching, termed subsegmental vessels[1] with higher interobserver correlation than pulmonary angiography (PA).[5] Consequently, PA is no longer considered the gold standard for subsegmental PE, or, in the view of some experts, for PE in general.[6] While small, previously undetectable peripheral clots now may be detected, the clinical significance of isolated subsegmental PE is still unclear. One study showed that in a small group of patients with isolated subsegmental emboli, 25% had concurrent lower extremity deep venous thrombosis (DVT).[4] In the absence of DVT, however, treating patients with isolated subsegmental emboli remains controversial.

Finally, compared with VQ, CT scanning takes less time to perform, may diagnose other cardiopulmonary diseases once PE has been excluded (25-76% of the time),[2,7] is readily available at most hospitals, and can be obtained easily after hours. Unfortunately, there continue to be some disadvantages to CT, including radiation exposure and the hazards of giving intravenous contrast to patients with renal insufficiency. Furthermore, with the high volume of CT studies that currently are performed, there are issues with managing and storing the enormous amounts of computerized data.

Outcome Studies

Previous PE studies evaluated the reliability of CT by comparing its sensitivity and specificity to PA, but in the past few years, studies have switched to more practical and realistic designs assessing patient outcomes. There is a growing body of literature that evaluates the clinical validity of CT by withholding anticoagulation in patients with a negative CT evaluation and subsequently determining their venous thromboembolic (VTE) rate at three-month follow-up. Each study, however, incorporates CT in a unique diagnostic algorithm, often using a strategy that includes some combination of pretest clinical probability assessment, d-dimer testing, and lower extremity ultrasound (US). Therefore, one must consider that the negative predictive values in these studies are attributed to the CT study as part of an entire diagnostic strategy, and not as used in isolation. The post-test probability of having a VTE event following a negative chest CT evaluation is directly related to the prevalence of PE in the population studied and, therefore, the selection of low, moderate, or high pretest probability patients will play an important role in determining the clinical validity of CT for PE.

One of the recent landmark studies by Musset and colleagues[3] was a prospective multicenter trial that enrolled 1041 patients with suspected PE, risk-stratified to low, intermediate, or high clinical probability, who underwent SDCT and lower extremity US. Patients with a low to intermediate clinical probability and negative CT and US studies had a VTE rate of 1.8% (95% CI, 0.8-3.3%) at three-month follow-up. Alternatively, high risk patients with negative CT and US evaluations had a VTE rate of 5.3% (95% CI, 1.5 13.1%), confirmed by VQ, angiography, or both. Patients with isolated subsegmental emboli and negative US (n = 12) were considered to have a nondiagnostic CT study, of which three (25%) patients were subsequently diagnosed with PE by VQ or PA. Of interest, 16% of patients with a negative CT study had positive US findings; more than half of the DVTs were below the popliteal veins. The authors concluded that in the low to intermediate risk patients, both negative CT and US studies are necessary to reliably exclude PE; high-risk patients must undergo additional testing.

The reliability of SDCT was evaluated further in a study[2] of 512 patients with suspected PE who underwent CT imaging. In this protocol, there were no pretest probabilities or d-dimers used, and patients with negative or inconclusive CT studies were evaluated with lower extremity US. Almost half (48.6%) of the study group had a normal CT study, of which only two patients had DVT detected by US on day 1, and no further DVTs were identified on days 4 and 7. The overall VTE rate at three-month follow-up was 0.8% (95% CI, 0.2-2.3%). Of note, if US had not been done and the two patients who were identified had returned with DVT on follow-up, the rate of VTE would have been 1.3% (95% CI, 0.4 3.1%). The authors concluded that CT imaging may be used reliably as the primary imaging study to exclude PE, and suggested that US has little additional value.

