



Resident Journal Review: November-December 2009

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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. These selections are from papers published in July and August 2009.

Seamon MJ, Smoger D, Torres DM, et al. A prospective validation of a current practice: the detection of extremity vascular injury with CT angiography. *J Trauma*. 2009 Aug;67(2): 238-243

For the evaluation of suspected vascular injuries from blunt and penetrating traumas, conventional arteriography (CA) has been the gold standard. Although less invasive than surgical exploration, there is still morbidity and mortality (1-3%) with the procedure as well as the potential for delays to definitive care. With advances in CT technology, the authors hypothesize that CT angiography (CTA) with timed contrast injection can provide the same injury detection ability as CA.

In this prospective cohort study, 21 patients with 22 injured extremities were enrolled in a single urban hospital. These patients exhibited no "hard sign" of vascular injury (arterial bleeding, absent distal pulses, limb ischemia, expanding or pulsatile hematoma, bruit or thrill over injured area, or hemorrhagic shock without other cause) and had ankle-brachial index (ABI) less than 0.9. Exclusion criteria included IV contrast dye allergy, renal insufficiency, diabetes, hypertension, multiple myeloma and hyperuricemia. All injuries underwent CTA with either 16- or 64-slice CT scanner, depending on availability during the time of the day. If limb-threatening injuries were found on CTA, these patients underwent surgery for evaluation and repair; otherwise, the patients underwent CA.

The patients in this study suffered from a variety of mechanisms including gunshot wounds, stab wounds and blunt MVAs. 21 of the 22 CTAs were diagnostic, and all were confirmed by surgical exploration or CA. A total of nine vascular injuries were found on CTA. Two were limb-threatening injuries and were confirmed in surgery. The other seven injuries were all found on CA. No new injuries were found on CA that were not seen on CTA. The authors propose a 100% sensitivity and specificity for CTA compared to CA.

This study suggests that CTA can be used reliably to detect clinically relevant vascular injuries in patients with abnormal ABIs. Limitations to this study include its small sample size, as well as its small number of patients with blunt injuries (n=2), which reduces applicability to blunt trauma victims. In addition, this study does not address sensitivity of finding false aneurysms or intimal tears that can present with normal ABIs. Of note, CTA sensitivity may also be affected by streak artifacts due to shrapnel. Overall, the use of CT may confer advantages of cost, availability and speed without missing significant injuries. This supports results from previous studies and makes a good case that CTA may supplant CA as the standard in evaluation of extremity vascular injuries along with ABIs and APIs (arterial pressure indices).

Jabre P, Combes X, Lapostolle F, et al. Etomidate versus ketamine for rapid sequence intubation in acutely ill patients: a multicentre randomised controlled trial. *Lancet*. 2009 Jul 25; 374(9686): 293-300

Etomidate has been a first-line agent for ED rapid sequence intubation (RSI) due to its sedative-hypnotic properties, ease of use and neutral hemodynamic properties. However, recent studies have questioned the use of etomidate due its potential for adrenal suppression and resultant effects. The authors of this study sought to compare the use of etomidate and ketamine, another popular sedative-hypnotic induction agent, in RSI.

In this prospective, randomized, controlled, single-blinded study, 655 consecutive patients who needed endotracheal intubation were enrolled from a large group of EDs and ICUs in France. Patients with pregnancy, cardiac arrest or contraindications to etomidate, ketamine or succinylcholine were excluded. Patients who were discharged alive less than three days after admission were also excluded to select for the most severely ill patients. All patients received either etomidate 0.3mg/kg or ketamine 2mg/kg as an IV bolus, followed by succinylcholine 1mg/kg. The primary endpoint was the maximum sequential organ failure assessment (SOFA) scores during the first three days in the intensive care unit. Secondary outcomes included ICU length of stay and 28 day all-cause mortality.

Results show that there were no statistically significant differences in the maximum SOFA scores or secondary outcomes. There were also no significant differences in difficulty of intubation scores or other safety measures such as blood pressure and oxygen saturation changes. Among patients in whom adrenal axis function was assessed, patients receiving etomidate had a significant reduction in basal cortisol levels, an increased rate of adrenal insufficiency, and non-response to the adrenocorticotropin stimulation test. There was no mortality difference among non-responders. There were also no significant differences in the trauma or sepsis subgroups with respect to SOFA scores or mortality.

The study supports the use of ketamine as a viable first-line alternative to etomidate for RSI. Patients who received etomidate had evidence of adrenal axis suppression; however, this did not appear to be clinically significant as evaluated by the outcome measures. Conclusions were limited in that criteria for adrenal axis evaluation were not clearly delineated. Nevertheless, ketamine and etomidate had similar safety profiles and intubation difficulty scores. While the debate over the role of etomidate for RSI continues, this study supports ketamine as a comparable alternative in the emergency physician's bag for RSI induction.

