



## Emergency Medicine for the Medical Office

Advanced IV Therapy

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### Description:

Office medical emergencies can come in many forms, and require basic but focused assessment and response for optimum output.

Having managed emergency situations in hospitals, clinics and on airplane— as well as having taught emergency medicine for many years I intend for this presentation to hit the more common incidents.

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### The Issues:

- Most clinics report at least one emergency presenting to their office per year.
- **Asthma, anaphylaxis, shock, seizures, and cardiac arrest** are among the most common adult and childhood emergencies in the office setting.
- Most offices are not fully prepared for these medical emergencies.

**Toback SL. Medical Emergency Preparedness in Office Practice. Am Fam Physician. 2007 Jun 1;75(11):1679-1684.**

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Toback 2007

### Most commonly encountered office emergencies

Primary Care	Child Care
Asthma exacerbation	Asthma exacerbation
Psychiatric	Severe respiratory distress (non asthma)
Seizure	Meningitis/sepsis
Hypoglycemia	Seizure
Anaphylaxis	Apnea
Impaired consciousness	Anaphylaxis
Shock	Shock
Poisoning	Obstructed airway
Drug overdose	Probable epiglottitis
Cardiac arrest	Cardiac arrest

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### Toback, 2007 - Recommendations

- The choice of emergency medications and equipment should reflect the spectrum of anticipated emergencies in a practice's patient population, the skills of the practitioners, and the distance to the nearest emergency department.
- Office physicians and staff should make every effort to maintain current certification in basic or advanced life support courses.
- Offices should create a written emergency protocol that outlines the steps to be followed in the event of an office emergency.

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### Why do emergency situations happen?

- Pathophysiology:
  - How does that system work normally?
  - What can go wrong?
  - Why would it go wrong?

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## Order of Frequency of Emergencies

- Nutrient Reactions
- Syncope
- Nausea and Vomiting
- Hypoglycemia
- Speed Shock
- Shock
- Hypertensive Crisis
- Endotoxin Reactions
- Fluid Overload/CHF
- Angina
- Abscess/Septicemia
- Airway Emergency
- Anaphylaxis
- Pulmonary Embolism
- Air and Catheter Embolism

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## Critical Labs

### Chemistry:

- BUN >99 mg/dL
- Calcium <5.1 or > 13.4 mEq/dL
- CO2 <11 mEq/L
- Glucose <41 or >599 mg/dL
- Potassium <2.8 or >6.4
- Sodium <121 or >159

### Coagulation:

- PT INR: >3.5
- PTT > 45 seconds

### CBC:

- Hb: <6.7 g/dL
- Hct: <19%
- WBC < 1000 or >50,000
- Plt <= 20,000 or >1,000,000
- 2+ spherocytes, agranulocytosis

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## Nutrient Reactions (IV)

**Thiamine** – hives (possible literature anaphylaxis)

**Vitamin B6**- Nausea and vomiting

**Magnesium**- Speed Shock

**Potassium**-Heart block

**Vitamin C**- dehydration and hypoglycemia

**Amino Acids**- Nausea and Vomiting

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## Syncope

### Cause:

- Impaired circulation,
- Decreased cardiac output/Perfusion
- Vasovagal episode
- Orthostatic hypotension
- Hypoglycemia
- Hyperventilation.

### Treatment:

- Lie horizontal
- Raise legs
- Break ammonia capsule under nose (smelling salts), if awake give rescue remedy
- Reorient patient
- Be patient and reassuring
- Note: can occur rapidly

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## Vaso-vagal Episodes onset from fright, pain or trauma (reflex inhibition of sympathetic activity)

### Causes:

- Increased thoracic pressure
- Sensitive carotid sinus mechanism
- Petit mal or grand mal seizures
- Hypoglycemia
- Other concurrent drug therapy (anti-hypertensives)
- Hyperventilation

### Symptoms

- Patient may state that they feel they are going to pass out
- Pale face with diaphoresis
- Classic drop in BOTH blood pressure and pulse.