Prompted by the flurry of trials using CT, Quiroz and colleagues[8] performed a systematic review comparing the results of studies using CT in various diagnostic strategies for PE. Fifteen studies, published between 1990 to 2004, met the study criteria, which included 3500 patients using predominantly SDCT (80%). The

overall negative likelihood ratio of VTE after a negative CT study for PE was 0.07 (95% CI, 0.05-0.11) with a negative predictive value of 99.1%. The NLR of a VTE after a negative SDCT was 0.08 and after MDCT was 0.15. The authors concluded that anticoagulation might be withheld safely in patients with a negative CT study because of the low incidence of VTE at follow-up.

Finally, in the most recently published prospective trial evaluating the utility of MDCT, researchers combined clinical probability, d-dimer testing, and lower extremity US to evaluate patients with suspected PE.[9] This was an international multicenter study of 756 patients who were risk-stratified into low, intermediate, and high clinical risk of PE using the Geneva score. In the low-intermediate probability group, 34% had a negative d-dimer and not a single VTE event was found at three-month follow-up. Of those low-intermediate risk patients with a positive d-dimer and negative CT and US, the VTE rate at follow-up was 1.7% (95% CI, 0.7-3.9) and only two patients with a negative CT scan were found to have DVT. In the 82 patients in the high pretest probability group, 95% had a positive CT scan and only one patient with a negative CT scan had a DVT. In all pretest probability groups, 0.9% (95% CI, 0.3-2.7) of patients had proximal DVT despite a negative CT scan. Because of the small numbers in the high clinical probability group, the authors suggested that US be eliminated in all patients, except those at high risk for PE.

New Questions

Lower Extremity Evaluation. Lower extremity CT venography increasingly is being used in conjunction with chest CT to detect DVT. Although variable by institution, a typical protocol utilizes only one contrast injection for CT pulmonary angiography, followed by scanning from the iliac crest to the popliteal fossa, after a 120-second delay from the chest evaluation. With approximately three minutes added to the scanning time[10] and no additional contrast, it is easy to see why this study is so appealing.

The gonadal radiation exposure, however, is increased 500-2000 fold compared with chest CT alone, although this is still within the thresholds provided by the ICRP-60 guidelines.[11] Although this risk is small, it is important to carefully weigh the risks of the extra radiation exposure with the benefits of the additional detection of concurrent DVT.

Since most studies have shown only a small number of patients who have DVT in the absence of PE, the additional evaluation may not be necessary in most patients, particularly patients of childbearing age. US may be a better alternative in those patients with a non-diagnostic CT study, when only isolated subsegmental emboli are detected, or when there is high probability of PE with a negative CT study.

Radiation Considerations. As both CT angiography and CT venography are used increasingly, there is mounting concern about the risks of radiation exposure, particularly in children and younger adults.[12-14] It has become clear with results from a longitudinal (> 50 years) study of atomic bomb survivors, that low-dose radiation (similar to the exposure incurred with a single abdominal CT study) is associated with a small, but statistically significant, risk of excessive cancer over a lifetime.[14] Of particular concern is that some patients undergo multiple CT imaging, thereby accumulating the radiation dose over their lifetime.[15] Some authors have suggested that because of the absorbed breast dose, younger women with a normal chest x-ray (high likelihood of diagnostic VQ) should be evaluated further with a VQ instead of CT.[16]

Fortunately, health care providers are more cognizant of this potential radiation exposure, such that clinicians avoid ordering unnecessary CT studies, radiologists and technologists make individual adjustments to scan parameters (based on indication and patient size), and the CT industry is encouraged to develop newer technology to reduce radiation dose. New studies have shown promising results in reducing radiation by using low-dose techniques,[12] testicular gonadal shields,[17] and CT scanners that have automatic exposure control for changing radiation dose to different regions of the body that require fewer photons for good imaging.[15]

