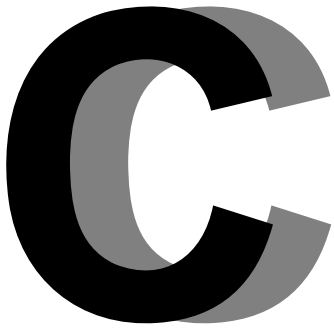

Colorado Compendium

First Edition

December 2006

The Denver Health Emergency Medicine residency program is a legacy. Attending physicians from our participating hospitals are leaders in their field and they possess a wealth of information regarding the practice of Emergency Medicine. But how do we codify this knowledge? How do residents become familiar with the library of knowledge that will aid us at the bedside? Textbooks are a start. Clinical hours are the mainstay. The Colorado Compendium is a first attempt to identify sentinel articles that are often referred to during clinical rotations but rarely are read by the average overworked resident.

When beginning this project, we asked the attendings at every institution in the residency program to suggest articles which they had found pertinent to their clinical practice. We were inundated with several hundred suggestions which were then pared down to a final list of one hundred articles. There were no absolute requirements regarding the characteristics of each article. The litmus test for inclusion was to ask whether an article would enhance the clinical expertise of residents practicing Emergency Medicine. For that reason, you will find a variety of different articles ranging from original research to health policy.

This document consists of one hundred summaries, each of which is limited to one page. These summaries are not simply copies of the article abstracts, nor do they serve as adequate substitutes for reading the article itself. They are meant to serve as a brief guide to the associated full text reference. While we would have preferred to include the articles in their entirety, copyright law prevents us from doing so. However, if you type the bold faced title into Pubmed or Ovid, you should have ready access to the referenced article and a link to the full text in some cases.

Acknowledging the continuing evolution of clinical knowledge, we intend for this Compendium to be a living document. We are interested in hearing your comments, criticisms, and suggestions as you reference this first edition. Please contact us at compendium@denverem.org. We gratefully acknowledge the reviewers listed on the following page for their contributions of time and expertise to this effort.

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Table of Contents

(1) Management of Patients with ST-Elevation Myocardial Infarction.

ACC/AHA Pocket Guidelines
Derived from the ACC/AHA Guidelines for the Management of Patients with ST-Elevation Myocardial Infarction, July 2004
ACC/AHA Writing Committee

Clinical Practice Guideline

This is the most recent ACC/AHA pocket guideline focusing on the advances in the diagnosis and management of patients with STEMI. Section III provides the most utility to the Emergency Medicine physician with its discussion centered on the "Onset of STEMI" covering pre-hospital issues and initial recognition and management in the ED. The other sections are less applicable to the EM physician with a brief introduction, primary care management of risk factors for STEMI, patient education, and inpatient management.

- Prehospital Goals: (1) keep total ischemic time within 120 minutes, (2) if EMS with fibrinolytic capability, prehospital fibrinolysis should be started within 30 minutes of EMS arrival on scene, (3) if non-PCI-capable hospital, door-to-needle time should be within 30 minutes, (4) if PCI-capable hospital, hospital door-to-balloon time should be within 90 minutes.
- Triage: A 12-lead ECG should be done within 10 minutes of arrival in the ED along with initial treatment for possible STEMI being implemented.
- A brief physical exam in the ED should include the ABCs, vital signs, assessment for JVD, rales, murmurs and gallops, and determine presence or absence of stroke, pulses, and systemic hypoperfusion (cool, clammy, pale, ashen).
- The EM physician should concomitantly interpret the EKG. If STEMI present, the physician should assess time since onset of symptoms, risk of STEMI, risk of fibrinolysis, time required for transport to skilled PCI center, then select and implement reperfusion therapy based on the reperfusion checklist below, all while administering appropriate medical therapy (ie: aspirin, nitrates, morphine, antithrombin, beta blockers.)
- Reperfusion Checklist includes three steps: (1) Has the patient experienced chest discomfort for greater than 15 min and less than 12 hours? (2) Are there contraindication to fibrinolysis? (3) Does the patient have severe heart failure or cardiogenic shock such that PCI is preferable? (Several issues around fibrinolysis versus PCI are predetermined by the ED and hospital protocol).
- Assessment of reperfusion options for patients with STEMI include: (1) Assess time required for transport to a skilled PCI facility, and (2) Determine whether fibrinolysis or invasive strategy is preferred (If presentation is less than 3 hours and there is no delay to an invasive strategy, there is no preference for either strategy.)
- Primary PCI should be performed in patients with STEMI (including true posterior MI) or MI with new or presumably new LBBB who can undergo PCI of the infarct artery within 12 hours of symptom onset, if performed in a timely fashion (90 minutes) by physicians skilled in the procedure (>75 PCI procedures / year).

Reviewed by Ben Honigman

(2) Practical implementation of the guidelines for unstable angina/non-ST-segment elevation myocardial infarction in the emergency department.

Gibler WB, Cannon CP, Blomkalns AL, et al; American Heart Association Council on Clinical Cardiology (Subcommittee on Acute Cardiac Care); Council on Cardiovascular Nursing, and Quality of Care and Outcomes Research Interdisciplinary Working Group; Society of Chest Pain Centers.
Circulation. 2005 May 24;111(20):2699-710.

Clinical Practice Guideline

This scientific statement provides a practical approach to implementing the latest ACC/AHA guidelines for the management of UA/NSTEMI.

- Risk stratification involves: (1) assessing the *likelihood* that the patient's symptoms are the result of ACS, and (2) among patients with probable/definite ACS, to identify patients who are at higher or lower *risk of death* and myocardial infarction (MI) as a complication of their ACS event.
- The pretest likelihood of ACS should be assessed and is based on patient age, sex, family history of CAD, smoking, dysplipidemia, hypertension, diabetes, previous CAD, and cocaine use.
- The physical exam should focus on identifying features that cause the patient to be at high risk for death and nonfatal MI (CHF findings such as JVD, rales, murmurs, S3/S4 gallops, peripheral edema). The physical examination also should be used to identify contraindications to antithrombotic or antiplatelet therapy such as gross rectal bleeding.
- The 12-lead ECG and cardiac biomarkers serve as the major ancillary testing tools for risk stratification in the ED.
- Half of the patients with ST-segment depression will develop MI within hours after presentation.
- T-wave inversion on the initial 12-lead ECG portends a less-adverse prognosis in patients with ACS; approximately 5% of these patients will have an MI or die within 30 days.
- Patients with suggestive histories and ST changes in the anterior precordial leads and/or I and L should have posterior leads recorded to detect possible posterior ST-elevation events.
- Numerous studies have demonstrated that any detectable elevation of troponin identifies patients at high risk for ischemic complications, including patients with renal failure. Elevation of troponin is associated with increased risk of death, and the risk of this complication increases proportionately with the absolute level.
- In view of a positive troponin, if the clinical presentation is not one of acute ischemic heart disease, then a careful search for alternative causes of cardiac injury is essential, such as CHF or PE.
- Several agents less commonly used are worth discussion. Calcium channel blockers (verapamil or diltiazem) are recommended in patients with continuing or frequently recurring ischemia when beta-adrenergic antagonists are contraindicated and no left ventricular dysfunction exists. ACE inhibitors are indicated when hypertension persists despite treatment with nitroglycerin and beta-adrenergic antagonists. Aspirin plus Clopidogrel (Plavix) results in 20% reduction in the primary outcomes of cardiac death, MI, or stroke in the CURE trial, although clopidogrel typically is not given due to the possibility of increased bleeding during catheterization or CABG. Enoxaparin is preferred over unfractionated heparin, yet heparin typically is given due to the possibility of catheterization or CABG.

Reviewed by Ben Honigman

(3) The rational clinical examination. Is this patient having a myocardial infarction?

Panju AA, Hemmelgarn BR, Guyatt GH, Simel DL
JAMA. 1998 Oct 14;280(14):1256-63.
Department of Medicine, McMaster University, Hamilton, ON

Clinical Practice Review

This meta-analysis provides several clinical scenarios of patients with potential myocardial infarction (MI) and discusses the relevance of the history, physical examination, and ECG findings in terms of likelihood of MI. The authors performed a MEDLINE search from 1980 to 1998 in order to obtain the relevant studies and graded them on methodological quality (A, B, or C) and identified 14 relevant references. (LR = likelihood ratio).

- Approximately 25% of MIs may go unrecognized due to either absence of chest pain or presence of atypical symptoms, according to a follow-up analysis of the Framingham Study cohort.
- In an inferior wall MI, nausea, bradycardia, and hypotension are believed to be due to the high number of vagal afferent nerve fibers located in the inferior cardiac wall.
- Panju et al. in 1996 attempted to determine the cause of non-cardiac chest pain and found of the 100 patients discharged from a coronary care unit with chest pain not yet diagnosed, more than 75% had evidence of esophageal disorders by objective GI testing.
- With regards to ECG interpretation, Gjorup et al. in 1992 found disagreement in 70% of the cases when 16 internal medicine residents read 107 ECGs of suspected MI patients. However, other studies comparing physicians with more experience and cardiologists found better agreement.
- Although the cardiac risk factors such as diabetes, hypertension, hypercholesterolemia, smoking, and family history of cardiovascular disease are frequently presented in patients with chest pain, there is little data to support their diagnostic value.
- The most useful historical feature is chest pain radiating to both the left and right arm simultaneously (LR, 7.1).
- The most useful physical exam finding is presence of a third heart sound (LR, 3.2) and hypotension (LR, 3.1).
- The most powerful features that increase the probability of MI and their associated LRs are new ST-segment elevation (LR range, 5.7 - 53.9) and new Q wave (LR range, 5.3 - 24.8).
- Overall, features of the ECG that increased the likelihood of MI include the following: new ST-segment elevation, new Q waves, any ST-segment elevation, and new conduction defect.
- The most powerful features that decrease the probability of MI are a normal ECG result (LR range, 0.1 – 0.3), pleuritic chest pain (LR, 0.2), chest pain reproduced by palpation (LR range, 0.2 – 0.4), sharp or stabbing chest pain (LR, 0.3) and positional chest pain (LR, 0.3).

Reviewed by Ben Honigman

(4) A comparison of coronary angioplasty with fibrinolytic therapy in acute myocardial infarction.

Andersen HR, Nielsen TT, Rasmussen K et al; DANAMI-2 Investigators.
N Engl J Med. 2003 Aug 21;349(8):733-42.
Department of Cardiology at Skejby Hospital, Aarhus University Hospital, Aarhus, Denmark.

Original Research

This study was a prospective multi-center substudy of the GUSTO IIb trial, involving fifty-seven hospitals in nine countries comparing primary coronary angioplasty with tissue plasminogen activator (t-PA) for acute MI. They randomly assigned 1138 patients from 57 hospitals who presented within 12 hours of acute MI (with ST-segment elevation on the ECG) to primary angioplasty or accelerated thrombolytic therapy with t-PA. They also randomly assigned 1012 patients to heparin or hirudin treatment. The primary study endpoint was composite outcome of death, nonfatal reinfarction, and nonfatal disability stroke at 30 days.

- At 30 days, the incidence of the primary study end point in the angioplasty and t-PA groups was 9.6 % and 13.7 %, respectively ($p = 0.033$).
- At 6 months, there was no significant difference in the incidence of the composite outcome (14.1% vs 16.1%, p not significant).
- In the angioplasty group, the primary end point was observed in 10.6% of the patients assigned to heparin and 8.2% of those assigned to hirudin ($p = 0.37$).
- If a skilled cardiologist (who performs at least 50 angioplasties yearly) is readily available, angioplasty may be preferable.
- Patients with severe hypertension, advanced age, or symptomatic cerebrovascular disease should also be treated with angioplasty, if available, to lower the risk of intracranial hemorrhage.
- Author's conclusion: The trial suggests that angioplasty provides a small-to-moderate, short-term clinical advantage over thrombolytic therapy with t-PA.

Reviewed by Ben Honigman

(5) Use of the electrocardiogram in acute myocardial infarction.

Zimetbaum PJ, Josephson ME.
N Engl J Med. 2003 Mar 6;348(10):933-40.
Cardiovascular Division, Department of Medicine, Beth Israel Deaconess Medical Center, Boston, MA.

Clinical Practice Review

This review article outlines the use of ECG for the identification of the infarct-related artery, electrocardiographic predictors of reperfusion, arrhythmias and conduction disease in acute myocardial infarction (MI), and tachyarrhythmias.

- Inferior MI may involve the right coronary artery (RCA) in 80% or the left circumflex artery (LCA) in 20%.
- Greater ST elevation in lead III than in lead II and ST-segment depression of more than 1 mm in lead I and aVL suggest involvement of the RCA rather than the LCA.
- ST-segment elevation in lead V_1 suggests proximal occlusion of the RCA with associated RV infarct.
- ST-segment depression in lead V_1 and V_2 can occur with LCA occlusion, dominant RCA, or concomitant infarction of the posterior wall of the left ventricle.
- The most sensitive ECG sign of right ventricular infarction is ST-segment elevation of more than 1 mm in lead V_{4R} with an upright T wave in that lead.
- Anterior wall MI is indicated with ST-elevation in V_1, V_2, and V_3 as a result of LAD coronary artery occlusion. Changes in aVL and aVF help to delineate proximal versus distal LAD occlusion.
- With spontaneous or pacing-induced LBBB, concordant ST changes with ST-segment depression of at least 1 mm or extremely discordant ST deviation (>5 mm) are suggestive of MI.
- The degree of ST-segment resolution is a simple and powerful predictor of ventricular function and prognosis after myocardial infarction.
- Bradyarrhythmias during the first few hours after an acute inferior MI are responsive to atropine since the bradycardia is typically due to heightened vagal tone. Conduction disease that begins or persists after the first 24 hours of MI is not responsive to atropine since is typically is related to edema and local accumulation of adenosine.
- Anterior MI conduction disease is not related to heightened vagal tone but instead is due to necrosis of the conduction system. The mortality associated with complete heart block in an anterior MI is as high as 80%, reflecting the extensive muscle infarction.
- Atrial fibrillation is associated with a worsened prognosis, regardless of the site of infarction.

Reviewed by Ben Honigman

(6) The management of cocaine-associated myocardial ischemia.

Hollander, JE.
N Engl J Med. 1995 Nov 9;333(19):1267-72.
Department of Emergency Medicine, State University of New York at Stony Brook, NY.

Clinical Practice Review

Although a dated article that may not be a "Current Concept", this article reviews many of the basic concepts known about cocaine-associated myocardial ischemia. This article covers the key features of pathophysiology, initial evaluation, cardiac chemical markers, treatment, cardiovascular complications, observation of patients, long-term prognosis, diagnostic evaluation, and secondary prevention.

- The five principal pathophysiologic mechanisms of cocaine-associated MI include: (1) increased myocardial oxygen demand, (2) coronary-artery vasoconstriction, (3) in situ thrombus formation, (4) premature atherosclerosis, and (5) left ventricular hypertrophy.
- Cocaine produces coronary vasoconstriction which an alpha-adrenergic antagonist (phentolamine) can reverse, and exacerbated by beta-adrenergic agonists.
- The frequency of myocardial infarction in the setting of acute cocaine intoxication is approximately 6 percent.
- As with the treatment of non-cocaine associated MI, treatment with aspirin, nitroglycerin, and oxygen is appropriate.
- Besides aspirin, nitroglycerin, and oxygen, the first-line therapy for cocaine-intoxicated patients are benzodiazepines.
- Beta-adrenergic antagonists, such as metoprolol, should be avoided in patients who have recently used cocaine due to enhanced cocaine-induced coronary vasoconstriction, increased blood pressure, failure to control the heart rate, increased likelihood of seizures, and decreased survival.
- For severe chest pain not relieved by the nitroglycerin and benzodiazepines, the second line treatments with alpha-adrenergic antagonists (phentolamine) or calcium-channel blockers (verapamil) may be indicated.
- For ventricular arrhythmias immediately following cocaine use, sodium bicarbonate should be considered since it reverses cocaine-induced QRS prolongation due to sodium channel blockade effects.
- 90% of cocaine-associated cardiovascular effects occur within 12 hours of presentation.

Reviewed by Ben Honigman

(7) Validation of a Brief Observation Period for Patients with Cocaine-Associated Chest Pain.

Weber JE, Shofer FS, Larkin GL, Kalaria AS, Hollander JE.
N Engl J Med. 2003 Feb 6;348(6):510-7.
Departments of Emergency Medicine, University of Michigan, Ann Arbor, and Hurley Medical Center, Flint, Mich.

Original Research

This prospective study evaluated whether discharging cocaine-associated chest pain patients with no evidence of ischemia after a 12-hour observation period could be done safely with a very low rate of complications. Previous retrospective studies showed safety and cost-effectiveness, even though the risk of MI is 24 times the base-line risk during the hour after cocaine use. This study shows that if the patient has not had their MI during a 9 to 12 hour observation period, that they are unlikely to manifest an MI beyond this time frame and are safe for discharge.

- 344 patients with cocaine-associated chest pain were evaluated with 42 (12%) directly admitted to the hospital, resulting in a 302 patient cohort.
- At 30 days, none of the patients died of a cardiovascular event.
- At 30 days, 4 of the 256 patients had a non-fatal MI.
- All four nonfatal MIs occurred in patients who continued to use cocaine.
- There was a very low risk of death or MI during the 30 days after discharge for patients with cocaine-associated chest pain who do not have evidence of ischemia or cardiovascular complications over a 9 to 12 hour period in a chest-pain observation unit.

Reviewed by Ben Honigman

(8) ST-segment elevation in conditions other than acute myocardial infarction.

Wang K, Asinger RW, Marriott HJ.
N Engl J Med. 2003 Nov 27;349(22):2128-35.
Hennepin County Medical Center, Cardiology Division, University of Minnesota, Minneapolis.

Clinical Practice Review

This review article highlights the conditions that cause ST-segment elevation, providing key insights and examples. The conditions that cause ST-segment elevation are:

- Normal ST-segment elevation and normal variants: Male Pattern is seen in approximately 90% of young healthy men and consists of ST-elevation of 1 to 3 mm in one or more precordial leads. Female Pattern (defined as females with ST elevation less than 1mm) is seen in approximately 20% of young health woman have ST-segment elevation of 1 mm or more. Normal EKGs can have no ST elevation, the female pattern ST elevation of less than 1 mm, male pattern ST elevation > 1 mm, early repolarization, or ST elevation of normal variant (combination of early repolarization and persistent juvenile T-wave pattern).
- Left ventricular hypertrophy.
- Left bundle branch block (LBBB): Sgarbossa et al. proposed concordance of QRS and ST-segment of > 1 mm in V_1, V_2, V_3 or II, III, F and > 1 mm in V_5 or discordance > 5 mm is suggestive of anteroseptal infarct with a LBBB. Madias et al. later found 6% of 128 patients with LBBB fitting the discordant criterion did not have an MI.
- Acute pericarditis and myocarditis: involvement of more than one coronary distribution and ST-elevation in pericarditis seldom exceeds 5 mm helps with differentiation from MI.
- Hyperkalemia: the ST segment is often downsloping.
- Brugada syndrome & arrhthymogenic right ventricular (RV) cardiomyopathy: Brugada syndrome is seen as a RBBB and ST-segment elevation in the right precordial leads in the absence of long QT intervals and any structural heart disease. The syndrome has been linked to mutations in the cardiac sodium-channel gene. Arrhythmogenic RV cardiomyopathy has as its hallmark the replacement of the RV myocardium with fibrofatty tissue, resulting in an EKG pattern similar to Brugada.
- Pulmonary embolism: A pseudo-infarction pattern can rarely manifest from PE.
- DC cardioversion.
- Printzmetal angina: the ST-segment elevation in Printzmetal's angina and in acute myocardial infarction are indistinguishable.
- Acute myocardial infarction.

Reviewed by Ben Honigman

(9) The International Registry of Acute Aortic Dissection (IRAD): new insights into an old disease.

Hagan PG, Nienaber CA, Isselbacher EM, et al.
JAMA. 2000 Feb 16;283(7):897-903.
University of Michigan, Ann Arbor, USA.

Original Research

Acute aortic dissection is a rare, deadly disease. This multi-center study prospectively enrolled a case series of 464 patients attempting to elucidate the presentation, management, and outcomes of acute aortic dissection.

- The most common risk factors for acute aortic dissection were hypertension (72.1%), atherosclerosis (31.0%), prior cardiac surgery (17.9%), and known aortic aneurysm (16.1%).
- The sudden onset of severe sharp pain was the single most common presenting complaint.
- The clinical presentation was highly variable, yet abrupt onset of pain was reported in 84.8% and severe or worst ever pain reported in 90.6%.
- Classic physical findings of aortic regurgitation murmur or pulse deficit were observed in only 31.6% and 15.1% of patients, respectively.
- Initial CXR and EKG were completely normal in 12.4% and 31.3% of patients.
- The most common CXR abnormalities were widened mediastinum (61.6%), abnormal aortic contour (49.6%), and abnormal cardiac contour (25.8%).
- CT was the initial imaging modality of choice in 61.1%.
- Overall in-hospital mortality was 27.4%.

Reviewed by Ben Honigman

(10) Does this patient have an acute thoracic aortic dissection?

Klompas M.
JAMA. 2002 May 1;287(17):2262-72.
Department of Medicine, Brigham and Women's Hospital, Boston, MA.

Clinical Practice Review

This article reviewed all literature from 1966 to 2000 pertaining to acute thoracic aortic dissection and identified 21 studies that met their selection criteria. They reviewed the accuracy of the history, physical examination, and plain chest radiograph in the diagnosis of acute thoracic aortic dissection. (LR = likelihood ratio).

- Severe pain (sensitivity, 90%) of sudden onset (sensitivity, 84%) was present in most patients.
- The absence of sudden pain onset lowers the likelihood of dissection (negative LR, 0.3).
- Be careful relying too heavily on the absence of sudden pain to exclude aortic dissection because the inclusion biases of these studies likely overestimate the sensitivity.
- Of note, the pooled sensitivity of the patient having any pain was 90% (85% to 94%).
- Rosman et al. in 1998 reported that by asking three basic questions regarding the patient's pain quality, radiation, and intensity at onset, physicians could increase their success at diagnosing thoracic aortic dissection. In their study, when all three questions were asked, physicians correctly diagnosed thoracic aortic dissection in 30 of 33 patients (91%).
- Pulse or blood pressure differentials (of greater than 20 mmHg) and neurological deficits increased the likelihood of disease (positive LRs, 5.7 and 6.6 - 33.0, respectively).
- Comparison of all major arteries, including the carotid, radial, femoral, dorsalis pedis, and posterior tibial pulses, should be done, rather than just assessment of blood pressure in both arms.
- The presence of a diastolic murmur does not significantly change the pretest probability of dissection (positive LR, 1.4). The diastolic murmur results from retrograde extension of the tear of the aortic valve resulting in an aortic regurgitation murmur.
- The chest radiograph was usually abnormal (sensitivity, 90%) in acute thoracic aortic dissection.
- The presence of a normal aorta and mediastinum decreased the probability of dissection (negative LR, 0.3).

Reviewed by Ben Honigman

(11) Management of Patients with Atrial Fibrillation.

ACC/AHA/ESC Pocket Guidelines
A report of the American Collect of Cardiology/American Heart Association Task Force on Practice Guidelines and the European Society of Cardiology Committee for Practice Guidelines and Policy Conferences (Committee to Develop Guidelines for the Management of Patients with Atrial Fibrillation
March 2002.

Clinical Practice Guideline

Atrial fibrillation (AF) is the most common cardiac dysrhythmia encountered in the emergency department. Hemodynamic impairment and thromboembolic stroke secondary to AF result in significant morbidity, mortality, and cost. This is the most recent ACC/AHA pocket guideline discussing the management of patients with AF and provides a useful classification scheme, epidemiology, clinical evaluation, and overview of algorithms for management of patients with AF.

- AF has a prevalence of 0.4% of the general population and the incidence increases with age.
- The ACC refers to the four “patterns of atrial fibrillation” which are first detected (new onset), recurrent paroxysmal (self-terminates, lasts less than 7 days), recurrent persistent (not self-terminating, usually greater than 7 days), and permanent (chronic or cardioversion failed/not attempted).
- Lone AF is defined as patients < 60 years of age without clinical or echocardiography evidence of cardiopulmonary disease.
- Recurrent atrial fibrillation is defined as 2 or more episodes of atrial fibrillation.
- The minimal evaluation of the AF patient should include: (1) history and physical exam (including symptoms, clinical type of AF, frequency, duration, precipitating factors, presence of any underlying heart disease), (2) EKG, (3) CXR, (4) echocardiogram, and (5) blood tests for thyroid disease (TSH).
- The article reviews the Vaughan Williams Classification of Antiarrhythmic Drug Actions: Type IA (procainamide), IB (lidocaine), IC (propafenone), Type II (beta blockers), Type III (amiodarone, sotalol, ibutilide), Type IV (calcium channel blockers).
- Recommendations for the acute and chronic management of atrial fibrillation depending on the clinical type are further described in the guidelines and worth reviewing in detail.

Reviewed by Ben Honigman

(12) Management of Patients with Supraventricular Arrhythmias.

ACC/AHA Pocket Guideline.
Based on the ACC/AHA/ESC Guidelines on the Management of Patients with Supraventricular Arrhythmias.
March 2004.

Clinical Practice Guideline

This is the most recent ACC/AHA pocket guideline on supraventricular arrhythmias (SVAs) and includes rhythms emanating from the sinus node, atrial tissue [atrial tachycardias (ATs), atrial flutter], and junctional tissue [atrioventricular nodal reciprocating tachycardia (AVNRT)]. This pocket guideline also covers specific arrhythmias (inappropriate sinus tachycardia, AVNRT, focal and nonparoxysmal junctional tachycardia, AV reciprocating re-entry tachycardia, focal atrial tachycardia, and macro-re-entrant atrial tachycardia). Atrial fibrillation is discussed in a separate ACC/AHA pocket guideline.

