EVIDENCE-BASED INFORMATION FOR HOSPITALISTS, INTENSIVISTS, AND ACUTE CARE CLINICIANS

HOSPITAL MEDICINE ALERT

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INSIDE

ICU Bed Availability Appears to Influence Goals of Care but not Hospital Mortality

Abstract & commentary

By Leslie A. Hoffman, RN, PhD

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Leslie A. Hoffman reports no financial relationships relevant to this field of study. This article originally appeared in the May 2012 issue of critical care Alert. *It was edited by David J. Pierson, MD, and peer reviewed by William Thompson, MD. Dr. Pierson is Professor Emeritus, Pulmonary and Critical Care Medicine, University of Washington, Seattle, and Dr. Thompson is Associate Professor of Medicine, University of Washington, Seattle. Drs. Pierson and Thompson report no financial relationships relevant to this field of study.*

Synopsis: *When fewer ICU beds were available, patients experiencing a medical emergency team call were less likely to be admitted to the ICU and more likely to have their goals of care changed.*

Source: stelfox Ht , et al. Intensive care unit bed availability and outcomes for hospitalized patients with sudden clinical deterioration. *Arch Intern Med* 2012;172:467-474.

This study examined outcomes for 3494 adult patients who experienced clinical deterioration that triggered a medical emergency team (MET) activation over a 2-year period. The study compared ICU admission rates within 2 hours of MET activation, patient goals of care (resuscitative, medical, and comfort), and hospital mortality according to the number of ICU beds available (0, 1, 2, or > 2) after adjusting for patient characteristics (reason for admission, goals of care, comorbidities), physician characteristics (ICU attending, ICU fellow, resident or non-ICU attending), and hospital characteristics

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(beds available, time of week). The facilities included three Canadian hospitals (total 53 ICU beds); ICUs were closed units staffed by intensivists.

The number of MET activations averaged 3.2 per day; patients had a median age of 72 years, 47% were female, 46% had > 1 comorbidity, and 10% had a prior ICU admission during their hospital stay. The decision to admit patients to the ICU was made by the attending physician on a case-by-case basis. Reduced ICU bed availability was associated with a decreased likelihood of patient admission to the ICU within 2 hours of MET activation ($P = 0.03$) and an increased likelihood of a change in patient goals ($P < 0.01$). Patients who experienced a MET activation when zero beds were available were 33.0% (95% confidence interval [CI], -5.1% to 57.3%) less likely to be admitted to the ICU and 89.6% (95% CI, 24.9% to 188.0%) more likely to have their goals of care changed compared with days when > 2 ICU beds were available. Hospital mortality ($P = 0.82$) did not differ when examined in relationship to the number of ICU beds available (range, 32.1% to 34.7%). There was also no difference in post-hospital disposition defined as home with support services, home without support services, or transfer to another facility ($P = 0.17$).

■ Commentary

During the past few years, we have seen a steady increase in the number of ICU beds, driven by escalating demand for this resource. Many predict that demand will further increase in future years as a consequence of our aging population, technologic advances that expand the scope of care delivered to more fragile patients, and other factors. Findings of this study are particularly timely as they suggest approaches for resolving escalating demands for more critical care beds not related to increasing capacity. To examine decision making, the authors chose the occasion of a MET activation. Of patients who experienced a MET activation when zero ICU beds were available, 11.6% were admitted to the ICU compared to 21.4% when > 2 beds were available. More patients had their goals of care changed from resuscitative care to medical or comfort care when zero ICU beds were available (14.9%) compared to when > 2 beds were available (8.5%). These findings suggest that care options outside the ICU were sufficient to meet patient needs and/or a change in the goals of care was indicated.

Editorials on the topic of ICU resources have primarily focused on how to meet future needs for more resources rather than how to identify more appropriate use of available resources, i.e., who is the most likely to directly benefit. As the authors note, health care providers routinely make decisions about likely benefits of care but, absent those trained in disaster response, most have limited or no training in triage, making it difficult to feel comfortable identifying those who are either "too well" or "too ill" to benefit from ICU care. Studies such as the present one challenge us to critically review decision making. More studies focusing on outcomes of MET activation in regard to post care destination are needed to better define appropriate actions and related criteria for these decisions. ■

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Please call Russ Underwood, Executive Editor, at (404) 262-5521 or e-mail at russ.underwood@ahcmedia.com.

