EMERGENCY MEDICINE ALERT®

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INSIDE

Are chest compression rates adequate during CPR? ***page 83***

Spinal epidural abscess— is drainage required? ***page 84***

Seldinger vs surgical approach to emergency cricothyroidotomy in cadaver models ***page 85***

Special Feature: Arachnophobia in the ED ***page 86***

Large Trial Examines Effect of Reviparin on Morbidity and Mortality in Acute MI

ABSTRACT & COMMENTARY

Source: CREATE Trial Group Investigators: Effects of reviparin, a low-molecular-weight heparin, on mortality, reinfarction, and strokes in patients with acute myocardial infarction presenting with ST-segment elevation. *JAMA* 2005;293:427-435.

In this large, randomized, double-blind, international clinical trial, investigators sought to evaluate the effect of reviparin (a LMWH similar to enoxaparin) on mortality, reinfarction, recurrent ischemia, stroke, and bleeding at seven and 30 days after STEMI. More than 15,000 STEMI patients at 341 centers in China and India were randomized to receive either a weight-based dose of reviparin (3436 – 6871 IU every 12 hours) or placebo injection. Patients were eligible if they presented within 12 hours of symptoms (with ST-segment elevation or new left bundle-branch block on electrocardiogram) with no contraindications to heparin. Subsequent care was left to the discretion of the clinicians and included standard ACS and reperfusion therapies as indicated.

There was a significant improvement in the primary outcome composite measure of death, reinfarction, and stroke at seven days following STEMI (9.6% vs 11.0%, $p = 0.005$, hazard ratio = 0.87, for the reviparin and placebo groups respectively). This beneficial advantage was maintained at 30 days following STEMI as well (11.8% vs 13.6%, $p = 0.001$, hazards ratio = 0.87, respectively). This improvement was seen for patients who underwent emergent fibrinolytic therapy (approximately 73% of patients) or alternatively direct percutaneous coronary intervention (6.1%). Moreover, the benefit was greatest in patients who received reviparin early. The relative risk reduction was 30% for patients treated within 2 hours, 20% for 2 to 4 hours, 15% for 4 to 8 hours, and negligible when started 8 or more hours after presentation.

The incidence of major or life-threatening bleeding was higher in the reviparin group, particularly in the first seven days (0.9% vs 0.4%, $p < 0.001$, respectively). As a result, the investigators per-

formed a benefit and risk balance analysis, utilizing a composite endpoint of death, reinfarction, strokes, and life-threatening bleeding, which still demonstrated benefit for the reviparin group at 7 days (9.8% vs 11.1%, p = 0.01, hazards ratio = 0.88) and at 30 days (12.0% vs 13.7%, p = 0.002, hazards ratio = 0.87, respectively).

These data suggest that for every 1000 patients treated with reviparin, 17 fewer major adverse outcomes would be prevented. The authors conclude that, for patients with STEMI (or new left bundle-branch block with presentations consistent with ACS), reviparin reduces mortality and re-infarction without a substantially increased risk of stroke; although it carries a slight increase in risk of major bleeding over placebo, the benefit clearly outweighs the risk of therapy. ❖

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COMMENTARY BY THEODORE CHAN, MD, FACEP

This study (also known as the CREATE trial – Clinical Trial of Reviparin and Metabolic Modulation in Acute Myocardial Infarction Treatment Evaluation) is the largest, randomized, double-blind clinical trial assessing the utility of heparin in the treatment of STEMI. As such, its findings of significant benefit of the LMWH reviparin over placebo are important. However, the question remains as to whether these findings are applicable to STEMI treatment in the United States.

First, while it's true that definitive evidence of mortality benefit for UFH in ACS is limited, heparins have become standard therapy for ACS.[1] Whether reviparin has additional benefit over UFH in the setting of STEMI is not answered by this study.

Second, this study was conducted in China and India where there are differences in the treatment of ACS. For example, while use of standard therapies in this study, such as aspirin, were high (97%), the fibrinolytic therapy (occurring in 73% of cases) was primarily streptokinase and urokinase, as opposed to tissue plasminogen activator, which is used more commonly in the United States. What effect these differences may have had on the beneficial outcome seen with reviparin remains unknown.

