



## Resident Journal Review: January-February 2010

Trushar Naik, MD MBA; Michael Yee, MD; Christopher Doty, MD; Michael C. Bond, MD

*This is a continuing column providing journal articles pertinent to EM residents. It is not meant to be an extensive review of the articles, nor is it wholly comprehensive of all the literature published. Rather, it is a short list of potentially useful literature that the busy EM resident may have missed. Residents should read the articles themselves to draw their own conclusions. This edition will include articles published over a two month period from September and October 2009.*

### **Viccellio A, Santora C, Singer AJ. The association between transfer of emergency department boarders to inpatient hallways and mortality: a 4-year experience. *Ann Emerg Med.* Oct 2009;54(4):487-491.**

Emergency department boarding remains one of the most significant impediments to the provision of emergency care and one of the most important issues affecting the field of emergency medicine. The boarding of admitted patients is recognized as a major determinant of emergency department overcrowding. To address this problem, many have advocated that some admitted patients board in inpatient hallways. Indeed, others have found that patients prefer to board on inpatient services and may move into beds faster than if they were waiting in the emergency department. Opponents often relay concern over potential poor outcomes of hallway boarding. The authors of this study sought to examine the safety of moving admitted patients to inpatient hallways.

In this retrospective cohort study, the charts of all patients admitted via the emergency department between 2004 and 2008 were included. The hospital instituted an interdepartmental collaborative full capacity protocol in 2001, in which the ED treating physicians identified patients suitable for inpatient hallway boarding during times of full capacity. Patients were excluded from hallway boarding if they were admitted to an ICU or step down unit or they required high flow oxygen or frequent suctioning, or needed isolation due to diarrhea, neutropenia or respiratory causes, or were at risk for elopement. Patients with seizures or chest pain with positive troponin were also excluded. Other monitored patients were included. The primary outcome was mortality, and the secondary outcome was transfer to ICU.

Of the 55,062 admissions, 4% went to a hallway bed. Mortality was lower for patients admitted to hallways (1.1%) than for those admitted to standard beds (2.6%). Transfers to the ICU were also lower for patients initially placed in hallways than for those admitted to standard beds (2.5% compared to 6.7%). Anecdotally, monitoring failed to identify any increased or direct harm to patients.

Noticeably, this study has important limitations – namely the fact that the inpatient hallway admissions group was pre-selected to be a lower risk group by the exclusion of high severity of illness patients. Despite this acuity difference, the study suggests that boarding of patients in inpatient hallways does not result in an overt increase in harm. Furthermore, it lays the foundation for prospective, controlled trials to evaluate this potentially ground-breaking practice that addresses the problem of overcrowding on an institutional and interdepartmental manner.

### **Bektas F, Eken C, Karadeniz O. Intravenous paracetamol or morphine for the treatment of renal colic: a randomized, placebo-controlled trial. *Ann Emerg Med.* Oct 2009;54(4):568-574.**

Acetaminophen has long been considered an effective oral or rectal treatment for acute pain. Additionally, at therapeutic doses, it may be associated with fewer side effects than many other analgesics, including opioids and non-steroidal anti-inflammatory drugs. Recently, intravenous formulations of acetaminophen (paracetamol) have become available in several European countries. In the U.S., intravenous acetaminophen was submitted for FDA in May of 2009 and is undergoing priority review. The authors of this study sought to evaluate the efficacy and safety of intravenous paracetamol compared to morphine and placebo.

In this prospective, randomized, double-blind, placebo-controlled trial, 146 subjects with renal colic were available for analysis after exclusions and randomization to receive 1 gram intravenous paracetamol, 0.1 mg/kg intravenous morphine or placebo. Rescue fentanyl 0.75 mcg/kg was provided at 30 minutes for treatment failures. The primary outcome was reduction in visual analog pain intensity score at 30 minutes. Secondary outcomes were need for rescue analgesics and adverse effects.

The mean reduction in pain intensity score at 30 minutes was equivalent for paracetamol (43mm, 95% CI 35-51mm) and morphine (40mm, 95% CI 29-51mm), and both were significantly greater than placebo (27mm, CI 95% 19-34). Use of rescue analgesics and combined adverse events were not significantly different among the groups. Among the paracetamol group, 11 patients (24%) had at least one side effect, most commonly nausea/vomiting (15%), versus the placebo group with eight patients (16%) with at least one adverse event. No serious adverse events were reported among any group.

This study adds to a small but increasing body of evidence to support the use of intravenous acetaminophen for acute pain. In this study, intravenous acetaminophen was as efficacious as intravenous morphine and without major adverse effects in the treatment of renal colic. Larger studies are required to validate these results; however, emergency physicians may have an additional, safe, intravenous analgesic agent available to treat pain found in emergency department patients.

