Medications to Treat the Acute Care Patient

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Treatment of the Acute Care Patient

• The Urgent Care Patient
  – Medications to treat common outpatient complaints
• The Emergency Department Patient
  – Serious presentations requiring aggressive pharmacologic interventions or referral
• The Hospitalized Patient
  – Examples of medications used to treat the in-house patient

Top Reasons For Patients to Present to Urgent Care

1. Wounds/trauma/fracture/contusion
2. ENT
3. Pulmonary
4. Flu
5. Genitourinary
6. Dermatological
7. Gastrointestinal (GI)
8. Cardiovascular
9. Eye
10. Psychiatric
11. Neurological
12. Other

Trauma, etc.

• Musculoskeletal pain
• Sprain
• Fracture
• Wound
• Contusion

Respiratory/ENT

• Sinusitis
• URI
• Pharyngitis
• Otitis
• Cough
• Influenza/Viral infection
• Rhinitis
• Ear disorder

Pulmonary

• Bronchitis
• Asthma
• Cough
• Influenza
• Viral infection
• Fever
GI and GU
• Abdominal pain
• Viral infection
• Gastric disorder
• Fever
• Cystitis
• Urinary tract infection (UTI)
• Genitourinary (GU) disorder

Cardiovascular
• Chest pain
• Hypertension
• Headache
• Fever
• Gastric upset?

Top Prescriptions Written in Urgent Care Settings
• Antibiotics—76.4%
• Non-narcotic analgesics—17.2%
• Allergy/flu—14.6%
• Narcotic analgesics—14.0%
• Corticosteroids—13.4%
• Cough—9.5%
• Asthma—5.8%
• GI—4.6%
• Neuro/Psych—4.6%
• Cardiovascular—3.0%

Antibiotics Prescribed
• Azithromycin (Zithromax)
• Amoxicillin/Clavulanate (Augmentin)
• TMP-Sulfa (Bactrim)
• Cephalexin
• Ciprofloxacin (Cipro)
• Levofloxacin (Levaquin)
• Cefdinir (Omnicef)
• Doxycycline
• Oseltamivir (Tamiflu)

Antibiotics Prescribed
• Clarithromycin (Biaxin)
• Moxifloxacin (Avelox)
• Fluconazole (Diflucan)
• Mupirocin (Bactroban)
• Erythromycin
• Cefuroxime (Ceftin)
• Clindamycin (Cleocin)
• Metronidazole (Flagyl)

Drotrecogin alpha (Xigris)
• Recombinant human protein C
• Used to treat sepsis in patients at risk of death due to multiple-system organ failure with an APACHE II score > 25
• NOT indicated in adult patients with severe sepsis and an APACHE score of <25
• Administered intravenously (IV) over 96 h; stop immediately if clinically significant bleeding is seen
Contraindications to Xigris
• Xigris increases the risk of bleeding. Xigris is contraindicated in the following clinical situations where bleeding could lead to significant morbidity or death:
  • Active internal bleeding
  • Recent (within 3 months) hemorrhagic stroke
  • Recent (within 2 months) intracranial or intraspinal surgery, or severe head trauma
  • Trauma with an increased risk of life-threatening bleeding
  • Presence of an epidural catheter
  • Intracranial neoplasm or mass lesion or evidence of cerebral herniation

Antibiotic Prescribing Pearls
• Watch for allergy!!!!
  – Cross allergy between cephalosporins and penicillins
  – Rash with sulfa drugs
• No fluoroquinolones in children!
• Warn of CDAD with broad spectrum agents
• No doxycycline in young children

Respiratory Drugs
1. Prednisone
2. Proair HFA (Albuterol)
3. Chlorpheniramine/Hydrocortisone (Tussicaps)
4. Methylprednisolone (Medrol)
5. Diphenhydramine (Benedryl)
6. Fluticasone (Flonase)
7. Benzonatate (Tessalon)
8. Mometasone (Asmanex Twisthaler)
9. Fexofenadine (Allegra)
10. Montelukast (Singulair)

Other Drugs of Significance
• Promethazine (Phenergan)
• Hydroxyzine (Vistaril)
• Ondansetron (Zofran)
• Hydrochlorothiazide

A Few Things to Remember...
• Ondansetron (Zofran) black box warning—arrhythmias
• Hydrochlorothiazide—the cheapest way to cause a significant (though small) decrease in blood pressure (BP). Will also reduce edema. Consider time of day when administering. Will likely not need electrolyte monitoring
• Hydroxyzine and Promethazine may cause dizziness and tiredness

Pain Medications Prescribed
• APAP/Hydrocodone (Lortab, Vicodin)
• Naproxen (Naprosyn)
• Tramadol (Ultram)
• Hydrocodone (Hycodan)
• Promethazine plus codeine (Phenergan plus codeine)
• APAP/Oxycodone (Percocet)
• Ibuprofen (Motrin)
• *Cyclobenzaprine (Flexeril)
Prescribing Pain Meds

Management of Pain

- Tapentadol (Nucynta)—Formulations available to treat acute and chronic pain
- Schedule II CS
- Works as an opioid agonist that also increases NE in the CNS
- Abuse potential is high
- Watch for serotonin syndrome

Management of Pain

- Tramadol (Ulterior, Ultracet)
- Not a controlled substance
- Works centrally to relieve pain
- New warnings for serotonin syndrome when taken alone or with SSRIs, triptans, TCAs, other antidepressants, and MAOIs
- Seizure risk warnings

Pain Management

- Watch for pain meds used in combination
- Drug seekers, drug tolerant
- Consider prn, limiting number of pills, referral
- Constipation, respiratory depression, itching, bleeding
- Sedation, muscle weakness, ataxia

The Trauma Patient

- Fractures
- Burns
- Wounds
- Sprains/Strains
Conscious Sedation

• Moderate sedation/analgesia is as follows:
  • Depression of consciousness is drug-induced.
  • Patient responds purposefully to verbal commands.
  • Airway is patent, and spontaneous ventilation is adequate.
  • Cardiovascular function is usually unaffected.

Drugs for Procedural Sedation

• Short-acting benzodiazepines
  – Midazolam or lorazepam (plus fentanyl or morphine)
  – Reversal agents must be available: flumazenil or naloxone
  • Midazolam has faster onset/offset, better amnesia, and improved awakening. Works within 30 to 60 minutes.
  • Lorazepam works within six to eight hours.