**Warn of possible re-entry seizure.**

### Treatment: according to cause

- Trendelenburg position ( feet higher than heart)
- Ammonia smelling salts
- Oxygen 1-2 L
- Rescue Remedy

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## Hypoglycemia

- Most likely induced by High dose IVC and EDTA.
    - Appears worse in those with reactive dysglycemia / early insulin resistance and IDDM. [1]
  - Best avoided by eating prior to and during IV.
    - Can formulate IV with added D-50 (2.5 – 5 Grams) or in a base of D-5W if necessary.
    - Acute treatment can include D-50 (25 - 50 mL) via IV push.
    - Recall: IVC makes glucometer readings falsely elevated – and therefore useless.
- [1] – Preliminary data – BIORC 'IVC effects on blood chemistry' interventional study.

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## Hypoglycemia

- In emergency situations hypoglycemia as a cause of syncope / LOC is considered something to be reversed even before diagnosis is sure.
- Reasoning is that a rapid dextrose infusion will save a life in hypoglycemic crisis and have little danger if the diagnosis is not hypoglycemia.
- Prefilled 50 mL syringes of D-50 (or 50 mL vials of D-50) are used.

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## Glycemic Emergency

- Hypo:
  - Prevention
    - Watch High dose Vitamin C, EDTA...
  - IV-Bolus D-50
    - 25-50 mL of D50 IVP or dilute in 250 – 500 mL NS
  - D5W administration or “50/50 mix” D50 & Water
    - Administer IV in a D5 base if patient is a recurrent reactor

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## Glycemic Emergency

- Hyper:
  - I.e. Steroid injection / D5 – D50 too fast
    - Watch and wait if appropriate with patient recumbent
    - Administer NS or ½ NS
  - Insulin (SQ or IV) if appropriate
    - Intravenous bolus of **regular insulin** at 0.15 units/kg body wt, followed by a continuous infusion of regular insulin at a dose of 0.1 unit · kg<sup>-1</sup> · h<sup>-1</sup> (5–7 units/h in adults), should be administered. ([http://care.diabetesjournals.org/content/26/suppl\\_1/s109.full](http://care.diabetesjournals.org/content/26/suppl_1/s109.full))

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## Anti-emetics

- Serotonin Agents - Ondansetron (Zofran):
  - Recommended dose: Three 0.15 mg/kg doses (up to a maximum of 16 mg per dose). The first dose is infused over 15 minutes.
  - Subsequent doses (0.15 mg/kg up to a maximum of 16 mg per dose) are administered 4 and 8 hours after the first dose.
  - Alternative therapies: Oral soluble film dosage form: 8 to 24 mg given successively as three 8 mg films

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## Anti-emetics

- Histamine Agents – Dilute if possible with NS (1 mL in 1-5 mL NS) – slow IVP not more than 25 mg / minute.
  - Promethazine (Phenergan) 12.5 to 25 mg, not to be repeated more frequently than every four hours.
  - Diphenhydramine (Benadryl) 12.5 to 50 mg not to be repeated more frequently than every four hours.

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## Speed shock:

- Rapid administration of a Medication / Vitamin or Mineral that causes a sudden rise in the plasma concentration of the substance.
- i.e. Magnesium pushed too fast causes BP to drop...
- Dilution, slow pushes, and patient interaction are the best prevention.