### **Pines JM, Isserman JA, Hinfey PB. The measurement of time to first antibiotic dose for pneumonia in the emergency department: a white paper and position statement prepared for the American Academy of Emergency Medicine. *J Emerg Med.* Oct 2009;37(3):335-340.**

The use of time to first antibiotic dose (TFAD) in community acquired pneumonia (CAP) as a performance measure of emergency

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department care has been highly controversial. Much of the debate revolves around concerns about the validity of data in the original studies, recommendations that were based on conflicting data regarding outcome benefit, and potential unintended consequences when such standards are practically applied. The authors of this study reviewed the literature regarding this topic in an attempt to address the two following questions: (1) Is measurement of TFAD associated with improved outcomes in CAP? (2) Is the measurement of TFAD associated with antibiotic overuse or interventions that could result in overuse in non-CAP conditions? This review was initiated by the Clinical Practice Committee of the American Academy of Emergency Medicine (AAEM).

After applying defined search criteria in PubMed, eight relevant articles were reviewed. Articles were assessed by separate reviewers and graded according to study quality and categorized with regard to direction of evidence. Two articles provided support for the use of TFAD protocols, one study was neutral, and five did not support the practice. Of the two supporting articles, one showed a mortality benefit while the other did not, after risk adjustment. Both studies showed significant decreases in length of stay. Importantly, both studies were before and after studies in which a complete pneumonia pathway protocol was initiated and included an early antibiotic administration component. Two of the other included studies did not show any mortality benefit.

Other studies showed some concerning consequences of instituting TFAD reduction methods: protocols prioritizing possible pneumonia patients over others, policies to give antibiotics before obtaining chest X-ray results, decreased accuracy of diagnosis of CAP (in two studies), and increased use of antibiotics in similarly presenting conditions (asthma, heart failure, COPD).

Importantly, the lead author of this study was also the lead author of an included study that questioned early TFAD measures and highlighted potential harms of these practices. Thus, the bias of the authors must be considered. Yet, given conflicting reports of benefits of this practice and lack of convincing evidence, combined with numerous studies showing unintended consequences, the authors of the study concluded that "it is difficult to support the continued measure of TFAD in the ED as a quality measure." The AAEM board unanimously approved a Class C recommendation (not acceptable or not appropriate) for the measurement of TFAD in the ED.

**Hwang SO, Zhao PG, Choi HJ. Compression of the left ventricular outflow tract during cardiopulmonary resuscitation. Acad Emerg Med. Oct 2009; 16(10):928-933.**

Since the 1960's, closed chest CPR has been used to provide artificial circulation via external compressions when rescuing patients from cardiac arrest. Recommendations from the 2005 International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiac Care Services state that rescuers should place their hands on the lower half of the sternum at the center of the chest between the nipples, depressing the chest 4-5cm. To date, little is known about which region of the heart is actually compressed. In

this single center prospective observational study, the authors sought to elucidate the morphological changes of the heart during chest compressions.

The study involved 34 patients over the age of 18 who presented with non-traumatic cardiac arrest or who developed cardiac arrest during their ED stay. CPR was performed by ED residents according to the American Heart Association (AHA) guidelines. Following endotracheal intubation and the first dose of epinephrine, transesophageal echocardiography was performed to monitor the heart during compressions.

Images that were captured during CPR showed there was significant narrowing of either the aortic root or the left ventricular outflow tract (LVOT) during chest compressions from 2.1cm to 1.0cm ( $p < 0.001$ ). The area of maximum compression (AMC) was found to be at the aorta in 59% of patients and at the LVOT in 41%. On linear regression, calculated left ventricular stroke volume increased as AMC moved closer to the left ventricle.

With recent literature emphasizing the importance of effective uninterrupted chest compressions on patient survival, this novel study shows that the current guidelines on hand position for CPR are not the most effective for generating forward blood flow. The authors suggest that the hands should be placed more caudal on the sternum in order to prevent compression of the aortic root or the LVOT.

**Kupperman N, Holmes JF, Dayan PS. Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. Lancet. 2009; 374: 1160-1170.**

Children who sustain minor head trauma infrequently have clinically important traumatic brain injuries (ciTBI) and rarely need neurosurgical intervention. Now that accessibility to CT scans has increased, close to 50% of children who are seen in North American emergency departments for head trauma undergo CT scanning. The vast majority have no significant findings. The unnecessary radiation exposure to this most vulnerable of populations has prompted researchers to seek criteria to risk-stratify those patients who are at very low risk for ciTBIs.

This multicenter prospective cohort study studied children under 18 years of age in 25 emergency departments in the U.S. who presented to the ED within 24 hours of head trauma. Exclusion criteria were trivial injury, defined as a ground-level fall or running into a stationary object, presence of ventricular shunt, GCS less than 14, and history of a bleeding diathesis. The outcome measure for the 42,414 patients in the study was the development of ciTBI (death, neurosurgical intervention, intubation for more than 24 hours or hospital admission for more than 24 hours due to brain injury). The decision for the patient to undergo CT scanning or to be admitted was at the discretion of the ED physician. Those who were discharged were followed up 7 to 90 days after the initial ED visit to identify missed injuries.