- First, determine whether the rhythm is regular (PSVT) or irregular (premature extra beats, atrial fibrillation, MAT).
- Sinus tachycardia is nonparoxysmal and accelerates and terminates gradually; as opposed to PSVT with abrupt onset and termination.
- Second, determine whether the rhythm has a narrow-QRS (almost always superventricular) or wide QRS-complex tachycardia (SVT with BBB, SVT with AV conduction over accessory pathway, ventricular tachycardia)
- If it is a narrow-QRS complex tachycardia, determine the response to adenosine. No change occurs with inadequate dose/delivery or VT. Gradual slowing then reacceleration occurs with sinus tachycardia, focal AT, nonparoxysmal junctional tachycardia. Sudden termination results from AVNRT, AVRT, sinus node re-entry, and focal AT. Persistent atrial tachycardia with transient high-grade AVB results from atrial flutter or AT.
- If it is a wide-QRS complex tachycardia, develop a differential diagnosis based on whether regular (SVT with BBB, antidromic AVRT, VT) or irregular (atrial fibrillation, atrial flutter/AT with variable with BBB and either BBB or antegrade conduction via atrial pathway). If the patient has a history of underlying heart disease (previous MI or structural heart disease), VT is likely.
- Adenosine should be used with caution when the diagnosis of wide-QRS complex tachycardia is unclear because it may produce VF in patients with CAD and AF with a rapid ventricular rate in pre-excited tachycardias.
- Recommendations for acute management of hemodynamically stable and regular tachycardias are further described in the guideline and worth reviewing.

Reviewed by Ben Honigman

(13) Syncope.

Kapoor WN.
N Engl J Med. 2000 Dec 21;343(25):1856-62.
University of Pittsburgh School of Medicine, Pittsburgh, PA.

Clinical Practice Review

This review article provides a broad overview of syncope. It provides details on how to differentiate syncope from other symptoms, clinical features suggestive of specific causes, and diagnostic testing in patients with syncope. Although the article is not tailored toward emergency medicine physicians, it does offer some great insight toward the sometimes challenging chief complaint of syncope. Although of limited utility, the authors' also briefly discuss the initial work-up and when to admit patients with syncope.

- In terms of distinguishing syncope from seizure, disorientation after the event, a slow return to consciousness, and unconsciousness lasting more than five minutes suggest seizure.
- The causes of syncope include neurally-mediated syncope (also termed neurocardiogenic or vasovagal syncope) (18%), cardiac syncope (18%), neurologic disease (10%), orthostatic hypotension (8%), medications (3%), psychiatric illness (2%), and unknown cause (34%).
- Special attention should be paid during the physical examination to orthostatic hypotension, measurements of blood pressure in two arms, and cardiovascular and neurologic signs. However, it is important to note that the utility of blood pressure differentials for assessment of dissection and orthostatic vital signs for assessment of orthostasis or volume depletion is known to be extremely limited.
- Routine use of basic laboratory tests (complete blood counts, electrolytes, and tests of renal function and glucose level) is not recommended because of their low yield.
- EKG is recommended in almost all patients.
- Underlying heart disease, irrespective of the cause of syncope, is the factor associated with an increased risk of death. Thus, in patients with structural heart disease or abnormalities on their ECG, telemetry monitoring for 24 hours is recommended.
- Further testing may include evaluation of underlying heart disease with an echocardiogram, a stress test, or both, testing for arrythmias with ambulatory monitoring (Holter) or continuous-loop event monitoring, electrophysiological studies, evaluation of neurally mediated syncope with a tilt test, neurologic testing with an EEG, and possibly even psychiatric evaluation.

Reviewed by Ben Honigman

(14) Heart failure.

Jessup M, Brozena S.
N Engl J Med. 2003 May 15;348(20):2007-18.
Heart Failure-Cardiac Transplantation Program, Cardiovascular Division, Department of Medicine, Hospital of the University of Pennsylvania, Philadelphia, PA.

Clinical Practice Review

The syndrome of heart failure is highlighted in this medical progress review article. It is important to recognize that this article was published before the most recent ACC/AHA 2005 guidelines that prefer to use the phrase Chronic Heart Failure rather than “Congestive” to indicate that many of the heart failure syndromes do not result in fluid overload. This article highlights the new approach to classification of heart failure with a staging system similar to cancer staging, as opposed to the New York Heart Association (NYHA) classification, which has been primarily used as shorthand to describe functional limitations.

- Think of heart failure as a syndrome resulting from a complex blend of structural, functional, and biologic alterations of the heart.
- Left ventricular remodeling occurs in several clinical conditions, including MI, cardiomyopathy, hypertension, and valvular heart disease; its hallmarks include hypertrophy, loss of myocytes, and increased interstitial fibrosis.
- ACE inhibitors, beta-adrenergic antagonists, and cardiac resynchronization results in a reverse-remodeling process.
- Left bundle-branch block is a significant predictor of sudden death and a common finding in patients with myocardial failure.
- 20% to 50% of patients with heart failure have preserved systolic function or a normal left ventricular ejection fraction. For a given ventricular volume, ventricular pressures are elevated, leading to pulmonary congestion, dyspnea, and edema identical to those seen in patients with a dilated, poorly contracting heart.
- Mortality among these patients and rates of hospitalization are the same between systolic and diastolic heart failure.
- NSAIDs have been associated with an increase in the incidence of new heart failure, decompensated chronic heart failure, and hospitalizations for heart failure.

Reviewed by Ben Honigman

(15) Infective endocarditis in adults.

Mylonakis E, Calderwood SB.
N Engl J Med. 2001 Nov 1;345(18):1318-30.
Division of Infectious Diseases, Massachusetts General Hospital, Boston, MA.

Clinical Practice Review

Infective endocarditis is a microbial infection of the endocardial surface of the heart, most commonly affecting heart valves. This review article discusses the progress made over the past decade in the epidemiological features and predisposing factors, microbiologic features, clinical manifestations, diagnosis, complications, treatment, and mortality and relapse of infective endocarditis.

- In developed countries, risk factors for infective endocarditis of native valves include injection-drug use, poor dental hygiene, long-term hemodialysis, diabetes mellitus, infection with HIV, and mitral valve prolapse. In developing countries, rheumatic heart disease remains the most common predisposing factor.
- Mechanical heart valves are at higher risk for infection than are bioprosthesis during the first three months after surgery, yet later converge to be similar at five years.
- Nosocomial infective endocarditis occurs in 7% to 29% of all cases of infective endocarditis.
- Staph. aureus has surpassed Strep. viridans as the most common cause of infective endocarditis.
- Only 5% to 7% of patients who have been diagnosed with infective endocarditis according to strict criteria and who have not received antibiotics will have sterile blood cultures.
- Most patients with infective endocarditis have a preexisting heart murmur.
- In 2000, a modified version of the previously validated Duke Criteria was established.
- For patients with a low pre-test probability, a transthoracic echocardiogram is sufficient. For patients with a high pre-test probability, transesophageal echocardiogram is necessary if the transthoracic echocardiogram is normal.
- Complications of infective endocarditis include infection-induced valvular damage leading to congestive heart failure (aortic-valve more frequently than mitral-valve infection), conduction abnormalities, stroke syndrome, and systemic emboli (most commonly involving the spleen, the kidney, the liver, and the iliac or mesenteric arteries).
- Antimicrobial therapy depends on blood culture results, presence of prosthetic-valve, and timing of prosthetic valve.
- The overall mortality of infective endocarditis is 20% to 25%, with the exception of right-sided injection-drug users with a 10% mortality.

Reviewed by Ben Honigman

(16) Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy, and prevention.

Niederman MS et al. and the American Thoracic Society
Am J Respir Crit Care Med. 2001 Jun;163(7):1730-54.

Clinical Practice Guideline

With consideration given to the PORT (Pneumonia Patient Outcome Research Team) study and the emergence of drug resistant *streptococcus pneumoniae*, the American Thoracic Society published this updated guideline in 2001. The guidelines are about 40 pages long so this summary only scrapes the surface. For complete explanations and underlying pathophysiology, read the article. The ATS divides patients who present with pneumonia into four categories:

- Group 1 can be thought of as the Simple Outpatient (no comorbidities).
- Group 2 can be labeled as the Complex Outpatient (comorbidities including a history of cardiopulmonary disease, nursing home resident, or age >65). Group 2 patients as a whole can usually have there pneumonia treated as an outpatient but 20% end up returning and requiring inpatient care.
- Group 3 is the Ward Inpatient.
- Group 4 is the ICU Inpatient. Group 4 patients are at particular risk for *Pseudomonas*.

The problem facing ED doctors is putting each patient in the appropriate group. The basis for delineating the need for hospitalization is largely borrowed from the PORT prediction rule which is reviewed on page 1740. The PORT classification, in a somewhat confusing difference, has five classifications. It is unclear why the ATS did not choose to borrow these classes directly. It is estimated that care for a course of antibiotics as an outpatient costs $150 to $350 while inpatient care averages $7,500. Tables 2 to 5 not only review the patient groups but also delineate probable organisms and recommended antibiotic regimens.

Efforts are often made to identify an organism. However, even with extensive testing, an organism will only be found in approximately half of all cases. Sputum cultures are not routinely recommended unless there is a strong suspicion of resistant organisms. Despite more recent evidence which suggests blood cultures rarely result in a change in antibiotic therapy, this guideline recommends drawing two sets, yet this dogma is slowly changing. The necessity of ICU admission is discussed beginning on page 1741 with a decision rule described which is based on minor and major criteria.

Most of the remainder of the article is more applicable to the inpatient setting and the use of various antibiotic regimens. Overall familiarity with this consensus statement will help guide evaluation and treatment of pneumonia in the ED and may also aid discussions with our internal medicine colleagues.

Reviewed by Kurt Whitaker

(17) A prediction rule to identify low-risk patients with community-acquired pneumonia.

Fine MJ, Auble TE, Yealy DM et al.
N Engl J Med. 1997 Jan 23;336(4):243-50.
Departments of Medicine and Emergency Medicine, University of Pittsburgh; Department of Medicine, Massachusetts General Hospital; Division of Infectious Diseases, Dalhousie University, Halifax, Nova Scotia.

Clinical Practice Guideline

Four million adults are diagnosed with community acquired pneumonia (CAP) each year. Of these patients, 600,000 are hospitalized costing an estimated $4 billion annually. Yet the criteria for admission vary widely. The subjective impression of clinical appearance often guides the physician's decision to admit and physicians generally overestimate the risk of death in patients who present with pneumonia. As a result of this expensive subjectivity, the authors of this study validate a prediction rule known as the PORT score.

The study looked at over 14,000 inpatients with CAP (AIDS patients were excluded). The derivation of a prediction rule was divided into two steps. Step 1 involved the identification of a subgroup of patients at low risk of death based only on history and physical exam. Step 2 looked at the remaining patients and quantified the risk of death based on history, physical, and lab and radiographic findings. Having established the rule, it was then validated in 38,039 patients. The following factors were associated with increased mortality:

1. Age > 50
2. Presence of cancer, CHF, cardiovascular disease, liver disease, renal disease
3. PE Findings: altered mental status, Pulse >125, RR >30, SBP <90, Temp <35 or >40

Step 2 expanded on these finding to include a variety of radiographic and lab findings which are listed on page 246. Using these factors, patients were placed in Class I through V categorizations. Patients who fell in the lowest risk class (Class I) could be sent home without any further lab or radiographic evidence. Class II and III patients could also be treated as outpatients in most cases.

The use of this prediction rule would have reduced inpatient stays by 31 percent. But how many patients who would have been characterized as Class I, II, or III died? The answer is 3, or 1% of this group. Another 18 patients (4.3%) were admitted to an ICU. Furthermore, if this prediction rule was already in place, 5 out of the 6 patients who were sent home and died would have been admitted as Class IV patients. It should be noted that any patient in Class I, II, or III who is hypoxic in the ED should probably be admitted.

Some weaknesses of the study include the need to consider whether a patient will take antibiotics as an outpatient (psychosocial). Rare conditions such as cystic fibrosis are not included in the variables and would obviously affect admission decisions. Finally, the yes/no dichotomous variables may oversimplify patient presentations. This paper is best appreciated by looking closely at the tables.

Reviewed by Kurt Whitaker

(18) Evaluation of D-dimer in the diagnosis of suspected deep-vein thrombosis.

Wells PS, Anderson DR, Rodger M et al.
N Engl J Med. 2003 Sep 25;349(13):1227-35.
Departments of Medicine, Radiology, and Emergency Medicine at the University of Ottawa, Ottawa, Ontario; Dalhousie University, Halifax, Nova Scotia; University of Western Ontario, London, Ontario; McMaster University, Hamilton, Ontario

Original Research

The lifetime incidence of a DVT is between 2% and 5%. Even prior to this study, the D-Dimer assay was found to have a high negative predictive value since the D-dimer is sensitive but not specific in the diagnosis of a DVT. The hypothesis of this study was that the use of D-dimer testing in conjunction with clinical judgement could safely reduce the number of ultrasound studies in ruling out DVT's.

Consecutive patients with suspected DVT were evaluated for eligibility. The complete set of excluded patients is described on page 1228. Enrolled patients were then evaluated by a physician using a clinical scale replicated in Table 1 on page 1228. A score was then assigned to each patient – a value of two or greater was the threshold for a likely DVT. Once this score was assigned, each patient was assigned to the control or the study group. In the control group, all patients were evaluated by ultrasound. In the study group, a D-dimer was performed next. If the D-dimer was negative and the likelihood score was less than two, the patient was discharged without ultrasound. If the D-dimer was positive but the likelihood score was less than two, an ultrasound was performed. Obviously, if the D-dimer was positive and the likelihood score was greater than two, an ultrasound was performed.

Follow-up on patients who were not initially diagnosed with a DVT occurred at one week and three months after the initial visit for evidence of development of a DVT or a pulmonary embolus. 566 patients were in the D-dimer group and 530 were in the control group. In the control group, 6 of 443 patients (1.4%) where DVT was "ruled out" had an embolic event during the three month follow-up. Two patients (0.4%) in the negative D-Dimer group returned with a thromboembolic event during follow-up. There was no significant difference between the rates of missed thromboembolic events between the D-dimer group and the control group (0.4% vs 1.4%). This study suggests that a low clinical suspicion and a negative D-dimer are as sensitive as a low clinical suspicion and a negative ultrasound when ruling out a DVT. Use of the D-dimer eliminated the need for an ultrasound in 38% of patients who would otherwise have been sent for ultrasound.

Reviewed by Kurt Whitaker

(19) Clinical practice. The evaluation of suspected pulmonary embolism.

Fedullo PF, Tapson VF.
N Engl J Med. 2003 Sep 25;349(13):1247-56.
Divisions of Pulmonary and Critical Care Medicine at the University of California, San Diego, CA; Duke University Medical Center, Durham, N.C.

Clinical Practice Review

There is an estimated 600,000 occurrences of pulmonary embolism (PE) annually in the United States resulting in at least 100,000 deaths. Most of these deaths result from failing to reach medical care or a failure to diagnosis since few patients die of a PE after its presence has been confirmed and therapy is commenced. The typical signs and symptoms of dyspnea, pleuritic chest pain, tachypnea, and tachycardia point to the diagnosis but should not be considered sensitive or specific.

In establishing the diagnosis, this article divides patients into three categories: low, medium, and high probability of embolism. Prior to delving into the diagnostic approaches for each of these subgroups, a look at the available imaging modalities is helpful. The traditional gold standard is pulmonary angiography. Why not just employ this imaging study to evaluate everyone? First, it is an invasive procedure with mortality rates approaching 0.5% in one cited study. Significant morbidity including renal failure or respiratory failure were documented in 0.8% of patients. Another traditional approach has been the Ventilation-Perfusion (VQ) scan. This used to be more commonly used prior to the advent of computed tomography. A normal VQ scan can be reliably used to rule out PE while a high probability VQ scan has a high specificity for embolism. Unfortunately, few patients fall into these categories and indeterminate studies are much more common. Ultrasound of the leg veins is positive in up to 20% of patients without leg symptoms who present for a PE evaluation and is positive in up to 50% of patients who have a proven PE. CT scans have become the most commonly used imaging modality in evaluating for a PE with sensitivity between 57% and 100% and specificity between 78% and 100%. The location of the embolus is a critical factor in whether it is detected on CT scan. Sensitivity for an embolus in significant pulmonary vasculature is greater than 90% while sub-segmental emboli are detected less frequently (71% to 84% sensitivity).

Several succinct management pathways in full page figures should be reviewed since explanation of them here would be redundant. A few key conundrums are also addressed. First, what do we do with patients with a proven history of PE who present with signs and symptoms suggestive of a recurrent episode? No definitive studies have evaluated the progression of resolution of pulmonary findings after treatment although it has been suggested in one study that 66% of patients show residual defects from prior PE after three months of therapy. Pulmonary angiography may be the answer in these cases since it is much better in determining the age of an embolic lesion – see above for attendant risks of this procedure. If the patient has an elevated creatinine, a VQ scan is an alternative modality to consider. If the patient is pregnant, a discussion with OB and radiology is warranted. Debate continues regarding the most appropriate study in the pregnant population. In patients with an elevated creatinine or who are pregnant, perhaps a better first study would be a duplex ultrasound of the lower extremities. If this study is negative, you still have to pursue further testing but a positive result on this noninvasive study would be a stopping point with treatment ensuing.

Reviewed by Kurt Whitaker

(20) Clinical practice. Pleural effusion.

Light, RW.
N Engl J Med. 2002 Jun 20;346(25):1971-7.
Department of Medicine, Vanderbilt University, Nashville, TN.

Clinical Practice Review

Richard Light's name invariably comes up in discussions of pleural effusions. The most common causes of effusions in the United States are congestive heart failure (CHF), pneumonia, and cancer. The first part of the article describes aspects of the physical exam which are characteristic of a pleural effusion.

When should thoracentesis be performed? The first criteria is clinical significance. In this review, that is defined as an effusion which is more than 10 mm thick on ultrasound or lateral decubitus x-ray. Even smaller effusions without a clear etiology may be candidates for a diagnostic tap. Patients with CHF who are afebrile and present with bilateral effusions without signs of distress may be treated with diuresis alone. Since most CHF related effusions are bilateral, a unilateral effusion should not be attributed to CHF and therefore should be tapped. While ultrasound guidance is increasingly becoming the standard for all taps, this review specifies it for small effusions or difficult taps. The review states there is no clear evidence that ultrasound reduces the incidence of thoracentesis and attributes more emphasis to the experience of the clinician doing the tap.

The big question in this article regards the classification of a transudate versus an exudate. Transudative fluids are a result of hydrostatic and oncotic pressure imbalances as would occur with CHF, cirrhosis, and pulmonary embolism. Exudative effusions (think *ex*tra) are the result of inflammatory processes associated with infectious, malignant, or other etiologies. Light's criteria are:

1) Ratio of pleural-fluid protein level to serum protein level > 0.5.
2) Ratio of pleural-fluid LDH level to serum LDH level > 0.6.
3) Pleural-fluid LDH level > two thirds the upper limit of normal for serum LDH level.

The main point is that if you think the fluid is probably a transudate but you just want to rule out an exudate by laboratory confirmation, just send lactate dehydrogenase and protein levels from the pleural fluid and the patient's serum. If these results point towards the possibility of an exudate, then additional labs can be sent as described in the article. If a transudative process was suspected but Light's criteria define the fluid as exudative a comparison of serum albumin to the effusion albumin should be performed. A difference of less than or equal to 1.2 g/dl indicates an exudates with 92% specificity.

The remainder of the article delineates the further testing which can be done to determine the etiology of effusion. Despite exhaustive testing up to and including thoracoscopy and pleural biopsy, no etiology of the effusion is found in about 15% of patients. Page 1973 gives a succinct roadmap for managing pleural effusions. Don't forget to consider a PE as a possible etiology of a pleural effusion.

Reviewed by Kurt Whitaker

(21) The management of acute severe asthma.

Marik PE, Varon J, Fromm R Jr.
J Emerg Med. 2002 Oct;23(3):257-68.
Department of Critical Care Medicine, University of Pittsburgh, Pittsburgh, PA; Division of Pulmonary and Critical Care, Baylor College of Medicine, Houston, TX.

Clinical Practice Review

Asthma accounts for over two million visits to the ED each year. In reviewing cases of fatal asthma, two patterns emerge. The first usually involves a chronic asthmatic with poor control who presents after several days of worsening respiratory distress. The second group refers to patients with an acute onset which progresses over minutes to hours. This paper reviews many topics which are briefly highlighted below.

- S-albuterol may be pro-inflammatory in the airway and is metabolized at $1/10^{th}$ the rate of R-albuterol so it remains in the system much longer.
- Subcutaneous terbutaline or epinephrine are both safe alternatives in patients who cannot tolerate an inhaled or nebulized beta agonist.
- Inhaled corticosteroids lead to faster improvement in peak flow and lower admission rates. More studies are needed.
- Leukotriene Modifiying Agents (LMA) work differently than steroids and early studies point to lower admissions rates when used to treat acute asthma.
- Patients should be discharged on inhaled beta agonists as well as inhaled and systemic corticosteroids.
- A fall in FEV_1 to 50% baseline correlates to a 700% to 1000% increase in inspiratory muscle work.
- Ketamine is a good agent for rapid sequence intubation but will increase laryngeal reflexes so pretreatment with lidocaine should be considered.

Reviewed by Kurt Whitaker

(22) State of the art: therapeutic controversies in severe acute asthma.

Gibbs MA, Camargo CA Jr, Rowe BH, Silverman RA.
Acad Emerg Med. 2000 Jul;7(7):800-15.
1999 SAEM State-of-the-Art Session.

Clinical Practice Review

This article reads like a coffeehouse discussion of the methods behind the madness that governs our asthma treatments in the ED. A couple of introductory references are highlighted. First is the extensive reference to the Cochrane Collaboration on airways and asthma. Second is the Multicenter Airway Research Collaboration based out of Boston. This discussion is filled with interesting aspects – a few of the highlights are listed below:

- A Cochrane Review shows no benefit of nebulizers over an MDI with a spacer. The problem lies with educating patients regarding this fact.
- Levalbuterol (xopenex) consists of the R enantiomer of albuterol. The S-enantiomer has no bronchodilating effect and may worsen airwary reactivity. There is no data which demonstrates that the use of levalbuterol rather than standard albuterol decreased the frequency of admission or relapse. More studies are needed.
- Early corticosteroid use administration reduces hospitalization.
- Oral corticosteroids are as effective as IV steroids in those who can tolerate PO.
- Inhaled corticosteroids used in addition to standard care seem to improve pulmonary function and reduce admission rates.
- Leukotriene modifying agents (LMA's) like zileuton, zafirlukast, and montelukast may have an additive effect to inhaled steroids and may be useful agents in emergency treatment. More studies are needed.
- Multiple doses of ipratroprium bromide in pediatric asthma reduces rates of admission. Severe asthma in adults and children should be treated with multiple doses of atrovent.
- Magnesium is beneficial in the treatment of severe asthmatics (FEV_1 < 25% of predicted).

Reviewed by Kurt Whitaker

(23) Refractory asthma, Part 1: Epidemiology, pathophysiology, pharmacologic interventions.

Refractory asthma, Part 2: Airway interventions and management.

Jagoda A, Shepherd SM, Spevitz A, Joseph MM.
Ann Emerg Med. 1997 Feb;29(2):262-81.
Department of Emergency Medicine, Mount Sinai Medical Center, NY; Department of Emergency Medicine, University of Pennsylvania, Philadelphia, PA; Departments of Medicine and Pediatric Emergency Medicine, University of Florida, Jacksonville, FL.

Clinical Practice Review

How well are we treating asthma and are our interventions evidence based? This comprehensive review, while not very recent, provides a foundation for further reading. About 10% of asthmatics are prone to status asthmaticus. Among those asthmatics requiring intubation, up to 20% will die on that admission. The article offers a review of the pathophysiology of asthma, reviewing the triad of airway obstruction, hyperresponsiveness, and inflammation.

- There is no benefit of nebulizer treatments versus a properly used metered dose inhaler.
- Studies cited in this review do not demonstrate any added safety from terbutaline versus epinephrine in patients with cardiac risk factors.
- A trend towards benefit from magnesium is demonstrated in refractory status asthmaticus.

Part 2 - Airway Interventions and Management

Many topics are covered in this section - here are a few highlights:

- "Well at least his pCO_2 is normal." Not so fast. An asthmatic will be blowing down his CO_2. A normal pCO_2 should be considered as one sign of fatigue in the right clinical setting.
- Ketamine is an excellent choice in the intubation of most asthmatics, use in conjunction with benzodiazepines in adults.
- "Just tube him and send him upstairs." This strategy might work but do not look at an intubated patient with any reassurance. Case series reviewed in this paper point to a consistent trend of deterioration *after* intubation.
- When the patient is intubated, your goal should not be to normalize the $PaCO_2$. Aim for hypoventilation to minimize auto-PEEP (permissive hypercapnea).
- If hypotension develops after intubation, its probably secondary to hyperinflation. Temporarily disconnect the ventilator and watch for an improvement in blood pressure.

Reviewed by Kurt Whitaker

(24) Severe acute pancreatitis.

