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February Introduction

Mel Herbert, MD and Anand Swaminathan, MD

- Mel and Swami discuss a case of status epilepticus in an adult patient.
- Key take-home points
 - Benzodiazepines are the first line.
 - Midazolam: 0.15 mg/kg
 - Lorazepam: 0.1 mg/kg
 - Start a typical antiepileptic drug (AED) early.
 - Levetiracetam 60 mg/kg (up to 4.5 g)
 - Phenytoin 20 mg/kg
 - Valproic acid 40 mg/kg
 - Typical AEDs are only successful about 40% of the time after benzodiazepines have failed

Phenobarbital

- The dose is 20 mg/kg (can repeat once)
- A recent study shows benefit over traditional AEDs
- Burman RJ, et al. A Comparison of Parenteral Phenobarbital vs. Parenteral Phenytoin as Second-Line Management for Pediatric Convulsive Status Epilepticus in a Resource-Limited Setting Front Neurol 2019; 10:506.
- **Ketamine** is another consideration in benzodiazepine-refractory patients although there is scant literature on it's role
- O Move to general anesthesia early if benzodiazepines not working
 - Propofol is an excellent antiepileptic medication but typically will require airway protection.
 - If blood pressure drops on propofol, add a vasopressor instead of titrating down the propofol (titrating down can lead to recurrent seizures)



Obtain an electroencephalogram (EEG) as soon as possible because subclinical status can be a difficult bedside diagnosis.

Related Links

EM:RAP 2020 October Status Epilepticus Revisited

CorePendium: Seizures in Adults

Community Acquired Pneumonia I

David Glaser, MD

- New guidelines were recently published from the Infectious Diseases Society of America (IDSA)
- The role of imaging in diagnosis:
 - CXR is insensitive, especially early, and their interpretation is subject to significant interrater reliability.
 - O Ultrasound has been noted to have higher sensitivity than CXR for the diagnosis of pneumonia while sparing the patient exposure to ionizing radiation.
 - O CT is also more sensitive than CXR for the diagnosis of pneumonia and can help make alternate diagnoses.

Critical Care Mailbag: Intubating with Severe Acidosis

Scott Weingart, MD and Anand Swaminathan, MD

- Background
 - O Patients compensate for metabolic acidosis with respiratory alkalosis.
 - This compensation works to maintain pH in a functional range.
 - O Taking away the respiratory drive and hyperpnea during rapid sequence intubation will cause the pH to drop into a non-functional range.
 - O The pH number itself is less important than the acuity of the underlying disease process.
 - O A patient with a chronic process (eg, COPD) will tolerate a lower pH than a patient with an acute one (eg, sepsis).

PEARLS 🎱

• Ideally, we avoid paralysis and intubation in patients with severe acidosis to allow the patient to continue their compensatory breathing while we fix the underlying problem.



- Role of bicarbonate administration prior to intubation
 - Bicarbonate can only increase pH if the patient increases their respiratory drive.
 - It is this increased "blowing off" of CO2 that raises the pH.
 - Patients with profound metabolic acidosis are already compensating maximally with increased ventilation; thus, bicarbonate won't help.

PERSPECTIVES |

- Or. Weingart does not give boluses of bicarbonate. If the patient needs fluids, he gives isotonic bicarbonate (3 amps of NaHCO3 in 1 L D5W).
- Approach to Intubation
 - Start the patient on NIPPV
 - NIPPV augments respiratory drive.
 - This can help you determine minute ventilation (useful for ventilator settings after intubation).
 - Intubation procedure

PERSPECTIVES |

- Dr. Weingart prefers RSI in most circumstances.
- Continue NIPPV (this may be done using the ventilator as well) during the apneic period.
 - This allows for continued gas exchange during the apneic period.
 - Empiric settings: RR 12, TV 8 cc/kg
- Awake approach
 - Consider awake intubation if there are predicted anatomical challenges.
 - Ideally the patient is fully awake, and only topical anesthetic is used.
 - If a fully awake intubation is not in your skill set, consider a medication-facilitated intubation with ketamine.
- Mechanical ventilation
 - Empiric settings: RR 30, TV 8 cc/kg
 - Use a square breathing curve with a high inspiratory flow rate.
 - Make sure that the patient fully exhales between breaths.
 - Use generous sedation and analgesia as the respiratory pattern will be uncomfortable (but very necessary).