Factors that Increase Risk for ICU Readmission: Implications for ICU Discharge Practices

Abstract & commentary

By Linda L. Chlan, RN, PhD

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Dr. Chlan reports that she receives grant/research support from the National Institutes of Health.

This article originally appeared in the May 2012 issue of Critical Care Alert. *It was edited by David J. Pierson, MD, and peer reviewed by William Thompson, MD. Dr. Pierson is Professor Emeritus, Pulmonary and Critical Care Medicine, University of Washington, Seattle, and Dr. Thompson is Associate Professor of Medicine, University of Washington, Seattle. Drs. Pierson and Thompson report no financial relationships relevant to this field of study.*

Synopsis: *A significant risk factor for ICU readmission is the illness severity (acute physiology score) associated with persistent physiological abnormalities at ICU discharge, regardless of initial ICU admission illness severity.*

Source: Kramer A, et al. Intensive care unit readmissions in U.s . hospitals: Patient characteristics, risk factors, and outcomes. *Crit Care Med* 2012;40:3-10.

The purpose of this study was to use data from the multi-institutional APACHE IV database (Cerner Corporation) to compare characteristics of and outcomes for patients who were readmitted to the ICU and those who were not readmitted after ICU discharge; to identify risk factors for ICU readmission; and to examine case-mix adjusted outcomes for patients with and without ICU readmission. The APACHE IV database accessed for this study represented information on consecutive ICU admissions over a period of 8 years (2001-2009). These data included in the sample consisted of 97 units and 35 hospitals from across the United States, which represented a cross-section of facilities by bed size, teaching and non-teaching hospitals, and geographic regions (except for the Northeast region of the United States, which was not represented). Demographic, clinical, and physiological data were collected on each patient on day 1 of ICU admission and again on the day of discharge associated with the initial ICU admission. Outcomes included mortality, length of ICU stay, and length of hospital stay; ICU stay and length of hospital stay were truncated at 30 days and 50 days, respectively, to limit extreme outliers.

The researchers used various statistical procedures to compare patients with ICU readmission and those without ICU readmission. The researchers focused their analysis at the patient level, meaning that they did not make comparisons among unit types or adjust for hospital or ICU characteristics. Patients were not included in the study if they died while in the ICU or were discharged from the ICU and were not candidates for readmission (e.g., discharged to another facility or home).

There were 229,961 patients who met the researchers' predefined inclusion criteria. Overall, 6.1% of patients from the hospitals included in the APACHE IV database were readmitted to the ICU. Of those patients who had an ICU readmission, 88.4% had one readmission whereas 11.6% had multiple readmissions. The median time between ICU discharge and readmission was 3.14 days. There were no differences among diagnoses (non-surgical indications). Patients who were readmitted were older, had more comorbidities, were receiving dialysis, and had a higher illness severity (Acute Physiology Score, APS) at discharge from the ICU. Not surprisingly, those patients readmitted to ICUs had longer ICU and hospital stays as well as higher mortality. Contrary to findings from other studies, there was no difference in mortality in those patients discharged from the ICU during the night or on the weekend. The researchers emphasized the importance of considering patient characteristics, particularly illness severity, when assessing ICU readmission rates.

■ **Commentary**

The findings from this large, nationally representative sample of ICU patients provide a comprehensive assessment of patient characteristics and risk factors for ICU readmission, including patient outcomes. Many of the findings from this study are consistent with those risk factors for ICU readmission previously reported in the literature, most prominently older age. A major finding from this study is that ICU readmission is associated, not surprisingly, with severe illness, specifically as measured by APS at ICU discharge and not at ICU admission. Further, readmission to the ICU is associated with an increase in mortality rate, longer ICU stay, and longer periods of hospitalization.