Swaroop VS, Chari ST, Clain JE.
JAMA. 2004 Jun 16;291(23):2865-8.
Department of Internal Medicine, Mayo Clinic, Rochester, MN

Clinical Practice Review

Over 200,000 patients are admitted each year with pancreatitis. Of these, about 20% have severe acute pancreatitis (SAP). The three criteria used to differentiate SAP from more benign cases of pancreatitis are: (1) organ failure with one or more of the following: shock (systolic blood pressure < 90 mm Hg), pulmonary insufficiency (PaO_2 < 60 mm Hg), renal failure (serum creatinine level > 2 mg/dL), and gastrointestinal tract bleeding (> 500 mL in 24 hours); (2) local complications such as necrosis, pseudocyst, or abscess; (3) at least 8 or the Acute Physiology and Chronic Health Evaluation II (APACHE II) criteria. Key points are found below:

- Excessive alcohol consumption is the etiology of 40% of cases of SAP.
- Gallstones accounts for 35% of cases of SAP.
- The degree of enzyme elevation does not directly correlate with the severity of the pancreatitis.
- Enteral feedings, despite past teachings, should be started as soon as they are tolerated. Three randomized control trials have demonstrated enteral feeding is not only safe, but is also associated with fewer infectious complications.
- Ranson's criteria is commonly used in clinical practice as an assessment of severity and predictor of mortality; however, the analysis cannot be completed before 48 hours, and thus has limitations for the emergency physician.
- Consider a CT abdomen to evaluate for a pseudocyst or abscess; however, no specific recommendations are given regarding when to obtain a CT abdomen in patients with pancreatitis. Of note, fine-needle aspiration of a necrotic area under CT-guidance can be done to determine whether it is infected or not.
- A more useful assessment of severity for the emergency physician is the CT severity index which is based entirely on CT findings, with a score of 7 or higher (>30% necrosis) implying SAP with high mortality and morbidity.

Reviewed by Fred Severyn

(25) Prospective randomized study of analgesic use for ED patients with right lower quadrant abdominal pain.

Mahadevan M, Graff L.
Am J Emerg Med. 2000 Nov;18(7):753-6.
Department of Emergency Medicine, National University Hospital, Singapore.

Original Research

Although the incidence is becoming increasingly rare, ED physicians still occasionally call a surgical consult regarding abdominal pain and are asked not to treat the pain before the surgeon examines the patient. This study sets out to debunk the notion that analgesics will mask right lower quadrant pain resulting from appendicitis. In this area of diagnosis, Rosen and two surgical texts support analgesia. Patients were randomized to either a placebo analgesic or treatment with intravenous tramadol – a morphine analog more commonly used outside of the United States. An interesting aspect of this study was the use of a "seven component" abdominal exam to gauge tenderness.

Patients receiving the placebo reported a 13% reduction in pain on a visual analog scale compared to 25% in the tramadol group. The individual aspects of the abdominal exam were evaluated as predictors of appendicitis through the use of likelihood ratios. In conclusion, it was found that analgesics not only did not lower the sensitivity for appendicitis but actually led to a more focused exam with retention of signs and symptoms predictive of an appendicitis.

Reviewed by Fred Severyn

(26) Clinical practice. Suspected appendicitis.

Paulson EK, Kalady MF, Pappas TN.
N Engl J Med. 2003 Jan 16;348(3):236-42.
Departments of Radiology and Surgery, Duke University Medical Center, Durham, NC

Clinical Practice Review

More than 250,000 appendectomies are performed each year in the United States. Approximately 20% of patients with suspected appendicitis who go to the OR have a normal appendix. The three most predictive signs and symptoms are RLQ pain, abdominal rigidity, and migration of pain from the periumbilical region to the RLQ. In women, pregnancy and PID should always be in the differential so a pelvic and pregnancy test are necessary.

The classic debate between surgeons and emergency physicians concerns the WBC count so special attention to this topic is deserved. Between 70% and 90% of patients with an acute appy will have an elevated WBC count. To quote the article verbatim from page 237, "Use of the leukocyte count alone to make management decisions in cases of suspected appendicitis may result in missed diagnoses or unnecessary surgery."

Another pitfall involves the classic "dirty" urine e.g. "Well they probably just have a UTI, look at that urine." An acute appy can cause pyuria due to proximity of the ureter to an inflamed appendix. Hematuria or bacteriuria is found in up to 40% of patients with a proven appy but RBC's > 30 per hpf or WBC's > 20 per hpf point towards a primary urinary disorder. A cath UA should be obtained in equivocal circumstances.

With regards to imaging, a CT abdomen/pelvis with "appy" protocol has become the gold standard with a sensitivity of 90% to 100% and a specificity of 91% to 99%. Additionally, the CT scan of the abdomen is helpful in diagnosing other non-appendiceal pathology which may be masquerading as appendicitis. Ultrasound in the proper hands has a sensitivity between 75% and 90% and a specificity between 96% and 100%. Unfortunately, a normal appendix is definitively reported in less than 5% of patients which makes the need for a CT very likely**.** In the absence of pregnancy**,** ultrasound is not recommended over a CT scan.

The question arises regarding the need for CT when the suspicion of appendicitis is high. One prospective study looked at 99 patients where the plan was either immediate surgery or a period of observation. Once these plans were documented, a CT scan and a RLQ ultrasound were ordered and the researchers evaluated how many patients' plans changed after the surgeon was aware of the results. Among the 44 patients originally scheduled for surgery, the CT scan results led to the cancellation of six surgeries. None of these patients returned with a missed appendicitis. All six of these patients were women. Among the 26 men originally assigned to surgery, only 2 (8%) did not have an appendicitis. Ultrasound was not a significant factor in changing the management plan for any patients. The upshot is that in men with a clinical presentation of appendicitis, a CT is unlikely to change management. In women, however, a CT is justified since many women may have alternative diagnoses. While not specifically addressed in the article, a chest x-ray may be a helpful adjunct, especially in males who do not require a CT since it will reveal free air. In children, a basal infiltrate may be found on CXR that is masquerading as abdominal pain.

In conclusion, there are no national guidelines regarding the management of right lower quadrant pain but this article offers a solid foundation. Review Figure 3 on page page 240 for a roadmap on management of suspected appendicitis.

Reviewed by Fred Severyn

(27) Does this Patient Have Acute Cholecystitis?

Trowbridge RL, Rutkowski NK, Shojania KG.
JAMA. 2003 Jan 1;289(1):80-6.
Department of Medicine, University of California, San Francisco

Clinical Practice Review

Acute cholecystitis accounts for 3% to 9% of admissions for abdominal pain. The continuum of disease is broad with one end reflecting self limited pain associated with cholelithiasis and the other end consisting of biliary colic with associated fever and lab markers for inflammation and cholestasis. One of surgery's seminal texts, *Cope's Early Diagnosis of the Acute Abdomen* attempts to clarify several misconceptions. First, biliary colic is incorrect terminology since biliary obstruction actually results in a constant pain as opposed to an intermittent pain. Furthermore, biliary colic is just as likely to present as epigastric pain as it is to be located in the RUQ.

Ultrasound is the imaging study of choice with a sensitivity of 94% and a specificity of 78%. Sensitivity drops to 88% and specificity rises to 80% when one considers verification bias. Verification bias, also known as workup bias, refers to the fact that the gold standard test (surgical operation) may not be done as a result of the preliminary test (ultrasound). In other words, if patients with a negative ultrasound will rarely undergo surgery, one must account for the fact that there will be few false negative ultrasounds discovered since the patients are sent home rather than to the OR. In similar fashion, specificity increases. CT is inferior in diagnosing acute cholecystitis.

In constructing this review, 195 studies were reviewed and 17 were found to evaluate the role of lab tests and clinical exam in evaluating for acute cholecystitis. One conclusion was that no single clinical examination or lab finding had a negative likelihood ratio low enough to rule out cholecystitis if the finding was not present. Therefore, even in a patient without RUQ tenderness, cholecystitis cannot be definitively excluded from the differential. Only Murphy's sign had a positive likelihood ratio above 2.

Ultimately, there is no combination of laboratory tests and clinical findings that reliably predicts acute cholecystitis in the absence of ultrasound. The article specifically falls back on undifferentiated clinical gestalt in determining the likelihood of acute cholecystitis. The article concludes by deferring to the continued reliance on the combination of clinical exam and ultrasound in diagnosing acute cholecystitis.

Reviewed by Fred Severyn

(28) Management of cirrhosis and ascites.

Gines P, Cardenas A, Arroyo V, Rodes J.
N Engl J Med. 2004 Apr 15;350(16):1646-54.
Barcelona, Beth Israel

Clinical Practice Review

Cirrhosis was the 12th leading cause of death in 2000 with hepatitis C and alcohol as the major etiologies. The pathophysiology of ascites is clearly explained in Figure 1 on page 1646. Cirrhosis leads to the development of portal hypertension which prompts the release of nitric oxide and other vasodilators into the splanchnic circulation. This vasodilatation eventually leads to decreased arterial pressure. As a result, sodium and fluid are retained resulting in fluid retention. The vasodilatation in the splanchnic bed in combination with portal hypertension leads to the extravasation of fluid allowing for the accumulation of fluid in the abdominal cavity. Advanced disease leads to the impairment of renal free water excretion and a dilutional hyponatremia – otherwise known as the hepatorenal syndrome.

Ascites serves as a prognostic indicator since less than half of patients with ascites will survive more than five years. Numerous studies have favorably compared large volume paracentesis to aggressive diuresis. If diuretics are used, amiloride and spironolactone are first line agents since they quickly achieve a negative sodium balance but overdiuresis leads to prerenal renal failure.

Paracentesis is a relatively safe procedure but a couple of points should be considered. First, plasma expanders should be used with high volume paracentesis. Failure to do this increases the rate of recurrence, the risk of hepatorenal syndrome, and the incidence of dilutional hyponatremia. Albumin, while expensive, is considered the agent of choice when more than 5 liters of fluid are extracted. Furthermore, having removed the fluid, the patient should be placed on diuretics at discharge to avoid rapid recurrence of the ascites. Many patients present with alterations in their INR or platelets. Most studies looking at the safety of paracentesis use a cutoff of INR < 1.6 and platelets > 50,000. The incidence of bleeding complications is rare. While patients may still be candidates for paracentesis with values that exceed these numbers, there is scant literature regarding the incidence of bleeding in this population.

A common complication of ascites is spontaneous bacterial peritonitis (SBP). SBP is "spontaneous" because there is no obvious intra-abdominal source of infection – it is caused by the translocation of intestinal lumen bacteria to the abdominal lymph nodes. The most common organism is *E. Coli* which is effectively treated with a third generation cephalosporin. Prophylaxis against recurrent cases of SBP is often accomplished treated with long term fluoroquinolones or bactrim.

In up to 10% of liver failure patients, as cirrhosis progresses, arterial underfilling leads to severe vasoconstriction of the renal circulation which leads to renal failure – referred to as the hepatorenal syndrome. Tables 3 and 4 review the diagnosis and differentiation of Type 1 vs. Type 2 hepatorenal syndrome and review treatment options. Perhaps most important for ED physicians, SBP triggers Type 1 hepatorenal syndrome in up to 30% of cases so it is critical that we diagnose SBP.

Reviewed by Fred Severyn

(29) Clinical practice. Acute infectious diarrhea.

Thielman NM, Guerrant RL.
N Engl J Med. 2004 Jan 1;350(1):38-47.
Departments of Medicine, Duke University, Durham, NC; University of Virginia, Charlottesville, VA.

Clinical Practice Review

Diarrhea accounts for more than 900,000 hospitalizations in the United States annually. This number reflects just a small fraction of the overall incidence of diarrhea in the American population. In evaluating the patient with diarrhea, the ED physician should consider its severity, the need for rehydration, and the identification of possible causes. Almost half of all episodes of diarrhea last less than 24 hours. Unless the patient has evidence of blood or pus in the stool or is severely ill or immunocompromised, microbiologic studies are not warranted. A review of six studies shows that stool cultures establish a microbiologic diagnosis in 1.5% to 5.6% of cases. The cost per positive culture hovers around $1,000.

Special cases should be considered. A recent ingestion of shellfish should prompt the physician to consider V*ibrio* species while a recent hospitalization or course of antibiotics may suggest the diagnosis of *C. difficile*. A camper or traveler who drank untreated water and presents with diarrhea persisting beyond seven days may have giardia or cryptosporidium. HIV patients, particularly those with AIDS, should be evaluated for cryptosporidium, microsporidia, cyclospora, and isospora. Surveillance for MAC and cytomegalovirus should also be considered in HIV patients with diarrhea.

Rehydration is a mainstay of treatment and can be done via the oral route in all but the sickest patients. In children, the BRAT diet (bananas, rice, applesauce, and toast) with avoidance of milk products is often anecdotally recommended. However, the clinical evidence to suggest improvement on this regimen is limited.

Patients will ask what they can take to reduce the symptoms of diarrhea. While numerous preparations exist, only three agents – loperamide, kaolin, and bismuth subsalicylate – have been proven to be safe and effective in treating diarrhea. Loperamide is an antimotility agent which reduces discomfort and can actually shorten the course of illness in patients with traveler's diarrhea when used with antibiotics. However, antimotility agents are contraindicated in shigellosis (causes prolonged fever), *C. difficile* (can cause toxic megacolon), and shiga toxin producing *E. Coli* [causes Hemolytic Uremia Syndrome (HUS)] so if there is a question of bloody or inflammatory diarrhea, loperamide should not be used. No agents are recommended in kids due to a lack of data supporting it.

The article continues by discussing specific pathogens and therapies. Figure 1 on page 40 gives a recipe for a homemade oral rehydration therapy which you could offer to patients without funds to buy Gatorade or Pedialyte. Page 41 gives a great summary of management in table format. Table 1 on page 42 offers a laundry list of pathogens with common epidemiologic patterns and clinical features. Then Table 2 on page 43 goes through antibiotic regimens.

Shiga toxin producing *E. coli* infection can lead to the development of HUS. Consider this etiology in patients with bloody diarrhea who are afebrile. Suggestive history includes eating rare hamburger or seed sprouts. Antibiotics can actually *increase* the production of shiga toxin and lead to HUS so they should be avoided. This is not intuitive but important to remember.

Reviewed by Fred

(30) Gastroesophageal variceal hemorrhage.

Sharara AI, Rockey DC.
N Engl J Med. 2001 Aug 30;345(9):669-81.
American University of Beirut, Duke University

Clinical Practice Review

Variceal hemorrhage occurs in about 30% of patients with cirrhosis and up to 30% of initial variceal bleeds in these patients are fatal. A portion of this article is devoted to the prevention of varices as well as post-hemorrhage management. This summary will focus on the management of active hemorrhage.

In the setting of acute GI hemorrhage where varices are likely, rapid empiric pharmacologic therapy is indicated. The mainstay of this treatment is octreotide. This is a synthetic analogue of somatostatin and has been shown to stop variceal hemorrhage in up to 80% of patients. Vasopressin and nitroglycerin are other therapeutic options but their side effect profile is more significant so they are considered a second line therapy behind octreotide which has minimal side effects. The location of varices makes little difference in the acute treatment regimen but it is worth knowing that gastric varices often result in massive hemorrhage that is more difficult to control.

With octreotide on board, consult GI to arrange an emergent endoscopy. Sclerotherapy as well as banding are two options used by our GI colleagues in controlling acute hemorrhage. A Minnesota, or Blakemore, is a special variation of an NG tube that allows inflation of a balloon to tamponade the hemorrhage temporarily while more definitive therapy is arranged. Review the use of these tools since catastrophic complications can occur. Since this procedure is rare, a review can be found in chapter 42 of the fourth edition of *Roberts and Hedges.*

After the resolution of acute variceal hemorrhage, a TIPS procedure, sclerotherapy, or banding procedure may be indicated. One important point regarding TIPS procedures involves the possibility of patients returning to the ED post-procedure with an acute worsening of hepatic encephalopathy. The TIPS (or Transjugular Intrahepatic Portosystemic Shunt) involves the placement of a stent between a hepatic and portal systems. This essentially shunts blood away from its natural course through a cirrhotic liver. This can temporarily alleviate the hepatic venous pressure gradient and thus decrease the incidence of variceal hemorrhage. However, any remaining liver function is bypassed, thus exacerbating the potential for hepatic encephalopathy. Understanding this anatomy and the resulting physiologic effect is critical in evaluating TIPS patients.

Reviewed by Fred Severyn

(31) Intestinal ischemia.

Burns BJ, Brandt LJ.
Gastroenterol Clin North Am. 2003 Dec;32(4):1127-43.
Montefiore Medical Center, Albert Einstein College of Medicine

Clinical Practice Review

The classic presentation of intestinal ischemia is pain out of proportion to exam. Labs will often reveal an elevated WBC count and an elevated lactate. Always look for pneumatosis intestinalis on plain film or CT scan. Unfortunately, a patient with all of these findings has already sustained significant bowel infarction and will probably die from it. The presentation of intestinal ischemia can be much more subtle and in order to make a timely diagnosis, a high index of suspicion must be maintained.

Acute vascular compromise involves the small intestine much more commonly than the colon. This is secondary to the vascular anatomy of these respective organs. The superior mesenteric artery, and to a lesser extent, the celiac axis supply blood to the small intestine. The straight end arteries which penetrate the small intestine have no anastamoses to allow for redundant vascular supply.

While the pain out of proportion to exam is a classic finding known to most interns, the variability of presentation should be noted. A late presentation can obviously involve peritonitis. Conversely, a history of “abdominal angina”, often involving chronic pain for weeks or months prior to presentation can be elicited from many patients with acute intestinal ischemia. Other findings include occult blood in up to 75% of patients.

While late presentations may demonstrate evidence of “thumbprinting” or pneumatosis intestinalis, early presentations will often have no findings on plain film. A contrast CT of the abdomen may be helpful, but similar to other findings, early presentations often have normal or nonspecific results while late findings will demonstrate necrotic bowel.

In light of the above information, a high index of suspicion is important. Furthermore, the authors of this paper recommend mesenteric angiography should be the “mainstay of diagnosis”. They point to a mortality rate between 70% and 90% unless an early diagnosis is made. Angiography has a sensitivity between 74% and 100% and a specificity approaching 100%. Finally, they emphasize the ability to immediately treat with vasodilators or thrombolytic agents once the diagnosis has been made. The remainder of the article focuses on treatment regimens and specific presentations of thrombus or embolus.

Reviewed by Fred Severyn

(32) Clinical policy: neuroimaging and decisionmaking in adult mild traumatic brain injury in the acute setting.

Jagoda AS, Cantrill SV, Wears RL, et al.
Ann Emerg Med. 2002 Aug;40(2):231-49.
International Brain Injury Association (IBIA), Department of Emergency Medicine, Mount Sinai School of Medicine, New York, NY, USA.

Clinical Practice Guideline

Approximately one million people visit the ED annually for traumatic brain injury (TBI) with a vast majority being mild TBI (MTBI). TBI refers specifically to an injury to the brain itself and is not always clinically evident on physical examination. The Task Force for developing this clinical policy chose to focus on patients with MTBI who have a GCS of 15; although some national associations include a GCS of 13 to 15 in their definition of MTBI. The inclusion criteria for application of this clinical policy are age older than 15 years, a GCS score of 15 on initial evaluation in the ED, any period of posttraumatic LOC or of posttraumatic amnesia, and blunt trauma to the head within 24 hours of presentation to the ED. Exclusion criteria include presence of a bleeding disorder, penetrating trauma, patients with multisystem trauma, and focal neurologic findings.

- The use of a single GCS determination cannot be used solely in diagnosing MTBI. However, serial determinations are quite valuable.
- Skull film radiographs are not recommended in the evaluation of MTBI.
- A head CT scan is not indicated in those patients with MTBI who do not have headache, vomiting, age greater than 60 years, drug or alcohol intoxication, deficits in short-term memory, physical evidence of trauma above the clavicle, or seizure. This recommendation is based on the Haydel et al. study published in NEJM 2000.
- Patients with MTBI who present 6 hours after sustaining the injury, have a normal clinical examination, and who have a head CT scan that does not demonstrate acute injury can be safely discharged from the ED. Patients can be discharged after shorter period of observation if they are under the care of a responsible third party. (Class C recommendation).

Reviewed by Kurt Whitaker

(33) Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma. National Emergency X-Radiography Utilization Study Group.

Hoffman JR, Mower WR, Wolfson AB, Todd KH, Zucker MI.
N Engl J Med. 2000 Jul 13;343(2):94-9.
Emergency Medicine Center and the Department of Medicine, University of California, Los Angeles, CA.

Original Research

The National Emergency X-Radiography Utilization Study (NEXUS) was a multi-center prospective, observational study to validate five clinical criteria used to identify patients at low risk of having a cervical spine injury and thus not necessitating radiography.

- The five clinical criteria (NEXUS criteria) in order to be classified as having a low probability of injury include:
    1) No midline cervical tenderness.
    2) No focal neurological deficit.
    3) Normal alertness.
    4) No intoxication.
    5) No painful, distracting injury.
- The NEXUS criteria have a sensitivity of 99.0%, NPV 99.8%, specificity 12.9%, and PPV of 2.7%; thus these criteria are a useful screening tool.
- The NEXUS criteria identified all but 8 of the 818 patients who had cervical spine injuries.
- Of the 8 with cervical spine injuries, two of the patients met the preset definition of a clinically significant injury, and only one of these two patients received surgical treatment.
- The NEXUS criteria could have resulted in a 12.6% reduction in radiographic imaging.
- The NEXUS criteria identify patients who have an extremely low probability of injury via 5 clinical criteria, and thus may not need imaging studies.

Reviewed by Kurt Whitaker

(34) The Canadian C-spine rule versus the NEXUS low-risk criteria in patients with trauma.

Stiell IG, Clement CM, McKnight RD, et al.
N Engl J Med. 2003 Dec 25;349(26):2510-8.
Department of Emergency Medicine, University of Ottawa, Ottawa, Ont, Canada.

Clinical Practice Validation Study

The Canadian C-spine Rule (CCR) and the National Emergency X-radiography Utilization Study (NEXUS) Low Risk Criteria (NLC) are decision rules to guide the use of cervical-spine radiography in patients with trauma. This multi-center prospective cohort study performed in Canadian Emergency Departments compared the CCR and NLC rules.

- Of the 8283 patients, 169 (2.0%) had clinically important cervical-spine injuries.
- In 845 (10.2%) of the patients, physicians did not evaluate range of motion as required by the CCR algorithm and thus were deemed indeterminate cases.
- Excluding these indeterminate cases, the CCR was more sensitive than the NLC (99.4% vs 90.7%) and more specific (45.1% vs 36.8%) for injury.
- Including all patients with the assumption that the CCR was negative for all indeterminate cases, the sensitivity was 95.3% (p = 0.09 for the comparison with the NLC) and specificity 50.7% (p = 0.001).
- The CCR would have missed one patient and the NLC would have missed 16 patients with important injuries
- The CCR is superior to the NLC with respect to sensitivity and specificity for cervical-spine injury when the full CCR is performed.

Reviewed by Kurt Whitaker

(35) Spinal cord injury without radiographic abnormality: results of the National Emergency X-Radiography Utilization Study in blunt cervical trauma.

Hendey GW, Wolfson AB, Mower WR, et al.
J Trauma. 2002 Jul;53(1):1-4.
University of California San Francisco-Fresno, CA.

Original Research

Spinal cord injury without radiographic abnormality (SCIWORA) syndrome was first coined in 1982 and since has been commonly thought to occur primarily in children based mostly on retrospective case series. SCIWORA for this study was defined as the presence of spinal cord injury, as shown by MRI, when a complete and technically adequate plain radiographic series consisting of at least 3 views revealed no fracture or subluxation. This was a multi-center prospective, observational study of blunt trauma patients undergoing, at minimum, a standard 3-view plain cervical radiograph with the purpose to determine the incidence and characteristics of SCIWORA. The study used the database of the National Emergency X-Radiography Utilization Study (NEXUS).

- Of the 34,069 patients, there were 818 (2.4%) with cervical spinal injury, including 27 (0.08%) patients with SCIWORA.
- All 27 SCIWORA patients had at least one of the five NEXUS criteria documented as being present; thus, the NEXUS criteria had 100% sensitivity for SCIWORA.
- Sixteen of the 27 (59%) SCIWORA patients had a focal neurologic deficit.
- Over 3000 children were enrolled, including 30 with cervical spine injury, but none had SCIWORA**.**
- The most common MRI findings among SCIWORA patients were central disc herniation, spinal stenosis, and cord edema or contusion.
- Using the NEXUS cohort, SCIWORA was an uncommon disorder and occurred only in adults.

Reviewed by Kurt Whitaker

(36) Prospective comparison of admission computed tomographic scan and plain films of the upper cervical spine in trauma patients with altered mental status.

Schenarts PJ, Diaz J, Kaiser C, Carrillo Y, Eddy V, Morris JA Jr.
J Trauma. 2001 Oct;51(4):663-8
Department of Surgery, Trauma Patient Care Center, Vanderbilt University Medical Center, Nashville, TN.

Original Research

The Eastern Association of the Surgery of Trauma (EAST) developed a practice guideline in 1998 in which CT scan of the upper cervical spine is used to evaluate patients with altered mental status for possible cervical spine injury. The purpose of this prospective, unblinded study was to prospectively evaluate the EAST guidelines in patients with blunt trauma. For the 1,356 patients who met inclusion criteria, a CT of the upper cervical spine (occiput to C3 [Co-C3]) and five-view cervical spine plain films were performed.

