Top 10 Clinical Problems in Emergency Medicine

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Board-Certified Specialist in Hyperbaric Medicine
Specialist in Wound Care
The Ohio State University Wexner Medical Center

Emergency Medicine

- Incredible variety of problems
  - Spans all specialties
- Daunting amount to know about each
  - One step beyond
- Keeping current

What’s New!

- Scope of a problem
- Background
- What is new!
Patients In Pain

Walking the Fine Line

• More complex than we used to believe
  – Interaction of the body and mind

The Two Faces of Pain

• Acute pain, for the most part, results from disease, inflammation, or injury to tissues.
  – Comes on suddenly
  – Accompanied by anxiety or emotional distress
  – The cause can be diagnosed and treated
  – Self-limiting
  – Can become chronic

• Chronic pain may be a disease itself
  – Exacerbated by environmental and psychological factors
  – Resistant to most medical treatments.
• A person can have 2 or more co-existing chronic pain conditions
  – Chronic fatigue syndrome, endometriosis, fibromyalgia, inflammatory bowel disease, interstitial cystitis, temporomandibular joint dysfunction, and vulvodynia.

*National Institute of Neurological Disorders and Stroke

Image is licensed under the Creative Commons Attribution-ShareAlike 3.0 License.
Mechanism-Genetic Factors

- Animal and human studies: Genetic factors determining who gets pain after nerve injury
- Clinical experience: Pts with chronic pain have personal or family hx of migraine, IBS, Fibromyalgia, etc!

“Pain Genes??”

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Pain...What’s New
What Lies in the Future

Neuroplasticity
As Pain Becomes Chronic...

- Increasing excitatory pathways
- Decreasing dependency on the original pain input
- Increasingly abnormal (non-physiologic and inappropriate) pain processing

National Institute of Neurological Disorders and Stroke

**NINDS**

“The dramatic changes that occur with injury and persistent pain underscore that chronic pain should be considered a disease of the nervous system, not just prolonged acute pain or a symptom of an injury.”

Induced Gene Expression \(\rightarrow\) Changes in Processing of Pain
New Trophic Factors \(\rightarrow\) Rewiring of the Spinal Cord
Enhanced Release of Neurotransmitters \(\rightarrow\) Amplifies Pain Signals

Serotonin & Norepinephrine Dysregulation

- Descending pathways modulate the ascending signals
  - NE & Serotonin are key neurotransmitters that promote pain inhibition

Alterations Develop = Problems

Serotonin & Norepinephrine Dysregulation

- In the ascending pain pathways...
  - Increased excitation
  - Decreased inhibition from above
Emotions & Painful Physical Symptoms…

A Shared Neurochemical Link in Depression??

- Dysregulation of serotonin and norepinephrine (NE) in the brain...
  - Strongly associated with depression
- The same imbalance of serotonin and NE in the spinal cord...

Enter The Glial Cells

- Just “Cement” and nourishment?
- Maybe not!
- Maybe one of the keys to chronic pain!

Role of Glial Cells

- Glia cause immune-associated cells in CNS to migrate to the region of the dorsal horn associated with nerve injury
- Glia release cytokines
  - Enhance dorsal horn excitability and release glutamate and prostaglandins from pain receptors which perpetuates the pain signal
**Glial Cells and Glycine**

- Glycine BLOCKS inter-neurons which normally transfer pain sensation to the brain
- Glial cells release large amounts of PGs after injury
- PGs inhibit glycine
- Therefore...blockade is broken!

**Opiates and Glia**

- Glial activation occur in response to opioids—opposes, enhances tolerance, dependence
- Not by usual opioid receptors
  - Toll-like receptor 4 (TLR4)

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**Not Lost On Big Pharma...**