These findings have numerous implications for ICU clinicians in this day and age of cost-containment. Given the immense pressure in some hospitals to discharge patients "quicker and sicker," these findings may give pause to this practice. Given that the major risk factor for ICU readmission was a continued high level of illness severity at discharge, in the end it may be a cost-savings or cost-neutral practice to keep a very ill patient in the ICU for a day or two longer, especially given that the median time to readmission was around 3 days! Given that those patients included in this sample with ICU readmission had much longer ICU and hospital stays, a careful examination of ICU discharge practices may be warranted. This paper calls attention to the importance of examining for patient differences and illness severity when contemplating discharge.

There also are implications of these findings for care processes, such as for clinician interactions with patients and their family members as to expectations after ICU discharge. For those patients who are the most ill and have higher APS scores, there may be a rocky recovery that may warrant readmission to the ICU. Family members may want to be prepared for this possibility. ■

CT Coronary Angiography in ER Patients with Chest Pain

Abstract & commentary

By Andrew J. Boyle, MBBS, PhD

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Dr. Boyle reports no financial relationships relevant to this field of study.

This article originally appeared in the May 2012 issue of c linical c ardiology Alert. *It was edited by Michael H. Crawford, MD, and peer reviewed by Ethan Weiss, MD. Dr. Crawford is Professor of Medicine, Chief of Clinical Cardiology, University of California, San Francisco, and Dr. Weiss is Assistant Professor*

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Source: Litt HI, et al. c t angiography for safe discharge of patients with possible acute coronary syndromes. *N Engl J Med* 2012;366:1393-1403.

Patients presenting to the emergency department (ED) with chest pain are often admitted to "rule out" myocardial infarction (MI). Many of the patients are subsequently found to have noncardiac causes of chest pain. The best method to differentiate noncardiac chest pain from acute coronary syndromes (ACS) remains unknown. Early differentiation between these entities would facilitate discharge directly from the ER and has the potential to prevent millions of needless admissions. However, early discharge must be safe. The evolution of computed tomography (CT) now allows visualization of the coronary arteries by coronary CT angiography (CCTA). This technique requires a regular heart rhythm, the ability to receive nitroglycerin and beta-blockers at the time of the scan, and the ability to hold one's breath in order to obtain adequate images. Litt and colleagues performed a multicenter, prospective, randomized trial comparing two strategies of assessing patients who present to the ED with chest pain: One involves the use of CCTA, the other involves usual care. Their results were presented at the recent American College of Cardiology Meeting and were recently published in the *New England Journal of Medicine*.

Patients older than the age of 30 presenting with symptoms compatible with a possible ACS were considered eligible for the study if they had an initial ECG with no ischemic changes, had a low-to-intermediate clinical risk profile (TIMI Risk Score of 0-2), and the treating physician thought they required further testing or admission to rule out ACS. Exclusion criteria were the need for admission for other reasons regardless of the cause of the chest pain, recent normal CCTA, coronary angiogram, and any contraindication to CCTA. Usual care was at the discretion of the physician. Patients could be randomized before the results of the first troponin were available. CCTAs were reported by experienced clinicians, and were graded as negative (normal or stenosis < 50%) or positive (stenosis ≥ 50%). Importantly, the patients with < 50% stenosis had a follow-up troponin 90-180 minutes after the first, and if it was normal, they could be discharged.

The authors enrolled 1370 patients and randomized them in a 2:1 fashion to CCTA (n = 908) vs. usual care (n = 462). Baseline characteristics were similar in the two groups. Of the 908 patients assigned the CCTA, 767 actually underwent CCTA: 10.4% had a positive result (≥ 50% stenosis), 6.1% had an indeterminate result, and 640 patients (83.4%) had a negative result (< 50% stenosis). Most patients in the usual care group underwent stress testing. MI occurred in 1% of the CCTA group and 0.9% of the usual care group (*P* = NS) during hospitalization. There were no differences in the rates of invasive coronary angiography or revascularization.