Finally, while similar to enoxaparin as an LMWH agent, reviparin is not used widely in this country. Whether the benefits reported in this study are specific to reviparin, or are generalizable to other LMWH agents, remains unknown. There is, however, one large trial with enoxaparin (TIMI 25) underway that should provide additional information in the future.[2]

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Are Chest Compression Rates Adequate During CPR?

ABSTRACT & COMMENTARY

Source: Abella BS, et al. Chest compression rates during cardiopulmonary resuscitation are suboptimal: A prospective study during in-hospital cardiac arrest. *Circulation* 2005; 111:428-434.

Approximately 1-6% of patients with out-of-hospital cardiopulmonary arrest survive to hospital discharge. This figure jumps to slightly more than 17% of in-hospital arrests. The study of cardiac arrest during recent years indicates that the timing and quality of caridiopulmonary resuscitation (CPR) have an effect on the incidence of return of spontaneous circulation (ROSC). Studies have demonstrated increased rates of ROSC among patients with shorter delays to CPR, fewer pauses in chest compressions, CPR prior to defibrillation, and the use of chest compression-only CPR.

This study from three hospitals in the Chicago area measured chest compression rates during in-hospital cardiac arrests to determine compliance with published international CPR guidelines (100 compressions per minute [cpm] are recommended). The authors felt that chest compression rates were a readily quantifiable surrogate marker of the quality of CPR, and that the measurement of compression rates at three hospitals would allow them to determine the general quality of CPR provided at in-hospital arrests. The secondary goal of the study was to compare rates of ROSC among patients who received recommended and less-than-recommended compression rates.

Cases included all arrests among patients older than 17 years occurring in one of the three study hospitals. Arrest was defined by the loss of a palpable pulse and the delivery of chest compressions by hospital staff. Persons certified in basic life support delivered all CPR. Patients were excluded if the arrest occurred in the operating suite or emergency department (ED), or if the investigator arrived at the arrest before other hospital personnel, such that their assistance was needed with the resuscitation. On arrival at an arrest, observers attempted to record compressions without alerting resuscitation providers to their presence.

Compression rates were recorded using a handheld device developed for the study and validated prior to initiation of the study. ROSC was defined as the return of a detectable pulse and perfusing rhythm was maintained for more than five minutes. Arrest recordings were divided into 30-second segments, and the rates computed for each segment were corrected for any pauses more than four seconds during which pulse checks or defibrillation occurred. Average compression rates were recorded for each arrest, and the frequency of ROSC was calculated for each quartile of average compression rates.

During the study period, 813 minutes of resuscitation were recorded during 97 cardiac arrest events. Patients had a mean age of 73 years, and 51% were female. Arrests occurred in ICU settings (55%), ward beds (32%), or in other areas such as the radiology suites (13%). ROSC as defined for this study occurred in 63% of arrests. Average compression rates were measured at 100 + 10 cpm in only 31% of cases, and were fewer than 80 cpm in 37%. Average resuscitation times were higher in patients not achieving ROSC, suggesting that providers were not biased in their compression rates against patients thought to have little chance of survival.

Mean compression rates were compared among patients who did or did not achieve ROSC. Mean rates for patients with ROSC were 90 + 17 cpm compared with 79 + 18 cpm for patients without ROSC (p = 0.003). When patients were grouped into quartiles by average compression rate, the patients in the highest quartile had a 75% rate of ROSC, while the patients in the lowest quartile had a 42% rate of ROSC (p = 0.008).