**Table from Scientific American, Dec 2009**

<table>
<thead>
<tr>
<th>SUBSTANCE</th>
<th>MECHANISM</th>
<th>TESTING STAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anoxy**</td>
<td>Inhibits synapse activity</td>
<td>Efficacy testing in rodent nociceptive circuitry, safety testing in human volunteers</td>
</tr>
<tr>
<td>Thamnagly</td>
<td>Anti-inflammatory properties</td>
<td>Human efficacy testing in peripheral neuropathic pain indices</td>
</tr>
<tr>
<td>Interneuronal*</td>
<td>Reduces synapse release</td>
<td>Cell and animal tests for pain</td>
</tr>
<tr>
<td>Amo B15</td>
<td>Anti-inflammation, anti-neuroinflammation</td>
<td>Cell and animal tests for pain</td>
</tr>
<tr>
<td>Multithymine</td>
<td>Reduces synapse release</td>
<td>Cell and animal tests for pain</td>
</tr>
<tr>
<td>Minocycline*</td>
<td>Inhibits synapses of microglia</td>
<td>Cell and animal tests for pain</td>
</tr>
<tr>
<td>Pronalizolene</td>
<td>Inhibits synaptic activity</td>
<td>Human efficacy testing in human peripheral neuropathic pain</td>
</tr>
<tr>
<td>Saline*</td>
<td>Activates cannabinoid receptors</td>
<td>Efficacy testing in rodent models of inflammatory pain and diabetes</td>
</tr>
<tr>
<td>GL9202</td>
<td>Inhibits neuroinflammation</td>
<td>Human efficacy testing in human peripheral neuropathic pain</td>
</tr>
</tbody>
</table>
What Else?

- Blockers to prevent pain signals from being amplified
- Transplantation of Chromaffin
- Blockers of tachykinins-neurokinin A and substance P
- Immune Modulation

The Definition of Sepsis

- Sepsis = SIRS with a presumed or confirmed infectious process
- SIRS = Systemic Inflammatory Response Syndrome (2 or more)
  - Temperature >38°C/100.4°F or <36°C/96.8°F
  - HR > 90/min
  - Respirations > 20/min
  - WBC > 12,000 or < 4,000

The Sepsis Spectrum

- Sepsis = SIRS + Infection
- Severe Sepsis = Sepsis + End Organ Failure
- Septic Shock = Severe Sepsis + Hemodynamic Instability
**Sepsis and Septic Shock**

- Altered Consciousness
- Confusion
- Psychosis
- Tachypnea
- \( \text{PaO}_2 < 70 \text{ mm Hg} \)
- \( \text{SaO}_2 < 90\% \)
- \( \text{PaO}_2/\text{FiO}_2 \leq 300 \)
- Tachycardia
- Hypotension
- Altered CVP
- Altered PAOP
- Oliguria
- Anuria
- Creatinine
- Jaundice
- Enzymes
- Albumin
- PT
- Platelets
- PT/APTT
- Protein C
- D-dimer

**Antibiotics - Minutes Matter**

Every hour in delay of appropriate abx = 7.6% lower survival
Median time to appropriate atbx = 6h


**Jaundice**

**Preventable Deaths in Septic Shock**

Adapted from Kumar et al. Crit Care Med 2006; 34: 1589-96.
**Impact!**

By getting door-to-balloon times of <2h for ALL STEMI patients, we would save 4775 lives per year (13 people a day)

By getting shock-to-antibiotic times of <2h for ALL septic shock patients, we would save...

32,360 lives per year
(89 people a day)
(3.7 people an hour)
(3.5 times the effect of STEMI intervention))

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**The Sepsis Six – To Be Delivered Within 1 Hour**

...and Identify Severe Sepsis and Septic Shock

**3 Treatments**
- High-flow oxygen
- IV antibiotics
- Fluid challenge

**3 Investigations**
- Blood cultures
- Measure lactate
- Measure urine output

Daniels et al. Emerg Med J 2010

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**Lactate and Mortality**

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Sepsis Management

- Aggressive Care Matters!
  - Two large bore IVs
  - Antibiotics
  - 2 L NS, unless contraindicated
  - Central Access and Vasopressors in ED

Effect of a rapid response system for patients in shock on time to treatment and mortality during 5 years
Sebat et al, Crit Care Med 2007; 35: 2568-2575

Among septic shock patients, mortality decreased from 50% to 10% NNT = 2.5

Top 10 Adult Emergencies

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Assistant Professor
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The Ohio State University Wexner Medical Center

STROKE
## Really, One Initial Question?

<table>
<thead>
<tr>
<th>Ischemic vs. Hemorrhagic</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Ischemic Brain Scan" /></td>
</tr>
</tbody>
</table>

Ischemic vs. Hemorrhagic

- ABC’s
- Vital Signs
- Check Glucose!
  - Aphasia and right sided hemiplegia with hypoglycemia is a good stroke mimic!
    - *Embarrassing to miss this one!!*
- Give NALOXONE if clinically indicated

## Immediate HEAD CT!

<table>
<thead>
<tr>
<th>Immediate HEAD CT!</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="HEAD CT Scan" /></td>
</tr>
</tbody>
</table>