Patients in the CCTA group were more likely to be discharged from the ED (50% vs. 23%) and were more likely to be diagnosed with coronary artery disease (9% vs. 4%). In the 30 days after discharge, MI occurred in 0.1% of the CCTA group and 0.4% of the usual care group (*P* = NS). There was no difference on the rate of repeat hospitalization. The authors conclude that a CCTA-based strategy for low-to-intermediate-risk patients presenting with possible ACS appears to allow the safe, expedited discharge from the ED in patients who would otherwise be admitted.

■ Commentary

ED presentations with chest pain are common and costly. There are millions of admissions to rule out MI each year that subsequently turn out to reveal noncardiac causes of chest pain. The CCTA-guided approach outlined by Litt and colleagues resulted in more patients being directly discharged from the ED, but no difference in the rates of invasive angiography, revascularization, or subsequent death or MI. This has the potential to decompress monitored hospital beds and busy EDs, and to realize significant cost savings. Discharge of chest pain patients from the ED is always daunting for ED physicians, as the prospect of missing an MI could result in poor patient outcomes and a potential lawsuit. Litt and colleagues identified 83% of low-to-intermediate risk patients presenting with possible ACS as having negative scans (< 50% coronary stenosis). With a combination of negative troponin and a negative CCTA, they were able to discharge 50% of patients from the ED, and there was a very low rate of MI in these patients in the 30 days after discharge, suggesting this approach is safe.

The results of this study are congruous with prior CCTA studies in the ED, such as the ROMICAT study. In appropriate patients, 64-slice CT scanners are known to be accurate, and several studies have now shown that those with negative scans have very low event rates after discharge directly from the ED. In addition to the clinical information that is relevant for the index admission,

CCTA provides valuable insight about the presence of plaque that may guide future preventive strategies, such as aspirin and statin therapy, in appropriate patients. A negative stress test does not provide such information, potentially missing an opportunity for aggressive preventive measures. Thus CCTA provides important information acutely, but also for the long-term follow-up of the patient. There are several limitations to this study. First, a formal cost-effectiveness analysis was not presented and is warranted. Second, we are not told whether the CCTA scans were prospectively or retrospectively gated. Retrospective gating is associated with similar levels of radiation to nuclear testing, but prospective gating significantly reduces the radiation to the patient (by around 70%). Dedicated teams can significantly reduce the radiation to patients by instituting a prospective gating policy. Overall, this study and others like it demonstrate the clinical utility of CCTA as an up-front approach in the assessment of patient with possible ACS. ■

PFO Closure for Cryptogenic Stroke?

Abstract & commentary

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Dr. Boyle reports no financial relationships relevant to this field of study.

This article originally appeared in the May 2012 issue of clinical cardiology Alert. *It was edited by Michael H. Crawford, MD, and peer reviewed by Ethan Weiss, MD. Dr. Crawford is Professor of Medicine, Chief of Clinical Cardiology, University of California, San Francisco, and Dr. Weiss is Assistant Professor of Medicine, Division of Cardiology and CVRI, University of California, San Francisco. Dr. Crawford reports no financial relationships relevant to this field of study, and Dr. Weiss is a scientific advisory board member for Bionovo.*

Source: Furlan AJ, et al. closure or medical therapy for cryptogenic stroke with patent foramen ovale. *N Engl J Med* 2012;366:991-999.

Some patients who experience stroke or transient ischemic attack (TIA) of unknown cause (i.e., cryptogenic) are subsequently found to have a patent foramen ovale (PFO). The presence of PFO has been associated with a higher rate of cryptogenic stroke in observational studies. However, whether closing PFO (percutaneously or surgically) reduces the rate of subsequent stroke compared to optimal medical therapy (OMT) remains unknown. Thus, Furlan and colleagues performed a prospective, multicenter, open-label, randomized trial of optimal medical therapy vs. percutaneous device closure of PFO in patients with a prior stroke or TIA.