• Fentanyl has faster onset/offset than morphine and fewer cardiosuppressive effects.
  • Half-life is two to four hours.
  • Monitor for respiratory depression

• Propofol (Diprivan)
  – Thought to enhance GABAergic activity in the CNS
  – Potent, short-acting
  – Shorter recovery times, may still cause respiratory depression
  – Painful injection—use larger veins if possible
  – MUST maintain sterile technique when using. Sepsis has been reported with use!
  – Potent hypnotic
  – Ultra short-acting
  – Lowers cerebral blood flow by 20 to 30%
<table>
<thead>
<tr>
<th>Drug</th>
<th>Adult Dose</th>
<th>Pediatric Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midazolam</td>
<td>0.02-0.1 mg/kg IV initially; may repeat q2-3h prn; (if further sedation is required, may repeat with 25% of initial dose after 3.5 min; not to exceed 2.5 mg/dose (1.5 mg for elderly persons) and 5 mg cumulative dose (2.5 mg for elderly persons)</td>
<td>may repeat q2-3h prn</td>
<td>Drug of choice for rapid onset of sedation, may be effective for short duration of procedure</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>1-2 mcg/kg/hr IV push (over 1-2 min); may repeat dose after 30 min</td>
<td></td>
<td>May cause chest wall rigidity, dryness, respiratory depression, or histamine release; useful for patients with trauma and hypotension</td>
</tr>
</tbody>
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**Reversal Agents**

<table>
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<tr>
<th>Reversal Agent</th>
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<tr>
<td>Naloxone</td>
<td>Postanesthetic opioid reversal</td>
<td>0.1-0.2 mg/kg IV/IM, may repeat q2-3h prn; (if further sedation is required, may repeat with 25% of initial dose after 3.5 min; not to exceed 2.5 mg/dose (1.5 mg for elderly persons) and 5 mg cumulative dose (2.5 mg for elderly persons)</td>
<td>may repeat q2-3h prn</td>
<td>Drug of choice for reversal of opioid-induced respiratory depression or hypotension</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>Partial antagonism (for sedation reversal)</td>
<td>0.05-0.1 mg/kg IV/IM, may repeat q2-3h prn;</td>
<td></td>
<td>Drug of choice for reversal of opioid-induced respiratory depression or hypotension</td>
</tr>
</tbody>
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**Treatment of Sickle Cell Disease**

- Most SCD crises are uncomplicated and require only aggressive pain management, but life-threatening complications can occur and lead to rapid deterioration. Therefore, nurses must be aware of the most common and serious potential complications and perform a targeted diagnostic evaluation. These complications may include:

**Complications of SCD**

- Acute chest syndrome (ACS) -- ACS is the most frequent cause of mortality in patients with SCD over the age of 2 years. Symptoms of ACS include acute distress with chest pain and at least one of the following symptoms: fever, respiratory distress, decreased oxygen saturation, and chest x-ray infiltrates.

- Splenic sequestration -- a complication seen in children, unrecognized sequestration can lead to death from circulatory collapse in as little as 30 minutes. Symptoms include splenic enlargement and left upper quadrant pain, pallor, weakness, rapidly falling hemoglobin levels, and hypovolemia.
Complications of SCD

3. Infection -- more than 90% of patients with SCD are effectively asplenic by the age of 5 years and thus immunocompromised. Fever is an ominous sign and a sepsis work-up must be obtained urgently.

Complications of SCD

4. Stroke -- a devastating complication seen in 11% of patients with SCD under the age of 20 years, stroke may present with headache and neurological deficits. Treatment of stroke in SCD is dramatically different and therefore prompt recognition, diagnosis, and rapid initiation of exchange transfusion to reduce hemoglobin SS levels are essential.

Pain Management in SCD

• It is preferable to administer pain medications subcutaneously rather than intramuscularly to avoid tissue damage.
• Nursing care should take a tiered approach that includes rapid assessment with early and aggressive initiation of analgesics. High doses of opioids are often needed as a result of both the severity of pain and the development of opioid tolerance in some individuals.

Migraine in the ED

• Subcutaneous sumatriptan
• IV Prochlorperazine (6 mg) plus diphenhydramine (12.5 mg)
  — Cheaper
  — Appears to be more effective

Respiratory issues

Respiratory drugs

The Respiratory Patient

• Asthma
• Bronchitis
• Sinusitis
• Chronic obstructive pulmonary disease (COPD)
• Upper respiratory infection (URI)
Costs of COPD Care

Who Has Asthma?
- 20 million Americans
- 9 million children
- 11 million adults
- In about 50% of children, there is a known trigger.
  - Asthma is the main reason for missed school days and for ER visits in children in the U.S.

Who Has Asthma?

The Nature of Wheezing
- More than 50% of children wheeze because of...
  - Small airways
  - Male gender
  - Low birth weight
  - Smoker in the home
  - Allergy
- IgE-mediated allergic wheezing is the most common cause in children.

The Nature of Wheezing

Asthma Prevalence

How Severe Is It?
- Mild asthma
  - Symptoms occur two times per week, plus one to two times per month at night
- Moderate asthma
  - Daily symptoms, plus nighttime attacks three to four times per month
- Severe asthma
  - Daily symptoms that significantly affect quality of life; severe nighttime attacks seven times per week

How Severe Is It?

During an Asthma Attack...
- 2-Step process
  - Allergenic molecules bind to IgE antibodies on mast cells causing release of histamine, leukotrienes, interleukins, and prostaglandins. This causes bronchoconstriction.

During an Asthma Attack...
During an Asthma Attack...

• 2-Step process
  – In the second step, inflammatory cells infiltrate the airway where the bronchoconstriction occurred. They release mediators that cause edema, mucus plugging, and airway obstruction.

Process of Asthma

Triggers for Asthma

• Dust
• Dander
• Mold/Mildew
• Pollen
• Cold air
• Tobacco or other smoke
• Pollutants
• Exercise

Drugs for Asthma

• 2 main classes: Anti-inflammatories and bronchodilators
  • Anti-inflammatory drugs: Glucocorticoids, cromolyns, leukotriene modifiers, ige antagonist
  • Bronchodilators: Beta-2 agonists, methylxanthines, and anticholinergics

Metered-Dose Inhalers

• May require good hand-lung coordination
• With an MDI, only about 10% of the dose gets to the lung. 80% gets deposited in the oropharynx; the other 10% is left in the device or exhaled.
  – A spacer helps increase drug delivery to the lungs and reduce waste. It also reduces the need for hand-lung coordination to a degree.