- ABC’s
- Vital Signs
- Check Glucose!
  - Aphasia and right sided hemiplegia with hypoglycemia is a good stroke mimic!
    - *Embarrassing to miss this one!!*
- Give NALOXONE if clinically indicated

## Immediate Workup

<table>
<thead>
<tr>
<th>Immediate Workup</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Workup Chart" /></td>
</tr>
</tbody>
</table>

- EKG
- CXR
- INR
- CBC with Platelets
- Chem-7
- Toxicology Screen

## Hemorrhagic Stroke

<table>
<thead>
<tr>
<th>Hemorrhagic Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Stroke Image" /></td>
</tr>
</tbody>
</table>

Hemorrhagic Stroke

- (15% of Acute Strokes, ICH and SAH)
- Close Monitoring of Mental Status and VS
- Correct Bleeding Disorders
- Manage Blood Pressure
- Transfer to Neurosurgical Care
### BP Control in ICH

- Treat for MAP > 130mmHg
  - Labetalol 20mg boluses, Nicardipine, Esmolol, Nitroprusside drips
- Beware Hypotension
  - IV Fluids and Pressor Support

### Ischemic Stroke

(85% of Acute Strokes)

- Time of Onset (last normal)
- Calculate NINDS/NIH Stroke Scale
- STROKE ALERT/Telestroke
- Consider Thrombolysis, tPA
- Close Monitoring of Mental Status and VS
- Consider Transfer to Stroke Center

### National Institute of Health Stroke Scale

<table>
<thead>
<tr>
<th>Score of 0 - 42</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Score of 0</td>
<td>No Stroke Symptoms</td>
</tr>
<tr>
<td>Score of 1-4</td>
<td>Mild Stroke</td>
</tr>
<tr>
<td>Score of 5-15</td>
<td>Moderate Stroke</td>
</tr>
<tr>
<td>Score of 16-20</td>
<td>Moderate to Severe Stroke</td>
</tr>
<tr>
<td>Score of 21-42</td>
<td>Severe Stroke</td>
</tr>
</tbody>
</table>

### NIH Stroke Scale

- LOC, Orientation, Response
- Gaze
- Visual Fields
- Motor – Face
- Motor – Arm
- Motor – Leg
- Limb Ataxia
- Sensory
- Language
- Dysarthria
- Inattention/Extinction

[http://www.nihstrokescale.org/](http://www.nihstrokescale.org/)
**Thrombolysis?**

**Inclusion Criteria**

- > 18 years old
- Diagnosis of Ischemic Stroke causing measurable deficit
- < 3 hours after symptom onset
- New 3 - 4.5 hour window

**Exclusion Criteria**

- Previous IC Bleed
- Head trauma <3 months
- Previous Stroke <3 months
- IC neoplasm, AVM, aneurysm
- INR of > 1.7

http://stroke.ahajournals.org/content/44/3/870/T10.expansion.html

**Blood Pressure Control?**

- Labetalol 20mg boluses
- Esmolol, Nicardipine, Hydralazine, etc.
- Get the BP down so they can get thrombolytics

**tPA**

- 0.9mg/kg (max of 90mg) infused over 1 hour, 10% bolus over 1st minute.
Further Management

- tPA = ICU,
- Consider transfer to Stroke Center
- Continue to control BP if tPA given
- Continuous Monitoring of VS and MS
- Permissive Hypertension if NO thrombolysis
  Don’t treat for BP <220/120

CHEST PAIN

Ok dude…
this isn’t funny anymore…get off! …Hello?

Acute Coronary Syndrome

- Acceptable miss rate = 0%
  – i.e. you may get sued
- Actual miss rate ≈ 2%

CP and . . .

324mg ASA, 600mg Plavix, Heparin Drip, NTG, CATH LAB!
E = MC^2
F = MA
F = GMm/r^2

AHA/ACC Goals
- D2B- Door to Balloon Time of < 90 minutes
- Door to Needle Time for tPA of < 30 minutes
- DIDO- Door In Door Out < 30 minutes
- Transfer Door to Balloon time of < 120 minutes

VS.

CP and . . .