The primary endpoint was a composite of stroke or TIA during 2 years of follow-up, death from any cause during the first 30 days, or death from neurologic causes between 31 days and 2 years. Inclusion criteria were age 18-60 years, stroke (proven by MRI) or TIA (typical symptoms or positive diffusion-weighted MRI) within the prior 6 months, and a transesophageal echo (TEE) demonstrating a positive bubble study for right-to-left shunting during Valsalva maneuver. Exclusion criteria included any identified potential cause of ischemic stroke or TIA other than the PFO, such as carotid artery stenosis > 50%, complex aortic arch atheroma, clinically significant left ventricular dysfunction or left ventricular aneurysm, or atrial fibrillation. Patients randomized to optimal medical therapy were scheduled to receive high-dose aspirin (or low dose only if gastrointestinal intolerance) and/or warfarin titrated to therapeutic INR at the discretion of the treating physician. Those randomized to closure underwent percutaneous device closure using the Starflex device (made by NMT medical, the sponsor of the trial), with aspirin 325 mg daily for life (or low dose only if gastrointestinal intolerance), and clopidogrel 75 mg daily for 6 months. The initial sample size was calculated at 1600 patients to detect a difference between groups, based on an event rate of 6% in the OMT group vs. 3% in the device group. This was reduced to a total sample size of 800 patients because of a change in the expected rates of ischemic events in the device group, which was revised down to 2%. Subsequently, the DSMB increased the sample size to 900 patients after a change in the rate of evaluable patients at follow-up.

It took more than 5 years to recruit 909 patients (n = 447 randomized to device closure and n = 463 randomized to OMT). The mean age of patients was 46 years and 52% were male. There was a trend toward more hypertension and dyslipidemia in the device arm. In the device group, 405 patients underwent attempted closure, which was successful in 89%. As analyzed by the intention-to-treat principle, the primary endpoint occurred in 5.5% of the device closure group vs. 6.8% in the OMT group (hazard ratio [HR] 0.78; $P = 0.37$). The rates of stroke and TIA were 2.9% vs. 3.1% (HR 0.90; $P = 0.79$) and 3.1% vs. 4.1% (HR 0.75; $P = 0.44$) in the device vs. OMT

groups, respectively. There were no deaths at 30 days in either group and there were no neurological deaths in either group at 2 years. The study was also analyzed by a modified intention-to-treat analysis and by per-protocol analysis (i.e., which treatment was *actually* received), and there was no difference in the outcome.

At 6-month TEE, only 86% of those who underwent device closure had achieved closure, and at 2 years that rate was 87%. Thrombus was present in the LA of four patients (1.1%) in the device closure group and two of the four patients had a stroke. Vascular complications occurred in 3.2% of the device arm and in none of the OMT group. Atrial fibrillation occurred in 5.7% of the device group vs. 0.7% of the OMT group ($P < 0.0001$). Importantly, in those patients who experienced stroke or TIA, there were potential explanations in the vast majority (such as new-onset atrial fibrillation, a clot in the left atrium, subcortical lacunar infarction with risk factors, aortic arch atheroma, complex migraine, vasculitis, and conversion disorder). The authors conclude that in patients with cryptogenic stroke or TIA who had a PFO, closure with a device did not offer a greater benefit than medical therapy alone for the prevention of recurrent stroke or TIA.

■ Commentary

The authors are to be commended on performing this randomized controlled trial of percutaneous device closure vs. medical therapy in patients with cryptogenic stroke and PFO. This is the first such trial for this patient group. The data presented reassure us that OMT with either high-dose aspirin or warfarin (at the physician's discretion) is a safe alternative to percutaneous device closure, at least out to 2 years. Importantly, there were no deaths in the first 30 days and no neurological deaths at 2 years in either group. Furthermore, there was no higher rate of stroke in those with atrial septal aneurysm, which was traditionally thought to confer higher risk of recurrence.