The authors conclude that chest compressions frequently are delivered at rates below the recommended rate of 100 cpm. The frequency of low rates was similar in all three study hospitals, suggesting a possible widespread problem. While the study was not designed with the power necessary to detect differences in ROSC rates, these differences were statistically significant in both direct and quartile analysis. The authors acknowledge the study's limitations: 1) possible bias against patients thought to have little chance of survival (i.e., "slow code"), 2) CPR quality goes beyond chest compression rate, 3) human error was possible in the counting of compressions, and 3) data from these three hospitals may not be applicable to hospitals everywhere. ❖

COMMENTARY BY JACOB UFBERG, MD

The applicability of this study suffers from several limitations. First and foremost, one cannot confuse ROSC, survival to hospital discharge, and good (or fair) neurologic function. Many studies of cardiac arrest use ROSC or survival to hospital admission as an endpoint although few of these patients will ever return home. I would be more interested in the study of compression rates as they relate to survival to hospital discharge; however, in the authors' defense, this was not a primary goal of the study.

Second, the authors admit that compression rate is only one part of the big picture of the quality of CPR. However, compression rate was used as a surrogate due to its measurability in the chaotic environment of an in-hospital arrest. Third, it is hard to compare ROSC rates when the baseline data of severity of illness are not recorded. It is possible that a far greater number of non-survivors were intensive care unit patients with severe co-morbid illnesses.

Despite these limitations, the major point of the study remains important. Compression rates routinely are sub-

optimal. We need to find a way to deliver an adequate compression rate during arrests. All CPR is not equal; we need methods that use monitoring and measurement and real-time and post-arrest feedback or debriefing to ensure CPR quality for our most critical patients.

Spinal Epidural Abscess—Is Drainage Required?

ABSTRACT & COMMENTARY

Source: Siddiq F, et al. Medical vs surgical management of spinal epidural abscess. *Arch Intern Med* 2004;164:2409-2412.

Researchers reviewed the management of 60 episodes of spinal epidural abscess in 57 patients seen during a 14-year period ending in 2002. The lumbar or lumbosacral region was involved in 54%, the thoracic in 18%, and the cervical in 28%. The number of vertebral levels involved was 1-8, with more than two vertebral levels involved in 45% of patients.

Blood cultures were positive in 26 (46%) patients, and abscess cultures were positive in 36 (63%). *Staphylococcus aureus* was recovered from 34 patients (60%), coagulase negative staphylococci from five (9%), streptococci from nine (16%), *Enterococcus faecalis* from three (5%), *Actinomycetes* from four (7%), and other organisms from eight (14%).

All patients received antibiotic therapy. Surgical decompression was performed in the management of 28 (47%) of episodes, and computerized tomography (CT)-guided percutaneous needle aspiration in seven (12%), while medical management alone was administered in 25 (42%) of episodes.

Neurologic impairment was present at presentation of approximately half of all episodes, and was marked in 11. Complete recovery was achieved in 43 (72%) episodes, while an additional ten (17%) were left with only minimal residual weakness. Recovery rates were similar regardless of the management mode. Only neurologic impairment at presentation was associated with a poor outcome. Complete recovery was achieved in only 17 of 30 (57%), with impairment at the outset of therapy, compared with 93% in those without initial impairment. Even in those with neurological complications at presentation, there was no significant difference noted in outcomes when surgical and non-surgical management were compared. ❖

COMMENTARY BY STAN DERESINSKI, MD, FACP

The management of spinal epidural abscess has evolved during the last two decades, with the most important change being the recognition that not all patients require surgery for a successful outcome. The most generally agreed upon approach has been to intervene surgically only in patients with a neurological deficit resulting from the infection. Thus, patients presenting with a deficit as the consequence of cord compression are referred for urgent decompression. Those without an initial deficit are examined carefully several times daily for evidence of its appearance, an event that triggers referral for a decompressive procedure. In any case, antibiotic therapy is prolonged, although the duration is somewhat arbitrary, since there is no good clinical evidence upon which to base a recommendation regarding duration. The necessary duration of therapy, however, is likely to be longer in cases in which osteomyelitis and/or diskitis are present than when they are absent.

The mode of decompression also has evolved with the recognition that many spinal epidural abscesses can be drained successfully using percutaneous CT-guided aspiration.[1] This procedure was, in fact, used successfully in seven of seven episodes in this series. When successful, this mode of decompression, as well as of specimen acquisition for microbiological studies, has an obvious advantage over surgical decompression.