Aspirin, sure, but then what?
### In the ED

- Further Risk Stratify
  - History and HPI
  - Physical Exam
  - CXR
  - Repeat EKG
  - Troponins
  - BNP

### Treatment Strategies

- Serial Troponins
- Serial EKGs
- Observational Stay
- Admission
- Outpatient Follow-up
- Cardiology Referral
- PCP Referral for outpatient Stress Test

### A Brief Foray Into RADIATION!

- CXR = 0.08mSV
- Abdominal CT = 10mSV

### Non-Invasive Cardiac Evaluation

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Cost</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Radiation Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise Stress</td>
<td>≈ $900</td>
<td>70%</td>
<td>70%</td>
<td>12-22 mSv</td>
</tr>
<tr>
<td>Nuclear Stress</td>
<td>≈ $6000</td>
<td>90%</td>
<td>75%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

- SPECT “MIBI”
## Non-Invasive Cardiac Evaluation

<table>
<thead>
<tr>
<th>Stress Echo</th>
<th>Other Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Functional</td>
<td>• Specificity 80%</td>
</tr>
<tr>
<td>• Exercise ≈ $3300</td>
<td>• $3800</td>
</tr>
<tr>
<td>• Pharmacologic ≈ $4500</td>
<td>• Cardiac PET</td>
</tr>
<tr>
<td>• Sensitivity 85%</td>
<td>• Specificity ≈ 100%</td>
</tr>
<tr>
<td>• Specificity 85%</td>
<td>• Sensitivity 85%</td>
</tr>
<tr>
<td>• No Radiation</td>
<td>• 8mSv, $9500</td>
</tr>
<tr>
<td>• Operator Dependent</td>
<td></td>
</tr>
<tr>
<td>• Cardiac MRI</td>
<td></td>
</tr>
<tr>
<td>• Sensitivity 85%</td>
<td></td>
</tr>
</tbody>
</table>

## Cardiac CTA

- **Low Risk Chest Pain**
- **Anatomic Study (not Functional)**
- 4-15 mSv

## Cardiac CTA

- Negative Predicative Value ≈ 100%
- Cheap- $1500
- Quick- <15 minutes
- Long Term Reassurance
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Venous Thromboembolism

VTE = DVT + PE

Resuscitative Thoracotomy for Presumed PE
Epidemiology of VTE

- 2,000,000 Americans have DVT/yr
- 300,000 die from PE, most result from DVT
  - More than AIDS and Breast cancer combined
- Risk is 1/1000 ED visits

Risk of Clotting

<table>
<thead>
<tr>
<th>Thrombophilic Status</th>
<th>RR of Clot</th>
<th>% Pop</th>
<th>% of VTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCPs</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor V Leiden (Heterozygous)</td>
<td>5-7</td>
<td>5-15</td>
<td>12-40%</td>
</tr>
<tr>
<td>Factor V Leiden + OCPs</td>
<td>30-35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prothrombin Gene Mutation</td>
<td>3</td>
<td>2%</td>
<td>6-18%</td>
</tr>
<tr>
<td>Prothrombin Gene Mutation + OCP</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein C Deficiency</td>
<td>7</td>
<td>0.2%</td>
<td>5-15%</td>
</tr>
<tr>
<td>Protein S Deficiency</td>
<td>6</td>
<td>Unknown</td>
<td>5-15%</td>
</tr>
<tr>
<td>Antithrombin III</td>
<td>5</td>
<td>0.02-1%</td>
<td>4%</td>
</tr>
<tr>
<td>Hyper-Homocysteinemia</td>
<td>2-4</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>Antiphospholipid Syndrome</td>
<td>2-4%</td>
<td>2-4%</td>
<td>5-15%</td>
</tr>
</tbody>
</table>

Diagnosis of PE

- Bayes Theorem RULES!
  - Very simply stated...Pretest probability influences posttest probability
- The goal of all testing is to get the post-test probability down to an acceptable number (< 1%)

"Estimation of pretest probability of the disease is imperative for proper application of results of diagnostic testing" - ACEP Clinical Policy on PE
Goal: Get to a Good PreTP

- If the Pre-test probability is low enough*...
  - A good D-dimer with confers a Post-test probability of < 1%
- But, if PTP is too high...
  * 40% = Wells Moderate = 6 points = Gestalt “not high”

Wells Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected DVT</td>
<td>3.0</td>
</tr>
<tr>
<td>An alternative diagnosis is less likely than PE</td>
<td>3.0</td>
</tr>
<tr>
<td>Heart rate &gt;100 beats/min</td>
<td>1.5</td>
</tr>
<tr>
<td>Immobilization or surgery in the previous 4 wk</td>
<td>1.5</td>
</tr>
<tr>
<td>Previous DVT/PE</td>
<td>1.0</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1.0</td>
</tr>
<tr>
<td>Malignancy (on treatment, treated in the past 6 mo or palliative)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Mean Probability of PE, %</th>
<th>% With This Score</th>
<th>Interpretation of Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;2 points</td>
<td>3.6</td>
<td>40</td>
<td>Low</td>
</tr>
<tr>
<td>&gt;6 points</td>
<td>66.7</td>
<td>7</td>
<td>High</td>
</tr>
</tbody>
</table>

The “Guess” Criteria

- 2603 patients evaluated by any of 142 clinicians
- Clinicians guessed at was a “low pre-test probability patient”
- Data suggests that we can accurately define Low PTP (< 15%)
- We can define “Not High” (< 40%)

Use Any Method You Want...