- 70 patients (5.2%) had a total of 95 injuries to the upper cervical spine.
- CT scan of Co-C3 identified 67 of 70 patients.
- Plain films identified 38 of 70 patients with injuries to the upper cervical spine.
- Three patients had false-negative CT scans of Co-C3, and one patient was quadriplegic.
- Three patients had injuries missed by CT scan that were identified by a plain radiograph series.
- 32 patients had false-negative plain films, including 4 patients with motor deficits.
- The most commonly missed fractures were to C2 and consisted of fractures to the vertebral body.
- No injury of the upper cervical spine was missed by both plain film series and CT scan.
- CT scan of Co-C3 was superior to plain films in the early identification of upper cervical spine injury.
- Plain films failed to identify 45% of upper cervical spine injuries; four of these missed injuries resulted in motor deficits.

Reviewed by Kurt Whitaker

(37) Clinical policy: Critical issues in the evaluation of adult patients presenting to the emergency department with acute blunt abdominal trauma.

ACEP Clinical Policies Committee; Clinical Policies Subcommittee on Acute Blunt Abdominal Trauma.
Ann Emerg Med. 2004 Feb;43(2):278-90.

Clinical Practice Guideline

Blunt abdominal trauma (BAT) is the leading cause of morbidity and mortality among adults and pediatric trauma victims. Physical examination is inaccurate for patients with altered mental status. In a large prospective study, abdominal tenderness was absent in 19% of BAT patients with intra-abdominal injuries. For this clinical policy, a MEDLINE search for articles published between January 1966 and June 2002 was performed to obtain the relevant articles. All articles were then classified based on the design of the study and reports were graded. Level A, B, and C recommendations are “generally accepted principles”, “reflect moderate clinical certainty”, and are contain “preliminary, inconclusive, or conflicting evidence” based on the panel consensus, respectively. Below is a list of answers to the specific critical questions addressed in the clinical policy and the final consensus summary statement.

- CT is ineffective in diagnosing diaphragmatic, pancreatic, and bowel injuries (Level B recommendation).
- Oral contrast as preparation for a CT scan is not essential to the evaluation of blunt abdominal trauma (Level B recommendation).
- The FAST is useful as an initial screening examination to detect hemoperitoneum in blunt abdominal trauma patients (Level B recommendation).
- Diagnostic peritoneal lavage (DPL) can be used to exclude hemoperitoneum in BAT patients. DPL does not define the extent of injury, has a 1% to 2% complication rate, and may lead to non-therapeutic laparotomies. (Level B recommendation).
- On the basis of consensus and current practice patterns, the initial choices for the evaluation of BAT are CT and FAST, depending on the patient’s hemodynamic stability.

Reviewed by Kurt Whitaker

(38) Admission or observation is not necessary after a negative abdominal computed tomographic scan in patients with suspected blunt abdominal trauma: results of a prospective, multi-institutional trial.

Livingston DH, Lavery RF, Passannante MR, Skurnick JH, Fabian TC, Fry DE, Malangoni MA.
J Trauma. 1998 Feb;44(2):273-80
Department of Surgery, New Jersey Medical School, Newark, NJ.

Original Research

This was a prospective, multi-center study evaluating all patients with blunt abdominal trauma (BAT) suspected by either physical examination or mechanism of injury. The protocol used was physical examination in the emergency department (with serial examinations at 4 and 8 hours), followed by abdominal CT, followed by hospitalization for observation. Outcomes were measured at 20 hours and at discharge and included clinical deterioration, the need for laparotomy, and death.

- Of the 2,774 patients who met inclusion criteria, 2,299 fulfilled the entire study protocol.
- CT scan was negative in 1,809 patients, positive for organ injury or abdominal free fluid in 389 patients, and nondiagnostic in 78 patients.
- 61% of patients had abdominal tenderness or bruising, but only 22% had a positive CT scan.
- 19% of patients with a positive CT scan had no tenderness.
- The negative predictive value of an abdominal CT based on the preliminary reading and as defined by the findings of subsequent laparotomy in the population fully satisfying the protocol was 99.63%.
- Abdominal tenderness is not predictive of an abdominal injury.
- Patients with a negative CT scan after suspected BAT do not benefit from hospital admission or prolonged observation.

Reviewed by Kurt Whitaker

(39) Clinical policy for children younger than three years presenting to the emergency department with fever.

American College of Emergency Physicians Clinical Policies Committee; American College of Emergency Physicians Clinical Policies Subcommittee on Pediatric Fever.
Ann Emerg Med. 2003 Oct;42(4):530-45.

Clinical Practice Guideline

Fever is defined as a rectal temperature greater than 38° C (>100.4°F). This policy applies to previously healthy term infants and children between the ages of 1 day and 36 months with exclusion of high-risk children. These guidelines address eight critical questions as outlined below.

- Are there useful age cutoffs for different diagnostic and treatment strategies in febrile children?
  Infants between 1 and 28 days old with a fever should be presumed to have a serious bacterial infection (SBI) and need a septic work-up. There are identifiable infants aged less than 90 days with low risk for developing SBI, as evidence by the "Rochester" and "Philadelphia" criteria, thus making this a useful age cut-off.
- Does a response to antipyretic medication indicate a lower likelihood of serious bacterial infection in the pediatric patient with a fever?
  A response to antipyretic medication does not change the likelihood of a child having SBI and should not be used for clinical decisionmaking.
- What are the indications for a chest radiograph during the workup of pediatric fever?
  A CXR should be obtained in febrile children younger than 3 months of age with evidence of acute respiratory illness (Level B recommendation). There is insufficient evidence to determine when a CXR is required in a febrile child older than 3 months, yet consider a CXR with a temperature > 39° C (> 102.2° F) and a WBC count greater than 20,000/mm^3 in conjunction with acute respiratory findings (Level C recommendation).
- Which children are at risk for UTI?
  All children younger than one year with fever without a source should be considered at risk for UTI (Level A recommendation). Females between 1 and 2 years old presenting with fever without a source should be considered at risk for having a UTI (Level B recommendation).
- What are the best methods for obtaining urine for urinalysis and culture?
  Urethral catheterization or suprapubic aspiration are the best methods for diagnosing UTI (Level B recommendation).
- What is the appropriate role of urinalysis, microscopy, and urine cultures?
  Obtain a urine culture in conjunction with other urine studies when UTI is suspected in a child aged younger than 2 years because a negative dip-stick or urinalysis result in a febrile child does not always exclude UTI (Level B recommendation).
- What is the prevalence of occult bacteremia in children aged 3 to 36 months, and how frequently does it result in significant sequelae?
  The current prevalence of occult bacteremia among febrile children aged 3 to 36 months is most likely between 1.5% and 2%. Preliminary studies indicate that approximately 5% to 20% of patients aged 3 to 36 months with occult bacteremia will develop significant sequelae. Approximately 0.3% of previously well children (aged 3 to 36 months) who have a fever without source will develop significant sequelae; however, only 0.03% will develop sepsis or meningitis. These studies are pre-Prevnar and some are pre-HIB so current rates are probably lower.
- What is the appropriate role of empiric antibiotics among previously healthy, well-appearing children aged 3 to 36 months with fever without a source?
  Consider empiric antibiotic therapy for previously healthy, well-appearing children, aged 3 to 36 months, with fever without a source with a temperature of 39.0°C or greater (>102.2°F) when in association with a WBC count of 15,000/mm^3 or greater if obtained (Level B recommendation.) In those cases when empiric antibiotics are not prescribed for children who have fever without a source, close follow-up must be ensured (Level C recommendations.) This recommendation is based on data from the post-HIB era; however, there are no studies yet available looking at the post-pneumococcal vaccination (post-Prevnar) era.

Reviewed by Genie Roosevelt

(40) Evaluation and management of febrile seizures in the out-of-hospital and emergency department settings.

Warden CR, Zibulewsky J, Mace S, Gold C, Gausche-Hill M.
Ann Emerg Med. 2003 Feb;41(2):215-22.
Department of Emergency Medicine, Oregon Health & Science University/Doernbecher Children's Hospital, Portland, OR.

Clinical Practice Review

Febrile seizures are the most common seizures seen in the pediatric population in the ED setting. This review discusses the risk of recurrent febrile seizures, indications for an lumbar puncture (LP) and neuroimaging (CT head or EEG), and the ED evaluation and management. This article also reflects the recommendations of the American Academy of Pediatrics as outlined in their most recent practice parameter from 1996.

- Risk of recurrent febrile seizures: (1) < 12 months of age, (2) temperature < 40° C on presentation, (3) < 24 hour duration of fever, (4) family history of febrile seizures, (5) complex seizure with first febrile seizure.
- Consider an LP when: (1) < 18 months of age and first febrile seizure, (2) abnormal appearance or mental status after the post-ictal period, (3) any physical signs of meningitis, (4) any complex features, (5) any slow postictal clearance of mentation, (6) pretreatment with antibiotics.
- Physical exam is more reliable in children older than 18 months of age, thus an LP can be deferred in the absence of signs or symptoms of CNS infection.
- A non-contrasted CT of the head is indicated if the physician is unable to exclude increased ICP based on the physical exam (papilledema, obtundation, “sunsetting” ocular motility), presence of status epilepticus or a complex febrile seizure, evidence of trauma, or CSF shunt is in place.
- EEG does not need to be performed in the evaluation of a neurologically healthy child with a first simple febrile seizure.
- Cooling measures and antipyretic administration have not been shown to decrease the initial occurrence or recurrence of febrile seizures.
- Check a blood glucose in all patients with persistent altered level of consciousness. Consider checking electrolytes if there is any evidence of significant dehydration, altered level of consciousness, diabetes, or other metabolic disorders.
- Treat with a benzodiazepine as first line therapy for any seizure lasting longer than 5 minutes.

Reviewed by Genie Roosevelt

(41) A randomized trial of a single dose of oral dexamethasone for mild croup.

Bjornson CL, Klassen TP, Williamson J, Brant R, Mitton C, Plint A, Bulloch B, Evered L, Johnson DW; Pediatric Emergency Research Canada Network.
N Engl J Med. 2004 Sep 23;351(13):1306-13.
Department of Pediatrics, University of Calgary, Calgary, Alta., Canada.

Original Research

The objectives of this study were to determine whether one dose of oral dexamethasone treatment of mild croup would reduce the incidence of a return to a medical care provider for croup and the associated economic costs. This was a multicenter, randomized, double-blind, placebo-controlled trial performed at four pediatric emergency departments in Canada in which 720 children with mild croup were randomly assigned to receive one oral dose of either dexamethasone (0.6 mg per kilogram of body weight, to max dose of 20 mg) or placebo. Mild croup, or acute laryngotracheobronchitis, was defined using a validated croup scoring system which effectively defined patients with mild symptoms, specifically, the presence of a barking cough, no audible stridor at rest, and mild or no indrawing of the chest wall. Return to medical care was significantly lower in the dexamethasone group (7.3% vs 15.3%, $p < 0.001$). The average savings was 21 Canadian dollars ($p = 0.01$) per case when treated with dexamethasone. Secondary measures demonstrated that in the dexamethasone group, there was quicker resolution of croup symptoms, less lost sleep, and less stress on the part of the parent. Interestingly, among the 720 patients studied, there were no significant sequelae, aside from seven patients later diagnosed with pneumonia (three in the dexamethasone group).

Reviewed by Genie Roosevelt

(42) Pharmacologic treatment of bronchiolitis in infants and children: a systematic review.

King VJ, Viswanathan M, Bordley WC, Jackman AM, Sutton SF, Lohr KN, Carey TS.
Arch Pediatr Adolesc Med. 2004 Feb;158(2):127-37
Cecil B. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, Chapel Hill, NC.

Clinical Practice Review

This review article analyzed 44 randomized controlled trials (RCTs) of commonly used interventions for RSV bronchiolitis, including epinephrine, beta-2-agonist bronchodilators (albuterol and salbutamol), corticosteroids, and ribavirin. This was intentionally not a formal meta-analysis. The authors point out that the heterogeneity introduced by study differences (such as drug doses used, duration of therapy, etc.) would make a formal meta-analysis inappropriate and misleading.

Overall, little evidence supports a routine role for any of these drugs in treating patients with bronchiolitis. Nevertheless, this article's recommendations are in agreement with the American Academy of Pediatrics Committee on Infectious Diseases about the treatment for RSV bronchiolitis in the 2003 Red Book. The committee recommends supportive care as needed, including hydration, supplemental oxygen, and mechanical ventilation as the primary treatment modalities for bronchiolitis. None of the treatments listed below have definitively been found to be effective.

- Nebulized epinephrine use was reviewed in 8 RCTs, yet most outcomes reported (better clinical scores immediately after initial treatment) were short term. One small study demonstrated a reduction in the length of hospitalization and another found a decreased rate of hospital admissions but these findings have not been duplicated despite multiple subsequent studies.
- Beta-2-agonist bronchodilator use was reviewed in 13 RCTs, with eight of them reporting no significant difference between need for or length of hospitalization versus placebo. Most studies showed short-term clinical improvements, yet one showed worsening hypoxia.
- Systemtic corticosteroids was reviewed in 5 RCTs and the authors' found inconclusive evidence that they offer any benefit in terms of rates and duration of hospitalization, nor did they find benefit when examining surrogate outcomes, such as clinical scores.
- Inhaled corticosteroids were reviewed in 6 RCTs, with two studies showing longer term clinical worsening of symptoms in the inhaled budesonide group.
- Ribavirin use was reviewed in 10 RCTs and in four of five studies looking at primary outcomes of interest (days of hospitalization, length of time that a child required more intensive supportive interventions, and duration of illness) found no significant differences with ribavirin treatment compared with placebo.

Reviewed by Genie Roosevelt

(43) Community-acquired pneumonia in children.

McIntosh K.
N Engl J Med. 2002 Feb 7;346(6):429-37.
Division of Infectious Diseases, Children's Hospital, Boston, MA 02115, USA.

Clinical Practice Review

This was a review article discussing the etiology, diagnosis, and treatment of community-acquired pneumonia (CAP) in children. The most common causes of CAP in otherwise healthy children include viral, *Mycoplasmia pneumoniae*, *Chlamydia* (*C. trachomatis*, *C. pneumoniae*), and bacteria (*Streptococcus pneumoniae*.) The lack of an etiologic gold standard makes the microbiologic diagnosis of CAP in children difficult. The classic typical (i.e., bacterial) vs atypical (i.e., viral or mycoplasmal) pneumonia differentiation has proven to be ineffective. However, the cause of pediatric pneumonia in relation to clinical or epidemiologic findings, the signs and symptoms (conjunctivitis, otitis media, and wheezing were found more frequently in viral) were surprisingly uniform throughout the etiologic spectrum. As in adults, CXR cannot be used to differentiate between viral and bacterial disease. Non-microbiologic laboratory tests (i.e., WBC, ANC, CRP) also cannot differentiate between viral and bacterial disease. Unlike in the treatment of pneumonia in adults where official treatment recommendations are made, CAP in children still lacks treatment guidelines for the United States. Canada however has developed a consensus statement of the treatment of CAP. This article summarizes the outpatient and inpatient treatment recommendations for CAP in children.

- Localized chest pain usually signifies pleural irritation which usually represents bacterial etiology.
- Wheezing in a child with pneumonia is likely to be a viral, *M. pneumoniae*, or *C. pneumoniae* infection.
- CXR is useful to confirm the diagnosis of pneumonia, although is not helpful to distinguish between bacterial and viral.
- CAP in infants ages birth to 20 days all should be admitted, and receive ampicillin and gentamycin +/- cefotaxime.
- CAP in infants ages 3 weeks to 3 months should be admitted if febrile or hypoxic.
- CAP in children ages 4 months to 4 years can be treated with high-dose oral amoxicillin (80 to 100 mg/kg/day) as an outpatient.
- CAP in children ages 5 to 15 years can be treated with oral erythromycin or azithromycin as an outpatient. Consider doxycycline in children older than 8 years of age.

Reviewed by Genie Roosevelt

(44) The infant with acute, unexplained, excessive crying.

Poole SR.
Pediatrics. 1991 Sep;88(3):450-5
Department of Pediatrics, University of Colorado School of Medicine, Denver.

Original Research

This study described 56 infants who presented to the ED during a one-year period with an episode of excessive, prolonged crying without fever and without a cause that was apparent to the parents. Parents were interviewed by phone 48 hours after the initial ED visit for follow-up to ensure serious diagnoses were not missed. Of the final diagnoses, 61% were considered serious. Of that 61%, the history suggested the diagnosis in 20% while the physical exam was critical in the other 41%. The clinician's evaluation should include a careful skin exam in an unclothed child, palpation of all long bones, fluorescein staining of the cornea, eversion of eyelids, rectal exam, and through neurologic examination. "Screening" laboratory tests, except for urinalysis and urine culture, were of little value. Of note, those infants who cease crying before or during the initial assessment are unlikely to have a serious cause. There was a subgroup of infants (18%) with acute, excessive, unexplained crying for whom the crying represents a single, transient event which resolved without sequelae.

Reviewed by Genie Roosevelt

(45) The management of minor closed head injury in children.

Committee on Quality Improvement, American Academy of Pediatrics. Commission on Clinical Policies and Research, American Academy of Family Physicians.
Pediatrics. 1999 Dec;104(6):1407-15.

Clinical Practice Guideline

This AAP practice parameter is specifically intended for previously neurologically healthy children of either sex two through 20 years of age with isolated minor closed head injury (CHI). This parameter is not intended for victims of multiple trauma, for children with unobserved loss of consciousness (LOC), or for patients with known or suspected cervical spine injuries, a history of bleeding diathesis, pre-existing neurologic disorder, suspected intentional head trauma, or presence of drugs or alcohol. This parameter only addresses patients without LOC or with brief LOC (< 1 minute) and does not address patients with a history of LOC of longer duration.

- Recommended evaluation and treatment of the child with minor CHI and no LOC include observation, either in an ED, office, or home with a competent adult and no imaging is recommended.
- Recommended evaluation of the child with minor CHI and brief LOC (< 1 min) include observation or neuroimaging (i.e., CT head). There are no published studies available for review that compared clinically meaningful outcomes between children receiving neuroimaging versus observation.
- Patients may then be discharged from the hospital for observation by a reliable observer if the postinjury CT scan is interpreted as normal.

Reviewed by Genie Roosevelt

(46) Development and validation of a multivariable predictive model to distinguish bacterial from aseptic meningitis in children in the post-Haemophilus influenzae era.

Nigrovic LE, Kuppermann N, Malley R.
Pediatrics. 2002 Oct;110(4):712-9.
Department of Medicine, Children's Hospital and Harvard Medical School, Boston, Massachusetts.

Clinical Practice Validation Study

The objective of this study was to develop and validate a simple multivariable model to distinguish bacterial meningitis from aspectic meningitis in children using objective parameters available at the time of patient presentation. Of the 696 previously healthy children aged 29 days to 19 years, 456 patients were used for the derivation set. A Bacterial Meningitis Score (BMS) was developed by attributing 2 points for a positive gram stain and one point for CSF protein > 80 mg/dL, peripheral ANC > 10,000 cells/mm^3, seizure at or before presentation, and CSF ANC > 1000 cells/mm^3. The BMS was then applied to a separate group of 240 patients prospectively. The negative predictive value of a score of 0 for bacterial meningitis was 100%, while a BMS > 2 predicted meningitis with a sensitivity of 87%, when applied to the validation set of patients. However, when the BMS was applied to the entire data set, the BMS misclassified only 3.3% of the patients. Of all patients with a BMS = 0 in the derivation and validation data sets, 2 of 404 patients actually had bacterial meningitis. The authors' point out that because patients with aseptic meningitis who were pretreated were excluded from the analysis, this model should not be applied to patients who have received systemic antibiotics within 72 hours of LP. This prediction rule needs to be validated prospectively on a separate population. If this is done, alike children with low risk for SBI and children with BMS scores of 0 could conceivably be followed as outpatients, perhaps after the administration of a long-acting parenteral antibiotics and immediate next-day follow-up.

Reviewed by Genie Roosevelt

(47) Oral versus initial intravenous therapy for urinary tract infections in young febrile children.

Hoberman A, Wald ER, Hickey RW, et al.
Pediatrics. 1999 Jul;104(1 Pt 1):79-86
Department of Pediatrics, University of Pittsburgh School of Medicine and Children's Hospital of Pittsburgh, Pittsburgh, Pennsylvania.

Original Research

Recent use of nuclear scans has indicated that the majority of febrile young children with UTI have pyelonephritis, putting them at risk for renal scarring and possible long-term sequelae of hypertension and chronic renal failure. Most pediatric textbooks and review articles recommend that young children be hospitalized, at least initially, to receive IV antibiotics for acute pyelonephritis. This multi-center, randomized clinical trial evaluated the efficacy of oral versus initial IV therapy in 306 children 1 to 24 months old with fever and UTI, in terms of short-term clinical outcomes (sterilization of the urine and defervesence) and long-term morbidity (incidence of reinfection and incidence and extent of renal scarring documented at 6 months by 99mTc-dimercaptosuccinic acid renal scans). Children received either oral cefixime for 14 days or initial IV cefotaxime for 3 days followed by oral cefixime for 11 days. There was no significant difference between the groups in terms of short-term outcomes or long-term morbidity. Both groups had a mean extent of scarring of approximately 8%. Mean costs were at least twofold higher for children treated IV compared with those treated orally. Oral cefixime is a safe, effective treatment for UTI in young febrile children.

Reviewed by Genie Roosevelt

(48) Screening for urinary tract infection in infants in the emergency department: which test is best?

Shaw KN, McGowan KL, Gorelick MH, Schwartz JS.
Pediatrics. 1998 Jun;101(6):E1
Department of Pediatrics, Children's Hospital of Philadelphia, PA

Original Research

This was a cross-sectional study conducted prospectively in an urban children's hospital ED. The clinical practice in their ED was to obtain urine cultures on boys < 1 year of age and girls < 2 years of age by urethral catheterization if they did not have a definite source for their fever (>38.3˚C) or did have UTI symptoms. The enhanced UA (WBC count plus Gram stain) has been proposed as being a more sensitive method for detecting UTI in young children and as a screen to eliminate cultures. The goals of this study were to (1) provide a prospective comparison of the rapid screening tests' abilities (urine dipstick, a combination of dipstick and microscopy, enhanced UA, and gram stain alone) to detect UTI in a sample of young children in their ED; and (2) compare the test costs and outcomes of three possible screening strategies for UTI (bedside dipstick and culture for all; enhanced UA for all, culture positive results only; and urine cell count for all, culture +/- Gram stain positive results only.) They obtained data for 3,873 infants less than 2 years of age who had a urine culture obtained in the ED by urethral catheterization. Results showed that the enhanced UA was most sensitive at detecting UTI (94%) but had more false-positive results (16%) than the urine dipstick or gram stain (3%). The most cost-effective strategy was to perform cultures on all infants and begin presumptive treatment on those whose dipstick had at least moderate (2+) leukocyte esterase or positive nitrite at a cost of $3.70 per child. This strategy identified all infants with UTI. The authors' note that their practice of performing a microscopic UA on all urine specimens that are positive on dipstick study does not appear to have any advantage over dipstick alone for screening for UTI in their ED. While the enhanced UA continues to be promoted by some clinicians, the logistics of implementing this in standard laboratory practice has been difficult.

Reviewed by Genie Roosevelt

(49) Enteral vs intravenous rehydration therapy for children with gastroenteritis: a meta-analysis of randomized controlled trials.

Fonseca BK, Holdgate A, Craig JC.
Arch Pediatr Adolesc Med. 2004 May;158(5):483-90.
Department of Paediatrics, St George Hospital, New South Wales, Australia.

Meta-analysis

This was a meta-analysis of sixteen randomized controlled trials involving 1,545 children that compared the relative efficacy and safety of enteral vs intravenous rehydration therapy in treatment of childhood gastroenteritis. The authors analyzed data on length of hospital stay, weight gain, duration of intestinal losses, quanitity of intestinal losses, failure rates, and major adverse events. Enteral rehydration by oral or nasogastric route is associated with fewer major adverse events and a shorter hospital stay. The failure rate of enteral therapy was only 4.0%. As with the American Academy of Pediatrics Practice parameter on management of acute gastroenteritis in young children published in 1996, this meta-analysis supports the first line treatment of oral rehydration therapy for acute gastroenteritis in children. The major shortcoming of this study was the implicit limitation of a meta-analysis and lack of subgroup comparisons (by age, nutritional status, severity of dehydration, and presence of electrolyte abnormalities.)

- Oral rehydration had significantly fewer major adverse events (seizure, death).
- Oral rehydration had a significant reduction in length of hospital stay (mean of 21 hours).
- There was no identifiable difference in treatment effect when comparing oral with IV over oral with nastogastric rehydration.
- There was no difference in weight gain between the 2 groups.
- There was no consistent association between recovery from diarrhea (as measured by duration of diarrhea and volume of stool output) and type of rehydration therapy across studies.
- The overall failure rate of enteral therapy was 4.0%.
- Conclusion: There is no evidence to support ongoing use of IV therapy for the first line management of most cases of childhood gastroenteritis.

Reviewed by Genie Roosevelt

(50) Acute renal failure.

Thadani R, Pascual P, Boventre JV.
NEJM. 1996 May 30;334(22):1448-57.
Department of Medicine and Renal Unit, Massachusetts General Hospital, Boston, MA.

Clinical Practice Review

This article provides an overview as to what was known at that time as to the causes and treatments of acute renal failure. This was a "best opinion" paper, with no research methodology.