However, there are several limitations to this study and the results must be interpreted in the light of these. First, the study was significantly underpowered. The expected event rates in both the device closure and the OMT groups were underestimated. Thus, both the initial power calculation and the subsequent revised sample sizes effectively under-powered the study to determine a statistically significant difference between groups. Second, there were issues specific to the Starflex device that was used. Both the rates of left atrial thrombus (1.1%) and the rates of incomplete closure of the defect (13.3% had moderate or substantial shunt 2 years after "closure") were higher than could be expected using some other devices, based on prior literature. Third, dual antiplatelet therapy was mandated in the device group but not in the medical therapy group. The medical therapy group could use aspirin or warfarin at the physician's discretion. This difference in anti-platelet/anticoagulant therapy may have introduced bias and we are not told how many patients were taking warfarin. Fourth, this may not have been a truly "cryptogenic" stroke group. After stroke was experienced, possible alternate causes were found in 20 of 23 (87%) patients in the closure group and 22 of 29 (76%) in the OMT group. Perhaps more rigorous screening for these causes would not have labeled these patients as "cryptogenic" in the first place.

In light of these new data, how are we to treat patients who suffer a stroke or TIA and have a PFO? Certainly a rigorous evaluation for other causes of stroke and treatment of these is warranted. Conditions such as paroxysmal AF, untreated hypertension, and aortic arch atheroma are common and represent a treatable "cause" of stroke. If not treated, they are more likely to result in future stroke than a small PFO is. These patients should have their traditional stroke risk factors aggressively managed, and we should consider adding aspirin therapy if there is not already a clear indication for it. Beyond this, clinicians should use their clinical judgment in each situation. Clearly, a "close all PFOs" approach appears to have little if any benefit in this study. Future trials with more rigorous inclusion criteria and better devices may yield different results. Until such data are available, clinicians should exercise caution before recommending device closure of PFOs, particularly in the presence of other causes of stroke. ■

The Future of Prehospital Treatment of Convulsive Status Epilepticus

Abstract & commentary

By Padmaja Kandula, MD

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Dr. Kandula reports no financial relationships relevant to this field of study.

This article originally appeared in the May 2012 issue of Neurology Alert. *It was edited by Matthew E. Fink, MD, and peer reviewed by M. Flint Beal, MD. Dr. Fink is Interim Chair and Neurologist-in-Chief, Department of Neurology and Neuroscience, Weill Cornell Medical College, New York Presbyterian Hospital, and Dr. Beal is Anne Parrish Titzel Professor, Department of Neurology and Neuroscience, Weill Cornell Medical Center. Dr. Fink is a retained consultant for MAQUET, and Dr. Beal reports no financial relationships to this field of study.*

Synopsis: *Early cessation of prehospital seizures via an intramuscular injection of midazolam was at least noninferior, if not superior, to traditional intravenous lorazepam.*

Source: Silbergleit R, et al. Intramuscular versus intravenous therapy for prehospital status epilepticus. *New Engl J Med* 2012;366:591-600.

Since the initial 1998 landmark Veteran's Administration (VA) study, intravenous benzodiazepines have been first-line treatment for status epilepticus (SE). However, the VA cooperative study, like many others to follow, only studies an intravenous route of administration of acute abortive agents. Over time, the medical community became increasingly aware that untreated prolonged convulsive SE has the potential to become refractory. Out of these clinical observations, the operational definition of SE has grown to include seizure activity of 5 minutes or greater duration. This timely article by Silbergleit et al is the first large-scale, randomized, blinded study to compare the traditional intravenous vs. intramuscular route of benzodiazepine administration for prehospital seizure cessation.

The Rapid Anticonvulsant Medication Prior to Arrival Trial (RAMPART) involved 79 centers nationwide and a total of 448 subjects assigned to active treatment with intramuscular midazolam and 445 assigned to active treatment with intravenous lorazepam. Patients met criteria for inclusion if convulsive seizures of longer than 5 minutes in duration were noted. Both patients and emergency medical personnel were blinded and randomized to treatment via the use of investigational autoinjectors and prefilled syringes with either 10 mg intramuscular midazolam followed by intravenous placebo, or intramuscular placebo followed by 4 mg of intravenous lorazepam. A time-stamped voice recorder in the prefilled study kit allowed paramedics to record orally when intramuscular treatment was administered, when intravenous access was gained, when intravenous study drug was administered, and when convulsions clinically stopped. Rescue therapy, as dictated by local paramedic protocol, was used for patients who were still convulsing 10 minutes after the last study medication was administered or if convulsions resumed after transient cessation.