<table>
<thead>
<tr>
<th>Rule to Assign PTP</th>
<th>Post Test Probability + Negative DD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wells “Moderate”</td>
<td>0.9%</td>
</tr>
<tr>
<td>Gestalt &lt; 40%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Yes...It Really Does Not Matter!
Can I Send a PE Home?

• We already do! DVTs
• Studies suggest this is safe in the right patients
• Scoring systems (any positive = Home treatment is not indicated)
  – PESI
  – sPESI
  – Hestia

Simplified Pulmonary Embolism Severity Index

<table>
<thead>
<tr>
<th>Simplified Pulmonary Embolism Severity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 80 years?</td>
</tr>
<tr>
<td>Cardiopulmonary co-morbidity?</td>
</tr>
<tr>
<td>History of cancer?</td>
</tr>
<tr>
<td>Arterial oxyhaemoglobin saturation level &lt;90%?</td>
</tr>
<tr>
<td>Systolic blood pressure &lt;100 mmHg?</td>
</tr>
<tr>
<td>Pulse frequency ≥110 beats/min?</td>
</tr>
</tbody>
</table>

Blood Coagulation, Fibrinolysis and Cellular Haemostasis
Thrombosis and Haemostasis 109.1/2013
When Do I Use Thrombolytics?

- 5% of PE may qualify
- Thrombolytics for confirmed PE plus:
  - Persistent hypotension (SBP < 100)
  - +/- Persistent severe hypoxemia
  - +/- Right heart strain on Echocardiogram

New Drugs of Abuse

Why?

- New drugs are created for a number of reasons
  - To fill a niche for cheap, easy to make, sometimes “legal” agents
  - To circumvent existing laws
  - To make a new experience
- Can pose new clinical challenges
  - Recognizing
  - Managing

Salvia Divinorum

- Sierra Mazatec region of Southern Mexico
  - Used by shamans as an “entheogen”
  - Psychedelic effects last minutes to < 1h
**Salvia Divinorum**

- Most potent natural hallucinogen
- *Salvinorin A* is the main active psychotopic molecule
  - Kappa-Opioid agonist
  - Seemingly little harm
- Many have a “bad trip”
- 20 seconds!!

**Crocodile aka: Krokodil (крокодил)**

- Desomorphine
  - Dihydromorphine
  - 8-10x morphine; 3x Heroin
  - Lasts 1-2 hours
- Invented in 1932, problems started in 2002. Problem in Russia in 2010
- Easy synthesis from Codeine

**Crocodile aka: Krokodil (крокодил)**

- Named for the scaly skin in users and from synthesis from chlorocodide
- Took “10 minutes”

**Sloppy Synthesis**

Image from http://www.ericdunbar.com/drugs/street/krokodil.htm
Average LE of a Krok User is 2-3 Years!

Image from http://www.ericdunbar.com/drugs/street/krokodil.htm

A Different Croc User

MCAT/CAT

- Mephedrone (4-methylmethcathinone)
  - Amphetamine and cathinone derivative
  - Chemically like “Khat”
  - Swallow, snort or inject
### Khat

*Image from Wikipedia*

- MDMA, amphetamine and cocaine-like experience
  - Euphoria, enhanced mood, improved mental function, sexual stimulation,
- Stimulant effects and the bad stuff
  - Bruxism, hyperthermia, hallucinations, delusions

### MCAT/CAT

- Synthetic cannabis is a piece of the THC molecule
  - Legal in some places
  - Known as K2 and Spice

### K2 (Spice)

- Produces a cannabis like effect
- Depends on which piece of the molecule you get...

### K2

- Synonyms: K2, Spice
- Legal in some places
- Known as K2, Spice
### K2

- John W. Huffman, Clemson University, is the first to create the synthetic analog to THC.
- JWH-018, JWH 073 and many others are used.