Chest Pain in Pregnancy: Part 3 Pulmonary Embolism

Rebecca Bavolek, MD and Mel Herbert, MD

Background

- While uncommon, venous thromboembolism is a leading cause of maternal death.
- Differentiating physiologic pregnancy-related shortness of breath and leg swelling from symptoms of venous thromboembolism can be very challenging.
- Prevalence studies have suggested that pulmonary embolism (PE) is less common in pregnancy, however, this may be a reflection of more testing in pregnant patients (which reduces the apparent prevalence).
- Deep vein thrombosis (DVT) occurs in the left leg more than the right due to the anatomy of the gravid uterus and the pressure it exerts on pelvic veins.
- DVT is more often proximal in pregnancy; 72% are iliofemoral (vs 9% in non-pregnant patients)
- The presentation of PE in pregnancy is similar to that of a non-pregnancy patient.

The YEARS algorithm

- The YEARS algorithm can help in the evaluation of suspected PE:
 - Order D-dimer and assess the presence of:
 - Clinical signs of DVT
 - Hemoptysis
 - PE as the most likely diagnosis
 - O With zero criteria and D-dimer < 1000 → no further investigation
 - With zero criteria and D-dimer > 1000 → order CT pulmonary angiogram (CTPA)
 - O With one criteria and D-dimer < 500 → no further investigation
 - With one criteria and D-Dimer > 500 → order CTPA
 - https://pubmed.ncbi.nlm.nih.gov/30893534/
 - In 11 patients who received CT despite a low D-Dimer value (a protocol violation), none were found to have PF
 - In 164 patients with a negative D-Dimer at 3 month follow-up there was no PE and only 1 DVT.
 - Old It was also noted that even patients with high D-Dimer levels had a low prevalence of disease on CTPA in the absence of other risk factors or clinical suspicion.



- 242 women had at least one high-risk clinical feature
 - In patients with one criteria and D-Dimer < 500, only a single PE was found on CTPA.</p>
 - In patients with one criteria and D-Dimer > 500, 15 out of 211 had PE on CTPA.
- Using the YEARS algorithm, 65%, 46%, and 32% of CTPAs that were not indicated were avoided in women who joined the study in the first, second, and third trimesters, respectively.

Other Imaging Modalities

- It should be noted that CTPA might be less sensitive in the pregnant patient.
- In patients with suspected venous thromboembolic disease, a positive ultrasound would be
 enough evidence to treat without further work up. A negative ultrasound, however, is not sufficient evidence to stop further work-up.
- Modified VQ scanning has also been studied, although no consensus has been reached about its utility compared to CTPA.

Treatment

- Treatment for PE in pregnancy is with low molecular weight heparin.
- Direct oral anticoagulants (DOACs) have not been studied in pregnancy.
- Warfarin is contraindicated in pregnancy.
- Thrombolytic therapy can be used in patients with massive PE, but few cases have been reported.

Cerebral Venous Thrombosis

Evie Marcolini MD, and Anand Swaminathan, MD

- Cerebral Venous Thrombosis (CVT) is an uncommon, serious cause of headache.
 - O CVT comprises 1% of all strokes.
- Risk Factors
 - Oral contraceptive pills
 - Hormone replacement therapy
 - Pregnancy/postpartum (up to 6 weeks)
 - Malignancy (particularly hematological)
 - O Inflammatory diseases (eg, lupus)



- Head/neck infections
- Recent neurosurgical procedure
- Presentation
 - New or unique persistent headache
 - Insidious or acute in onset
 - Increases with movements that increase intracranial pressure such as bending over or coughing
 - Three categories of symptoms/signs:
 - Increased intracranial hypertension
 - Papilledema
 - Nausea/vomiting
 - Visual disturbances
 - Focal syndromes
 - Motor deficits
 - Seizures
 - Encephalopathic syndromes (more common with deep sinus involvement)
 - Altered mental status
- Non-contrast head CT (NCHCT)
 - Only 1/3 of CVT will show up on NCHCT
 - O CT findings in CVT include:
 - Delta sign: hyperdensity of posterior superior sagittal sinus
 - Venous infarct (spans more than one arterial territory) (very specific)
 - Diffuse cerebral edema
 - Hydrocephalus
 - Secondary subarachnoid hemorrhage
- CT venogram or MRI/MR venogram
 - These are considered "gold standard" for CVT.
 - O CT venogram performs as well as MRI/MRV in most cases.