Accepting the implications of the report by Siddiq and colleagues at face value would, however, indicate that the approach to management described above results in unnecessary surgery in many patients. Siddiq and colleagues conclude that surgery is not required in most instances, even in patients presenting with a neurological complication of the infection. However, clinical experience has led to observations of sometimes apparently dramatic results from decompression, including the resolution of tetraplegia in some patients with epidural abscess involving the cervical spine.[2] Not all spinal cord complications in patients with this problem are amenable to surgical intervention or to percutaneous aspiration because myelopathy may result from compression and/or thrombosis of spinal vasculature in the absence of cord compression.[3]

The retrospective nature of this study, patient heterogeneity, and small sample size all contribute to a wariness concerning its conclusions. I continue to believe that patients who develop a neurological deficit as the result of cord compression should be considered candidates for decompression, especially if this can be achieved by percutaneous drainage. I also continue to believe that an important key to a successful outcome is early recognition of this infection, since delayed diagnosis is associated with increased risk of permanent neurological deficit.[4]

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Seldinger vs Surgical Approach to Emergency Cricothyroidotomy in Cadaver Models

ABSTRACT & COMMENTARY

Source: Schaumann N, et al. Evaluation of Seldinger technique: Emergency cricothyroidotomy versus standard surgical cricothyroidotomy in 200 cadavers. *Anesthesiology* 2005; 102:7-11.

THE PURPOSE OF THIS STUDY WAS TO COMPARE THE proficiency of emergency physicians (EPs) in the performance of Seldinger and surgical approaches to cricothyroidotomy using a human cadaver model. Twenty novice EPs completed a standardized 30-minute didactic training session. During the subsequent four months, participants performed each procedure five times in random order. Outcome measurement included three time intervals (i.e., time to location of the cricothyroid membrane [CTM]; time to tracheal puncture and tube insertion; and time to first ventilation), successful tube placement, and the presence or absence of injuries to airway structures upon post-procedure anatomic dissection.

The results in 13 cadavers were excluded because of incomplete data. The airway was placed accurately in 82 of 93 cases (88%) in the Seldinger group, and in 79 of 94 cases (84%) in the surgical group. Time to location of the CTM was not significantly different between groups (7.9 ± 11 sec Seldinger; 8.2 ± 9.7 sec surgical [p = NS]). Time to tracheal puncture was significantly longer in the surgical group (98.7 ± 58.3 sec Seldinger; 119.2 ± 61.2 sec surgical [$p < 0.01$]), as was the time to first ventilation (108.6 ± 59.5 sec Seldinger; 136 ± 66.3 sec surgical [$p < 0.001$]). The procedure was aborted seven times in the Seldinger group due to kinking of the wire and six times in the surgical group due to inability to advance the tube. No injuries were observed in the Seldinger group; there were six punctures of the thyroid vessels among those using the surgical approach. ❖

COMMENTARY BY MICHAEL GIBBS, MD, FACEP

Acknowledging the limitations of a cadaver model, this is the largest investigation to date examining the success rates and complications of Seldinger vs surgical cricothyroidotomy. Although EPs in this study were able to perform the Seldinger technique more rapidly, with comparable success rates and less injury to the airway, I believe it is our responsibility as experts in airway management to become proficient with both techniques. We should take advantage of every training opportunity available to us to achieve this goal. In clinical practice, the performance of an emergency surgical cricothyroidotomy is unfortunately not likely to be a one-technique-fits-all experience. Remember, the last box on every failed airway algorithm ever published says the same thing: surgical airway.

Special Feature

Arachnophobia in the ED

By Richard Hamilton, MD, FAAEM, ABMT

BASED UPON THE EXPERIENCES IN MY LAST FEW shifts in the ED, you would think that my community is being attacked by hordes of angry spiders. The mystery of this arachnid epidemic is furthered by the inability to identify spider species; most spiders are crushed beyond recognition when brought for identification, and spider identification itself is a tricky business. In fact, the only way to approach the problem of the boil of unknown origin (BUO) is to presume that the patient contracted it in a fashion consistent with the prevalent conditions in the community. This commentary will

look at the differential diagnoses of boils, furuncles, and skin infections and the pitfalls of ignoring the presence of truly prevalent conditions.