### Bath Salts

- Bath salts is the "street name" for designer drugs based on substituted cathinones.
  - Similar to amphetamines and cocaine.
- Different drugs...same moniker.
  - Originally Methyleneoxypyrovalerone (MDPV).
  - New drugs now exist.

### Bath Salts

- Typically cause stimulant effects via DA, NE and Serotonin.
  - Swallowed, snorted, smoked or ingested.

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### Top 10 Adult Emergencies

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EXCITED DELIRIUM

“Mmmmm, Bath Salts”

http://www.charlydmiller.com/LIR02/2002jems.html

Excited Delirium- Definition

Not in DSM-IV or ICD-9

• Altered Mental Status
• Severe Psychomotor Agitation
• Autonomic Instability

Epidemiology

• Males < 40 Years Old
• Acute Drug Intoxication/Withdrawal
  – Cocaine, Methamphetamines, PCP, LSD, “Bath Salts”, EtOH withdrawal, etc.
• Underlying Psychiatric Illness
**SYMPATHETIC STORM**

- STIMULANT Intoxication
- Exaggerated Adrenergic Response
- Severe HYPERTHERMIA (Central Dopaminergic)
- Metabolic Acidosis

**Clinical Features**

- Tachycardia
- Hypertension
- Hyperthermia
- Diaphoresis
- Tachypnea
- Confusion
- Paranoia
- Hallucinations
- Increased Pain Tolerance
- Agitation
- Inappropriately Clothed
- Unusual Strength
- Unusual Endurance
- Noncompliance

**Immediate Management**

*Goal = Safety for Staff and Patient*

- Physical Restraints
- Chemical Restraints

**Physical Restraint**

*The Means to an End*

- OVERWELMING Force
  - At least 5-6 people, the bigger the better. One to control each limb/head, one to provide medications

- FOUR POINT Supine Restraints
  - “Leathers” or Hard Restraints, NO HOG TIE/PRONE!

- Cardiac Monitor
### Chemical Restraints

*DON’T MESS WITH IV, GO IM!*

- Sedative Hypnotics
- Antipsychotics

### Sedatives

<table>
<thead>
<tr>
<th>Medication</th>
<th>Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIDAZOLAM</td>
<td>10-15 minutes</td>
</tr>
<tr>
<td>– IM 5mg</td>
<td></td>
</tr>
<tr>
<td>– IV 2-5mg</td>
<td></td>
</tr>
<tr>
<td>LORAZEPAM</td>
<td>5-10 minutes</td>
</tr>
<tr>
<td>– IM 4mg</td>
<td></td>
</tr>
<tr>
<td>– IV 2-4mg</td>
<td></td>
</tr>
<tr>
<td>DIAZEPAM</td>
<td>15-30 minutes</td>
</tr>
<tr>
<td>– IM 10mg</td>
<td></td>
</tr>
<tr>
<td>– IV 5-10MG</td>
<td></td>
</tr>
</tbody>
</table>

### Antipsychotics

<table>
<thead>
<tr>
<th>Medication</th>
<th>Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>HALOPERIDOL</td>
<td>15 minutes</td>
</tr>
<tr>
<td>– IM 5-20mg</td>
<td></td>
</tr>
<tr>
<td>– IV 5-10mg</td>
<td></td>
</tr>
<tr>
<td>DROPERIDOL</td>
<td>10 minutes</td>
</tr>
<tr>
<td>– IM 5mg</td>
<td>3-5 minutes</td>
</tr>
<tr>
<td>– IV 2.5-5mg</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

### Sedative + Antipsychotic?

You Betcha!
Ketamine?

<table>
<thead>
<tr>
<th>Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM 4-5mg/kg</td>
</tr>
<tr>
<td>IV 2mg/kg</td>
</tr>
</tbody>
</table>

IM vs. IV?

Phew! Now What?

<table>
<thead>
<tr>
<th>Testing</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor</td>
<td>Wet and Windy!</td>
</tr>
<tr>
<td>EKG</td>
<td>Redose Sedation Meds</td>
</tr>
<tr>
<td>RECTAL TEMP</td>
<td>Work up underlying cause</td>
</tr>
<tr>
<td>Blood Sugar</td>
<td>Workup Injuries</td>
</tr>
<tr>
<td>Chem-7</td>
<td>Admit ICU vs Floor</td>
</tr>
<tr>
<td>CK</td>
<td></td>
</tr>
<tr>
<td>Blood Gas</td>
<td></td>
</tr>
<tr>
<td>Urine Drug Screen</td>
<td></td>
</tr>
<tr>
<td>Head CT</td>
<td></td>
</tr>
<tr>
<td>Airway</td>
<td></td>
</tr>
<tr>
<td>IV Fluids</td>
<td></td>
</tr>
</tbody>
</table>
MINOR HEAD INJURY

Mild Traumatic Brain Injury

- 1.5 million Mild TBIs yearly
- 300,000 Sports Related TBIs
- Increased Awareness of Concussions
- Increased Medical Investigation
- Increased Concern for Student Athletes

Who Needs a Scan?