Dry Powder Inhalers

• These are breath-activated.
• No hand-lung coordination required
• Contain no propellants to harm environment
• Deliver about 20% of the drug dose to the lungs
**Nebulizers**

- Convert a drug solution into a mist
- Inhalation of the mist can be done through facemask or through a mouthpiece held between the teeth.
- Takes several minutes to deliver the drug to the lungs

**Recommendations**

- **Mild Asthma**
  - Occasional beta2 agonist
- **Moderate Asthma**
  - Daily beta2 agonist
- **Severe Asthma**
  - Beta2 agonist plus steroids; systemic steroids for exacerbations

**Short-Acting Beta-Agonists**

- Overused
- Watch for abuse/overuse
- Use of more than one canister/month indicates a poorly controlled patient
- Examples: Albuterol (Ventolin, Proventil), levalbuterol (Xopenex), Bitolterol (Tornalate), pirbuterol (Maxair), or terbutaline (Breathaire)

**Considerations of SABA Use**

- Avoid excessive use
- Watch for cardiovascular effects, seizures, diabetes, hyperthyroidism, and hypertension
- Most are pregnancy category C and are not recommended in nursing mothers.
- Drug interactions of note: Sympathomimetics, MAOIs, TCAs; monitor digoxin and other drugs that cause hypokalemia

**Long-Acting Beta-Agonists**

- Only used in patients not controlled on other meds, OR those who need two or more maintenance meds
- For children > 12 not controlled with ICS alone; usually given with ICS
- Black box warning because of increase risk of asthma-related deaths and exacerbations
- Examples: Formoterol (Foradil), Salmeterol (Serevent), albuterol, and terbutaline per os (PO)

**Considerations of LABA Use**

- Not for acute attacks; do not exceed recommended dose
- Watch in diabetes, thyroid disorders, cardiovascular disease, seizures
- Do not use with spacers; prescribe a SABA for acute symptoms
- Pregnancy category C; not recommended for nursing mothers
- Hypertension, sinus congestion, rhinitis, bronchospasm, transient hypokalemia, and muscle cramps
- Watch with MAOIs, TCAs, and/or drugs that decrease potassium
### Corticosteroids

- Inhaled or PO
  - ICS
    - Good News: Decreased symptoms, increased quality of life, and lung function; decreased hyperresponsiveness of airways and decreased exacerbations
    - Bad News: Bruising, adrenal suppression, thrush, dysphonia, bone demineralization, possible growth suppression. These drugs do not help one “grow out” of asthma.

### Examples of Corticosteroids

- ICS: Beclomethasone (QVAR), budesonide (Pumicort Turbohaler), flunisolide (Aerobid), fluticasone (Flovent), mometasone (Asmanex Twisthaler), and triamcinolone (Azmacort)
- PO GCs: Prednisone; prednisolone
- Combination Agent: Fluticasone plus salmeterol (Advair Diskus)

### Considerations for CS Use

- Monitor for infections!
  - Chicken pox, measles, and URI
- Monitor for adrenal insufficiency and suppression of the HPA axis
  - Monitor for osteoporosis, growth suppression, and hypercortisolism
- Monitor intraocular pressure
- Pregnancy category C; caution in nursing
- Headache, respiratory infections, oral candidiasis, sinusitis, GI upset, depression, dysmenorrhea; discontinue if bronchospasm occurs

### Leukotriene Modifiers

- Safe and effective for pediatric and adult use
- Alternative or add-on to ICS
- But...not as effective as ICS when added to a LABA
- Examples: Montelukast (Singulair), zafirlukast (Accolate), and zileuton (Zyflo)
- Available as tablets, chewables, and granules

### Considerations of LTRAs

- Pregnancy category B
- Adults may complain of headache, fatigue, fever, and/or GI upset. Children may complain of urticaria, flu/cold symptoms, ear/leg pain, and/or thirst.

### Respiratory Medication Prescribing Pearls

- For asthma and respiratory distress, beta agonists are the fastest-acting.
  - Steroids reduce inflammation and will have long-lasting effects.
- Mometasone, fexofenadine, or montelukast will NOT give your patient immediate relief. These are “send-home” drugs and may take up to 10 d-2 weeks to work.
Bacterial Rhinosinusitis

• With no previous antibiotic, use: amoxicillin/clavulanate, amoxicillin, cefpodoxime proxetil, cefuroxime axetil, and cefdinir.
• With previous antibiotic use or more severe disease, use: amoxicillin/clavulanate, respiratory fluoroquinolones, and ceftriaxone.
  – Second or third generation cephalosporins may be used in penicillin-allergic patients with a non-type 1 allergy.

Treatment for CAP

• Joint guidelines issued in 2007 by the Infectious Disease Society of America and the American Thoracic Society (ITSA/ATS) recommend that mild community-acquired pneumonia (CAP) in otherwise healthy patients be treated with oral macrolide antibiotics (azithromycin, clarithromycin, or erythromycin).

Determining Factors

• Antibiotic treatment for CAP is determined by a number of factors, including:
  – The patient's history of antibiotic therapy
  – Co-existing diseases (such as COPD, diabetes, and heart failure)
  – Whether the patient is well enough to be treated at home or requires hospitalization or nursing home care

In Comorbid Conditions...

• Many patients with heart disease, kidney disease, diabetes, or other comorbid conditions may still be treated as outpatients. However, they should be given a fluoroquinolone (moxifloxacin, gemifloxacin, or levofloxacin) or a beta-lactam (preferably high-dose amoxicillin or amoxicillin-clavulanate), plus a macrolide, unless they live in an area with high S. pneumoniae resistance to macrolides.

Duration of Treatment?

• Current recommendations call for seven to 10 days of treatment for S. pneumoniae
• 10 to 14 days for Mycoplasma pneumoniae and Chlamydia pneumoniae
• Some research suggests that patients with mild-to-moderate CAP may be successfully treated with seven days or less of antibiotics. The shorter treatment may increase the patient’s tolerance, improve adherence to the treatment regimen, and help limit antibiotic resistance.