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Bhatt M, Joseph L, Ducharme FM, et al. Prospective validation of the pediatric appendicitis score in a Canadian pediatric emergency department. Acad Emerg Med. 2009 Jul; 16(7): 591-596

Appendicitis is a challenging diagnosis in the pediatric population, with misdiagnosis rates reportedly greater than 1 in 3. In order to provide the most appropriate treatment for this surgical emergency, EM providers must balance risks associated with diagnostic imaging (namely, radiation exposure) with the risk of misdiagnosis and/or negative laparotomy. Recently, the Pediatric Appendicitis Score (PAS) was developed to aid in the diagnosis and management of appendicitis. However, two subsequent validation studies had variable results. The authors of this study attempted to validate the use of the PAS.

This study was a prospective, observational study, which included 246 children age 4 to 18, presenting with abdominal pain of <3 days duration and in whom the treating ED physician considered the diagnosis of appendicitis based on their clinical judgment and results of testing. Children were excluded if they were nonverbal, had a prior appendectomy or had chronic abdominal pathology. The PAS incorporates the presence of cough/percussion/hop tenderness (2 points), RLQ tenderness (2 points), anorexia, pyrexia, nausea/vomiting, leukocytosis, neutrophilia and migration of pain (1 point each).

At the best cut-off point (score 6), sensitivity and specificity were 92.8% and 69.3%. This translates into a 37.6% negative appendectomy rate and 7.2% missed appendicitis rate. Results were improved when two thresholds were used; a score of ≤ 4 used to discharge to home, ≥ 8 for appendectomy, and further imaging studies for scores in between. With this scoring system, a score of 4 would result in sensitivity of 97.6% and at a score of 8, a specificity of 95.1%. Of the studied patients, 2.4% would have been erroneously sent home and 8.8% would have had appendectomies unnecessarily. 41% of imaging investigations would have been avoided.

This study has several important limitations to consider. First, patients were enrolled on a convenience basis and at the discretion of the treating physician if he/she "considered" a diagnosis of appendicitis. Furthermore, enrolled patients had a high rate of appendicitis (34%), possibly related to the noted pre-screening considerations. Eligible patients who were not enrolled may include a larger percentage of "missed" cases. Despite the significant limitations, the study lends credence to the use of a scoring system for pediatric appendicitis. Further prospective, standardized investigations may provide stronger support for such a tiered scoring system and improve diagnostic accuracy while limiting unnecessary radiologic studies.

Lucas R, Farley H, Twanmoh J, et al. Emergency department patient flow: the influence of hospital census variables on emergency department length of stay. Acad Emerg Med. 2009 Jul;16(7): 597-602

Overcrowding is a ubiquitous problem affecting many aspects of the care provided in our nation's EDs. It is associated with worsened

clinical outcomes, decreased patient/provider satisfaction, litigation and potential financial losses. This phenomenon has come under increased scrutiny and evaluation after the Institute of Medicine highlighted the critical importance of crowding in its 2006 report on the state of emergency care. The authors of this study sought to further explore hospital based factors associated with ED length of stay (LOS) in order to shed light on strategies to relieve ED crowding.

This was a multicenter cohort study which included data from five diverse hospitals, located in different states, encompassing a range of patient volumes, trauma acuity and academic versus community affiliations. Data from 27,325 consecutive ED patients presenting to the hospitals during the second week of the month for a five month period was compiled. All hospitals had electronic medical record systems that recorded time of patient arrival, time of admission request and time of physical patient departure from the ED. Daily median LOS over a 24-hour period was calculated as were other ED and hospital-wide variables, including ED daily admissions, total hospital census, hospital capacity, ICU census, cardiac telemetry unit census, cardiac procedures and surgical procedures.

Median ED LOS was 247 minutes. The hospitals, on average, operated at 86% of total capacity. For the pooled cohort, median ED length of stay demonstrated a significant relationship with ICU census (Pearson correlation coefficient 0.46, $p < 0.001$), telemetry census (0.62, $p < 0.001$), and the percentage of ED patients admitted each day (0.40, $p < 0.001$). Median ED LOS did not have a significant relationship to total hospital census, cardiac procedures or surgical procedures. When each hospital's data was analyzed individually, median LOS correlation to other examined factors was variable and did not always reach significance.

In this study, ED overcrowding correlated not only with intrinsic ED factors (percentage of ED patients admitted), but also with hospital-wide variables including telemetry unit census and intensive care unit census. While hospitals undoubtedly have unique practices, operations and process flow relationships, this study points to several hospital census variables that may play a critical role in contributing to ED overcrowding. Indeed, the challenge of solving the nation's overcrowding crisis requires that emergency department physicians and administrators look not only at the operations of the emergency department itself, but also to hospital wide factors that play a significant role.