- Canadian Head CT Rule (GCS of 13-15)
- New Orleans Head CT Rule (GCS of 15)
- If any of the criteria are positive, SCAN AWAY!
- Sensitivity approaches 100%

Canadian HCT Rules

- GCS <15 2 hours post-injury
- Suspected open/depressed skull fracture
- Any signs of Basilar Skull fracture
- Vomiting ≥ 2 episodes
- Age ≥ 65
- Amnesia before impact ≥ 30 minutes
- Dangerous Mechanism
### New Orleans HCT Rules

- Headache
- Vomiting
- Age > 60
- EtOH or Drug Intoxication
- Persistent Anterograde Amnesia
- Visible Trauma Above Clavicle
- Seizure

### NEXUS II

- Evidence of a significant skull fracture
- Scalp Hematoma
- Neurologic deficit
- Altered level of alertness
- Abnormal Behavior
- Coagulopathy
- Persistent Vomiting
- Age 65 and older

National Emergency X-ray Utilization Study

### Acute Evaluation

- SAC- Standardized Assessment of Concussion
- SCAT2- Sports Concussion Assessment Tool 2
- WPTAS- Westmead Post-Traumatic Assessment and Cognitive Testing

### WPTAS

- What is your name?
- What is the name of this place?
- Why are you here?
- What month is it?
- What year is it?
- What town are you in?
- How old are you?
- What is your date of birth?
- What time of day is it?
- Three picture Recall
**Recommendations**

- NO return to play that day
- Multiple Guidelines for Management
- Period of Physical and Cognitive Rest
- Out of the ED - NO play until reevaluated

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**2008 Consensus Statement on Concussions in Sport**

- 6 day return to play
- Graduated Return to Play
- Cognitive and Physical Rest Until Asymptomatic

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**Top 10 Clinical Problems in Emergency Medicine**

Colin G. Kaide, MD, FACEP, FAAEM, UHM
Associate Professor of Emergency Medicine
Board-Certified Specialist in Hyperbaric Medicine
Specialist in Wound Care
The Ohio State University Wexner Medical Center

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**Beyond FFP: Emergency Reversal of Anticoagulation in 2013**
A Balance

Hemostasis Has 2 Parts

- Primary Hemostasis: Platelet Aggregation

Coagulation: Getting to Fibrin

- 2 pathways lead to fibrin via the common pathway
- This is a “Gross Simplification” of the system

Secondary Hemostasis

2 pathways lead to fibrin via the common pathway
This is a “Gross Simplification” of the system
**Simple...and All You Need to Know!**

- Warfarin affects the vitamin K dependent synthesis of the ACTIVE forms of 2, 7, 9, 10

**Warfarin (Coumadin®)**

- Warfarin affects the vitamin K dependent synthesis of the ACTIVE forms of 2, 7, 9, 10

**Warfarin Reversal**

- 2 parts to treatment
  - Sustained reversal
  - Immediate reversal
**Vitamin K**

- Allows for the generation of active forms of II, VII, IX, and X
- No more SQ dosing
  - Oral or IV

**Fresh Frozen Plasma (FFP)**

- Each ml of FFP contains:
  - 1 unit @ coagulation factor
  - 200-250 ml volume = 200-250 units of @ factor
  - $250/unit

**Prothrombin Complex Concentrate (PCC)**

- A mix of NON-ACTIVATED clotting factors
- 2 types of mixes: 3 factor and 4 factor
  - 3 factor preps have only small amounts of 7

**Warfarin and PCC**

- Good Reversal *in vivo and in the lab*
- Cost ~ $0.59/Unit
- Dosing is not consistent we use the INR based dosing
  - INR 2-4 25 Units/kg
  - INR 4-6 35 Units/kg
  - INR >6 50 Units/kg
The New Anticoagulants