Treatment for Nosocomial Pneumonias

• A broad range of antibiotics are available for the treatment of hospital-acquired pneumonias. Factors that may determine the choice of an antibiotic include:
  – Immune status
    • Patterns of antibiotic resistance within a particular hospital or community
  – Recent antibiotic usage
  – Specific organism identified
  – Use of ventilators
Antibiotics to Use?

- Depends on the organism and level of resistance
- The American Thoracic Society recommends a regimen containing a cephalosporin, carbapenem, or beta-lactam and beta-lactamase inhibitor; an aminoglycoside or fluoroquinolone (colistin acceptable in resistance); and linezolid or vancomycin.
- Monitor for antibiotic-induced renal toxicity (colistin and aminoglycosides!)
- Monitor for ventricular arrhythmias (fluoroquinolones!)

Treatment of Viral Pneumonias

- Oseltamivir (Tamiflu) and zanamivir (Relenza) are the recommended drugs for influenza A or B infections. Their use is recommended only if they are started in the first 48 hours of symptoms. Taken early, these medications may be effective in reducing symptoms and reducing the duration of illness.
- Patients with pneumonia caused by varicella-zoster and herpes simplex viruses are usually admitted to the hospital and treated with parenteral acyclovir IV for seven days.

Treatment of Viral Pneumonias

- No antiviral drugs have been proven effective in adults with respiratory syncytial virus (RSV), parainfluenza virus, adenovirus, metapneumovirus, the severe acute respiratory syndrome coronavirus, or hantavirus. Treatment is largely supportive, with patients receiving oxygen and ventilator therapy as needed.

Treatment of Viral Pneumonias

- Treatment of RSV in Children. Ribavirin is the first treatment approved for RSV pneumonia, although it has only modest benefits. The American Academy of Pediatrics recommends this drug for children who are at high risk for serious complications of RSV.
- Ribavirin (Virazole)—administered by inhalation. Category X drug—do not expose pregnant women to patients getting this drug. Treatment is via a small particle aerosol generator (SPAG-2) for 12 to 18 hours per day for three days to up to one week.

Other Respiratory Emergencies

- Angioedema—edema of the lips, periorbital region, extremities; nonpruritic urticaria. Responds to epinephrine, corticosteroids, antihistamines. For angiotensin-converting-enzyme inhibitor (ACEI) angioedema, manage with supportive care and airway support.

Other Respiratory Emergencies

- Epiglottitis—seen more in adults than children. Responds to second or third generation cephalosporins (with activity against H. influenzae). Admit to intensive care unit (ICU).
Other Respiratory Emergencies

• Ludwig’s angina—usually secondary to dental work. Infection of submandibular space. Treat with airway management and IV penicillin, clindamycin, metronidazole plus steroids. Surgical drainage may be necessary.

Other Respiratory Emergencies

• Malignant otitis externa—usually seen in immunocompromised patients or comorbid patients (diabetes). Mortality rate is 50-80%. Treat with IV ciprofloxacin and debridement.

Cardiovascular Issues and Cardiovascular Drugs

Cardiovascular

• Heart failure
• Chest pain
• Hypertension
• Headache
• Stroke
• Fever
• GI disturbances???

The Patient in Heart Failure

• Diuretic use should always be considered.
  – Dietary indiscretions
  – Volume overload
  – Medication noncompliance
  – IV Furosemide will ease pulmonary edema
• Nitrates
  – Reduce afterload; some reduce both preload and afterload
  – Nitroglycerin or nitroprusside

The Patient in Heart Failure

• Nitroglycerin
  – Relieves pulmonary edema
    – Venous vasodilator
  – Monitor for hypotension and reflex tachycardia
• Sodium nitroprusside
  – Venous and arteriolar vasodilator
  – Decreased afterload and reduced pulmonary edema
  – Profound hypotension
The Patient in Heart Failure

3. Nesiritide (Natrecor)
- A BNP derivative
- Indicated for short-term IV treatment in patients with dyspnea at rest and increased pulmonary capillary wedge pressure
- Suppresses renin-angiotensin-aldosterone system (RAAS), decreases pre- and afterload, and decreases central sympathetic outflow
- Outcome is long-lasting vasodilation and enhanced Na and H2O excretion
- Dose 48 hours or less; symptomatic hypotension or renal compromise are indications to STOP.

The Patient in Heart Failure

- **Inotropic Agents**
  - *Dopamine*
    - Short-term rescue measure for acute heart failure (HF)
    - Activates beta-1 receptors in the heart increasing cardiac output (CO), increases renal blood flow and urine output
    - Activates alpha-1 receptors increasing vasoconstriction—a disadvantage
  - *Dobutamine*
    - Only works on beta-1 receptors to increase CO and contractility

The Patient in Heart Failure

- **Phosphodiesterase Inhibitors**
  - *Inamrinone*
    - Increases contractility and causes vasodilation (an inodilator)
    - 2-3 day IV treatment for acute HF patients who have not responded to diuretics, RAAS inhibitors, and digoxin
    - Constant monitoring
  - *Milrinone*
    - As above

The Patient in Heart Failure

- **ACEI**—not in acute decompensated HF
  - Prolong life
  - Dilate arterioles and veins
  - Suppress aldosterone release
  - Favorable impact on cardiac remodeling with prolonged use (Angiotensin II Receptor Blockers less favorable here)
- **Aldosterone antagonists** (Eplerenone—Inspra)
  - Eliminates residual adverse effects of aldosterone on HF
  - Do not use in renal impairment
  - Monitor for hyperkalemia with all of the above

The Patient in Heart Failure

- **Beta blockers**
  - Carvedilol (Coreg), bisoprolol (Zebeta), and metoprolol (Toprol XL) improve left ventricular (LV) ejection fraction, slow progression of HF, and decrease hospitalizations when added to regimens (watch in stage D)
  - May take up to a month to show response/improvement
- **Thiazide diuretics if renal function is good**
- **Digoxin and cardiac glycosides**
  - Increases CO, but do not correct remodeling
  - Do more harm than good in females
  - Multiple drug interactions

Drugs to Avoid in the HF Patient

- **Antidyssrhythmic drugs**
  - Are cardioselective
  - Amiodarone (Cordarone) and dofetilide (Tikosyn) do not adversely affect survival.
- **Calcium channel blockers (CCBs)**
  - Worsen HF
  - Vasoselective CCBs (e.g., Nifedipine, Amlodipine) do not reduce survival
- **Nonsteroidal antiinflammatory drugs (NSAIDs)**
  - Decrease renal blood flow, promote vasoconstriction, fluid (sodium) retention
Hypertensive Crisis

- Diastolic BP >120 mm Hg
- Due to...
- Severity gauged by possible end-organ damage including papilledema, intracranial hemorrhage, myocardial infarction (MI), and/or acute HF

Hypertensive Crisis

- All drugs are vasodilators
- All are administered IV
  - Sodium nitroprusside (Nitropress)
    - Continuous IV
    - Monitor BP
    - Longer than 72 hours can cause thiocyanate accumulation
  - Fenoldopam (Corlopam)
    - Causes vasodilation by activation of dopamine receptors
    - Continuous IV
    - Hypotension plus rebound tachycardia (Give with beta blocker?)