Brown Recluse and Other Spider Species

The arachnid most often indicted in the BUO situation is the dreaded *Loxosceles reclusa*—the brown recluse or fiddleback spider. This spider has a flat 1-cm body with longer legs making its overall size slightly larger than a U.S. quarter. As its name implies, it is reclusive and decidedly nocturnal unless disturbed. Living indoors, it uses its flat body to hide in dark quiet places like closets, where it finds clothing and other comfortable items.

Most importantly, its habitat is limited to the southern Midwest United States (Nebraska, Kansas, Oklahoma, Texas, Louisiana, Arkansas, Missouri, Kentucky, Tennessee, Mississippi, Alabama, northern Georgia, and southern portions of Ohio, Indiana, Illinois, and Iowa). It has never been identified on the East or West Coast. A brown recluse occasionally has emerged from a shipment of materials from an endemic area, but this is extremely rare.[1] In fact, the spider is so reclusive that bites in infested endemic areas are unusual. Entomologists reported a home in Kansas where they collected more than 2000 *L. reclusa* spiders in a six-month period without any of the inhabitants ever being bitten.[2]

There are a number of other species of *Loxosceles* in the United States, but the important ones are *deserta, arizonica, apachea, blanda,* and *devia*. These latter species are found in the desert regions bordering Mexico. None of these species are found in the chaparral or coastal regions of southern California. Practitioners in endemic areas have learned to identify the subtle, bluish subcutaneous necrosis surrounding a rather unimpressive bite mark as the classic recluse bite.

There are plenty of examples of spiders that possibly can produce necrotic bites: hobo spiders (*Tegenaria agrestis*) from the northwestern United States; yellow sac spiders (*Cheiracanthium* species) and wolf spiders (*Lycosidae* family), found worldwide; crab spiders (*Sicarius testaceus* and *S. lbospinosus*) from South Africa; white-tailed spiders (*Lampona cylindrata* and *murina*) and black house spiders (*Badumna* species) from Australia. However, most of these species have proven to cause very weakly necrotic bites. For example, the hobo spider, introduced into the Pacific Northwest from Europe in the 1920s or 1930s, is presumed to be the cause of necrotic spiders bites in that region (though unproven), although the same spider is considered nontoxic in Europe.[4]

This fascination with spiders is not a trivial problem. In the 2001 bioterrorism attack, a pediatric case of cutaneous anthrax in New York City originally was treated as a *Loxosceles* envenomation.[3]

Beyond Spider Bites

When examining these lesions, the practitioner must rigorously consider the locale and adopt an approach that adheres to Baye's theorem: Correct empiric diagnosis presumes an awareness of the prior probability of that disease being present. For example, early Lyme disease can manifest as a lesion surrounding the tick bite that closely mimics the brown recluse spider bite. The distribution of Lyme disease—whether the vector is *Ixodes scapularis* or *pacificus*—is virtually throughout the United States. Importantly, the Northeastern coastal areas, which decidedly are not brown recluse country, are most definitely Lyme country. Better to appropriately consider Lyme disease than to inappropriately presume a brown recluse bite. In fact, the majority of furuncular lesions are simple staphylococcal skin infections. They often start as rather painful folliculitis lesions, as insect bites, or other minor trauma that becomes becomes infected secondarily. These infections traditionally respond to the wound management regimens that are appropriate for these lesions: incision and drainage when necessary, warm compresses, and antistaphylococcal antibiotics, such as cephalexin, when there is a surrounding cellulitis. A more recent concern has been the emergence of non-hospital-associated, methicillin-resistant *Staphylococcus aureus* (MRSA). This organism is emerging rapidly and is resistant to cephalexin.