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## Speed Shock Calcium

### • Magnesium Sulfate

- For spasm or Calcium overdose:
  - 1G (2 mL of 50%) over 1-2 min. IVP [dilute in saline or sterile water]
  - then 3-5G in 250-500 NS

### • Magnesium Chloride

- For spasm or Calcium overdose:
  - 1G (5 mL of 20%) over 1-2 min. IVP [dilute in saline or sterile water]
  - then 3-5G in 250-500 NS

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## Speed Shock Magnesium

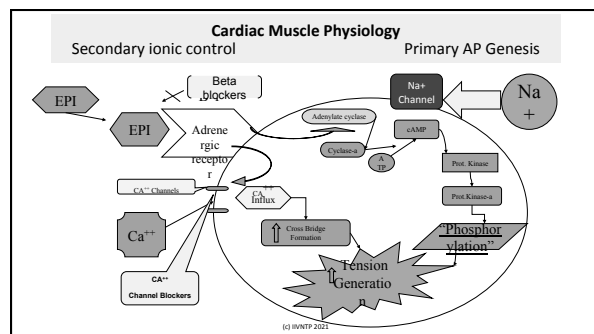
### • Calcium Gluconate - To reverse hypocalcemia (magnesium speed shock)

- Up to 1G (10 mL of 10%) over 2 min X3 [watch for response and when positive switch to diluted form below]
- Dilute form: 1G in 250-500 mL NS

### • Calcium Chloride

- Up to 1G (10 mL) over 2 min X1
  - Note: as CaCl is 3X stronger per mL than CaGluconate it is customary to push 3 mL of the CaCl and wait 20-30 seconds for a response.
- Dilute form: 1G in 500 mL NS

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## Speed Shock: Lidocaine / Na channel Blockers:

<http://emedicine.medscape.com/article/1844551-treatment#a1156>

- Attention to impending airway compromise, significant hypotension, dysrhythmias, and seizures takes precedence. Once other possible etiologies of the patient's new symptoms have been excluded, management of the specific symptoms can begin.
- Benzodiazepines are the drugs of choice for seizure control. Propofol can be used to control seizures but has the risk of potentiating cardiovascular toxicity. Refractory seizures may require neuromuscular blockade (eg, with succinylcholine).
- In severe reactions, monitor the cardiovascular system and support the patient with intravenous fluids and vasopressors as required. Small bolus doses of epinephrine are preferred. Vasopressin is not recommended.

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## Speed Shock: Lidocaine / Na channel Blockers:

<http://emedicine.medscape.com/article/1844551-treatment#a1156>

- Hypoxemia and metabolic acidosis may potentiate the cardiovascular toxicity of lidocaine and other local anesthetics. Early control of seizures and aggressive airway management to treat hypoxemia and acidosis may prevent cardiac arrest. Use of sodium bicarbonate may be considered to treat severe acidosis.
- Cardiac arrest due to local anesthetic toxicity is a rare but well recognized complication that may occur in cases of large overdose, especially those involving inadvertent intravascular injection. These patients have a favorable prognosis if circulation can be restored before hypoxic injury occurs. Aggressive resuscitation is therefore indicated in most cases. Cardiopulmonary bypass has been used effectively to treat cardiac arrest due to local anesthetic toxicity.[5]

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## Speed Shock: Lidocaine / Na channel Blockers:

<http://emedicine.medscape.com/article/1844551-treatment#a1156>

- Prolonged PR, QRS, and QT intervals potentiating reentrant tachycardias with aberrant conduction may herald cardiovascular toxicity. Cardiac resuscitation of such patients may be difficult and prolonged (30-45 min) because some anesthetics are very lipid soluble and require a long time for redistribution. However, some of these patients can be successfully treated with properly conducted cardiopulmonary resuscitation (CPR).