Hypertensive Crisis

- labetalol (Trandate)
  - Beta and alpha blocker so see vasodilation with no reflex tachycardia
  - Can worsen respiratory disease or HF
  - Slow IV
- Diazoxide (Hyperstat IV)
  - CCB that will cause reflex tachycardia (give with beta blocker?)
  - May cause fluid retention (add diuretic)
- Clevidipine (Cleviprex)
  - CCB with ultra-short half-life
  - Reflex tachycardia and hypotension

Hypertensive Crisis

- Other Drugs
  - Phentolamine (Regitine)
    - Used in patient with HTN due to pheochromocytoma
    - Alpha-1 blocker
    - Do not use in patient with MI or ACS
    - Combine with a beta-blocker

Hypertensive Crisis

- Other Drugs
  - Esmolol
    - Used for postperioperative HTN
    - Monitor for HF, severe bradycardia, sympathetic (alpha) storm—do not use unopposed!
    - Beta blockade should precede the use of other drugs that cause reflex tachycardia or reflex sympathetic outflow
  - Nitroglycerin
    - Tolerance limits usefulness
  - Hydralazine
    - May be used but long-lasting effects do not make it a first-line choice
  - Enalaprilat
    - ACEI with long-lasting effects
    - Do not use in preeclampsia or eclampsia
    - Avoid in renal stenosis and acute MI
### Acute Coronary Syndrome

- Acute coronary syndrome (ACS) includes patients with unstable angina (UA), non-ST-segment elevation MI (NSTEMI) and ST-segment elevation MI (STEMI).
- A common presentation of coronary artery disease, accounting for more than one million hospital admissions in the USA annually.

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Preferred Agent(s)</th>
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<tbody>
<tr>
<td>Acute aortic dissection</td>
<td>Esmolol**</td>
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<tr>
<td>Acute congestive heart failure</td>
<td>Nesiritide; nitroglycerin, nitroprusside</td>
</tr>
<tr>
<td>Acute intracerebral hemorrhage</td>
<td>Labetalol, nicardipine</td>
</tr>
<tr>
<td>Acute ischemic stroke</td>
<td>Labetalol, nicardipine</td>
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<tr>
<td>Acute myocardial infarction</td>
<td>Clevidipine, esmolol, nitroglycerin, nitroprusside</td>
</tr>
<tr>
<td>Acute pulmonary edema</td>
<td>Nesiritide; nitroglycerin, nitroprusside</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>Clevidipine, fenoldopam, nicardipine</td>
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<tr>
<td>Eclampsia or preeclampsia</td>
<td>Hydralazine, labetalol, nicardipine</td>
</tr>
<tr>
<td>Perioperative hypertension</td>
<td>Clevidipine, esmolol, nicardipine, nitroglycerin, nitroprusside</td>
</tr>
<tr>
<td>Sympathetic crisis or catecholamine toxicity</td>
<td>Clevidipine, fenoldopam, nicardipine, phentolamine</td>
</tr>
</tbody>
</table>

### Patient Complaints Seen in ACS

- Palpitations
- Pain, which is usually described as pressure, squeezing, or a burning sensation across the precordium and may radiate to the neck, shoulder, jaw, back, upper abdomen, or either arm
- Exertional dyspnea that resolves with pain or rest
- Diaphoresis from sympathetic discharge
- Nausea from vagal stimulation
- Decreased exercise tolerance

### Etiology of ACS

- ACS is almost always associated with rupture of an atherosclerotic plaque and partial or complete thrombosis of the infarct-related artery.
- Stable coronary artery disease (CAD) may result in ACS in the absence of plaque rupture and thrombosis, when physiologic stress (e.g., trauma, blood loss, anemia, infection, tachyarrhythmia) increases demands on the heart.

### Pathophysiology of ACS

ACS is caused primarily by atherosclerosis. Most cases of ACS occur from disruption of a previously non-severe lesion. The vulnerable plaque is typified by a large lipid pool, numerous inflammatory cells, and a thin, fibrous cap.

- The major trigger for coronary thrombosis is considered to be plaque rupture caused by the dissolution of the fibrous cap, caused by the release of metalloproteinases (collagenases) from activated inflammatory cells. This event is followed by platelet activation and aggregation, activation of the coagulation pathway, and vasoconstriction. This process culminates in coronary intraluminal thrombosis and variable degrees of vascular occlusion.
Pathophysiology of ACS

Standard Treatment for STEMI

- **M** Morphine
  - Relieves pain; dilates veins so also reduces preload, may also reduce afterload a bit
- **O** Oxygen
  - Increases O2 delivery to the ischemic myocardium
- **N** Nitroglycerin
  - Reduces preload; increases collateral blood flow; reduces hypertension; limits infarct size and improves LV function....but does not reduce mortality
- **A** Aspirin
  - Suppresses platelet aggregation; synergistic with fibrinolytics; improves mortality. Chew first dose.

Reperfusion Therapy

- Restore perfusion via fibrinolytic drugs or percutaneous coronary intervention (PCI)
- Success rate is higher with PCI
- Benefits last longer with PCI
- Fibrinolytics cost less and work faster
- More access to fibrinolytics

Fibrinolytic Therapy

- Streptokinase (Streptase)
- Alteplase (tPA, Activase)
- Reteplase (Retavase)
- Tenectaplase (TNKase)
  - Convert plasminogen to plasmin
  - When given within 30 minutes of patient presentation to emergency department (ED), LV function improves, infarct size is limited and mortality improves.
  - Chest pain must be present no more than 12 hours prior to drug administration.