The primary outcome of this study was clinical seizure cessation without the need for rescue therapy before emergency room arrival. In particular, the authors' primary aim was to demonstrate noninferiority of intramuscular midazolam vs. intravenous lorazepam in prehospital treatment of convulsive seizures. Secondary outcome measures included time from study box opening to seizure cessation, time from initiation of study drug to termination of seizures, frequency and duration of hospitalization to the intensive care unit, frequency of endotracheal intubation, and seizure recurrence.

Seizures were successfully aborted in 73.4% and 63.4% in the intramuscular vs. intravenous treatment groups respectively. The median time to active treatment in the intramuscular group was 1.2 minutes vs. 4.8 minutes in the intravenous group. However, the actual onset of action (termination of seizures) was more immediate in the intravenous group vs. the intramuscular group (1.6 vs. 3.3 minutes). The secondary endpoints of frequency of intubation, recurrent seizures, and duration and frequency of hospitalization were similar in both treatment groups.

■ Commentary

Results of the study not only showed that intramuscular midazolam was noninferior to intravenous lorazepam in terminating seizures, but that intramuscular administration of midazolam was more rapidly accomplished. In a setting where brain recovery is time dependent, intramuscular midazolam presents a novel method of achieving seizure cessation even before emergency room assessment. The logistical ease of intramuscular delivery in a convulsing individual and lack of need for refrigeration of midazolam are also attractive and useful properties in an abortive agent. Currently, the only alternative to oral administration for acute abortive treatment in the home setting is rectal diazepam. In an actively convulsing patient, particularly in an adult, rectal delivery presents a great challenge to effective and timely administration of the drug.

The future of effective status cessation is largely dependent on early treatment. So, perhaps the timely treatment of seizures actually lies in the hands of the very first responders, which may include family and nonmedical bystanders. By exploring alternative routes of home-based drug administration, such as buccal and nasal midazolam in current development, it is possible that prolonged hospitalization and increased mortality associated with convulsive SE may become a relic of the past. ■

CME / Objectives

Upon completion of this educational activity, participants should be able to:

- discuss pertinent safety, infection control and quality improvement practices;
- explain diagnosis and treatment of acute illness in the hospital setting; and
- discuss current data on diagnostic and therapeutic modalities for common inpatient problems. ■

CME Questions

1. In the study by Stelfox and colleagues, patients who experienced a medical emergency team (MET) activation when zero ICU beds were available were:

a. More likely to die

b. More likely to be transferred to another hospital

c. More likely to have their goals of care changed

d. More likely to be discharged home with support services

2. In a recent study by Kramer, et al., the factor(s) associated with being readmitted to the ICU after discharge include:

a. Older age

b. Receiving dialysis

c. Multiple comorbidities

d. Higher illness severity

e. All of the above

3. In the randomized trial by Silbergleit, comparing treatment of status epilepticus with intramuscular midazolam to intravenous lorazepam, what outcomes were observed?

a. Intramuscular midazolam was equivalent to intravenous lorazepam in ending siezures.

b. Intravenous lorazepam was superior to intramuscular midazolam in ending seizures.

c. Intramuscular midazolam was superior to intravenous lorazepam in ending seizures.

d. Intramuscular midazolam led to a higher rate of intubation.

CME Instructions

1. Read and study the activity, using the provided references for further research.

2. Log on to **www.cmecity.com** to take a post-test; tests can be taken after each issue or collectively at the end of the semester. *First-time users will have to register on the site using the 8-digit subscriber number printed on their mailing label, invoice, or renewal notice.*

3. Pass the online tests with a score of 100%; you will be allowed to answer the questions as many times as needed to achieve a score of 100%.

4. After successfully completing the last test of the semester, your browser will be automatically directed to the activity evaluation form, which you will submit online.

5. Once the evaluation is received, a credit letter will be sent to you. ■