- There is no formal definition of acute renal failure, but commonly used criteria include an increase in serum creatinine > 0.5 mg/dL from baseline.
- Renal failure causes can be divided into three categories: pre-renal, intrinsic renal (glomerular, tubular, interstitial), and post-renal (obstructive). Prerenal is the most common community cause of renal failure.
- Non-oliguric renal failure (> 400 cc of urine per day) has a better prognosis than oliguric renal failure (< 400 cc per day)
- The workup of acute renal failure includes a good history and physical exam, with a focus on medications, recent procedures, or physical findings of volume depletion. Additional studies include urine evaluation (including indexes such as urine osmolality, sodium concentration, and FENA, BUN, Cr) and evaluation for obstruction, such as ultrasound.
- The initial management of ARF is aimed at reversing the inciting cause; overall, volume replacement is considered the most effective prophylactic strategy. Electrolyte imbalances should be corrected.
- Mannitol and loop diuretics may convert oliguric into non-oliguric renal failure, but no evidence exists for an improved outcome in *these* particular cases.
- The main difference between continuous veno-venous hemodialysis (CVVHD) and intermittent hemodialysis (HD) is that with CVVHD there is less change in fluid balances, decreased hemodynamic instability, and an enhanced possibility of removing cytokines. Drawbacks are prolonged anticoagulation and intensive monitoring.
- Patients with acute renal failure who do not have pre-renal, post-renal, or ischemic/toxin-mediated intrinsic renal causes may benefit from a renal biopsy.

Reviewed by Ravi Morchi

(51) Hyponatremia.

Androgue HJ, Madias NE.
NEJM. 2000 May 25;342 (21):1581-89.
Baylor College of Medicine, Houston, TX.

Clinical Practice Review

This article is a two author review of hyponatremia, with no research methodology noted.

- Hyponatremia is defined as a serum sodium of less than 136 mmol/L; the most common form is dilutional hyponatremia, secondary to water retention. The three categories are based on tonicity: low, normal, and high. Each have separate causes that should direct acute management.
- Hypertonic hyponatremia is most commonly associated with hyperglycemia, where a rise in serum glucose of 100 mg/dL) corresponds to a decrease in serum sodium concentration of 1.7 mmol/L.
- The major categories of hypotonic hyponatremia are based on volume status: hypervolemic (hepatic disease, renal disease, CHF), hypovolemic (poor intake, GI losses, insensible losses, diuretics), and euvolemic (excessive water intake or impaired free water excretion).
- The clinical effects of hyponatremia are due to brain edema and increased intracranial pressure; typical complaints include lethargy, headache, nausea, vomiting, muscle cramps, seizures, coma, and death.
- Symptomatic hyponatremia in the euvolemic or hypovolemic state should initially be treated with hypertonic saline for a calculated rise in serum sodium of 1-2 mmol/liter/hour until symptoms begin to improve. At that point, the approach to treatment can be changed based on the volume status (below) and the rate of correction can be reduced to avoid osmotic demyelination.
- Asymptomatic euvolemic hyponatremia from excessive water intake (primary polydypsia in adults, or dilute formula/tap water enemas in children) or impaired free water excretion (adrenal dysfunction, thyroid dysfunction, SIADH) can be treated by free water restriction, sodium tablets, and (when needed) attention to endocrine issues.
- Asymptomatic hypovolemic hyponatremia can be treated with normal saline.
- Asymptomatic hypervolemic hyponatremia can be treated by free water and sodium restriction while addressing the underlying organ dysfunction.
- Loop diuretics (furosemide) can be used to help excrete free water in excess of sodium, thereby raising the serum sodium concentration, in certain clinical circumstances.

Reviewed by Ravi Morchi

(52) Oral agents for the treatment of type 2 diabetes mellitus: pharmacology, toxicity, and treatment.

Harrigan RA, Nathan MS, Beattie P.
Ann Emerg Med. July 2001;38:68-78.
Division of Emergency Medicine, Temple University Hospital, Philadelphia, PA.

Clinical Practice Review

Diabetes is characterized by the overproduction and underutilization of glucose (predominantly through resistance to and underproduction of insulin). This article reviews oral agents available for the treatment of diabetes and examines their mechanism of action as well as complications associated with their use.

Sulfonylureas: examples Diabinase (Chlorpropamide), Glucatrol (Glipizide), Micronase (Glyburide), and Amaryl (Glimepiride)

- Mechanism of action (MOA): increase insulin secretion (through stimulating pancreatic beta cells) and enhance insulin activity (by inhibiting ATP dependent potassium channels, which leads to release of stored insulin in cells).
- Toxicity: hypoglycemia (severe); Chlorpropamide is also associated with hyponatremia.

Biguanides: examples Glucophage (metformin)

- MOA: decreases hepatic production and intestinal absorption of glucose, in addition to increasing insulin sensitivity (anti-hyperglycemic, NOT hypoglycemic agent).
- Toxicity: lactic acidosis, which occurs more often with renal insufficiency, cardiac or pulmonary insufficiency, liver disease, use of contrast agents, alcohol abuse, or with a history of lactic acidosis; other side effects include nausea, vomiting, and diarrhea.

Alpha-glucosidase inhibitors: examples Precose (acarbose), Glyset (miglitol)

- MOA: competitively and reversibly inhibit alpha-glucosidase, a brush border enzyme in the intestine. There is a subsequent decrease in the amount of carbohydrate absorbed, resulting in a decrease in hyperinsulinism.
- Toxicity: predominantly GI symptoms secondary to an increase in unabsorbed sugars; nausea, abdominal bloating, diarrhea.
- Hypoglycemia treatment: Oral glucose (sucrose will not be broken down).

Thiazolidinediones: examples Avandia (rosiglatazone) and Actos (pioglitazone)

- MOA: thought to enhance the effect of insulin in peripheral tissues and in the liver without enhancing insulin secretion; exact mechanism unknown.
- Toxicity: cases of hepatotoxicity reported with another precursor, but no definitive reports currently.

Benzoic Acid derivatives: example Prandin (repaglinide)

- MOA: binds to ATP mediated potassium channels on pancreatic beta cells which decreases insulin levels with resulting increased insulin sensitivity.
- Toxicity: hypoglycemia.

When treating hypoglycemic episodes, general supportive treatment is the mainstay (ABCs, airway protection). Administer glucose intravenously to correct initial hypoglycemia and consider charcoal administration to prevent further absorption of hypoglycemic agents. For children with unintentional ingestion of hypoglycemic agents, conservative therapy of monitoring for 8 hours without administration of glucose is recommended. Other agents for severe overdoses or persistent hypoglycemia include octreotide, diazoxide, and glucagon.

Reviewed by Ravi Morchi

(53) Causes and outcomes of the acute chest syndrome in sickle cell disease.

Vichinsky EP, Neumayr LD, Earles AN, et al.
N Engl J Med. June 2000; 342:1855-1865.

Clinical Practice Review

Acute chest syndrome (ACS) is the most common cause of death in patients with sickle cell disease. This study assessed potential causes and interventions for ACS by monitoring characteristics of admitted patients. As such, it worked as an ACS registry done prospectively, with diagnostic plans left to treating physicians.

Thirty centers participated in the study. All patients with a phenotype of hemoglobin SS, SC, or SS beta-thalassemia with an episode of ACS (defined as a new pulmonary infiltrate in the setting of chest pain, cough, wheezing, tachypnea, or a fever greater than 38.5° C) were included.

A standardized treatment protocol was followed for 538 patients who presented with 671 episodes of acute chest syndrome; this protocol consisted of oxygen therapy, antibiotics, intravenous fluids, pain management, and transfusions, although the timing, choice, and duration of these interventions was not standardized. Laboratory monitoring and other diagnostic tests were included as a portion of the protocol. Subsequently, a multi-variable logistic-regression model was developed to assess for predictors of complications. Cause for episodes of acute chest syndrome was established based on autopsy results, cultures, or sputum analysis.

Almost two-thirds of the episodes of acute chest syndrome were still attributed to "unknown" causes. Of the patients that had an etiology defined, infection was the number one cause responsible for 54% of all cases of acute chest syndrome. Infarction was responsible for 30% of all cases, while fat embolus was found to be the cause 16% of the time. Of patients with infection causing acute chest syndrome, the three most common etiologies (in order) were *Chlamydia pneumoniae, Mycoplasma pneumoniae*, and RSV.

- ACS is the most common cause of death in sickle cell patients. Infection, infarction, and fat embolism are the most common causes. With this being said, over half of all cases still had unknown causes, pointing towards the need for further research.
- Often, patients ultimately diagnosed with acute chest syndrome are initially admitted for pain crisis, so suspicion for acute chest syndrome in these patients should be high.
- Neurologic complications (altered mental status or seizures) occurred in a significant percentage of patients with acute chest syndrome.
- Treatment for acute chest syndrome should be directed towards the known causes; antibiotics, bronchodilator therapy (for presumed airway hyper-reactivity), transfusions, and mechanical ventilation are recommended by the authors. However, this study was not a prospective evaluation of different treatment modalities, so definitive statements about the efficacy of various treatments cannot be made.

Reviewed by Ravi Morchi

(54) Adrenal insufficiency.

Salvatori R.
JAMA. 2005 Nov 16;294 (19):2481-88.
Department of Medicine, Division of Endocrinology, Johns Hopkins University, Baltimore, MD.

Clinical Practice Review

This article provides an overview of adrenal insufficiency presented through a case presentation. This was a "best opinion" paper, with no research methodology.

- There are two types of AI; primary, resulting from direct blocking of the secretion of cortisol, or secondary, which has decreased cortisol from decreased ACTH levels.
- The most common cause of primary AI in the developing world is autoimmune adrenalitis; in the developing world, TB is the most common. The most common cause of secondary AI is discontinuation of steroids.
- The traditional symptoms of AI are chronic fatigue, joint pain, lack of appetite, weight loss, abdominal pain, or diarrhea. Acute onset AI can cause cardiovascular collapse.
- In primary AI, the increase in ACTH levels result in the stimulation of beta lipotropin, which causes melanocyte stimulation (and subsequent hyperpigmentation of the mucosa and skin).
- Primary AI is more likely to have hyponatremia *and* hyperkalemia from mineralocorticoid deficiency, whereas secondary AI may just have hyponatremia.
- To diagnose AI, one can do a morning serum cortisol level (abnormal if < 3 µg/dL and indeterminate if < 18 µg/dL), an insulin tolerance test, a metyrapone test, a CRH stimulation test, or an ACTH stimulation test (normal if cortisol > 18 µg/dL at 30 minutes post administration). Each test has pluses and minuses.
- The treatment of AI begins with glucocorticoids. Hydrocortisone 50 mg every six hours is preferred in stressed patients, due to its similarity to normal cortisol and its mineralocorticoid properties *at this dosage*. Decadron is an alternative and does not affect the cortisol stimulation test. In non-stressed patients, fludrocortisone is preferred for mineralocorticoid replacement.

Reviewed by Ravi Morchi

(55) Secondary symposium on the Definition and Management of Anaphylaxis: Summary Report.

Sampson HA, Munoz-Furlong A, Campbell RL, et al.
Ann Emerg Med. 2006 April;47 (4):373-80.
National Institute of Allergy and Infectious Disease.

Clinical Practice Review

This article provides consensus on the definition and treatment of anaphylaxis, as agreed upon by a large group of people considered experts from various fields, including EM. It is a consensus statement, with no research methodology documented.

- The brief definition of anaphylaxis is "a serious allergic reaction that is rapid in onset and may cause death". The specific criteria require an acute onset of symptoms with involvement of either skin or mucosa *plus* respiratory, gastrointestinal, or cardiovascular compromise. Also included within the definition is a decreased blood pressure after exposure to a known allergen.
- Epinephrine is the treatment of choice for anaphylaxis.
- When administering epinephrine solutions by IM route, use the 1:1,000 concentration, given as a dose of .01 mg/kg IM at a maximum initial dose of 0.5 mg every 5 to 15 minutes. IM is preferred over SQ due to increased absorption.
- When administering epinephrine solutions by IV route, always use the more dilute 1:10,000 concentration. Furthermore, in the absence of peri-arrest conditions, IV epinephrine should not be pushed but diluted with saline to avoid excessive iatrogenic cardiac strain.
- High flow oxygen and beta-agonists are also supported. Additional supportive measures, such as fluid resuscitation (to replace extravasated intravascular volume secondary to vasodilatation and capillary leak) and pressors, in addition to H1 and H2 blockers, as well as corticosteroids (1 to 2 mg/kg of solumedrol every 6 hours), are recommended in specific situations.
- For patients on beta-blockers, glucagon 1 to 5 mg may be considered.
- There have been reports of patients having recurrence within 72 hours, but 4 to 6 hours is the recommended observation period. .
- The recommendations of discharge instructions from an ED after anaphylaxis include a prescription for self-injectable epi pen patient education, and follow up evaluation.

Reviewed by Ravi Morchi

(56) Prospective evaluation of repeated supratherapeutic acetaminophen (paracetamol) ingestion.

Daly FF, O'Malley GF, Heard K, Bogdan GM, Dart RC.
Ann Emerg Med. 2004 Oct;44(4):393-8.
Rocky Mountain Poison and Drug Center, Denver Health, University of Colorado; Royal Perth Hospital, Perth, Australia

Original Research - Prospective Case Series

The Rocky Mountain Poison and Drug Center addressed the need to clarify the treatment of chronic supratherapeutic acetaminophen ingestions after noting an increase in the incidence of these cases. For the purposes of the study, an acute acetaminophen ingestion was defined as a dose of greater than 4 grams within an 8 hour period. A repeated supratherapeutic ingestion was defined as "more than one ingestion of acetaminophen in a period exceeding 8 hours that resulted in a cumulative does of greater than 4 grams per 24 hours. When confronted with the latter scenario, the protocol calls for measuring the serum AST as well as the serum acetaminophen level. If the AST is less than 50 IU/L and the acetaminophen is less than 10 mg/L, no further evaluation or treatment is recommended. The entire management algorithm is presented in Figure 1 on page 395.

Having established this protocol, the center began a prospective study to monitor its efficacy. This is the first study of its kind – no guidelines previously existed regarding the management of repeated supratherapeutic acetaminophen ingestions. Of all calls taken by the center regarding acetaminophen, 3.8% met the inclusion criteria. The patients were categorized on the basis of their initial AST level. Of the 249 patients who were enrolled, 126 patients had an AST less than 50 IU/L, 47 patients had an AST between 50 and 1,000 IU/L, and 37 patients had an AST greater than 1,000 IU/L. No patient who presented with an AST below 50 IU/L (normal range) subsequently developed hepatotoxicity and only 2 of the 126 patients showed a delayed bump in the AST on repeat testing – both of these patients remained asymptomatic. All patients who ended up developing hepatotoxicity presented with an abnormal initial AST.

- There are two questions to ask:
    - What is the acetaminophen level?
    - What is the AST at presentation?
    - If the answers are less than 10 mg/L of acetaminophen and an AST of less than 50 IU/L, no further work-up or intervention is needed. Discharge the patient.
- More research is needed to determine management of patients with an AST greater than 50 but less than 1,000 so you should presume hepatotoxicity may develop.

Reviewed by Kennon Heard

(57) Management of drug and alcohol withdrawal.

Kosten TR, O'Connor PG.
N Engl J Med. 2003 May 1;348(18):1786-95.
Departments of Medicine and Psychiatry, Yale University Hospital, New Haven, CT

Clinical Practice Review

This article offers a brief summary of current concepts in withdrawal management of several intoxicants. Alcohol and benzodiazepines are the two sedatives discussed. Alcohol acts to increase gamma-aminobutyric acid (GABA) activity and decrease glutamate (NMDA) activity. Therefore, in the withdrawal state, GABA decreases and NMDA increases. Dilantin plays no role in mediating these pathways so it should not be used for alcohol withdrawal seizures. Benzodiazepines and barbiturates both work by increasing GABA activity but benzodiazepines are more effective and less dangerous than barbiturates. A concise summary of alcohol withdrawal protocols is worth reviewing (see Table 1 on page 1787), including the use of carbamazepine Clonidine can potentially decrease withdrawal symptoms but it will not prevent seizures – an important point if you are treating a heroin/alcohol withdrawal patient who did not look shaky but now the nurse says their seizing. The clonidine may mask the alcohol withdrawal but has no anticonvulsant property.

Opioid withdrawal is addressed next. A useful summary of the withdrawal timelines of heroin, buprenorphine, and methadone is reviewed (see Figure 1 on page 1789). Only 40% of patients in methadone programs reach the goal of opioid abstinence. A review of the rapid detoxification protocols now in vogue is listed (see page 1790). Opioids act at the mu-opioid receptor and act by inhibiting the cyclic AMP in noradrenergic neurons. When opioids are discontinued, a resultant increase in cyclic AMP results in increased noradrenergic activity leading to the manifestation of withdrawal symptoms. Clonidine works on adrenergic autoreceptors to antagonize this increased activity. Lofexidine is an alternative to clonidine with a decreased risk of hypotension but is not FDA approved for this purpose.

Withdrawal from stimulants is briefly reviewed. There is no treatment regimen that has been proven to effectively treat the dysphoria and behavioral disturbances associated with cocaine or amphetamine withdrawal. A review of methylphenidate and amantadine as treatment regimens are cursory due to the limited supporting data.

Finally, a clinically useful management tool for alcohol withdrawal, known as the Clinical Institute Withdrawal Assessment for Alcohol (CIWA) scale, is discussed (see Appendix A). Although many physicians assess patients with a general gestalt for the severity of symptoms, the CIWA scale proves to be a useful resource to assist in this decisionmaking.

- Dilantin does not work on alcohol withdrawal seizures.
- Carabamazepine can also be used for management of alcohol withdrawal
- Clonidine can mask sedative withdrawal but does not prevent seizures.
- The CIWAA scale in Appendix A systematically evaluates alcohol withdrawal symptoms

Reviewed by Kennon Heard

(58) The role of activated charcoal and gastric emptying in gastrointestinal decontamination: a state-of-the-art review.

Bond GR.
Ann Emerg Med. 2002 Mar;39(3):273-86.
Departments of Pediatrics and Emergency Medicine, University of Cincinnati, Cincinnati, OH

Clinical Practice Review

Two methods of gastric decontamination include activated charcoal and gastric emptying. An ongoing controversy remains with regards to their efficacy and safety. This is not an evidence based review of the literature but rather a narrative review based on a series of questions. Having made that disclaimer, the author provides an exhaustive list of references to support the positions in this article (see pages 277-278).

- Does gastrointestinal decontamination change patient outcome? Emesis, gastric lavage, and activated charcoal are effective when used early, but none are effective when treatment is delayed (see Figures 1, 2, and 3 on pages 275 and 276).

- The classic dilemma arises when some clinicians suggest treatment with charcoal while others vehemently argue that the aspiration risk will outweigh any benefit. In a number of studies, it has become clear that the charcoal itself does not increase the risk of aspiration.

- When considering gastric lavage, one should include the potential costs and risks associated with intubation since many patients will be prophylactically intubated to definitively protect the airway during the procedure. It should also be noted that intubation does not provide complete protection from aspiration. In one study referenced, 8 of 163 patients who were intubated prior to charcoal and gastric lavage aspirated. In the same study, of 194 patients who only received charcoal and were not intubated, none of them aspirated.

- Who can forgo gastrointestinal decontamination all together? Perhaps most importantly, 90% of preschool children who ingest a drug are managed at home without complication. Knowing this should reduce the temptation to “do something” for every patient who walks through the door.

- Gastric emptying prior to charcoal has not been shown to be beneficial. The basic thought process behind this is that toxins “available” to gastric emptying is also available to binding by charcoal. However, read the interesting discussion of the risk of Type II error (see page 281) which makes this conclusion less certain. It should be recalled that none of this discussion would apply to those toxins not affected by charcoal which include iron, lithium, acid, alkali, and hydrocarbon ingestions.

Overall, this article reads like a discussion and is difficult to succinctly summarize. Not only does it offer a review of the literature, it also cogently explains the limitations of previous studies and the potential for Type II error.

Reviewed by Kennon Heard

(59) Fomepizole for the treatment of ethylene glycol poisoning.

Brent J, McMartin K, Phillips S et al. (Methylpyrazole for Toxic Alcohols Study Group)
N Engl J Med. 1999 Mar 18;340(11):832-8.
University of Colorado; Louisiana State University; Pennsylvania State Geisinger Health System

Original Research - Multicenter Prospective Trial

Ethylene Glycol poisoning leads to the formation of oxalic acid via the pathway demonstrated in Figure 1 on page 832. Oxalic acid, in turn, causes metabolic acidosis and renal failure along with CNS dysfunction. Ethanol has been the traditional antidote but a therapeutic level is hard to monitor and can lead to hypoglycemia, liver toxicity, and altered mental status. Fomepizole (4-methylpyrazole) inhibits alcohol dehydrogenase and thus can also be used as an antidote for ethylene glycol poisoning. In comparison to ethanol treatment, fomepizole does not cause mental status changes or hypoglycemia and it is more reliably maintained at a therapeutic level. Having stated this, the study before us does not intend to prove an advantage of fomepizole versus ethanol but rather demonstrate that fomepizole is at least an effective alternative for the treatment of ethylene glycol poisoning.

Nineteen patients were given fomepizole. One patient had severe acidosis and suffered an myocardial infarction prior to enrollment which led to his death. Nine patients had elevated creatinine upon enrollment and continued to show worsening renal function despite therapy. Of the ten patients with normal creatinine levels on presentation, none showed a decrease in renal function upon the conclusion of treatment. Seventeen of the patients also underwent hemodialysis per the standard protocol. Hemodialysis is still indicated as part of the treatment regimen when acidosis is present even with administration of fomepizole. Side effects possibly associated with fomepizole were minimal.

- This paper points to the comparative ease of administration of fomepizole versus ethanol but does not compare fomepizole to ethanol.
- Dialysis should still be utilized in the setting of acidosis. Fomepizole alone is not sufficient therapy.
- Patients who presented with impaired renal function did not improve after treatment but actually got worse.

Reviewed by Kennon Heard

(60) Fomepizole for the treatment of methanol poisoning.

Brent J, McMartin K, Phillips S, Aaron C, Kulig K; Methylpyrazole for Toxic Alcohols Study Group. N Engl J Med. 2001 Feb 8;344(6):424-9.
University of Colorado; University of Massachusetts; Louisiana State University.

Original Research - Multicenter Prospective Trial

This study evaluates the efficacy of fomepizole in the treatment of methanol poisoning. Importantly, this study does not compare fomepizole versus ethanol for the treatment of methanol poisoning. Only eleven patients were enrolled and the rarity of methanol poisoning would make such a comparison study difficult. Rather, it demonstrates that fomepizole is an effective alternative treatment in the setting of methanol poisoning.

The metabolite of methanol is ultimately formic acid (see Figure 1, page 425). This is the culprit responsible for the blindness, metabolic acidosis, and cardiovascular instability which can occur after a methanol ingestion. Traditionally, ethanol has been given as a competitive substrate for alcohol dehydrogenase (ADH), thus preventing the formation of formic acid. However, ethanol has erratic pharmacokinetics and thus requires frequent checks of blood alcohol level. Hypoglycemia and liver toxicity can also ensue from this therapy. Fomepizole, or 4-methylpyrazole, is an inhibitor of ADH with treatment advantages over ethanol.

Patient eligibility for the study required a serum methanol of greater than 20 mg/dL or a strong suspicion of methanol ingestion. The patient had to also exhibit two of the three following findings: an arterial pH < 7.3, a serum bicarbonate < 20, and/or a serum osmolar gap of more than 10 mosm/kg of water. Treatment was intitated per a standard protocol and terminated when the serum methanol level fell below 20 mg/dL. Some patients with severe metabolic derangements also underwent hemodialysis.

The median duration of treatment was 30 hours. Of the patients where visual acuity could be tested, no patients suffered any decremental loss of vision at the end of treatment. Formic acid concentrations fell and the acidosis resolved in all patients treated with fomepizole. The plasma concentration of fomepizole was maintained in the therapeutic range in 98% of all measurements taken to ensure an adequate level to prevent formic acid formation.

- This paper does not compare fomepizole to ethanol but points to its effectiveness in treating methanol poisoning.
- Fomepizole levels are less likely to be subtherapeutic in comparison to traditional ethanol therapies.
- Dialysis may still be used in the setting of fomepizole due to the long elimination half life of methanol (54 hours in this study).

Reviewed by Kennon Heard

(61) Gamma hydroxybutyric acid (GHB) intoxication.

Mason PE, Kerns WP 2nd.
Acad Emerg Med. 2002 Jul;9(7):730-9.
Department of Emergency Medicine, Carolinas Medical Center, Charlotte, NC.

Clinical Practice Review

GHB is an analog of gamma-aminobutyric acid (GABA) and has FDA approval for the treatment of narcolepsy. It is more popular, however, as a recreation drug and is referred to on the street as “Georgia Homeboy” and “Liquid X”. It is most commonly associated with raves and is the “date rape drug” that is often described in the popular culture. GHB is undetectable on routine drug screens.

Exogenously administered GHB leads to CNS and respiratory depression while providing a euphoria for the abuser. Patients will present somewhere on the spectrum from somnolent to comatose. Resolution of this CNS depression can be sudden so an unresponsive patient may still be difficult to intubate. There is some debate regarding the presence of seizures versus myoclonic jerks as a result of GHB intoxication. Respiratory manifestation may include periodic breathing with apnea followed by hyperventilation.

Most GHB patients will require no more than supportive care. There are no reports of deaths from GHB overdose once patients have presented for medical care. While many patients will require intubation for CNS and respiratory depression, they will often wake up abruptly, self extubate and be ready for discharge over a very short period of time. While it is tempting to consider intubation without an induction agent, reports of agitation as mentioned above should discourage this practice. Review Table 3 on page 734 to understand the clinical course of GHB intoxication in the ED.

Activated charcoal is unlikely to be helpful due to the rapid absorption of the drug and its risks usually outweigh any benefits. There is no specific antidote for GHB. Naloxone is not effective in reversing the respiratory and CNS depression in humans. While physostigmine has been used in some anesthesia settings as a reversal agent, coingestants make the risk of physostigmine induced seizures or arrhythmias too great to recommend its use. Reversal of a GHB induced coma does not improve outcomes. Withdrawal from GHB is similar to that associated with alcohol.