Recommended Algorithm

In patients with a low-intermediate clinical suspicion for PE, a negative ELISA d-dimer assay effectively excludes the diagnosis. A negative CT evaluation in patients with a low-intermediate PE risk and an elevated d-dimer assay also excludes PE, with an acceptable miss rate similar to that of pulmonary angiography. However, a negative CT evaluation in high-risk patients may not reliably exclude PE, and requires lower extremity imaging to exclude concurrent DVT Further outcome studies in high-risk patients would help to clarify this strategy. Moreover, when a lower extremity evaluation is indicated in patients of childbearing age, US should be the test of choice to minimize unnecessary radiation. In older patients, however, the risk/benefit ratio of CT venography may support its use. Finally, patients with inconclusive CT studies or isloated subsegmental emboli require further diagnostic imaging. ❖

References

1. Schoepf UJ, et al. CT angiography for diagnosis of pulmonary embolism: State of the art. *Radiology* 2004; 230:329-337.

2. van Strijen MJ, et al. Single-detector helical computed tomography as the primary diagnostic test in suspected pulmonary embolism: A multicenter clinical management study of 510 patients. *Ann Intern Med* 2003; 138:307-314.
3. Musset D, et al. Diagnostic strategy for patients with suspected pulmonary embolism: A prospective multicentre outcome study. *Lancet* 2002;360:1914-1920.
4. Revel MP, et al. Diagnosing pulmonary embolism with four-detector row helical CT: Prospective evaluation of 216 outpatients and inpatients. *Radiology* 2005; 234: 265-273.
5. Stein PD, et al. Reassessment of pulmonary angiography for the diagnosis of pulmonary embolism: Relation of interpreter agreement to the order of the involved pulmonary arterial branch. *Radiology* 1999;210: 689-691.
6. Ravenel JG, et al. CT in the diagnosis of pulmonary embolism. *AJR Am J Roentgenol* 2005;184:1707; author reply 1707-1708.
7. Kavanagh EC, et al. Risk of pulmonary embolism after negative MDCT pulmonary angiography findings. *AJR Am J Roentgenol* 2004;182:499-504.
8. Quiroz R, et al. Clinical validity of a negative computed tomography scan in patients with suspected pulmonary embolism: A systematic review. *JAMA* 2005; 293:2012-2017.
9. Perrier A, et al. Multidetector-row computed tomography in suspected pulmonary embolism. *N Engl J Med* 2005;352:1760-1768.
10. Cham MD, et al. Deep venous thrombosis: Detection by using indirect CT venography. The Pulmonary Angiography-Indirect CT Venography Cooperative Group. *Radiology* 2000;216:744-751.
11. 1990 Recommendations of the International Commission on Radiological Protection. *Ann ICRP* 1991;21: 1-201.
12. Tack D, et al. Multi-detector row CT pulmonary angiography: Comparison of standard-dose and simulated low-dose techniques. *Radiology* 2005;236:318-325.
13. Golding SJ. Multi-slice computed tomography (MSCT): The dose challenge of the new revolution. *Radiat Prot Dosimetry* 2005;114:303-307.
14. Slovis TL. Children, computed tomography radiation dose, and the As Low As Reasonably Achievable (ALARA) concept. *Pediatrics* 2003;112:971-972.
15. Frush DP, et al. Computed tomography and radiation risks: What pediatric health care providers should know. *Pediatrics* 2003;112:951-957.
16. Ravenel JG, et al. CT angiography with multidetector-row CT for detection of acute pulmonary embolus. *Semin Roentgenol* 2005;40:11-19.
17. Hohl C, et al. Radiation dose reduction to the male gonads during MDCT: The effectiveness of a lead shield. *AJR Am J Roentgenol* 2005;184:128-130.

CME Objectives

To help physicians:

- Summarize the most recent significant emergency medicine-related studies;
- Discuss up-to-date information on all aspects of emergency medicine, including new drugs, techniques, equipment, trials, studies, books, teaching aids, and other information pertinent to emergency department care; and
- Evaluate the credibility of published data and recommendations.

Physician CME Questions

23. The gum elastic bougie, used to assist in intubation after failed direct laryngoscopy, is:

a. most useful for patients lying prone on the ground.
b. unable to facilitate intubation.
c. successful in nearly 80% of cases.
d. extremely difficult to learn to use.