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The data showed that 14,969 (35.3%) patients had head CTs performed, and 5.2% had traumatic brain injuries on CT (defined as intracranial hemorrhage or contusion, cerebral edema, infarction, diffuse axonal injury, shearing injury, midline shift, herniation, diathesis of the skull, pneumocephalus, sinus thrombosis or depressed skull fracture). Prediction criteria for children under age two who developed ciTBI included altered mental status, non-frontal scalp hematoma, loss of consciousness for more than five seconds, severe injury mechanism, palpable skull fracture and abnormal behavior. For children aged two years and older, predictors include altered mental status, loss of consciousness, vomiting, severe injury mechanism, signs of basilar skull fracture and severe headache. Severe injury mechanism was defined as motor vehicle crash with rollover or patient ejection, death of another passenger, pedestrian or unhelmeted bicyclist struck by a motor vehicle, fall more than three feet in those less than two years old, fall more than five feet in those two years of age or older or head struck by high-impact object. If all of the criteria are negative, then the negative predictive value and sensitivity for predicting ciTBIs in those under two years of age were 100% and 100%, respectively; and for those two years of age and older, they were 99.5% and 96.8%, respectively.

The authors state that if the rules had been applied to the patients in this study, 25% of the head CTs would have been avoided. Interestingly enough, for those under two years old with altered mental status or palpable skull fracture, the risk of ciTBI was as high as 4.4%. Although these prediction criteria are helpful to risk-stratify patients, this study must be reproduced and validated in different populations. As with all clinical prediction rules, the purpose is not to replace clinical decision-making but to inform the clinician.

**Tauber M, Koller H, Moroder P. Secondary intracranial hemorrhage after mild head injury in patients with low-dose acetylsalicylate acid prophylaxis. J Trauma. 2009; 67(2):521-525.**

Low dose acetylsalicylic acid (LDA) prophylaxis is commonly used for

patients with ischemic heart disease, cerebrovascular disease and peripheral vascular disease, among other reasons. The relationship between the use of LDA and the risk for intracranial bleeding after head trauma has not been clearly defined. This study sought to evaluate the prevalence of secondary intracranial hemorrhage after head trauma in patients taking LDA.

This was a single-center prospective study at a level one trauma center in Austria. One hundred consecutive subjects were enrolled who met the inclusion criteria of age over 65, taking regular LDA-prophylaxis (100mg/d), isolated mild head injury with a GCS of 15, preliminarily negative head CT, and no hypertensive irregularities (systolic blood pressure over 150 mmHg). Exclusion criteria included use of clopidogrel, warfarin or NSAIDs, hematologic or oncologic disease, and moderate or severe head injuries. Regular repeat head CT (RRHCT) were done for all patients within 12-24 hours.

Results of the RRHCT showed that four patients developed a secondary intracranial hemorrhagic event (SIHE), one of which was a large intraparenchymal hemorrhage with midline shift resulting in death, and one other who required neurosurgical drainage of a subdural hematoma. The other two patients required no interventions and did well. Initial coagulation profiles were similar among those who had SIHE and those who did not. Based on these results, the authors support the decision to have all patients over age 65 on LDA prophylaxis with mild head trauma admitted for observation and have a RRHCT in 12 to 24 hours. If RRHCT is not done, then the patient should be observed for more than 48 hours.

There were many limitations to this study. First, this small prospective study did not have a matched control group not taking LDA for comparison. Also, mild head injury was never defined. In addition, patients were included if they were admitted to the hospital, and this may represent a selection bias, studying a more acute subset of patients. Finally, other co-morbidities were not considered in the study. Before the recommendation can be made to admit all patients over age 65, further studies must be done.

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malpractice statute...[and] relief for Christopher Torretti's traumatic brain injuries may be available in other forms, but is not provided under EMTALA."

In affirming the trial court's ruling, the appellate court reviewed EMTALA, as well as the Department of Health and Human Services' Centers for Medicare and Medicaid Services (CMS) regulations promulgated to interpret and apply EMTALA. Turning to the regulation's interpretation of the statute, the court wrote: "EMTALA's requirements are triggered when an 'individual' comes to the emergency department. An 'individual' only 'comes to the emergency department' if that person is not already a 'patient'... The Regulation defines 'patient'...as '[a]n individual who has begun to receive outpatient services as part of an encounter... CMS explains that EMTALA does not apply to outpatients, even if during an outpatient encounter 'they are later found to have an emergency medical condition...[and] are transported to the hospital's dedicated emergency department.'" The court then

iterated the fact that Torretti "came to Paoli for her scheduled appointment involving routine monitoring of her high-risk pregnancy and did not present as an emergency to the Paoli medical staff; thus concluding that "Torretti's circumstances are not those contemplated by EMTALA coverage."

As to the Torrettis' stabilization claim that defendants violated EMTALA because they did not stabilize her emergency condition and inappropriately transferred her, the appeals court concurred with the district court's dismissal of the claim on summary judgment because the Torrettis could not show that defendants had actual knowledge of an emergency medical condition, and "the requirement of actual knowledge is the key to this [EMTALA] issue." This court conformed with all its sister circuit courts of appeals that have addressed this issue under EMTALA and have determined that "Congress did not intend EMTALA to serve as a federal malpractice statute or cover cases of hospital negligence."

*Case synopses prepared by Terri L. Nally, Principal, KAR Associates, Inc.*