- O However, in patients with signs of deep cerebral vein involvement (encephalopathy, altered mental status) MRI/MRV is superior.
- Discuss with your radiologist to help make best imaging decision in your facility
- Treatment
 - Consult neurology and neurosurgery
 - Heparinization: unfractionated or LMWH

EMA Ultra Ultra Summary January

Mel Herbert, MD

- Abstract 1: Out-of-Hospital TXA vs Placebo in Moderate or Severe TBI
- Abstract 2: Intensive BP Reduction in ICH with Excessively High BP
- Abstract 3: Lidocaine + Ketamine During RSI in Septic Shock: A RCT
- Abstract 5: IM Droperidol vs Ziprasidone vs Lorazepam for Acute Agitation
- Abstract 10: Greater Occipital Nerve Block vs IV Metoclopramide for Migraine
- Abstract 13: The TWIST Score: Testicular Torsion in Pediatric Patients
- Abstract 15: The Impact of Teach-Back on Patient Recall of Discharge Information
- Abstract 17: Prevalence of Depression Symptoms During the COVID-19 Pandemic
- Abstract 19: First-Attempt Intubation Success: Standard vs Hyperangulated
- Abstract 21: Delayed ICH After Blunt Head Injury with DOACs

Tetanus Vaccines

Isaac Bogoch, MD and Anand Swaminathan, MD

- The administration of tetanus vaccine boosters in the ED is a common deployed measure but, is it necessary for those who have had a complete primary immunization series?
- A complete childhood series includes vaccines at 2, 4, and 6 months, 15-18 months, and 4-6 years
- There are three commonly used booster shots: Dtap, TDap and Td
 - All three are functionally similar for boosting tetanus immunity.
 - O Dtap is typically given to kids.
 - O Those with "ap" (acellular pertussis) will also boost pertussis immunity.



- Current tetanus booster indications in the ED for patients with tetanus prone injuries:
 - unknown immunization status
 - o an incomplete primary series
 - not had a booster in the last 10 years
 - o not had one in the last 5 years in the setting of a contaminated wound
- If the patient has a complete, 5 vaccination childhood series, they are likely to be protected even if they don't get another booster. However,
 - It is difficult to know if the patient has had a complete series.
 - O Dtap and TDap also boost immunity for pertussis and diphtheria. Immunity to these bacteria wanes over time so a booster is useful both for the patient and for herd immunity.

PERSPECTIVES

We recommend following the guidelines currently in place, ideally, with Dtap or TDap to boost immunity for diphtheria and pertussis.

Related Links

Hammarlund E et al. Durability of vaccine-induced immunity against tetanus and diphtheria toxins: a cross-sectional analysis. Clin Infect Dis 2016; 62(9): 1111-8.

Rural Medicine: MCADD

Vanessa Cardy, MD and Mel Herbert, MD

CASE: A 6-month-old boy, delivered normally at 37 weeks and with no prior medical problems presents in status epilepticus. He is unvaccinated and no blood screening was done at birth. He has been tolerating food until recently when he stopped breastfeeding. 2 days prior he was fussy and had diarrhea. Now he is more lethargic, seizure at home went for 10 plus minutes and went to remote clinic

- Glucose was low 40 mg/gl or 2.4 mmol/l
- IV and IO access was a difficult issue
- Rectal benzodiazepines not effective
- IM glucagon given for low glucose
- Patient retrieval planned via helicopter
- Baby stopped seizing, presumably due to corrected glucose
- Final diagnosis was MCADD stands for medium-chain acyl-CoA dehydrogenase deficiency
 - Most common fatty acid disorder in the west



- 1 in 17.000 live births
- Usually picked up on neonatal screening
- Present with hypoglycemia in the face of gastroenteritis or periods of fasting
- If suspected consult pediatrics and genetics
- Low fat high carbohydrate diets
- Avoid foods with lots of medium chain fatty acids like coconut oil

Time to Thrombolytics in Stroke

Salim Rezaie, MD and Anand Swaminathan, MD

- Since the publication of the NINDS study in 1994, the idea that "time is brain" has been imprinted into our collective psyche.
- Over the last 26 years, numerous systems have been developed to deliver thrombolytics faster to patients with presumed ischemic strokes.
- Clinical Questions:
 - O Is faster better? Does it matter if the patient gets thrombolytics at 30 minutes in comparison to 60 minutes? What cost does faster come with?
- Potential costs of pushing for faster thrombolytic delivery
 - Determining whether the patient is having an ischemic stroke or a stroke mimic can take time in some cases.
 - O It takes time to weigh the risks and benefits of alteplase and to discuss this with the patient in order to facilitate shared decision making.
 - Resources are finite. If we dedicate more resources to delivering alteplase faster, there will be less resources for other time sensitive conditions (eg, STEMI, sepsis)
 - Misidentifying and mistreating cases can lead to harm

PERSPECTIVES |



- Avoiding thrombolytic administration in stroke mimics
 - O This is very challenging but important, as there is no benefit and only potential harm in these cases.
 - O There is a 2% rate of intracerebral hemorrhage following thrombolytic administration in patients with stroke mimics.