24. Defensive medicine practices that would be considered avoidance behaviors or "negative defensive medicine" include:

a. obtaining a head CT scan for a patient with very minimal head injury.
b. refusing care to a trauma patient.
c. referring a patient to a subspecialist for care that is not required.
d. performing an invasive procedure that is not clinically indicated.

25. Patients with high pretest suspicion of pulmonary embolism probably should get _____ in addition to a CT angiogram of the chest, if the latter test is negative.

a. lower-extremity ultrasound
b. pulmonary angiography
c. transesophageal echocardiography
d. transthoracic echocardiography

26. Lower extremity CT venography _____ CT angiography of the chest.

a. requires an additional intravenous contrast load when following
b. adds 15 minutes to the total CT scan time, when following
c. is contraindicated in patients with a history of joint replacement who receive
d. increases gonadal radiation exposure 500-2000 fold over

Answers:

23. c; 24. b; 25. a.; 26. d.

CME Instructions

Physicians participate in this continuing medical education program by reading the article, using the provided references for further research, and studying the questions at the end of the article. Participants should select what they believe to be the correct answers, then refer to the list of correct answers to test their knowledge.

To clarify confusion surrounding any questions answered incorrectly, please consult the source material. After completing this activity, *you must complete the evaluation form that will be provided at the end of the semester and return it in the reply envelope provided to receive a certificate of completion.* When your evaluation is received, a certificate will be mailed to you.

A History of "Falling Out"

By Ken Grauer, MD, Professor and Associate Director, Family Practice Residency Program, College of Medicine, University of Florida, Gainesville.

Figure: Rhythm strip recorded on telemetry from a 70-year-old woman admitted to the hospital for episodes of "falling out."

Clinical scenario: The rhythm in the Figure was obtained from a 70-year-old woman who was admitted to the hospital with a history of "falling out" on several occasions during the week prior to admission. Her initial 12-lead electrocardiogram (ECG) was unremarkable, and acute serum markers were negative for recent infarction. Telemetry monitoring was described as "unremarkable," except for the tracing shown in the Figure. This rhythm strip was interpreted as sinus rhythm with a brief run of "SVT." Your thoughts on the case?

Interpretation: It is difficult to determine from the history provided what may have occurred. The patient's description of "falling out" on several occasions during the week prior to admission could represent a variety of benign phenomena, or could reflect true syncope from a recurrent and serious cardiac arrhythmia. Potentially life-threatening arrhythmias may occur without associated acute infarction and on an infrequent, intermittent basis. Documentation by telemetry monitoring in such cases may be unrevealing because no abnormalities may be seen over an extended period of time. That condition could be what is happening for this patient.

In view of the history given for this case, the rhythm strip shown in the Figure is worrisome. Baseline artifact is present, accounting for undulation in the baseline that distorts ST segments and alters P-wave morphology. Nevertheless, it seems clear that the underlying rhythm is sinus, as evidenced by regular occurrence of narrow QRS complexes at a rate of 80/minute for the last six beats on the tracing. Each of these beats is preceded by an upright P wave, albeit the artifact slightly changes the P wave appearance. The QRS complex looks very different for the first seven beats on the tracing. Although the rS complex for these seven beats does not appear to be widened, one cannot be sure where the QRS begins and ends from this single monitoring lead. The rhythm is fairly regular at a rate of about 150/minute, and no definite atrial activity is seen; it has to be assumed to be ventricular tachycardia (VT) until proven otherwise.

Unfortunately, the beginning of the run of abnormal beats is cut off, such that one has no idea of the duration of the episode. Further evaluation of the tachycardia (e.g., thyroid function studies, serum electrolytes levels measurement, oxygenation status study, and history of potentially causative drugs) is warranted. If no obvious precipitating cause is found however, the occurrence of the arrhythmia seen here in a patient with a history of "falling out" may warrant electrophysiologic study with consideration of an implantable cardioverter-defibrillator (ICD). ❖

In Future Issues: Timing of coronary reperfusion