In 2000, a number of infectious disease surveillance experts noticed that MRSA appeared in patients who had developed staphylococcal infections not associated with the hospital—a community-associated MRSA (CA-MRSA). CA-MRSA differs from hospital-associated MRSA in that it is more likely to be susceptible to multiple antimicrobial classes (but not cephalosporins). It does not require vancomycin for treatment. CA-MRSA seems to be most sensitive to some fluoroquinolones (levofloxacin), trimethoprim/sulfamethoxasole, tetracyclines, or rifampin (although the latter agent should not be used as a solo agent for treatment).

One interesting feature of CA-MRSA is that it encodes for genes that make Panton-Valentine leukocidins, a feature that is found rarely in hospital-associated MRSA. The Panton-Valentine leukocidins are cytotoxins that cause tissue necrosis and leukocyte destruction by forming pores in cellular membranes. Therefore, these lesions often will appear fairly necrotic and have aggressive cellulites, features that might incline the

physician to consider an envenomation.[5] The recent report of an outbreak of CA-MRSA in the St. Louis Rams organization highlights the degree to which this organism can spread in the local environment, another factor that might create arachnophobia.[6]

Causative Conditions to Consider

Other conditions to consider when evaluating a BUO include insects (infection and allergic reactions resulting from flies, mosquitoes and ticks); viral causes (herpes simplex especially herpetic whitlow); and other infectious causes (impetigo, staphylococcal and streptococcal, CA-MRSA, cutaneous anthrax, disseminated gonococcus pustules, *Mycobacterium ulcerans*, diabetic ulcer, necrotizing fasciitis, pyoderma gangrenosum, toxic epidermal necrolysis, cat scratch disease, rat bite fever, chancriform pyoderma, and lymphogranuloma venereum). Additional conditions are drugs/toxins (erythema nodosum, warfarin skin necrosis, erythema multiforme, Stevens-Johnson syndrome, self-inflicted wounds [drug injection sites], retained foreign bodies); topical causes (poison ivy/oak infection, hydrogen fluoride exposures); and neoplasia (papilloma, fibroma, lymphoma, osteosarcoma, fibrosarcoma, epithelial carcinoma, melanoma).

The list of possible conditions is significant. In the next patient who presents to the ED with a potential spider bite, consider your locale and how the prevalence of certain conditions makes a certain diagnosis probable or improbable, and adjust your differential accordingly.

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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

22. The study of compression rates during in-hospital CPR found that compression rates were:

a. routinely at or above the recommended level of 100 compressions per minute.
b. routinely below 60 compressions per minute.
c. not correlated with the return of spontaneous circulation.
d. higher among the patients that had return of spontaneous circulation.

23. In a study comparing Seldinger and surgical approaches to cricothyroidotomy in cadaver models, the Seldinger approach:

a. was associated with less injury to the thyroid vessels.
b. led to faster times to location of the cricothyroid membrane.
c. was aborted three times more often than was the surgical approach.
d. proved to be easier for left-handed individuals.

24. In the CREATE study, trial investigators reported that the LMWH agent reviparin in the setting of STEMI:

a. reduced the risk of mortality compared with UFH.
b. reduced the risk of reinfarction compared with enoxaparin.
c. increased the risk of major bleeding when combined with UFH.
d. reduced the risk of mortality compared with placebo.

25. Community-acquired methicillin-resistant S*taphylococcus aureus* usually is sensitive to:

a. cephalexin
b. dicloxacillin
c. trimethoprim/sulfamethoxasole
d. nitrofurantoin

Answers: 22.d: 23.a; 24.d; 25. c

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 CVA to be Anticoagulated?