- Angioedema is another serious side effect.
- It is unlikely that we can eliminate thrombolytic administration in all stroke mimics based on current diagnostic limitations.

PERSPECTIVES |

- Man S et al. Association Between Thrombolytic Door-to-Needle Time and 1-Year Mortality and Readmission in Patients with Acute Ischemic Stroke. JAMA 2020; 323(21): 2170-84. DOI: 10.1001/jama.2020.5697
 - Retrospective study of > 60,000 patients
 - O The authors conclude that faster administration is better but, there are numerous issues with their data:
 - The group receiving alteplase later were sicker at baseline with more comorbid conditions.
 - It is unclear why patients who received alteplase later was it due to a diagnostic challenge?
 - The early administration group includes more stroke mimics and TIAs patients who would get better regardless.*
- What should we be doing clinically to reduce harm?
 - O Don't rush and cut corners do a thorough evaluation to determine first if the patient is having an ischemic stroke and secondary, whether they will benefit from alteplase.
 - O Take a thorough history to try to eliminate stroke mimics.
 - Take time to review the inclusion and exclusion criteria in each case.
 - Take the time to discuss goals of care and values with the patient and/or family.

Community Acquired Pneumonia II

David Glaser, MD

- Infectious Diseases Society of America (IDSA) guidelines do not support withholding antibiotics for community acquired pneumonia (CAP) based on a low procalcitonin level.
- The IDSA has "major and minor" criteria for pneumonia. Pneumonia can be diagnosed with either one major criterion **or** three or more minor criteria.
 - Minor criteria
 - Respiratory rate > 30 breaths/min
 - PaO₂/FiO₂ ratio < 250



- Multilobar infiltrates
- Confusion/disorientation
- Uremia (blood urea nitrogen level > 20 mg/dl)
- Leukopenia (WBC < 4,000 cells/μL)
- Thrombocytopenia (platelet count 100,000 cells/μL)
- Hypothermia (core temperature<36.8C)
- Hypotension requiring aggressive fluid resuscitation

Major criteria

- Septic shock with need for vasopressors
- Respiratory failure requiring mechanical ventilation
- Leukopenia due to infection alone (ie, not due to chemotherapy)
- The IDSA suggests sending Legionella urinary antigen:
 - o in adults with severe CAP, and
 - when indicated by epidemiological factors, such as association with a Legionella outbreak, or recent travel.
- Not all admitted patients with pneumonia need blood cultures
- During flu season the IDSA guidelines suggest testing for influenza in all community acquired pneumonia cases, even in those accompanying COPD exacerbations, and treatment of all patient testing positive, regardless of duration of illness.
- The PSI or Port Score is suggested to aid in decision making for disposition.
 - MDCalc: PSI/PORT Score: Pneumonia Severity Index for CAP
- Latest treatment recommendations

PEARLS •

- O Antimicrobial therapy is now recommended for just 5 days (longer 7-14 day courses are discouraged)
- No longer does the IDSA recommend additional coverage for suspected aspiration in patients with CAP.
- Steroids are not indicated for CAP alone, but are safe in patients with other indications for steroids (eg, COPD exacerbation).