Fibrinolytic Therapy

- Alteplase has best clinical outcomes but is expensive
- Antibodies may be made to streptokinase (within 5 days of administration), necessitating use of an alternate agent
- All patients should also be receiving an anticoagulant (heparin IV) and an antiplatelet drug (aspirin plus clopidogrel) but not a glycoprotein IIb/IIIa inhibitor
  - Bleeds are the major risk of use!!!

Absolute Contraindications to Fibrinolytic Therapy

- Any prior intracranial hemorrhage or known structural vascular cerebral lesion
- Ischemic stroke within last three months EXCEPT ischemic stroke within last three hours
- Intracranial neoplasm
- Active internal bleeding
- Suspected aortic dissection
Antiplatelet Drugs—Thienopyridines

- Clopidogrel (Plavix) — give ASAP and continue...
- Prasugrel (Effient)
- Ticagrelor (Brilinta, Brilique)
- Ticlopidine (Ticlid)
- Used with aspirin to prevent platelet aggregation. Used in patients undergoing PCI and in those getting fibrinolytics.
  - For PCI patient, aspirin dose should be 162 to 325 mg for first month for patients with a bare-metal stent; three months for sirolimus-eluting stent; six months for paclitaxel-eluting stent, then switch to low dose (81 to 162 mg) indefinitely.

Antiplatelet Drugs—Thienopyridines

- Prasugrel and Effient becoming first line agents
  - Clopidogrel in patients who cannot take the others
- Give patients with a history of bleeds a proton pump inhibitor, not omeprazole

Glycoprotein IIb/IIla Inhibitors

- Abciximab (Reopro)
- Tirofiban (Aggrastat)
- Eptifibatide (Integrilin)
- Treatment should begin as soon as possible before PCI and continue for 12 hours thereafter. NOT to be used in patients receiving fibrinolytics.

Other Drugs With Effects on Bleeding/Coagulation

- Direct Thrombin Inhibitors
  - Desirudin (Iprivask)
  - Bivalrudin (Angiomax)
  - Argatroban (Argatroban)
  - Dabigatran (Pradaxa)
  - Lepirudan (Refludan)
- Indicated for Stroke, heparin-induced thrombocytopenia, deep venous thrombosis (DVT) prophylaxis

ACS

- Nitroglycerin
- Spray (Nitrolingual, Nitromist)
- Sublingual tabs (Nitrostat 0.4 mg) every 5 min for a total of three doses. Assess if IV nitroglycerin is needed.
  - Persistent chest pain, pulmonary congestion, HTN
- Warnings/contraindicated in tachycardia, (>100 bpm), bradycardia (<50 bpm) systolic hypotension (<90), right ventricular infarct. Concomitant sildenafil or vardenafil (24 hours) or tadalafil (48 hours)

Beta Blockers

- Used in the patient with ACS and/or N/STEMI to decrease cardiac work, pain, infarct size and short-term mortality.
- Atenolol and metoprolol
- Initial dose may be PO or IV; PO thereafter for 2-3 years +
- Contraindications include severe HF, severe bradycardia, severe hypotension, advanced heart block, cardiogenic shock
Other Drugs for ACS

- ACEI and ARBs (Captopril, lisinopril, valsartan)
  - ACEIs decrease mortality in patients by decreasing pre- and afterload, reducing fluid load, and favorably altering ventricular remodeling.
  - Recommended for ALL STEMI patients within 24 hrs. Continue for at least 6 weeks (indefinitely in patients with LV dysfunction). Monitor for a cough; check K levels
  - ARBs may be used in patients intolerant of ACEIs

Other Drugs for ACS

- CCBs (Verapamil, Diltiazem)
  - Used to control rapid ventricular rate caused by atrial fib and flutter but...
  - Indicated only if beta blockers do not work or are contraindicated
  - DO NOT USE in patients with HF, LV dysfunction, or AV block

Useful Educational Tools for Patients with ACS and CAD

- A = Aspirin and antianginals
- B = Beta blockers and blood pressure (BP)
- C = Cholesterol and cigarettes
- D = Diet and diabetes
- E = Exercise and education

Stroke

- Third leading cause of death in the US
- The leading cause of disability in the US
- 87% of all strokes are ischemic; 10% are due to intracerebral hemorrhage, 3% are due to subarachnoid hemorrhage.
- Smokers have double the risk; atrial fibrillation increases risk 5-fold.
- High BP is most important risk factor.

How Many?

- 600,000 strokes occur in the US per year!
- 150,000 of these are fatal!
- Higher incidence in African Americans than Caucasians
- Males and females present at equal rates, but more likely to be fatal in females.
- Much more likely to occur (and be fatal) in patients 65 and older (ischemic stroke)

Therapy for Strokes

- Thrombolytic and antiplatelet drugs
  - Reduce risk of death and nonfatal ischemic stroke
  - Reduce risk of nonfatal transient ischemic attack (TIA)
- Adenosine diphosphate receptor antagonists
  - Clopidogrel, etc.
  - Thienopyridines that decrease platelet aggregation
  - Watch for bleeds!
Therapy for Strokes

3. Glycoprotein IIb/IIIa receptor antagonists
   - “Super aspirins” — decrease platelet aggregation
   - Administer IV with aspirin and low-dose heparin
   - Expensive!
   - Watch for bleeds!

Therapy for Strokes

- Antiplatelet
  - Dipyridamole plus aspirin
  - Decrease platelet aggregation
- Thrombolytic
  - Dissolve clots in ischemic stroke via activation of plasminogen to plasmin
  - Intracranial bleeding is a big risk.
  - Tenectaplaste is easiest to use because of bolus dosing.
**Antiplatelet + Nonsteroidal Antiinflammatory Drugs (NSAID)**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggrenox</td>
<td>Dipyridamole and aspirin</td>
</tr>
<tr>
<td></td>
<td>Reduce risk of stroke after transient ischemia of the brain or complete ischemic stroke due to thrombosis</td>
</tr>
<tr>
<td></td>
<td>Take one capsule twice daily (AM and PM) with or without food; swallow whole.</td>
</tr>
</tbody>
</table>

**Tissue Plasminogen Activators (tPA)**

- **Aggrastat tirofiban**
  - TNKase tenecteplase
  - For acute MI
  - Management of acute MI
    - Give 20 mg/hr for 2 hrs. (1 hr (of which 6–10 mg is given as bolus), then 60 min. 3-hr infusion: (>65 kg): 60 mg infused for 30 min, then 0.5 mg/kg (max 35 mg) for 60 min. 3-hr infusion: (≤67 kg): 15 mg IV bolus, then 50 mg infused for 1 hr of which 6–10 mg is given as bolus), then 2 mg/kg for 2 hrs. (10–35 kg): 1.25 mg/kg for 3 hrs (as described above). Concomitant use with heparin.
  - Management of acute ischemic stroke
    - Give 20 mg/kg IV bolus, administered 30–60 min before start of PCI, then a continuous infusion of 0.122 µg/kg/min (max 5 mg/hr) for 12 hrs. Use with heparin and aspirin.
  - Management of acute massive PE
    - Give 0.25 mg/kg IV bolus followed by an 18–20 µg/hr infusion of 350 µg/min, concluding 3 hr after PCI.