by Ken Grauer, MD

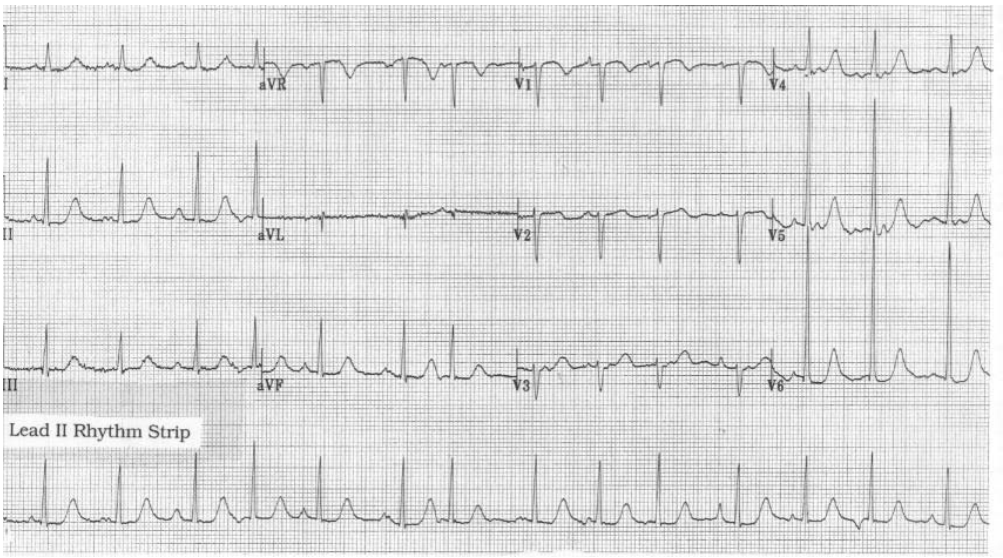

Figure: 12-lead ECG and rhythm strip obtained from an elderly woman with an acute stroke. Should the patient be anticoagulated?

Clinical Scenario: The electrocardiogram (ECG) and rhythm strip in the Figure were obtained from an elderly woman admitted for an acute stroke. Her neurologic deficit was not progressing, and she was clinically stable at the time of admission to the hospital. There was no history of smoking. The computer interpreted her rhythm as atrial fibrillation. Do you agree? Should the patient be anticoagulated?

Interpretation: In the absence of contraindications, the finding of atrial fibrillation is an indication for acute anticoagulation when a patient presents with an acute cerebrovascular accident (CVA) (e.g., non-hemorrhagic transient ischemic attack or stroke). However, the rhythm strip in the Figure does not represent atrial fibrillation; atrial activity is clearly present throughout the rhythm strip. P-wave morphology varies, virtually from beat to beat. A spectrum of disorders exists among the irregular supraventricular entities known as sinus rhythm or sinus arrhythmia with premature atrial contractions (PACs), wandering atrial pacemaker, and multifocal atrial tachycardia (MAT).

The key to distinguishing among these three entities lies with determining if there is an underlying sinus mechanism to the rhythm. This is defined by the presence of an upright P-wave shape with consistent morphology and a constant PR interval preceding many (if not most) of the QRS complexes on the tracing. Although in its extreme form, a marked sinus arrhythmia with frequent PACs may be difficult to recognize, one usually can identify the presence of an underlying sinus mechanism by recognizing at least a few consecutively occurring upright P waves with consistent P-wave morphology in at least selected portions of a sufficiently long lead II rhythm strip. This is very different than the phenomenon of a wandering atrial pacemaker, in which several beats occur with one P-wave shape, followed by a gradual shift for the ensuing consecutively conducted beats to a second or third P-wave shape—ultimately returning to the original P-wave morphology. This is consistent with the physiologic concept of a gradual shift in pacemaker site from different places in the atria.

In contrast to sinus mechanism rhythms and wandering pacemakers, P-wave morphology in the Figure is completely different from beat to beat, most consistent with the entity known as MAT. Admittedly the overall heart rate is not as rapid as the name of this entity implies. Although most often seen in long-term smokers with chronic pulmonary disease, MAT also may occur occasionally in non-smokers.

The clinically important point in this case is that despite constant alternation of atrial impulse sites, atrial contraction is maintained, such that anticoagulation of this rhythm is not essential as it would be if an elderly patient with acute non-hemorrhagic stroke presented with atrial fibrillation. ❖

In Future Issues:

New therapy for intracranial hemorrhage