- Associated with raves, the “date rape drug”.
- GHB is not detected on most drug screens.
- You may intubate and discharge a GHB patient over the course of your shift
- Narcan will not reverse the CNS and respiratory depression.
- Physostigmine has been reported to reverse CNS depression from GHB, but there are no controlled human data to support its use.

Reviewed by Kennon Heard

(62) Ingestion of toxic substances by children.

Shannon M.
N Engl J Med. 2000 Jan 20;342(3):186-91.
Division of Emergency Medicine, Children's Hospital and Harvard Medical School, Boston, MA

Clinical Practice Review

There are over one million annual reported ingestions in children under the age of six. The number of unreported ingestions is probably much higher. These ingestions lead to 85,000 annual visits to the Emergency Department. Highlights of this article are listed below.

- Hazard Factor Analysis – this provides a numeric evaluation of the relative toxicity of an ingested agent. The formula is:

$$\frac{\text{\# of episodes of major toxic events}}{\text{total number of exposures to that substance}}$$

- Know some of the more toxic ingestions by memory:
  - Iron Supplements
  - Cocaine
  - Antidepressants
- Charcoal does not absorb:
  - Alcohol
  - Hydrocarbons
  - Metals and Minerals
- Charcoal can reduce absorption by up to 75% when given within one hour of the ingestion.
- Charcoal is dosed in a 10:1 ratio to the toxin. The standard dose is 1 gram/kg. Some are proposing smaller, more specific dosing regimens.
- Gastric emptying shows no benefit in children and delays charcoal administration.

Reviewed by Kennon Heard

(63) Medications that can be fatal for a toddler with one tablet or teaspoonful: a 2004 update.

Bar-Oz B, Levichek Z, Koren G.
Paediatr Drugs. 2004;6(2):123-6.
Division of Clinical Pharmacology, The Hospital for Sick Children and The University of Toronto, Toronto, ON; Department of Neonatology, Hadassah Medical Center and The Hebrew University, Jerusalem, Israel.

Clinical Practice Review

This simple but useful study reviewed lethal doses of medications in children (or calculated a weight-based fatal dose from adult data). The authors acknowledged the shortcoming of presuming a linear dose-toxicity relationship in converting adult toxicities to children. They then identified drugs where a fatal dose to a 10 kg toddler would be delivered by just 1 to 2 tablets or teaspoonfuls. Having compiled this list of highly toxic drugs, they then looked at reported fatal overdoses and found that 40% of ingestions resulting in toddler fatalities between 1990 and 2000 involved drugs on the list. In conclusion, they suggest that special labeling be used to demonstrate the extreme toxicity to toddlers from a single dose.

- Of note, iron tablets, while not lethal after one or two pills, accounted for 32 out of 85 deaths in the ten year period.
- The list of medications that can be fatal to a toddler upon ingestion of one dose included:
    - Tricyclic Antidepressants
    - Thioridazine (a rarely used antipsychotic) – arrhythmias
    - Quinine Derivatives – often used by patients with rheumatoid arthritis
    - Calcium Channel Blockers
    - Opioids
    - Oral Hypoglycemics
    - Theophylline
    - Podophylline
    - Camphor
    - Methyl Salicylate (oil of wintergreen)

Reviewed by Kennon Heard

(64) Clinical Policy: Critical Issues in the Evaluation and Management of Patients Presenting to the Emergency Department with Acute Headache.

Jagoda AS et al. for the clinical policy committee for ACEP
Ann Emer Med 2002, Jan 39(1): 108-122.

Clinical Practice Review

This review is the product of the ACEP clinical policies committee and follows the traditional clinical policy format of literature review and subsequent evaluation of the literature based on the standard level I, II, and III criteria and were then classified into the standard Level A, B, and C recommendations. Four areas of controversy were addressed:

(1) Response to headache therapy as an indicator of underlying pathology.
(2) Clinical findings predictive of increased intracranial pressure.
(3) Indications for emergent neuroimaging in patients with a complaint of headache, and
(4) Indications to pursue emergent diagnostic studies in patients with thunderclap headache but with normal findings on a head computed tomography (CT) scan and negative findings on a lumbar puncture.

The findings of this policy are listed below:

- Response to therapy should not be used as the sole diagnostic tool for ruling out serious pathology.
- Adult patients with headache exhibiting signs of increased intracranial pressure including papilledema, absent venous pulsations on funduscopic examination, altered mental status, or focal neurologic deficits should undergo a neuroimaging study before having an LP.
- Patients with headache and neurologic abnormalities should have neuroimaging, as should HIV positive patients with a headache or patients presenting with sudden onset headaches. It is suggested that patients over the age of 50 with new types of headaches should also undergo neuroimaging.
- Patients with a thunderclap headache who have negative findings on a head CT scan, normal opening pressure, and negative findings in CSF analysis do not need emergent angiography and can be discharged from the ED with follow-up arranged with their primary care provider or neurologist.

Reviewed by Ravi Morchi

(65) Dexamethasone in adults with bacterial meningitis.

de Gans J, van de Beek D; European Dexamethasone in Adulthood Bacterial Meningitis Study Investigators.
N Engl J Med. 2002 Nov 14;347(20):1549-56.

Original Research - Randomized Prospective Controlled Trial

The issue: Acute Bacterial meningitis causes significant morbidity and mortality. In animal studies on meningitis, corticosteroids have shown some benefit. Do corticosteroids have the same effect in humans with acute bacterial meningitis?

The population: Patients over the age of 17 with suspected meningitis *and* either cloudy CSF, bacteria in the CSF on gram stain, or a CSF white count >1000. Exclusion criteria included sensitivity to beta-lactam antibiotics or corticosteroids, pregnancy, a cerebral shunt, active fungal infection or tuberculosis, a recent history of head trauma, neurosurgery, or peptic ulcer disease.

The study: Patients were randomized to one of two groups; either a placebo medication, or 10 mg of dexamethasone every 6 hours for 4 days. This medication was given either 10 to 20 minutes before, or concurrently, with the administration of antibiotics. Initial antibiotic treatment was with 2 grams of amoxicillin with the drug regimen changed based on the gram stain of the CSF.

The results: 301 patients were enrolled; baseline characteristics of the two groups were similar, but the dexamethasone group had an increased occurrence of seizures. 7% of steroid patients and 15% of placebo patients died; 15% of the steroid group had an adverse outcome, compared to a 25% incidence of adverse outcomes in the placebo group (adverse outcomes defined as greater than mild disability measured on the Glasgow Outcome scale at 8 weeks). In the subgroup of patients with *N. meningitidis* meningitis, dexamethasone did not appear to have any benefit. There was no benefit in terms of neurologic sequelae (hearing loss, etc.) regardless of group.

- Dexamethasone decreases deaths in patients with pneumococcal meninigitis
- There was no proven benefit in patients with *N. meningitidis* meningitis
- The authors conclude that dexamethasone should be administered either before or with antibiotics in all patients with meningitis.

Reviewed by Ravi Morchi

(66) Computed tomography of the head before lumbar puncture in adults with suspected meningitis.

Hasbun R, Abrahams J, Jekel J, Quagliarello VJ.
N Engl J Med. 2001 Dec 13;345(24):1727-33.
Dept. of Internal Medicine, Diagnostic Radiology, and Epidemiology and Public Health, Yale University School of Medicine, New Haven, Conn.

Original Research

Key Points:

- Patients without a series of high risk baseline characteristics are able to undergo lumbar puncture (LP) without a prior head CT.
- Head CT scans done prior to LP significantly delay the performing of LPs in patients with suspected meningitis.

Summary: This was a prospective ED study of 301 patients, where patients with suspected meningitis were evaluated for clinical characteristics that predicted herniation (or predicted lack of herniation) on performance of a lumbar puncture. The only requirement was that the patient actually underwent a lumbar puncture (with the exception of patients who had significant mass effect on their CT). The criteria studied were a variety of neurologic functions (level of consciousness, responses to questions/commands, focal deficits, etc.) and baseline characteristics (age, sex, immunocompromised state, prior history of seizure within one week, history of CNS disease, etc.). There was no requirement of head CT; the decision to obtain or not obtain a head CT was left to the physician's judgement.

Based on their data, the following **baseline characteristics** were associated with CT abnormalities:

- Age > 60 years
- Immunocompromised state
- History of CNS disease (CVA, mass, or focal infection)
- Seizure within 1 wk of presentation

The following baseline **neurologic findings** were associated with CT abnormalities:

- Abnormal level of consciousness
- Inability to answer two questions correctly
- Inability to follow two commands correctly
- Abnormal language (aphasia, dysarthria, or extinction)
- Gaze palsy
- Abnormal visual fields
- Facial palsy
- Arm or leg drift

The authors found only 4 patients who had mass effect that prevented LP. Of these 4, all had baseline characteristics or baseline neurologic findings concerning for an abnormal CT scan. Of the 7 other patients with mild to moderate mass effect that did undergo LP, none of these patients herniated.

- Delay to LP was significantly greater for patients who underwent a CT scan first (5.3 hours for patients who went for a head CT vs. 3 hours for patients who went straight to LP)
- There is a set of criteria whose absence can identify patients that do not need a CT scan prior to their LP.

Reviewed by Ravi Morchi

(67) Guidelines for the early management of patients with ischemic stroke: 2005 guidelines update a scientific statement from the Stroke Council of the American Heart Association/American Stroke Association.

Adams H, Adams R, Del Zoppo G, Goldstein LB; Stroke Council of the American Heart Association; American Stroke Association.
Stroke. 2005 Apr;36(4):916-23.

Clinical Practice Guideline

This article is a 2005 update of the previous recommendations published in *Stroke* in 2003 which can be found at http://stroke.ahajournals.org/cgi/content/full/34/4/1056. This update is best understood if the original guidelines have been reviewed. The first part of this article focuses on the efficacy of brain imaging. CT remains the standard neuroimaging modality in evaluating stroke despite continued discussion regarding the role of MRI. Since 2003, one study which has compared MRI with CT as a replacement modality and found it be 100% sensitive and specific with CT being used as the gold standard of detection. While this would suggest that MRI is at least an equally useful tool in the evaluation of possible CVA's, the availability of CT is still much greater. No studies to date have demonstrated that MRI is superior to CT in identifying those patients who are appropriate candidates for intravenous recombinant tissue plasminogen activator (rtPA).

While prior National Institute of Neurologic Disorders and Stroke (NINDS) studies have shown the effectiveness of rtPA, the primary complication is symptomatic hemorrhagic transformation of the infract. This risk of hemorrhage after rtPA is 5.2% but a lower when guidelines were followed. Furthermore, the administration of aspirin prior to rtPA therapy did not increase the risk of symptomatic hemorrhage. One potential side effect of rtPA is angioedema which was reported in 9 of 176 patients in one study. Patients who were on an ACE inhibitors prior to rtPA administration were at increased risk for this complication but history of ACE inhibitors in the medication history is *not* a contraindication to rtPA administration.

The recommendation continues to state that rtPA should only be administered within three hours of the onset of stroke symptoms. References to a 4.5 hour window are discussed in the first column of page 918 but did not mount to any changes in policy. While ongoing studies concerning intraarterial thrombolysis may eventually support this route over standard IV administration of rtPA, no current recommendation supports its use outside of clinical trials. No current support exists to recommend anticoagulation as a routine part of post stroke therapy or to prevent re-occlusion after intravenous rtPA. Aspirin is still recommended to be started within 48 hours of presentation with a CVA but the evidence points to modest benefits at best. Studies continue concerning abciximab and other anti-platelet agents but there are no current treatment recommendations.

While mechanical thrombolysis is being studies extensively, no current mechanism has been proven to be effective at this time. Similarly, neuroprotective agents such as magnesium and citicoline continue to be studied but are not currently supported or recommended. Hypothermia after stroke is another growing area of study but no guidelines support this a standard procedure at this time. Considering the brief period of time in which the ED physician can change the course of a patient's CVA, familiarity with pathophysiology and the current arsenal of therapies available will be critical in making timely decisions with patients.

Reviewed by Ravi Morchi

(68) Treatment of acute ischemic stroke.

Lewandowski C, Barsan W.
Ann Emerg Med. 2001 Feb;37(2):202-16.
Department of Emergency Medicine, Henry Ford Hospital, Detroit, MI.

Clinical Practice Review

Acute ischemic stroke is the leading cause of disability among adults and the third leading cause of death. This article provides a solid review of the pathophysiology surrounding acute vascular occlusions in the brain. One key concept to review is the differentiation between the core area of ischemia where cerebral blood flow (CBF) is usually less than 25% of normal and the surrounding region of marginal blood flow (25% to 50%) called the “ischemic penumbra”. While the core almost immediately sustains irreversible ischemic damage, the penumbra is in the precarious state between continued functionality and irreversible ischemia. This state may continue for 6 to 8 hours and it is this penumbra which we, as ED physicians, are fighting to save. Obviously, as the duration of ischemia progresses, what was once characterized as penumbra becomes part of the core lesion.

Clinical trials are reviewed (see page 204). There are multiple studies reviewed here which are worthwhile to understand. The National Institute of Neurologic Disorders and Stroke (NINDS) rTPA Stroke Trial evaluated the use of intravenous rtPA. In Part 1, the odds ratio favoring treatment with rtPA was 2.1. In Part 2 of the study, an odds ratio of 2.0 was found in comparing normal or near normal functionality three months after receiving rtPA in comparison to placebo during an acute stroke. The main concern regarding the use of rtPA is intracranial hemorrhage. When criteria are followed, including the use of rtPA only within 3 hours from onset of symptoms, the risk of intracranial hemorrhage (ICH), while increased was outweighed by the benefits of rtPA in comparison to placebo. However, because of this increased risk of ICH, a careful discussion of the risks and benefits of rtPA is necessary. There was no proven benefit of low molecular weight heparin or unfractionated heparin (beyond DVT prevention) in treatment of acute ischemic stroke.

The principles of stroke management in the Emergency Department are reviewed beginning on page 207. Review of the National Institutes of Health Stroke Scale in Table 1 is useful since it can help in making decisions regarding the risks and benefits of rtPA administration. The American Heart Association recommends that all patients presenting with possible stroke should have an ECG, chest x-ray, CBC, coagulation studies, blood sugar, and basic metabolic panel ordered upon arrival. Later in the paper, the need for coagulation studies is discounted in patients with no underlying medications or medical history which would indicate a derangement. A discussion of early CT findings is found on page 208. This becomes important since evidence of early ischemia on the first CT increases the chances of intracranial hemorrhage if rtPA is administered and should be included in the decision-making algorithm. Recommendations have been made to treat blood pressures in excess of 220/115, or a MAP greater than 130, in acute ischemic stroke. The AHA recommends that blood pressure should not exceed 185/110 in patients receiving intravenous tPA. Control of glucose levels and temperature are covered on the following pages.

Finally a discussion regarding absolute and relative contraindications begins on page 210. The nuances of a patient with a seizure and other more challenging cases are discussed briefly. The paper concludes by encouraging the development of stroke algorithms to streamline care protocols in the ED, especially in light of the three hour time window for administration of rtPA. This article provides a solid review of multiple aspects of stroke care and research as it applies to the ED physician. This article can serve as a foundation for further reading regarding the best means of approaching patients who present with a possible ischemic stroke.

Reviewed by Ravi Morchi

(69) Benign paroxysmal positional vertigo.

Furman JM, Cass SP.
N Engl J Med. 1999 Nov 18;341(21):1590-6.
University of Pittsburgh School of Medicine, Pittsburgh & Department of otolaryngology, University of Colorado Health Sciences Center, Denver.

Clinical Practice Review

This is a review article written by two otolaryngologists. There is no methodology quoted in their reference selection. This review focuses on the pathogenesis, clinical symptoms, evaluation, treatment, and differential for benign paroxysmal positional vertigo (BPPV).

- Vertigo is the illusory sensation of motion of either oneself or one's surroundings.
- BPPV refers to episodes of vertigo, usually lasting 10 to 20 seconds each, occurring suddenly after specific head movements or changes in position (rotation, rolling to the lateral position in bed, bending over, upward gaze with neck extension), and accompanied by unidirectional, multi-component nystagmus.
- The symptoms of BPPV are believed to be due to otolith movement in the posterior semicircular canal.
- Vertigo that occurs spontaneously (without any relation to head movement or changes in position), that persists for hours or days without relief, or that is accompanied by other neurologic complaints, should not be considered BPPV.
- In patients with the classic clinical presentation (above), the Dix-Hallpike maneuver is diagnostic and no further evaluation is needed unless there are abnormal findings on neurologic exam or atypical positional nystagmus.
- The mainstay of treatment is the Epley maneuver. Due to the motion of the neck, contraindications to this procedure include severe neck disease, high grade carotid stenosis, or unstable heart disease.
- Episodes of BPPV may persist for weeks to years with unpredictable periods of remission and recurrence.
- Singular neurectomy and occlusion of the posterior semicircular canal are two surgical options for those patients with intractable symptoms.

Written by Ravi Morchi.
Reviewed by Jonathan Claud.

(70) Status epilepticus: pathophysiology and management in adults.

Chen JW, Wasterlain CG.
Lancet Neurol. 2006 Mar;5(3):246-56.

Clinical Practice Review

This is a review article written by a neurologist and a pharmacist. There was no methodology tied to their reference selection.

This article goes into the definition, pathophysiology, and treatment of status epilepticus. Of note, it also provides an extensive differential diagnosis for the causes of status epilepticus, which it divides into acute and chronic processes. In acute processes, metabolic disorders, CNS infection, stroke, head trauma, drug toxicity, and hypoxia are the leading culprits. Chronic processes include pre-existing epilepsy with either breakthrough seizures or medication non-compliance, chronic alcohol abuse related seizures, or old stroke/tumor related seizures.

- *Impending* status epilepticus is defined as greater than 5 minutes of continuous or intermittent seizure activity without a return to baseline.
- *Established* status epilepticus is defined as greater than 30 minutes of continuous or intermittent seizure activity without a return to baseline.
- With time, status epilepticus may develop a resistance to pharmacotherapy, likely due to changes in neuronal surface receptors and neuropeptides, rendering the condition more difficult to treat.
- Neuronal firing, even in the absence of physical convulsions, may contribute to cell death.
- Given the potentially deleterious effects of neuronal firing and its time-dependent pharmacoresistance, treatment should ensue as soon as *impending* status epilepticus is identified:
    - Prehospital rectal or IV Diazepam
    - Lorazepam (0.1 mg/kg)
    - Phenytoin or Fosphenytoin (20 mg/kg)
    - An additional dose of Phenytoin (5-10 mg/kg)
    - Phenobarbital (20 mg/kg)
    - An additional dose of Phenobarbital (5-10 mg/kg)
    - Anesthesia with midazolam (0.2 mg/kg initial dose) or propofol(1 to 2 mg/kg initial dose) with required intubation and EEG monitoring
    - Limited experience with Ketamine, but this may be useful for certain refractory cases requiring anesthesia.
- Neuronal changes from an episode of status epilepticus *may* predispose to future seizure activity after the acute event has ended (epileptogenesis).

Written by Ravi Morchi
Reviewed by Jonathan Claud

(71) High-altitude illness.

Hackett PH, Roach RC.
N Engl J Med. 2001 Jul 12;345(2):107-14.

Clinical Practice Review

High altitude illness is a spectrum of pathologies that occurs when some persons who are not acclimatized ascend to altitude. There are three basic types of High altitude illness: Acute mountain sickness (AMS), high altitude pulmonary edema (HAPE), and high altitude cerebral edema (HACE). In this article, definitions and pathophysiology of each is noted, as is the different treatment regimens for each.

- AMS is defined as a *subjective* collection of non-specific symptoms including headache in the setting of an unacclimatized person arriving at an altitude above 2500 meters. These other symptoms include anorexia, nausea, vomiting, insomnia, dizziness, or fatigue.
- Treatment for AMS is to descend 500 meters, or rest and acclimatize, or speed acclimatization with acetazolamide and/or dexamethasone (dexamethasone is thought to be a second line agent), and symptomatic treatment.
- Prevention of AMS can include planning a gradual ascent, prophylaxis with acetazolamide (dexamethasone is thought to be a second line agent).
- HAPE is the presence of hypoxemia and pulmonary edema /infiltrates induced by the low partial pressure of oxygen at high altitude. It should be treated with immediate supplemental oxygen and rapid descent.
- HACE is AMS with altered mental status or ataxia. It should be treated with immediate supplemental oxygen and rapid descent.

Reviewed by Kennon Heard

(72) Heat stroke.

Bouchama A, Knochel JP.
N Engl J Med. 2002 Jun 20;346(25):1978-88.

Clinical Practice Review

This article summarizes the diagnosis and management of heat stroke, an acute life threatening illness that is often fatal, despite appropriate treatment. Heat stroke is defined as a core temperature over 40.0°C with hot, dry skin and CNS symptoms such as delirium, seizures, or coma. Two main groups of causes are listed; environmental and exertional.

Pathogenesis:
In general, the body regulates temperature by controlling blood flow to the skin, with vasodilatation resulting in increased cooling. Sweating assists with cooling by establishing a thermal gradient, allowing for increased efficiency of vasodilatation resulting in decreased temperature. When acute heat changes are encountered, a variety of inflammatory cytokines are produced (interleukin 1, interleukin 6) which result in fever, leukocytosis, and acute inflammatory responses. Heat shock proteins are also created which allow cells to survive increased temperatures. As one goes from heat stress to heat failure, compensatory mechanisms are exceeded and thermoregulatory failure occurs. Thermoregulatory failure consists of three components:

- Inability to increase cardiac output to necessary levels secondary to volume depletion, cardiac disease, or medications.
- Exaggeration of the acute phase response with a breakdown of immunologic barriers.
- Alteration of the heat shock response with decreased production of heat shock proteins with resulting loss of protection for individual cells.

Pathophysiology:

- Heat: Heat directly induces tissue injury; at extremes, cellular structures break down and result in cell death.
- Cytokines: Imbalance of cytokines results in an inflammatory cascade, resulting in a loss of immune response.
- Coagulation Disorders and Endothelial Cell injury: Hyperthermia incites vascular permeability, in addition to inciting a prothrombotic state. This results in activiation of the coagulation cascade with subsequent DIC.

Symptoms:
Hyperthermia (temp > 40°C) and CNS dysfunction must be present. Tachycardia and hyperventilation are common.

- Hypophosphatemia and hypokalemia are common; hypercalcemia and hyperproteinemia are also seen. Rhabdomyolysis may occur, in which case monitoring serum potassium is critical.
- Exertional heat stroke commonly causes a respiratory alkalosis and lactic acidosis.
- Non-exertional heat stroke commonly causes a respiratory alkalosis.

Treatment:

- Conduction - cold water immersion, application of ice packs in venous plexus areas, iced gastric lavage.
- Convection – fanning.
- Evaporation - misting the body with fanning.
- Dantrolene *has not* been shown to help.

Reviewed by Kennon Heard

(73) Continuous Arteriovenous Rewarming: Rapid Reversal of Hypothermia in Critically Ill Patients.

Gentilello LM, Cobean RA, Offner PJ, Soderberg RW, Jurkovich GJ.
J of Trauma 1992 Mar;32(3):316-25.
Department of Surgery, Harborview Medical Center, University of Washington, Seattle.

Original Research

This study evaluated treating hypothermia through standard methods as opposed to a novel (at the time) method of rewarming by creating a direct conduit from the femoral artery to the femoral vein with the fistula being warmed by a countercurrent fluid warmer.

Thirty four hypothermic patients (defined as a temperature < 35°C) were evaluated and divided into two groups (AV rewarming vs. standard treatment) with patients evaluated for APACHE scores, fluid requirements, and other criteria of injury to make sure randomization was accurate. Time to rewarming was significantly decreased.

- There was a significant trend towards improved survival.
- There was also a significant reduction in ICU length of stay and organ failure.

Reviewed by Kennon Heard

(74) Current Concepts: Initial management of burns.

Monalfo W W
NEJM 2006, Nov 21; 335 (21) 1581-86.
Department of Surgery and the Burn, Trauma, Surgical Critical Care Section, Washington University School of Medicine, St. Louis, MO.

Clinical Practice Review

Burn treatment has progressed significantly so that mortality from burns is only 4% of patients admitted for burns at burn centers; however, burns still cause a significant degree of morbidity and affect 1.25 million people annually in the US.

One of the major factors in burn resuscitation is based on fluid extravasation. Burns cause vessel permeability based on both direct tissue injury and mediators. As a result, fluid resuscitation is a critical element. Urine output is the key monitoring device for adequate fluid resuscitation.

Airway management is a second key element in burn management. Although symptoms of airway compromise may not develop over a 12 to 24 hour period, intubation should be performed early. Toxic inhalants should also be considered.

The management of superficial burns is based on dressing changes and topical antimicrobials. The management of deep burns is based on excisions and skin grafts. Extensive deep burns are covered in staged procedures. Alternatives to skin grafts include skin substitutes or cultured skin cells.

- Fluid recommendations are crystalloid at 4 cc per % BSA burned per weight in kg over the first 24 hours with half over the first 8 hours.
- Colloid administration or hypertonic saline are not recommended due to increased mortality.
- 1% silver sulfadiazide cream is one of the recommended topical antimicrobials, but it can cause leukopenia.

Reviewed by Kennon Heard

(75) Carbon monoxide poisoning.

Ernst A, Zibrak JD.
N Engl J Med. 1998 Nov 26;339(22):1603-8.
Department of Medicine, Beth Israel Deaconess Medical Center, Boston, MA.