- O Azithromycin as a single agent is not recommended for the treatment of pneumonia
 - > 25% Streptococcus pneumoniae resistant rate
- For patients with CAP **without** comorbidities being discharged home
 - Amoxicillin 1 gram PO Q8H for 5 days
 - Doxycycline 100mg PO Q12H for 5 days
- For patients with CAP with comorbidities being discharged home combination therapy:
 - Amoxicillin, Amoxicillin/clavulanate or cephalosporin AND macrolide or doxycycline or monotherapy with fluoroquinolone.
 - All regimens below are recommended for 5 days.
 - Dosing options:
 - Amoxicillin
 - Amoxicillin 1000 mg PO Q8H (IDSA rec)
 - Amoxicillin/clavulanate: 500 mg/125 mg PO Q8h, amoxicillin/clavulanate 875 mg/125 mg PO Q12H, or amoxicillin/clavulanate 2 g/125 mg PO Q12H
 - Amoxicillin/clavulanate preferred to amoxicillin in patients with high-risk features or comorbidities
 - Cephalosporins
 - Cefpodoxime 200 mg PO Q12H
 - Cefuroxime 500 mg PO Q12H
 - Macrolides
 - Azithromycin 500 mg on the first day then 250 mg PO daily
 - Clarithromycin: 500 mg PO Q12H,
 - Clarithromycin ER 1 g PO daily
 - Doxycycline 100 mg PO Q12H
 - Fluoroquinolones
 - Levofloxacin 750 mg PO daily
 - Moxifloxacin 400 mg PO daily
 - Gemifloxacin 320 mg PO daily



- For patients with CAP requiring admission the combination of ceftriaxone azithromycin is still recommended.
- O The IDSA guidelines do not recommend inpatient oral therapy, in contrast to the findings of some recent studies.
- The guidelines recommend covering MRSA and *Pseudomonas* if:
 - these organisms were cultured from respiratory tract in previous year, or
 - the patient was admitted in the last 90 days and has severe pneumonia.
- The World Health Organization (WHO) recommends antimicrobial therapy in patients with suspected viral pneumonia when it is severe.

Ricks Rants: RAND Reimbursement Study

Rick Bukata, MD

- Nationwide Evaluation of Health Care Prices Paid by Private Health Plans
- This 2020 RAND study (data from 2016-2018) compares hospital reimbursement among third-party insurance companies.
- Data was obtained from all but one state in the US.
- The data reveal enormous variability in individual and system reimbursement from third-party insurers, expressed as a percentage of Medicare reimbursement.
- Variation occurred between states but also within states from just over 100% of the Medicare rate to over 350%.

PERSPECTIVES



Dr. Bukata notes that private insurers are subsidizing Medicare rates in a paradox that results in insured patients paying more for health care. He calls for more appropriate medicare reimbursement.

CorePendium Spotlight: Appendicitis

Jessica Mason, MD and Neeraja Murali, DO

PEARLS •

- The combination of anorexia, right lower quadrant pain, and nausea/vomiting (with or without fever) is considered "classic" for appendicitis, but is often not present (< 50% of the time)
- The strongest predictor of appendicitis is pain that migrates to the right lower quadrant.



PITFALLS ◆

- Named signs, like Rovsing and psoas signs, might be helpful if positive but are usually not present.
- Avoid CT in pregnant and pediatric patients.
 - O Ultrasound is the first line imaging modality in these groups. Failure to visualize the appendix does not rule out appendicitis.
 - MRI can also be used safely in both groups but is much less accessible.
- CT with IV contrast is considered a "gold standard" but non-contrast studies are also excellent when contrast cannot be given.
- Oral contrast is not recommended as it does not improve the sensitivity of CT.
- Antibiotics are indicated in patients with confirmed appendicitis to reduce infectious complications.
 - O Commonly used combinations include piperacillin/tazobactam, metronidazole plus fluoroquinolone or cephalosporin.
 - In sick patients, ertapenem may be considered.

PERSPECTIVES ...

• Antibiotics alone may be considered as an alternative to surgery in select patients, however, Dr. Murali still considers surgery the first line.

References:

CorePendium Appendicitis Chapter

EM:RAP HD: The CODA Trial

Mailbag

- From Joe R.
 - O "What is the data to use morphine IR instead of oxycodone or hydrocodone as an oral opiate? In prior segments, Reuben Strayer has stated that morphine is less euphoric and less addictive but, is there evidence for this?"
- Dr. Strayer's response:
 - O Three recommendations to reduce opiate use disorder in the opiate naive patient
 - Reduce the number of opiate prescriptions you write (MOST IMPORTANT).
 - When you do write a script, write it for the minimum number of pills necessary.
 - Prescribe morphine IR instead of hydrocodone or oxycodone. (LEAST IMPORTANT, LEAST EVIDENCE BASED)



- Morphine IR dosing
 - In the US, morphine IR comes as 15 mg tabs but this may be too much.
 - Reuben recommends 7.5 mg (½ tab) PO Q4 for severe pain
- Prescription Monitoring Program (PMP) Query
 - If positive, the patient likely has a use disorder.
 - If negative, the patient may still have a use disorder. Even if they don't, it is still risky to prescribe and should be deliberated.