**Thrombolitics**

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<tr>
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<tr>
<td>Esmolol</td>
<td>250 µg/kg i.v. push loading dose</td>
<td>25–300 µg/kg/min</td>
</tr>
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<td>Hydralazine</td>
<td>5–20 mg i.v. push every 30 min</td>
<td>1.5–5 µg/kg/min</td>
</tr>
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<td>Labetalol</td>
<td>5–20 mg every 15 min</td>
<td>2 mg/min (maximum of 300 mg daily)</td>
</tr>
<tr>
<td>Nicardipine</td>
<td>Not applicable</td>
<td>5–15 µg/hr</td>
</tr>
<tr>
<td>Nitroglycerin</td>
<td>Not applicable</td>
<td>20–400 µg/min</td>
</tr>
<tr>
<td>Nitroprusside</td>
<td>Not applicable</td>
<td>0.1–10 µg/kg/min</td>
</tr>
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</table>

*Because of the risk of precipitous blood pressure lowering, the enalapril first test dose should be 0.625 mg.*

**Antihypertensives for Treating High BP in Intracerebral Hemorrhage**

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Endocrine Issues
Diabetes

Hyperglycemia and Pathology
• Hyperglycemia is a strong predictor of adverse clinical outcome in patients presenting with:
  – Stroke
  – Chest pain
  – Sepsis
  – Heart failure
  – CAP

Insulin Use in the ICU patient
• Glycemic control is the goal
• Maintaining tight glucose control (80-110 mg/dl) without significant hypoglycemia [blood glucose (BG) < 70 mg/dl] is associated with less acute renal failure, less sepsis, decreased neuropathy, and reduced mortality in critically ill patients.
• IV insulin is the best way to maintain BG in this patient population

Drawbacks to SC Rapid-Acting Insulins
• Even though rapid-acting insulin analogs have clearly advanced glycemic control in both type 1 and type 2 diabetes, their pharmacologic profile still falls short of mimicking the physiologic effects of endogenous insulin release. It usually takes more than 90 minutes for insulin, delivered conventionally, to reach maximal effect, and the duration of significant hyperinsulinemia often exceeds three hours.

Tight Control—but Not TOO Tight
• The NIH sponsored ACCORD trial which hoped to prove that aggressive control of blood sugar could lead to an improvement in cardiovascular outcomes (it didn’t) was stopped early because of deaths in the intervention group. Many believe that hypoglycemia was a major contributor to these excess deaths.

Treatment of DKA and HHNK
• Correct hyperglycemia and acidosis, replace lost water and sodium, correct potassium
• IV insulin—initial bolus of 0.1 to 0.15 units/kg body weight, then a continuous infusion at 0.1 units/kg/hr until BG is reduced to 250 mg/dL. Then infuse at 0.05 to 0.2 units/kg/hr with 5% dextrose in half normal saline at 150 to 200 ml/hr. Adjust insulin to maintain BG at 200 mg/dL until acidosis is resolved.
• Monitor potassium; administer as needed
Insulin Overdose? Hypoglycemia?

- Treat with IV glucose
  - Treatment of choice in severe hypoglycemia
- Second choice is glucagon
  - Not a choice in the malnourished patient

Other Drugs for Diabetes

- Metformin (Glucophage)—a biguanide that decreases glucose production in the liver, decreases glucose absorption from the gut and sensitizes insulin receptors in target tissues. May be used alone or in combination with a glitazone, a sulfonylurea, or exenatide. Does not cause hypoglycemia.
  - Watch for lactic acidosis. Must discontinue metformin 48 hours before elective radiography with contrast media.

Other Drugs for Diabetes

- Pioglitazone (Actos)—a glitazone that activates peroxisome proliferator-activated receptor gamma (PPAR gamma) which helps up-regulate cellular responses to insulin. Takes several weeks to work.
  - Monitor liver enzymes
  - Watch for fluid retention and hypoglycemia, especially when combined with insulin

Sitagliptin (Januvia)

- Dipeptidyl Peptidase IV (DPP-4) inhibitor
  - Results in prolonged increase in incretin hormones (glucagon-like peptide-1 (GLP-1) and glucose-dependent insulino tropic polypeptide (GIP))
  - Increases insulin synthesis; decreases glucagon release
  - Use with caution in moderate-severe renal impairment

Sitagliptin (Januvia)

- Indicated for type 2 diabetes mellitus (DM)
- Monotherapy or combined with metformin or a glitazone
- Main SE include respiratory tract infection, headache, sinusitis, sore throat
- Metformin/sitagliptin (Janumet)

Saxagliptin (Onglyza)

- Once-daily tablets for type 2 DM
- Dipeptidyl peptidase-4 inhibitor
  - Stimulates insulin synthesis and secretion from the pancreas
Exenatide (Byetta)
- Injectable Glucagon-like peptide 1 (GLP-1) agonist—twice-daily injections
- Increases insulin excretion in the type 2 diabetic, increases beta cell growth and replication, slows gastric emptying and decreases food intake
  - As a result, weight loss is usually seen
- Acute pancreatitis has been reported, so monitor for acute GI pain.

Exenatide (Byetta)
- Adjunctive therapy with metformin or a sulfonylurea
- Dose—related hypoglycemia with sulfonylureas is seen
- GI effects—nausea, vomiting, and diarrhea
- Since it delays gastric emptying, this drug may effect absorption of other PO meds—give other drugs one hour before exenatide.