Hayward G, Thompson M, Heneghan C, et al. Corticosteroids for pain relief in sore throat: systematic review and meta-analysis. BMJ. 2009 Aug;339:b2976

Sore throat is a common ED complaint stated to be associated with almost 2% of all ambulatory care visits. Antibiotics have only shown modest benefits in regards to reducing symptoms and fever. Corticosteroids inhibit pro-inflammatory mediators to reduce pharyngeal inflammation and pain. They have been beneficial in other upper respiratory tract diseases and are hypothesized by the authors to offer symptomatic relief in patients with sore throat.

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This review included only RCTs comparing systemic corticosteroids with placebo in children and adults in the outpatient setting. Studies involving infectious mononucleosis, recent tonsillectomy or intubation or peritonsillar abscess were excluded. Primary outcomes were improvement or resolution of symptoms, mean time to pain relief and mean time to complete resolution of symptoms.

The eight studies from four countries included 743 patients (369 children and 374 adults); 47% had exudative pharyngitis and 44% were positive for group A beta-hemolytic streptococcus. Patients received comparable dosages of beclomethasone, dexamethasone or prednisone. In the pooled analysis, patients treated with corticosteroids were three times more likely to have complete resolution of pain at 24 hours and 48 hours, with a number needed to treat (NNT) of 3.7 and 3.3, respectively. Mean onset of pain relief was also an average of 6.3 hours faster in the treatment group (95% CI 3.4 to 9.3). There was no significant change in time to onset of pain relief in children. Time to complete resolution of symptoms was 15-45 hours in the corticosteroid group vs. 35-54 hours in the placebo group.

This study compiles good evidence that corticosteroids can be beneficial in the treatment of sore throat, with a reasonable NNT to reduce pain at 24 and 48 hours and possibly reduce time to complete resolution of symptoms. Limitations to this study include variation in the use of antibiotics, heterogenous outcome measures of clinical improvement, and patient recall bias. Further, studies are needed to review corticosteroid use with and without antibiotics and for comparison of single dose corticosteroid versus multiple-day regimens, since most of the improvements are within the first 24-48 hours. Although the 6.3 hour difference in time of onset to pain relief may not be large, reduction in pain at 24-48 hours for the symptomatic patient may warrant corticosteroids.

Arnold RC, Shapiro NI, Jones AE, et al. Multicenter study of early lactate clearance as a determinant of survival in patients with presumed sepsis. Shock. 2009 Jul;32(1):35-39

Severe sepsis has high morbidity in critically ill patients. With early-goal directed therapy (EGDT), much focus has been placed on early resuscitation to improve patient outcomes. An elevated serum lactate level has been used as an indicator of tissue under-perfusion even in patients without significant arterial hypotension. The authors of this study look to see if early lactate clearance is associated with improved survival in the ED patient and if there is a correlation between lactate clearance and central venous oxygen (SVO₂) improvement.

This prospective cohort study enrolled 166 consecutive patients from three urban emergency departments. Inclusion criteria included age >17, suspected infection, two or more systemic inflammatory response syndrome criteria, SBP <90mmHg after 20ml/kg fluid bolus or initial lactate >4mmol/L, initial and repeat lactate levels within six hours of resuscitation initiation and ICU admission. Patients enrolled underwent resuscitative efforts following EGDT guidelines including the use of a central line catheter with continuous ScvO₂ monitoring ability. The primary outcome was in-hospital mortality. Lactate clearance was an *a priori* value defined as ≥10% decrease in initial level.

Of the 166 patients, 9% (n=14) failed to clear lactate. In these patients in-house mortality was 60% compared to 19% in the lactate clearance group. There was no significant difference in initial lactate level, incidence of vasopressor use, total SOFA scores or optimization of ScvO₂ to >70%. However, those in the non-clearance group did have a higher percentage of patients whose blood pressure was non-responsive to IV fluid boluses.

This study shows that lactate non-clearance (<10% decrease) in patients with severe sepsis undergoing aggressive resuscitation correlate with a higher in-house mortality. Optimization of ScvO₂ was not associated with improved mortality. Since this was an observational study, one can not state that this is a cause and effect relationship. Another limitation is the non-standardization of serial lactate levels between patients - the authors did not clarify the timing of the repeat values; something very important if evaluating its impact on mortality. Thirdly, the low incidence of the lactate non-clearance group does not provide significant power. Overall, this study is not definitive but does add to the literature that shows a persistently elevated lactate level can be prognostic in critically ill patients.

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AAEM CONGRATULATES the emergency medicine

residency programs listed below on their recent accreditation by the Accreditation Council for Graduate Medical Education. Residency training in emergency medicine is an essential step towards recognition as a specialist in emergency medicine. Faculty and staff at these programs are to be commended for their work in establishing these programs and contributing to the continued growth of our specialty.

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