Clinical Practice Review

Carbon monoxide (CO) poisoning results in approximately 600 accidental deaths each year in the United States. CO is a product of incomplete combustion of hydrocarbons. Sources of CO include inhaled tobacco or house fire smoke, motor vehicle exhaust fumes, poorly functioning heating systems, and skin absorption of methylene chloride, a common component of paint remover and other solvents.

- Tobacco smokers commonly reach a blood carboxyhemoglobin level of 10%, as compared with 1% to 3% in nonsmokers.
- CO appears to result from a combination of tissue hypoxia due to the binding of CO to hemoglobin and direct CO-mediated damage at the cellular level from the small fraction of free CO dissolved in plasma.
- CO exposure is especially harmful on pregnant woman because of the fetus is extremely sensitive to the deleterious effects of the CO.
- CO exposure mimics a nonspecific viral illness with the most common symptom being headache, occurring in 91%.
- The classic findings of cherry-red lips, cyanosis, and retinal hemorrhages occur rarely.
- Delayed Neuropsychiatric Syndrome reflects the delayed symptoms such as cognitive and personal changes, Parkinsonism, incontinence, dementia, and psychosis, and occurs in 10% to 30% of victims.
- Oxygen shortens the half-life of carboxyhemoglobin and improves tissue oxygenation.
- The decision whether to administer hyperbaric oxygen therapy cannot be made only on the basis of the carboxyhemoglobin levels.

Reviewed by Kennon Heard

(76) Acute chemical emergencies.

Kales SN, Christiani DC.
N Engl J Med. 2004 Feb 19;350(8):800-8
Department of Medicine, Occupational and Environmental Health, Harvard Medical School, Cambridge, MA.

Clinical Practice Review

This article reviews the health effects of exposure to industrial and environmental substances and chemical weapons. The classes of substances that correspond to these clinical syndromes are asphyxiants (e.g., cyanide, carbon monoxide), cholinesterase inhibitors (e.g., organophosphates), respiratory tract irritants (e.g., chlorine), and vesicants (e.g., mustard).

- Removing contaminated clothing can eliminate 85% to 90% of trapped chemical substances.
- Diazepam, cyanide antidote kits, atropine, and pralidoxime are the most important drugs to stockpile locally for the potential treatment of mass casualties of a chemical emergency.
- Asphyxiants can be divided into simple asphyxiants (displace oxygen in inspired air) or chemical asphyxiants (interfere with oxygen transport and cellular respiration and therefore cause tissue hypoxia). The most common chemical asphyxiant is carbon monoxide while other examples include cyanide and hydrogen sulfide. Simple asphyxiants are considered low-risk for use chemical weapons, but are frequently encountered in environmental exposures.
- Cholinesterase inhibitors (e.g., sarin, soman, tabun, VX, carbamate insecticides) result in muscarinic (SLUDGE, bronchorrhea, bronchoconstriction), nicotinic (muscle weakness or fasciculations, paralysis), and central nervous system effects (seizure). The three antidotes are atropine, pralidoxime, and diazepam which treat the muscarinic, nicotinic, and CNS effects, respectively.
- Clinical effects of respiratory tract irritants depend on direct tissue reactivity, reflex stimulation, water solubility, and dose. Highly soluble irritants (e.g., ammonia) are absorbed in the upper respiratory tract potentially resulting in laryngeal edema; whereas, low soluble irritants (e.g., phosgene) penetrate more deeply and may cause acute lung injury with a delayed onset.
- Vesicants and skin caustics are notably irritating to the eyes, skin, and airways. The most important agent in this class is mustard. Pulmonary complications are the most common cause of death from exposure to mustard.

Reviewed by Kennon Heard

(77) A randomized multicenter trial of crotalinae polyvalent immune Fab (ovine) antivenom for the treatment for crotaline snakebite in the United States.

Dart RC, Seifert SA, Boyer LV, Clark RF, Hall E, McKinney P, McNally J, Kitchens CS, Curry SC, Bogdan GM, Ward SB, Porter RS.
Arch Intern Med. 2001 Sep 10;161(16):2030-6
Rocky Mountain Poison and Drug Center, Denver Health Medical Center, Denver, CO.

Original Research

This is the first randomized trial of antivenom in the United States. This multi-center randomized trial had a unique study design such that all patients in the study were treated with crotalinae polyvalent immune Fab antivenom (Fab AV), one group being on a PRN basis (PRN group) compared to repeated treatment during 18 hours (scheduled group).

- 31 patients were enrolled
- The mean severity score of the 31 patients decreased from 4.35 to 2.39 points ($p < 0.001$).
- No patient in the scheduled group received unplanned Fab AV doses; whereas 8 of 16 patients in the PRN group received unplanned doses ($p = 0.02$).
- Acute reactions occurred in 6 patients (19%) and serum sickness occurred in 6 of 26 patients who returned for follow-up (23%).
- Fab AV effectively terminated venom effects.
- The treatment regimen may require more than the initial dose since the unplanned use of Fab AV in the PRN group was common.

Reviewed by Kennon Heard.

(78) The management of occupational exposures to blood and body fluids: revised guidelines and new methods of implementation.

Schriger DL, Mikulich VJ; Centers for Disease Control and Prevention.
Ann Emerg Med. 2002 Mar;39(3):319-21.
UCLA Emergency Medicine Center; UCLA School of Medicine, Los Angeles, CA.

Clinical Practice Review

Considering the number of blood and body fluid exposures that occur in the emergency department, physicians should know the basic tenets of management for the sake of their own health as well as in the care of others. This article summarizes the updated recommendation from the CDC released in 2001. First, the use of rapid HIV testing of the source patient is recommended in order to minimize the need for unnecessary doses of post-exposure prophylaxis (PEP) medications. With regards to Hepatitis B, if the exposed individual is certain that he has successfully completed the series with a documented titer, no active or passive immunization is required. About 10 % of the population are nonresponders to the Hepatitis B vaccine. For these individuals, those who have failed one series of 3 immunizations can be given either Hep B vaccine and HBIG (Hepatitis B Immune Globulin) or two doses of HBIG one month apart. For those who have not responded after two complete immunization series, they should receive the HBIG in two doses a month apart. No prophylactic or active treatment is currently effective against an exposure to Hepatitis C.

In a rare gesture, this article internally suggests that its contents cannot and will not be remembered completely by most clinicians. For that reason, two resources are made available as points of reference in the case of questions regarding an exposure. These resources are listed below.

- National Clinician's Postexposure Prophylaxis Hotline (PEPline). This is a 24/7 resource available to clinicians with any questions regarding appropriate management of an exposure but is particularly helpful in formulating a plan for special cases such as an unknown source, a pregnant exposed clinician, and so forth. The number of this PEPline is 888-448-4911.
- www.needlestick.mednet.ucla.edu is a needlestick electronic medical record that works by prompting the clinician for information regarding the exposure and then offering a proposed treatment plan with a rationale explaining the evidence behind the recommendations. After care instructions can then be printed along with a permanent record for the patient's chart. It can be done anonymously or with the clinician's name included.

Reviewed by Jason Haukoos

(79) Early goal-directed therapy in the treatment of severe sepsis and septic shock.

Rivers E, Nguyen B, Havstad S, et al; Early Goal-Directed Therapy Collaborative Group.
N Engl J Med. 2001 Nov 8;345(19):1368-77.
Departments of Emergency Medicine, Surgery, Medicine, and Epidemiology at Henry Ford Health Systems, Case Western Reserve University, Detroit, MI

Original Research - Prospective Randomized Controlled Trial

This research article served as a clarion call to change how we approach septic patients in the first hours of their presentation. As emergency physicians, we often make the diagnosis, provide limited treatment, and transfer patients to the ICU for further, more aggressive management. The authors of this article not only blurred the lines between ED and ICU care, but also demonstrated the unacceptable aspects of our traditional sepsis management protocols.

The general premise is that early assessment of shock through the use of a physical exam, review of vital signs, measuring a central venous pressure (CVP), and urinary output fail to adequately detect global tissue hypoxia. Early goal directed therapy proposes a more sophisticated approach to matching systemic oxygen delivery with demand. The “goals”, also referred to as resuscitation end points, include a normalized mixed (or central) venous oxygen saturation ($S_{cv}O_2$), serum lactate concentration, base deficit, and serum pH.

This was a prospective randomized study where presenting patients with possible sepsis were included based on criteria listed on page 1370. The 263 patients were then randomized to either a goal directed protocol or a standard protocol. The diagram on page 1369 succinctly demonstrates this process and delineates the associated interventions and goals of the control group vs. the study group. In the goal-directed group, the CVP, mean arterial pressure (MAP), and $S_{cv}O_2$ were all measured and treated with crystalloid, vasoactive agents, transfusions to maintain a hematocrit above 30%, and inotropic agents. Control group patients were also eligible for any of these interventions, but at the discretion of the treating physician. However, it was found that these patients were undertreated in the first six hours. In subsequent days, these undertreated patients in the control group were found to require more fluids, transfusions, and vasopressor support than those from the goal-directed group. Look at Table 4 on page 1375 for a concise review of these interventions.

A previous study had found that aggressive optimization of hemodynamics led to a higher mortality rate. This study found a decrease in mortality as a result of early goal directed therapy with a near 50% decline in deaths from sudden cardiovascular collapse. Potential problems with this study include the fact that as this study occurred at a single institution, the control group may have started receiving a more goal directed approach and the investigators supervising the goal directed group were not blinded. However, upon admission to the ICU, the clinicians were blinded to the goal directed vs. control status of the patients. This article has spurred an abundance of ongoing research concerning the specific role that we, as emergency physicians, play in the early management of sepsis. We have included this article since it has served as a foundation for further research and clinical practice modifications. A search of the literature will find more recent articles by Rivers and others which build further on the basic premises of this study.

Reviewed by Jason Haukoos

(80) Acute human immunodeficiency virus type 1 infection.

Kahn JO, Walker BD.
N Engl J Med. 1998 Jul 2;339(1):33-9.
AIDS Program, University of California at San Francisco, CA; Partners AIDS Research Center, Massachusetts General Hospital, Harvard Medical School, Boston, MA

Clincal Practice Review

The advent of rapid HIV testing has allowed more rapid evaluation of at-risk patients in the emergency department. This article is several years old but still offers a concise reminder of the need to consider acute HIV infection in patients with unexplained febrile illness and chronic HIV infection in those who present with specific clinical features consistent with this disease. It is estimated that 40% to 90% of patients who contract HIV will exhibit signs of an acute antiretroviral illness. The first part of this paper focuses on the transmission of the HIV virus. The symptoms associated with acute HIV infection most likely reflect immune system responses to the virus and the onset of these symptoms corresponds with a decrease in viremia.

So how hard can it be to focus in on this diagnosis? Look at Table 1 on page 35 where you find common signs and symptoms include fever, headache, lymphademopathy, pharyngitis, myalgia, arthralgia, weight loss, and aseptic meningitis. That narrows the possibilities down to about one in every three patients that we see. The presence of a maculopapular rash could also be somewhat helpful in differentiating this but it is not always present. Considering the ubiquitous and nonspecific symptoms associated with this diagnosis, ED physicians should always have this prospect in the differential and ask questions that would elicit risk factors predisposing the patient to HIV infection. Without a high degree of suspicion, we will continue to miss these diagnoses. Time of onset after infection ranges from days to weeks and duration of the acute HIV illness usually is 7 to 14 days. When testing, know that a serum ELISA will probably be negative. While an ELISA should be sent, HIV-1 RNA testing should also be performed.

Having reminded the clinician of this disease entity in the acute phase, why is it important to diagnose? First, while data to support long term benefit is limited, preliminary research suggests that after initial infection, a “set point” viral load is established. Treating patients within weeks of infection likely lowers this set point which corresponds with a more benign course of disease and lower mortality. Secondly, early identification of patients with HIV will not only diagnose them as HIV positive but may also lead to more comprehensive awareness of other infected persons in the community e.g. “I’ve only been infected a few weeks and I’ve only slept with one person in the last two months – so he probably has it as well.” This obviously could reduce further casual transmission of the virus by unwitting HIV positive patients.

- Early identification and treatment of HIV helps the patient by lowering the viral set point and also helps prevent spread to others.
- ELISA will probably be negative during the acute retroviral illness.
- Include acute HIV infection in the differential of any unexplained febrile illness or you will continue to miss it.

Reviewed by Jason Haukoos

(81) Management of tuberculosis in the United States.

Small PM, Fujiwara PI.
N Engl J Med. 2001 Jul 19;345(3):189-200.
Division of Infectious Diseases and Geographic Medicine, Stanford University Medical Center, Stanford, CA; New York City Department of Public Health, NY.

Clinical Practice Review

Despite a resurgence of tuberculosis (TB) in the early 1990's, the disease was at a historic low in the United States in the year 2000 with the number of cases decreasing by 45% from its peak. Decreased public health infrastructure, immigration trends, and the HIV epidemic had all contributed to the previous upswing in cases and multi-drug resistant strains became more common. While the goal of eliminating TB in the United States is still plausible, one third of the world population is currently infected. Management of TB certainly transcends the scope of emergency medicine practice. However, some basic tenets regarding the disease and its treatment should be recognized since these patients will present at 3 AM when there are no other resources available.

TB skin testing is notoriously confusing. Some basic points should be remembered. HIV positive patients should be considered positive with as little as 5 mm of reaction. Patients with end-stage AIDS may exhibit no reaction at all. Most patients are considered positive at 10 mm. Patients with a past history of TB may actually test negative! So a patient from Nigeria with a negative skin test should be retested in two weeks when the "booster effect" will have prompted a positive reaction. Finally, patients from overseas may have received a BCG vaccine which will cause a positive skin test even in the absence of disease.

Patients with latent disease should be treated with nine months of isoniazid. An alternative regimen is rifampin and pyrazinamide for two months but this regimen has more side effects. Active TB can be treated with 18 months of INH alone, 9 months of INH and Rifampin, or 6 months of INH and Rifampin plus two months of pyrazinamide. These regimens all presume susceptible TB strains. Local drug resistance patterns should be evaluated prior to starting anyone on a treatment regimen. Finally, HIV positive patients on HIV meds will probably not tolerate rifampin alone. Rifampin levels will be toxic and acute antiretroviral agents will be subtherapeutic. Rifabutin is an acceptable substitute in these patients.

- Patients with a history of TB may have a false negative skin test intitially.
- Patients with a history of BCG vaccination may have a false positive skin test.
- INH is the foundation of most treatment regimens.
- HIV patients will not tolerate rifampin well so substitute rifabutin.

Reviewed by Jason Haukoos

(82) Illness after international travel.

Ryan ET, Wilson ME, Kain KC.
N Engl J Med. 2002 Aug 15;347(7):505-16.
Division of Infectious Diseases, Massachusetts General Hospital, Harvard Medical School, Boston, MA; Mount Auburn Hospital, Cambridge, MA; Division of Infectious Diseases, Toronto General Hospital, University of Toronto, ON.

Clinical Practice Review

In reviewing this article, it is hard not to be thankful for the United States' temperate climate and relatively well developed public health infrastructure. Most of us approach internationally acquired illnesses with a combination of curiosity and bewilderment. We're happy if we remember the details of malaria and order a peripheral smear but what other things lurk out there? In reviewing this article, the original intent was to quickly run through all of the diseases discussed. Unfortunately, that is essentially the structure of the article itself, condensing infectious disease and travel medicine from across the world into a brief summary article. They tackle this daunting task with gusto and the resulting tables and figures are informative but disheartening because it's quite evident that they are beyond memorization. Having admitted that a comprehensive review will be impossible in this page, be satisfied with the summary notes below and refer to the article itself when that next patient arrives on the red-eye flight from Nairobi.

- Determine the incubation period (time prior to onset of fever or other symptoms) to narrow the differential diagnosis – see Table 1 on page 507.
- *P. falciparum* malaria should be considered in all patients with fever from malaria endemic areas.
- 90% of *P. falciparum* is contracted in sub Saharan Africa.
- *P. falciparum* is often resistant to multiple antimalarials and can be rapidly fatal – admit all patients with this suspected organism.
- Send a blood smear, if negative, repeat in 12 to 24 hours if malaria is still suspected.
- Traveler's diarrhea – consider empiric treatment with a fluoroquinolone or a macrolide
- With persistent diarrhea, consider protozoa like G. lamblia or tropical sprue.
- Read the dermatologic section and you'll probably stay out of the water on your next trip.

Reviewed by Jason Haukoos

(83) West Nile virus.

Petersen LR, Marfin AA, Gubler DJ.
JAMA. 2003 Jul 23;290(4):524-8.
National Center for Infectious Diseases, Centers for Disease Control and Prevention, Fort Collins, CO

West Nile Virus has become a significant source of public angst over the past several years, prompting patients to arrive with a mosquito bite and malaise convinced that they have WNV. Emergency physicians should know this disease well in order to calm the fears of their patients while also remaining aware of the rare but real dangers of this virus. The disease was first isolated in the US in 1999 and by 2002 it had reached the west coast. It lives in a bird-mosquito-bird cycle so 85% of cases are reported in August and September since almost all human infections are mosquito borne.

Among patients who get WNV from a mosquito, it's estimated that 20% will develop West Nile Fever. This is a mild 3 to 6 day course of fever, malaise, anorexia, and nausea. The incidence of active infection and severity of infection increases with age. A maculopapular rash covering the entire body was more commonly seen in the past but has decreased in frequency and is certainly not a required aspect of infection. Less than 1% of patients with WNV will have CNS involvement. While rare, this form of the disease can be devastating. Almost all of these patients will have a fever along with profound weakness and headache. CNS features may include parkinsonian features, instability, and hyporeflexia. Acute flaccid paralysis may occur as a result of WNV damage to anterior horn cells in the spinal cord in a fashion very similar to polio. Evaluation of the serum and CSF for IgM antibodies can establish the diagnosis although residual IgM antibodies from prior infection can remain present for over a year. The CSF usually shows lymphocyte dominant pleocytosis as well as elevated protein. A head CT in CNS infected patients will almost always be negative while an MRI will likely be negative but sometimes demonstrate damage to the basal ganglia, thalamus, or pons which correlates with the findings of parkinsonian features in some patients.

Once the diagnosis is established, treatment is supportive. No studies have yet demonstrated an effective intervention regimen. Vaccines for horses now exist but a human vaccine is still in development. Mosquito spray is our best preventive measure currently. In comparing WNV to St. Louis encephalitis and other related diseases, WNV displays a higher viremia in birds and easier transmission through multiple mosquito species which explains why WNV has a higher risk of epidemic spread.

- 85% of cases in the U.S. present in August and September.
- About 20% of patients with WNV will develop West Nile Fever.
- 1% of patients with WNV will have CNS manifestations.
- Care for infected patients is supportive.
- No vaccine for humans exists yet.

Reviewed by Jason Haukoos

(84) Low back pain.

Deyo RA, Weinstein JN.
N Engl J Med. 2001 Feb 1;344(5):363-70.

Clinical Practice Review

There are many causes for low back pain (LBP). Up to 85% of all patients with LBP cannot be given a precise diagnosis. As such, there are three questions which can help a clinician focus on patients that need additional evaluation:

- Is there a systemic disease causing the pain?
- Is there neurologic compromise that may require surgical evaluation?
- Is there social or psychological distress that may amplify or prolong the pain?

The following list of concerning findings is followed by the disease that bears contemplation.

Concerning History elements:

- Weight loss - cancer
- IV drug use - epidural abscess
- Leg pain after walking - claudication
- Numbness - disk herniation
- Bowel or bladder dysfunction - cauda equina syndrome

Concerning Physical Exam elements:

- Cachexia – cancer
- Fever- Spinal infection
- Vertebral tenderness- Spinal infection
- Decreased chest expansion- Ankylosing spondylitis
- Positive straight leg raise- Herniated disk (highly sensitive)
- Positive crossed leg raise- Herniated disk (highly specific)
- Pulsatile abdominal mass- Abdominal aortic aneurysm
- Pain better with flexion of spine- Spinal stenosis

The evaluation of back pain can be accomplished with a variety of modalities available. Plain films should be limited to those with trauma or in whom the possibility of systemic disease must be excluded. All patients who continue to experience pain after more than 6 weeks should receive plain films. Furthermore, patients who are more than 65 years of age should receive plain films to rule out occult fracture in the setting of trauma. The use of CT or MRI should be limited. It should be remembered that 90% of patients with acute LBP will recover within two weeks. Only 10% of patients with a herniated disk will require surgical intervention.

Therapy for LBP obviously varies with the extent of injury. A succinct review of these treatment regimens is reviewed and a discussion of prevention of future injury is also included.

Reviewed by Kurt Whitaker

(85) Orthopedic pitfalls in the ED: acute compartment syndrome.

Perron AD, Brady WJ, Keats TE.
Am J Emerg Med. 2001 Sep;19(5):413-6.
Departments of Emergency Medicine and Radiology, University of Virginia, Charlottesville, VA

Clinical Practice Review

Compartment syndromes most commonly stem from fractures with associated hemorrhage or swelling which compromises circulation to nerves and muscles in a closed space. A circumferential burn eschar or a cast can also cause a compartment syndrome through external compression on the compartment. It is most commonly seen with tibial fractures, supracondylar fractures, humeral shaft fractures and forearm fractures. Less common locations are also reviewed (see page 414). Besides leading to disablility involving the affected limb, unchecked compartment syndrome can lead to myoglobinuria and renal failure.

This review emphasizes “a very high suspicion remains the cornerstone of diagnosis”. While pain out of proportion to the visible injury is a classic finding, this obviously will be absent in the obtunded patients whom we often encounter. The classic five P’s of diagnosis are pain, paresthesia, paresis, pallor, and pulselessness. Pain will likely be the earliest indicator but the loss of normal sensation is the most reliable sign (see page 414). The maintenance of a pulse should not reassure the clinician. Despite elevated pressures in the compartment, they are still usually less than arterial blood pressures. Therefore, the loss of pulses or a delayed capillary refill are late findings and would be dire indicators.

The normal compartment pressure should be less than 20 mm Hg. Pressure can be measured using a Stryker pressure monitor. Descriptions of the needle technique and a wick catheter are also described (see page 415). One study by Heckman et al. suggests that multiple pressures should be measured since missing the area of peak pressure is relatively common.

Treatment of a compartment syndrome centers on decreasing pressures in the compartment, maximizing blood flow, and minimizing further tissue damage or functional loss. To this end, any external pressure from dressings or casts should obviously be removed. Elevate the limb to the level of the heart which minimizes venous pooling while promoting continued arterial flow. Do not place ice on the affected area since this will lead to local vasoconstriction. The definitive treatment is a surgical fasciotomy and should be considered a true surgical emergency requiring orthopedic consultation regardless of the time of day. Delay in diagnosis or treatment can lead to devastating consequences including Volkmann’s ischemic contracture.

Reviewed by Kurt Whitaker

(86) Orthopedic pitfalls in the ED: pediatric growth plate injuries.

Perron AD, Miller MD, Brady WJ.
Am J Emerg Med. 2002 Jan;20(1):50-4.
Departments of Emergency Medicine and Orthopedic Surgery, University of Virginia Health System, Charlottesville, VA.

Clinical Practice Review

In skeletally immature patients, the area of growing cartilage that allows for bone growth is termed the physis or growth plate. It is susceptible to traumatic injury that may result in bone growth arrest.

Epidemiology:

- 15% to 30% of all skeletal injuries in children are physeal injuries.
- 80% of all physeal injuries are between the ages of 10-16 (period of greatest growth)

Salter-Harris Classification: The most common system used to differentiate these injuries is the Salter Harris classification, where a higher number connotes a more serious injury in most instances.

- Type I - Most common in infants and toddlers
    - Widening at the physis (epiphysis separates from metaphysis)
    - Good prognosis
- Type II - Most common type
    - Through physis, then out metaphysis
    - Segment of metaphyseal bone is called “Thurston Holland” fragment
- Type III - rare (10%)
    - Through epiphysis then out physis
    - Chance for disturbance of blood supply
- Type IV- rare (10%)
    - Starts at articular surface, through the epiphysis, physis, and then out metaphysis
    - Again, higher chance of growth disturbance
- Type V - Most rare (1%)
    - Crushed physis
    - Diagnosis
        - High suspicion of injury
        - Point tenderness over physis

Treatment:

- I - Ice, splint, elevate
- II - Ice splint, elevate
- III - Ortho evaluation in ED, subsequent ORIF
- IV - Ortho evaluation in ED, subsequent ORIF (still with poor outcome)
- V - Ortho evaluation in ED, cast, non-weight bearing (poor outcome)

Reviewed by Kurt Whitaker

(87) Difficult airway management in the emergency department.

Orebaugh SL.
J Emerg Med. 2002 Jan;22(1):31-48.
Department of Anesthesiology, University of Pittsbugh Medical Center, Pittsburgh, PA.

Clinical Practice Review

While this review article was written by an anesthesiologist, it provides an excellent review of emergency department tools and also provides useful comparisons between the patients encountered by ED physicians as opposed to anesthesiologists. It should be remembered that a difficult airway can refer to trouble with either intubating of ventilating a patient. A patient whom you cannot intubate may very well be ventilated using a bag valve mask until an alternative plan is formulated. Furthermore, a patient may be successfully intubated but still present challenges of ventilation.

- Grading of laryngeal and oropharyngeal exposures is worth knowing (see page 32).
- Make your first attempt at intubation your best attempt.
- A combitube or LMA can be a temporizing measure that allows for ventilation and then creates a calmer environment as you set up for a definitive surgical airway.
- Intubating through an ILMA requires practice ahead of time since studies have shown that novice users are unlikely to be successful on their first attempt (see page 40).
- If you can't intubate, and BVM isn't working – don't hesitate in preparing to "cric" the patient (see page 35).
- A comprehensive review of blades and aids for direct laryngoscopy is worth reviewing on pages 35 to 38.
- A basic review of the surgical airway is found on page 44.