- The Direct Thrombin Inhibitors
  - Dabigatran (Pradaxa®) – The first oral DTI
- The 10a Inhibitors
  - Rivaroxaban (Xarelto®) – The First oral 10a inhibitor
  - Apixaban is coming soon

Direct 10a Inhibitors

Rivaroxaban (Xarelto®)

These Present and Interesting Challenge

Rivaroxaban (Xarelto®)

Dabigatran (Pradaxa®)
Factor VII (rVIIa) NovoSeven®

- It also binds to platelets and promotes Factor X activation and thrombin generation
- 1 mg vial = 1000 mcg x $1.10/mcg = $1100
  - 90 mcg/kg x 70 kg x $1.10 = $6930!
  - q 2h till bleeding is controlled. Assume 8 initial doses = $6930 x 8 doses = $55,440!!!

PCCs

- In the US 3 fx only: Bebulin®, Profilnine®
  - 3 Factor Preps
  - Everywhere else 4 fx: Beriplex®, Octaplex® and many others

aPCC: Feiba® *

*Not FDA approved for this indication

- FEIBA “Factor Eight Inhibitor Bypassing Activity”
- Activated 2, 7, 9, 10

Direct Thrombin Inhibitors (Dabigatran)

*Not FDA approved for this indication

- rVIIa
  - Worked on markers and in rats/rabbits
  - Inconsistent results in human volunteer studies
  - Case reports showed questionable reversal
  - High dose 4 fx PCC and aPCC (Feiba®)
    - Worked on markers & rats/rabbits
    - Complete reversal in volunteer ex vivo studies
Direct Xa Inhibitors (Rivaroxaban)

- rVIIa
  - Worked on markers and in rats/rabbits
- aPCC (Feiba®)
  - Worked on markers and in rats/rabbits
  - Human volunteer studies...
- 4 Factor PCCs
  - Inconsistent results

*Not FDA approved for this indication

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Top 10 Adult Emergencies

Maxwell Hill, MD
Assistant Professor
Department of Emergency Medicine
The Ohio State University Wexner Medical Center

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ALLERGIC REACTIONS

Go ahead... Make my Day!
VS

Or This

Otolaryngology - Head and Neck Surgery

www.aafp.org
Anaphylaxis

- Respiratory Compromise
- Hypotension/End Organ Dysfunction
- Mucosal/Oral Involvement

Treatment for Anaphylaxis

**EPINEPHRINE!**

- 0.3 mg IM Immediately!
- (0.01mg/kg for kids)

Adjuncts

- IV Fluids- Wide Open
- Diphenhydramine 25-50mg IV
- Famotidine 20mg IV
- Albuterol Nebulizer for Bronchospasm
- Solumedrol 125mg IV
- Oxygen
- Consider low dose Benzos

Not Responding to IM Epi?
REPEAT, still no response?
Uh Oh!
Epinephrine Drip
A do it yourself guide!

- 1mg of Epinephrine
  ✓ 1ml of 1:1000 Anaphylaxis Epi -or- 10ml of 1:10000 Cardiac Epi
- Inject into a 1L bag of Normal Saline
- SHAKE (don’t stir)
- 1ml of solution = 1mcg of Epinephrine
- Start drip at 120ml/hr (2mcg/min)
- Titrate up/down as needed

On B-Blocker?

- May not respond to Epinephrine
- GLUCAGON- 5mg IV over 5 minutes

Then What?

- Observe for 6-10 hours
  ✓ Biphasic Anaphylaxis
- Home with EpiPen and with Steroids

Angioedema

- ACEI Induced
- HAE
- Anaphylaxis
- Idiopathic

New England Journal of Medicine, 365;2, July 14 2011
<table>
<thead>
<tr>
<th>Airway, Airway, AIRWAY!</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Stridor or Respiratory Distress</td>
<td>• AIRWAY</td>
</tr>
<tr>
<td>• Tongue Enlargement</td>
<td>• The Usual (no clinical evidence)</td>
</tr>
<tr>
<td>• MOST Experienced Person Manages Airway</td>
<td>– Epinephrine, Antihistamines, Steroids</td>
</tr>
<tr>
<td>• ENT backup, call them down!</td>
<td>• The UNUSUAL and NEW</td>
</tr>
<tr>
<td></td>
<td>– Ecallantide</td>
</tr>
<tr>
<td></td>
<td>– Icatibant</td>
</tr>
<tr>
<td></td>
<td>– Human C1-esterase inhibitor</td>
</tr>
<tr>
<td></td>
<td>– FFP</td>
</tr>
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