Liraglutide (Victoza)
- Injectable GLP-1 agonist for type 2 DM
- Works even if patients develop antibodies to it
- Appears to be superior to sitagliptin in early clinical trials
- Once—daily injection...it MAY have some benefit for type 1 patients as well

Pramlintide (Symlin)
- May be used in Type 1 or Type 2 DM
- An amylin analog; reduces postprandial glucose when used in conjunction with insulin
  - Watch for hypoglycemia when used with insulin; decrease insulin dose 50% initially
- Injectable. ISMP alert for complicated injection volumes (patient or HCP may confuse micrograms with units and inadvertently overdose)
- Do not administer at insulin injection sites; inject into abdomen or thigh only for best absorbance

Bydureon
- A once-a-week injection form of exenatide
- Coming soon? Currently being tested and seeking market approval for long-term glucose control
- Similar to liraglutide in mechanism, but efficacy?

Gastrointestinal and Genitourinary issues
GI/GU Disturbances
- Ulcers/gastroesophageal reflux disease (CV?)
- Nausea/Diarrhea
- UTI
- Infection
- Abdominal pain

Upper GI Bleed
- Consider peptic ulcer disease
  - If positive for H. pylori, treat aggressively to eradicate
- Gastric ulcer hemorrhage, erosive gastritis, erosive esophagitis, and stress gastritis (in ICU patients)
  - Consider NSAID use, stress, shock, trauma
- Discontinue aspirin/NSAIDs
- Eradicate H. pylori (Omeprazole/lansoprazole, bismuth subsalicylate, and ranitidine bismuth citrate)

Upper GI Bleed
- The American Society for Gastrointestinal Endoscopy (ASGE) grouped patients with UGIB according to age and correlated age category to risk of mortality. The ASGE found a mortality rate of 3.3% for patients aged 21 to 31 years, a rate of 10.1% for those aged 41 to 50 years, and a rate of 14.4% for those aged 71 to 80 years.

Risk Factors that Increase Mortality from UGIB
- Age older than 60 years
- Severe comorbidity
- Active bleeding (e.g., witnessed hematemesis, red blood per nasogastric tube, fresh blood per rectum)
- Hypotension
- Red blood cell transfusion greater than or equal to 6 units
- Inpatient at time of bleed
- Severe coagulopathy

Psychiatric Issues
Drugs of Abuse

The Eyes Have It
### Quick Check of Eyes
- Alcohol and opioids cause miosis (note: miosis is less with meperidine)
- Cocaine, crack, ecstasy, LSD, mescaline, psilocybin, amphetamines, and SSRIs cause mydriasis

### Common Drugs of Abuse/Suicide
- Acetaminophen
- Sedatives
- Alcohol
- Antipsychotics
- Prescription drugs were involved in more than nine out of ten of these drug-related suicide attempts, but the substances used differed considerably by age and gender groups.

### Common Drugs of Abuse/Suicide
6. Acetaminophen was the most commonly used substance involved in ED visits by female adolescents attempting suicide (28.5%), while anti-anxiety drugs were the most commonly used substances in cases involving females age 25 or older (49.4%).
7. Adolescent males admitted for drug-related suicide attempts were more than three times as likely to have used anti-psychotic drugs as females (14.3% versus 4.3%).

### Treatment for Drug Overdose
- Opiates: Heroin, oxycodone (Oxycontin), and meperidine
- For treatment of acute toxicity, naloxone is the treatment of choice to reverse respiratory depression, coma, and pinpoint pupils.
  - Titrate dose; repeat dosing until blood levels fall to pre-opioid levels
  - Naltrexone (PO) may be used long-term to block opioid abuse. Also used for alcohol abuse.

### Sedative Overdose
- Supportive care for barbiturate overdose
- Benzodiazepine (BZD) overdose may be treated with flumazenil (Romazicon) IV
  - Consider prescription BZDs such as alprazolam, and illegal BZD-like drugs like rohypnol (flunitrazepam) and GHB
  - Often these drugs are combined with alcohol or something else. Flumazenil will not reverse effects of other drugs.

### Cocaine/Crack Overdose
- Presents with psychiatric symptoms and cardiovascular symptoms
- Agitation, dizziness, aggression, seizures, tremor, dysphoria, and hyperpyrexia
- Ventricular dysrhythmias, chest pain, hemorrhagic stroke, angina, and MI
  - IV diazepam or lorazepam relieves many symptoms but typically also need something for cardiac symptoms. Consider nitropusside, phentolamine, or labetalol; aspirin and cooling
Amphetamines

• Prescription amphetamines may be taken orally, snorted, or injected. Methamphetamine or “crystal meth” may be snorted or smoked.
• May induce a state of psychosis; also hypertension, angina, and dysrhythmias. Cerebral and renal vasculitis may be seen, with stroke and renal failure as outcomes.
  – Antipsychotics (Haloperidol)
  – Alpha blockers (Phentolamine)
    or alpha/beta blockers (labetalol)
  – Ammonium chloride to acidify urine

D-Lysergic Acid Diethylamide (LSD)

• Usually taken PO, but may be injected or smoked; duration of about 8 to 12 hours
• Hallucinations, changing/volatile emotions high BP, tachycardia, tremor, hyperthermia, and/or flashbacks
• Benzodiazepine sedatives may be used to manage some symptoms....supportive care

Mescaline, Psilocybin, Psilocin

• Found in mushrooms
• Effects last 8 to 12 hours
• Effects resemble psychosis, hallucinations
• Supportive care

Phencyclidine (PCP)

• Hallucinations, confusion, combativeness, and/or psychosis resembling schizophrenia
• In overdose hypertension, coma, seizures, and/or muscle rigidity
• Treat with diazoxide, IV diazepam, external cooling, dantrolene; gastric lavage and acidification of the urine also helpful

3,4-Methylenedioxymethamphetamine
MDMA, Ecstasy

• Both stimulant and psychedelic properties
• Low doses cause psychedelic effects related to LSD; higher doses produce effects similar to amphetamines.
• Neurotoxicity, seizures, hyperthermia and cardiac stimulation are seen at higher doses.
• Rapid cooling, rehydration, dantrolene; beta blockers if needed

Ecstasy (MDMA)
SUMMARY

• Consider these things in the acute patient:
• Drug use or exposure
  – Prescription
  – Drugs of abuse
• History
  – Cardiac, renal, and respiratory
• Importance of BG!
• Potential outcome