Reviewed by Fred Severyn

(88) Pharmacology of emergency department pain management and conscious sedation.

Blackburn P, Vissers R.
Emerg Med Clin North Am. 2000 Nov;18(4):803-27.
Department of Emergency Medicine, Maricopa Medical Center, Phoenix, AZ; Department of Emergency Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC.

Clinical Practice Review

Numerous studies demonstrate that physicians inadequately address their patients' complaints of pain. This paper offers a systematic review of the different pain medications in our arsenal. Major points are summarized below:

- High dose fentanyl can lead to chest wall rigidity making ventilation difficult or impossible. Naloxone is only partially effective in reversing this.
- Codeine is only minimally more effective than acetaminophen alone for analgesia.
- NSAID GI complications lead to 107,000 hospitalizations and 16,500 deaths in the United States annually.
- The COX II section of this paper does not account for recent cardiac complications now recognized.
- Toradol should never be used for more than five days.
- Toradol 60mg IM has comparable analgesia to ibuprofen 800 mg PO.
- Amitryptiline is a good choice for neuropathic pain.
- Midazolam is preferable to diazepam for conscious sedation.
- Ketamine acts as a bronchodilator, increases heart rate and blood pressure, and produces a dissociation between the cortical and limbic systems.
- Propofol provides no analgesia and decreases systemic vascular resistance, thus lowering blood pressure.

Reviewed by Fred Severyn

(89) Clinical policy: evidence-based approach to pharmacologic agents used in pediatric sedation and analgesia in the emergency department.

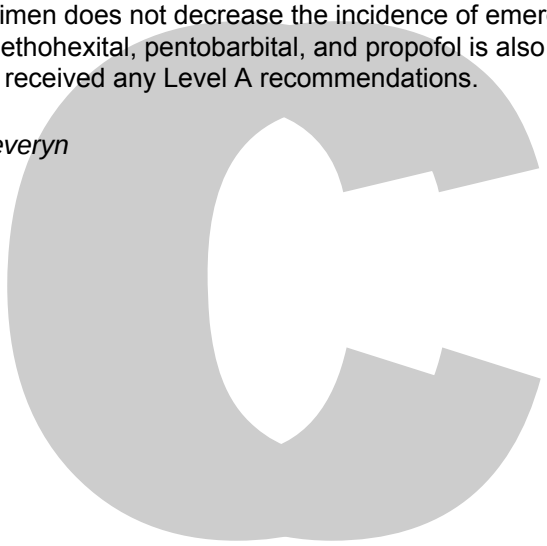
Mace SE, Barata IA, Cravero JP et al. and the American College of Emergency Physicians. Ann Emerg Med. 2004 Oct;44(4):342-77.

Clinical Practice Review and Guideline

This systematic review looks at different sedation and analgesia drugs used in the pediatric emergency department population. Committee members included representatives from the ASA and the AAP. The definitions of the Level A, B, and C recommendations are reviewed on page 344.

- Fentanyl in high doses or infused rapidly can lead to chest wall rigidity.
- Ketamine received a Level A recommendation for its use in brief painful pediatric procedures.
- Contrary to common belief, a Level A recommendation stated that midazolam added to a ketamine regimen does not decrease the incidence of emergence reactions in children.
- The use of methohexital, pentobarbital, and propofol is also reviewed although none of these agents received any Level A recommendations.

Reviewed by Fred Severyn



(90) Laceration management.

Hollander JE, Singer AJ.
Ann Emerg Med. 1999 Sep;34(3):356-67.
Department of Emergency Medicine, University of Pennsylvania, Philadelphia, PA; SUNY at Stony Brook, Stony Brook, NY.

Clinical Practice Review

The goals of wound management are concisely summarized on the first page: reduce wound contamination, debride devitalized tissue, restore perfusion, and reapproximate the wound edges well. Surprisingly, few clinical trials support current wound management techniques. Exploration for foreign bodies is critical – especially in consideration of the fact that a failure to diagnose a foreign body is the fifth most common cause of litigation against emergency physicians. Two studies cited in this review suggest that sterile technique does not reduce wound infections. While much attention is paid to using bicarbonate as a buffering agent to reduce the pain of local anesthetic injections, warming the anesthetic to body temperature is another consideration in minimizing the pain.

Wound irrigation with 5 to 8 psi is most effective in minimizing infection although this review cites preliminary studies which suggest that irrigation of relatively clean wounds on the face may not be necessary. A review of the "golden period" of wound closure is found on page 361. Staples are briefly reviewed and are reported as being associated with a lower rate of infection in comparison with the use of sutures. Tissue adhesives are reviewed with a reminder that wounds which cannot be manually approximated without significant tension are not candidates for tissue adhesives. Wounds over joints or areas of repetitive motion are not suitable for tissue adhesives. Remember that Dermabond polymerization releases heat so the "more is better" technique may cause discomfort to the patient – 3 to 4 coats should be sufficient. Quick removal of Dermabond can be accomplished with acetone. Don't put any topical ointments over Dermabond since this may lead to dehiscence. Bathing or swimming may also lead to dehiscence with the use of tissue adhesives.

As a general rule, cleaning the wound thoroughly at the time of presentation is much more effective than "covering for infection" with prophylactic antibiotics. Open fractures, exposed tendons or joints, bites, or large intraoral lacerations are the main indications for the use of antibiotics.

- Sterile technique has not been shown to lower wound infection rates.
- Irrigate with 5-8 psi to reduce bacterial counts.
- No ointment on tissue adhesives.
- Acetone can remove tissue adhesives quickly.
- Don't routinely dispense prophylactic antibiotics for lacerations.

Reviewed by Fred Severyn

(91) Necrotizing fasciitis associated with injection drug use.

Chen JL, Fullerton KE, Flynn NM.
Clin Infect Dis. 2001 Jul 1;33(1):6-15. Epub 2001 May 23.
Division of Infectious Disease, University of California, Davis Medical Center, Sacramento, CA

Original Research – Retrospective Case Series

Patients commonly present to the emergency department with complaints of a cellulitis or an abscess after a "bug bite". Further questioning often reveals that the bug may have actually resembled a hypodermic needle. In most cases, if an abscess is present, it's drained and the patient is given antibiotics with the presumption of methicillin resistant *Staph aureus* (MRSA) if there is any surrounding cellulitis. In rare cases, however, these patients are presenting with an early necrotizing fasciitis. Most ED clinicians would agree that necrotizing fasciitis is one of the scariest disease entities since it often appears benign until it has caused extensive underlying damage. This article not only offers a review of necrotizing fasciitis but also specifically focuses on those cases resulting from IV drug use (IVDU). The ultimate diagnosis of necrotizing fasciitis involves a surgical exploration. Other than IVDU, obesity and diabetes mellitus are two other commonly implicated risk factors for the development of necrotizing fasciitis.

The study reviewed the charts of patients who ultimately were diagnosed with necrotizing fasciitis who had presented to the ED at UC Davis between 1984 and 1999. Only patients with a confirmed diagnosis who underwent surgical debridement were included in the study. IV drug use (IVDA) was determined through chart review. Of the 107 patients included in the study, 55% were IV drug users. Interestingly, while the study period extended from 1984 to 1999, the incidence of cases increased dramatically in the latter half of the nineties (see Figure 1 on page 7).

Among all the patients in the study, the average time between presentation to the ED and the first debridement was 29 hours. The time to first debridement was significantly lower among IVDUs with necrotizing fasciitis, perhaps because of early identification of a more serious necrotic process occurring when an abscess was debrided. Non-IVDUs were more likely to present with a celullitis without an obvious abscess requiring drainage. Mortality rates were 10% and 21% among IVDUs and non-IVDUs, respectively. The lower mortality rate among IVDU's is potentially explained by the more aggressive management in this population. This is lower than other case series where up to a quarter of all cases of necrotizing fasciitis prove fatal.

An analysis of the bacteriologic isolates is discussed (see page 8 and Table 4 on page 13 for a succinct list of organisms). Most patients grew out polyaerobic or mixed aerobic-anerobic isolates. The presence of polymicrobial isolates in so many cases reaffirms the need for broad spectrum antibiotics. The patient's best chance for survival depends on the ED physician entertaining the diagnosis early in the evaluation and reassessing the patient over time. Definititive, and potentially life or limb saving management requires a scalpel and a surgeon.

Reviewed by Kurt Whitaker

(92) Cellulitis.

Swartz MN.
NEJM 2004 Feb 26; 350 (9):904-912.
Massachusetts General Hospital, Boston, MA.

Clinical Practice Review

This article is a review of cellulitis presented in the context of a clinical case. There is no research methodology in obtaining the data for this article, and it should be considered a "best opinion" paper.

Cellulitis is defined as an acute, spreading, pyogenic inflammation of the dermis and underlying tissue. The author lists a variety of specific sites and situations that may be related to particular bacterial etiologies; however, he subsequently discusses diagnostic strategies for identification of the etiologic agent. Although needle aspiration is not considered standard of care, it is successful in 29% of aspirations. Punch biopsies were slightly better. 79% of all causes of cellulitis were gram positive organisms based on these studies. Diabetics, however, had a more commonly mixed bacterial picture, including anaerobes and pseudomonas in up to 22% of the cases studied.

Blood cultures were found to be notoriously poor for diagnosis, due to the lack of bacteremia; one study only had 4% positive blood cultures. In one small study on patients with cellulitis overlying lymphedema, blood cultures were more commonly positive. The only time radiologic studies are needed is if the concern for osteomyelitis exists. MRI may be helpful for diagnosing necrotizing fasciitis, but surgical exploration is the only definitive method of diagnosis.

Treatment recommendations are based on the most likely bacterial etiology. Thus, with a preponderance of strep and staph aureus, beta-lactam antibiotics are considered the first line of treatment. The author recommends the first dose be intravenous. Diabetic foot infections should have broader coverage due to the numerous bacterial causes.

Additional care measures such as elevation of the affected extremity and immobilization are recommended. Peripheral edema should be treated with compression stockings to decrease the risk of recurrent cellulitis.

- Aspirates of cellulitis are not indicated in routine care.
- Diabetics should be treated with broad spectrum antibiotics initially.
- The only definitive modality to diagnose necrotizing fasciitis is by surgical exploration.

Reviewed by Kurt Whitaker

(93) High prevalence of Methicillin-Resistant Staphylococcus aureus in Emergency Department Skin and Soft tissue Infections.

Frazee BW, Lynn J, Charlebois ED, et al..
Annals Emerg Med 2005 May; 45 (3):311-20.
Alameda County Medical Center Highland Campus

Original Research - prospective observational study using convenience sample of patients

This article is a study that focuses on how frequently methicillin-resistant *Staph aureus* (MRSA) is found in common wounds in the emergency department. 137 patients presented to a busy urban emergency department (ED) with skin or soft tissue infections had those wounds cultured, as well as their nares; 119 isolates grew *Staph aureus,* with 75% of these isolates being MRSA. Of the total number of cultures (of all bacteria) 51% were MRSA.

The point of culturing *Staph aureus* from the nares was to check for colonization. 52.1% of patients who both had an infection and were colonized were concordant (same bacteria for both colonization/infection). All MRSA cultured was susceptible to bactrim and vancomycin. Almost half of all abscesses grew MRSA and 95% of all furuncles grew MRSA. The main point of this study was to emphasize that MRSA is increasingly prevalent and we should be vigilant in treating it.

- MRSA was present in 51% of all wounds or nares cultured in the ED.
- All MRSA cultured was sensitive to Vancomycin and Bactrim..

Reviewed by Kurt Whitaker

(94) Trauma in pregnancy.

Shah AJ, Kilcline BA.
Emerg Med Clin North Am. 2003 Aug;21(3):615-29.
Department of Emergency Medicine, Madigan Army Medical Center, Fort Lewis, WA.

Clinical Practice Review

This review article discusses the management of traumatized pregnant patients, reviewing the anatomic and physiologic changes in pregnancy, pre-hospital care, general management, and diagnostic and radiographic studies.

- Maternal blood pressure and respiratory rate return to baseline as pregnancy approaches term. The pregnant trauma patient's vital signs may lead to a false sense of security, because changes in pulse and blood pressure may not occur until hemorrhage of 1500 to 2000 mL.
- Hypoxemia occurs earlier in pregnant patients and they have very little reserve to adequately compensate.
- The potential for aspiration is markedly increased due to multiple physiologic changes.
- Abdominal tenderness, rebound, and guarding may be absent in the trauma patient with significant injury.
- Placing patients on a backboard with a 15 degree angle to the left (to achieve near left-lateral decubitis position) should be employed in all patients beyond 20 weeks' gestation to avoid the compressive effect of the gravid uterus on the vena cava.
- Fetal viability is likely if the uterine fundal height is between the umbilicus and the xyphoid.
- Fetal heart tones are part of the vital signs, and estimated gestational age and viability should be ascertained while obtaining the ultrasound.
- Cardiotocographic monitoring (CTM) should be initiated in the emergency department as soon as possible. CTM has an excellent sensitivity in detecting placental abruption and should be performed for a minimum of 4 hours for all patients of ≥ 20 weeks' gestation.
- Chest tubes should be placed 1 to 2 intercostal spaces higher to avoid diaphragmatic injury.
- Fetal distress may be the first sign of maternal hemodynamic compromise.
- Pelvic examination should be part of the secondary survey by performing a sterile speculum examination and a bimanual examination.
- Vaginal bleeding may herald placental abruption, uterine rupture, pelvic fracture with vaginal injury, or other injuries.
- A Kleihauer-Betke (KB) test may be considered in an Rh-negative patient with significant trauma.
- Normal pelvic radiographs reveal widening of the sacroiliac joints and the pubic symphysis.
- After 20 weeks' gestation, radiation is unlikely to cause any fetal anomalies.
- As a general rule, abdominal CT should be avoided in early pregnancy.
- Relatively minor trauma may result in placental separation and fetal demise.
- Uterine rupture is devastating to the fetus with fetal mortality nearly 100%.
- Maternal acidosis may be predictive of fetal outcome.
- Necessary radiographs should not be withheld at any period of gestation.

Reviewed by Ben Honigman

(95) HELLP syndrome: the state of the art.

Baxter JK, Weinstein L.
Obstet Gynecol Surv. 2004 Dec;59(12):838-45.
Department of Obstetrics and Gynecology, Fellow, Division of Maternal-Fetal Medicine, Thomas Jefferson University, Philadelphia, Pennsylvania, USA.

Clinical Practice Review

HELLP syndrome is an acronym for hemolysis, elevated liver enzymes, and low platelets and is a severe variant of the preeclampsia/eclampsia spectrum of disease. Hemolysis is due to microangiopathic hemolytic anemia resulting in elevated LDH and indirect bilirubin, as well as peripheral blood smear findings (e.g., burr cells, schistocytes.) The elevated liver enzymes result from periportal or focal parenchymal necrosis. The increased rate of consumption of platelets at the sites of damaged vascular endothelium results in thrombocytopenia. Researchers at the University of Tennessee in Memphis defined HELLP syndrome as hemolytic anemia (LDH > 600 U/L), elevated liver enzymes (AST > 7 U/L), and thrombocytopenia (platelets < 100,000).

- 67% of HELLP syndrome patients experience symptoms during the early third trimester, whereas 25% occur in the postpartum period.
- HELLP syndrome can occur in patients with normal blood pressures and no proteinuria.
- It has been suggested that preeclampsia, HELLP syndrome, pregnancy-associated HUS, TTP, acute fatty liver of pregnancy, and postpartum acute renal failure are diseases that are part of a spectrum of the same illness.
- Patients with RUQ abdominal pain along with neck pain, shoulder pain, hypoglycemia, or relapsing hypotension should undergo imaging of the liver.
- The optimal treatment in confirmed cases of severe preeclampsia or HELLP syndrome is delivery.
- Steroids may improve fetal outcomes with minimal risk to the mother.
- There are no large randomized trials comparing conservative versus aggressive management for the treatment of HELLP syndrome.

Reviewed by Ben Honigman

(96) Evaluation of vaginal complaints.

Anderson MR, Klink K, Cohrssen A.
JAMA. 2004 Mar 17;291(11):1368-79.
Department of Family and Social Medicine, Albert Einstein College of Medicine, Bronx, NY.

Clinical Practice Review

The objective of this study was to evaluate the role of the clinical examination and determine the positive and negative likelihood ratios for the diagnosis of vaginal candidiasis, bacterial vaginosis (BV), and vaginal trichomoniasis.

- Symptoms (e.g., discharge characteristics, itching, irritative symptoms, self-diagnosis) do not allow clinicians to distinguish between the causes of vaginitis.
- Physical examination signs are limited in their diagnostic power.
- Office laboratory tests, particularly microscopy of vaginal discharge, are the most useful way of diagnosing these three conditions.
- The presence of clue cells, typically used to diagnosis BV, makes candidiasis unlikely, but has no impact on differentiating BV from trichomoniasis.
- pH does not distinguish between the three conditions given the overlap.
- A positive whiff test (one of the diagnostic criteria for BV) makes candidiasis less likely, but is positively associated with trichomoniasis.
- Microscopic identification of yeast or trichomonads is diagnostic; yet cannot be ruled out by negative findings on microscopy.

Reviewed by Ben Honigman

(97) Quality of cardiopulmonary resuscitation during out-of-hospital cardiac arrest.

Wik L, Kramer-Johansen J, Myklebust H, Sorebo H, Svensson L, Fellows B, Steen PA.
JAMA. 2005 Jan 19;293(3):299-304.

Original Research – Case Series

This case series reviewed out-of-hospital cardiac arrest patients older than 18 years of age. The authors fitted AEDs with an additional chest pad to be mounted on the sternum that had an accelerometer and a pressure meter attached. The rescuer's hand was placed on the chest pad, and the assumption was made that the mechanics applied to the chest pad also applied to the patient's chest. A second accelerometer was placed within the defibrillator, so by subtraction of the defibrillator's accelerometer's readings, only the sternal pads movements could be studied. The researchers examined several outcome variables which included ROSC, "admitted alive to hospital", and "discharged alive from hospital".

The mean compression rate was too high (120 compressions per minute) and the depth was too shallow (35 mm). The authors note that a significant amount of the delay in receiving compressions was secondary to defibrillator analysis (66%) and that ACLS guidelines are not being followed.

Reviewed by Kurt Whitaker

(98) The EMTALA Paradox. Emergency Medical Treatment and Labor Act.

Wanerman R.
Ann Emerg Med. 2002 Nov;40(5):464-9.

Healthcare Policy Review

Definitions:
EMTALA - Emergency Medical Treatment and Labor Act - a law enacted stating that any hospital that participates in the Medicare program must offer a medical screening exam to any patient to determine if an emergency medical condition exists. If an emergency medical condition does exist, the hospital must either provide stabilizing treatment within the capabilities of the facility, or if the patient cannot be stabilized, the hospital must arrange for appropriate transfer. No inquiry into payment status or ability may delay this process.
HHS - Department of Health and Human Services - the enforcing government branch for this law.
OIG - Office of the Inspector General - the compliance and enforcement branch of HHS.
CMS - Centers for Medicare and Medicaid services - the government branch that deals with the financial administration of Medicare and Medicaid.

When reviewing a possible EMTALA violation, the CMS regional office will determine if an investigation is necessary. If it deems that an investigation is necessary, it authorizes a state agency to do an on-site unannounced visit to assess for violations. The state agency has five days in which to finish investigating and ten days in which to finish it's report; any physician review must occur within five days in association with a state peer review organization by board-certified physician reviewers, with one of the reviewers from the specialty of the physician in question, with a caveat that there can be no bias, financial or otherwise, on the part of the reviewing physician.
If there is a violation, the regional CMS office's only recourse in terms of punishment is to initiate the process to withdraw the hospital's Medicare provider agreement. It also forwards the case to the OIG for possible civil monetary penalties. OIG can impose penalties of up to $50,000 for each violation to the hospital and the same amount to individual physicians.

EMTALA was enacted in 1986, with the regulations codified in 1994 and enforcement beginning in 1998, after CMS published guidelines that included distinct obligations for on-call physicians, an obligation to provide screening and treatment of patients with psychiatric emergencies, approaching medical screening as a dynamic process, and making a distinction between stable for discharge and stable for transfer. Then, in 1999, CMS and the OIG jointly published a bulletin that states that some patients may voluntarily leave before having all pieces of EMTALA met. It states that it is the hospital's responsibility to inform them of the risks and benefits of leaving and take steps to attempt to obtain written documentation of this refusal; if not possible, it should be documented by staff. In 2000, CMS stated that the EMTALA rules apply to all hospital buildings within 250 yards of the main campus and off campus facilities that are part of the hospital for reimbursement purposes. This clarification was narrowed to facilities that have "dedicated EDs". Most recently, in 2002 the OIG published a set of clarifications that allowed for consideration of other instances of violations in the institution of penalties.

One legal consequence of EMTALA was that a hospital was penalized financially when they refused to accept a patient who needed specialized vascular care when a vascular surgeon was available at their hospital. Thus, the law was interpreted as stating that availability of on call specialists constitutes a "specialized capability" and obliges the hospital to accept patients needing these capabilities. Another legal decision states that EMTALA applies even to patients in the process of transfer to another hospital, so overwhelmed emergency departments already on diversion are still obligated to accept unstable patients. Therefore, the concern exists that some transfers may be delayed in verifying if appropriate resources are available.
Reviewed by Kurt Whitaker

(99) Promoting patient safety and preventing medical error in emergency departments.

Schenkel S.
Acad Emerg Med. 2000 Nov;7(11):1204-22.

Healthcare Administration

The issue: Medical errors are frequent (one in 50 patients sustains a preventable iatrogenic injury) and they are common in the emergency department (3% of all medical errors). What can we do to decrease this number?

Why are there medical errors in ED's?

- Sickest patients go through the ED
- 24 hour activity contradicts circadian rhythms, resulting in increased errors
- Increased time pressures
- Inconsistent arrivals result in flux of boredom versus overload
- Less information on patient medication and medical history is available
- No down time
- Rotating staff
- No time for central order review

Problems with evaluating and detecting medical error:

- No formal definition what constitutes an "error"
- Stigma attached with error reporting

Most common type of medical error: Administration of medications (wrong medication, wrong dose, allergic reaction)

Methods of Error prevention:

- Teaching is the fundamental method of error prevention, designed to "avoid repeating preventable errors" (Rosen P, Markovchick V, Dracon D. Normative and technical error in the emergency department. *J Emerg Med*. 1983; 1:155-60) - focuses on the individual as the solution to preventing medical errors.
- Professional continuing medical education supplements prior training - focuses on the individual as the solution to preventing medical errors.
- Morbidity and Mortality conferences act to broaden clinical experience- focuses on the individual as the solution to preventing medical errors.
- Computerized systems
- Pharmacy Changes
    - Computer order entry decreases problems with interpretation of orders.
    - Computerized assisted decision making helps with appropriate prescribing practices.
- Pharmacy Changes
    - Decreased numbers of drugs available (so fewer possible prescribing errors).
    - Moving drug mixing to pharmacy.
    - Preprinted orders with standard drugs and drug doses.
    - Eliminating look-alike drugs.

Reviewed by Kurt Whitaker

(100) Therapeutic hypothermia after cardiac arrest. An advisory statement by the Advancement Life support Task Force of the International Liaison committee on Resuscitation.

Nolan JP, Morley PT, Hoek TL, Hickey RW; Advancement Life support Task Force of the International Liaison committee on Resuscitation.
Resuscitation. 2003 Jun;57(3):231-5.

This is a consensus statement released by the International Liaison Committee on Resuscitation (ILCOR) based on accumulated evidence. Although no specific methodology was quoted in terms of selecting the studies they reference, it is assumed that all studies to date that could be found are referenced.

Their consensus is that unconscious adult patients who had an initial rhythm of ventricular fibrillation (VF) with the return of spontaneous circulation after out-of-hospital cardiac arrest should be cooled to 32-34 degrees Celsius for 12-24 hours. They also mention cooling might be beneficial for in-hospital arrest or for arrests resulting from other rhythms such as pulseless electrical activity or asystole.

Two main studies are referenced- one from Europe and one from Australia (both published in the same edition of the *New England Journal of Medicine*). In the European study, patients who received therapeutic hypothermia had a higher rate of subsequent favorable neurologic outcome at 6 months (55%) versus those who were not cooled (39%). In the Australian study, the neurologic outcome at discharge was more favorable for those who were cooled (49% vs. 26%). There were exclusion criteria for both studies, including persistent hypotension and other causes for coma aside from cardiac arrest, with a resulting exclusion of 92% of the initial possible enrollees.

The mechanism of cooling on improving neurologic outcome is thought to be related to a reduced cerebral metabolic rate for oxygen utilization, in addition to suppressing many of the chemical reactions associated with reperfusion injury, such as free radical induction, excitatory amino acid release, and calcium shifts, which can lead to cell death. That being said, hypothermia is not without risks - it may induce dysrhythmias, coagulopathy, or immune suppression, although these are probably minimal.

Cooling should begin as soon as possible, although in the European study, the range of time to achieve the desired temperature was between 4 and 16 hours with more positive results shown for delayed cooling. Multiple methods of cooling have been used, including ice packs to the groin, axillae and neck, wet towels and fanning, cold crystalloid infusion, or even a “cooling helmet”. No specific device is recommended. Temperature should be continuously monitored via a temperature probe in the bladder, rectum, or pulmonary artery.

Reviewed by Jason Haukoos