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### Speed Shock: Lidocaine / Na channel Blockers:

<http://emedicine.medscape.com/article/1844551-treatment#a1156>

- If cardiac arrest occurs, the ASRA recommends standard Advanced Cardiac Life Support (ACLS) with the following modifications:
- If epinephrine is used, small initial doses (10-100 µg boluses in adults) are preferable
- Vasopressin is not recommended
- Avoid calcium channel blockers and beta-blockers
- If ventricular arrhythmias develop, amiodarone is preferable

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### Speed Shock: Lidocaine / Na channel Blockers:

<http://emedicine.medscape.com/article/1844551-treatment#a1156>

- In patients with cardiac toxicity, avoiding the use of lidocaine and related class IB antidysrhythmic agents (eg, mexiletine, tocainide) is crucial because they may worsen toxicity. Lidocaine has been used successfully in bupivacaine-induced dysrhythmias, but its additive CNS toxicity is still a major concern.
- In patients who do not respond to standard resuscitative measures, some case reports have indicated that the use of cardiac pacing and cardiopulmonary bypass may improve the outcome.[2] Cardiopulmonary bypass may serve as a bridging therapy until tissue levels of the local anesthetic have cleared.[1]

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### Speed Shock: Lidocaine / Na channel Blockers:

<http://emedicine.medscape.com/article/1844551-treatment#a1156>

- In a Korean study, combined boluses of glucose, insulin, and potassium were successful in reversing bupivacaine-induced cardiovascular collapse. [8] However, the 2 units/kg dose of insulin used in this protocol may be challenging to use in clinical practice because of physicians' reluctance to administer such unusually high doses. In China, shenfu, an extract of traditional Chinese herbal medicines, was shown to reduce the CNS and cardiovascular toxicity of bupivacaine on rats.[9]

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### Response:

#### Based on presence or absence of shock signs

- If NO Respiratory or Cardiac shock signs:
  - Treat the originating cytokine / tissue triggers and monitor
- If Respiratory compromise and or CV shock:
  - Treat the originating cytokine triggers, secondary effects and monitor

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If the dividing line in the continuum is shock  
– then what is that?

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### What is Shock?

- The state of metabolic failure that may be caused by either inadequate delivery of oxygen to the tissues or improper metabolism of oxygen at the tissue site.
- Types:
  - Early (compensated) reversible in nature
    - General sympathetic nervous system reaction to causative factors, body is compensating
  - Late (decompensated) difficult to reverse effects
    - System is unable to maintain sympathetic responses to causative effects, starts to decompensate and go into failure mode

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## Signs of Shock

- **Tachycardia**
  - Earliest signs of shock
- **Hypotension**
  - Late sign of shock
- **Adrenergic responses**
  - Restless, agitated
  - cool clammy skin
  - "livedo reticularis"-mottled skin
- **Altered Mental Status**
- **Orthostatic Vital Signs**
  - Problems occur in standing position, often resolve supine

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## Classification of Shock

- **Hypovolemic Shock**
  - Due to a loss of fluids
- **Cardiogenic Shock**
  - Cardiac obstruction or pump failure, MI
- **Obstructive Shock**
  - Significant fall in cardiac output, CHF
- **Distributive Shock**
  - Loss of intravascular and decreased vascular volume;
  - Neurogenic, sepsis, infectious problem

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## Shock Severity Determinants

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• <b>Compensated Shock</b></li> <li>• Mechanism</li> <li>• Signs/symptoms               <ul style="list-style-type: none"> <li>• <b>Tachycardia</b>, anxiety, restlessness, apprehension, delayed capillary refill, diaphoresis, widened pulse pressure</li> </ul> </li> <li>• Treatments are preventative in nature with ABC interventions</li> </ul> | <ul style="list-style-type: none"> <li>• <b>Decompensated Shock</b></li> <li>• Mechanism</li> <li>• Signs/symptoms               <ul style="list-style-type: none"> <li>• <b>Hypotension</b>, confusion, Loss of consciousness, oliguria, acidemia</li> </ul> </li> <li>• Treatments is aggressive and rapid volume resuscitation, medications and invasive procedures</li> </ul> |
|---|---|

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A 25-year-old man comes to an outpatient clinic complaining of low-grade fever and sore throat, and he receives an injection of intramuscular penicillin for presumed streptococcal pharyngitis. He is otherwise healthy and takes no regular medications. Within 20 minutes, he begins to complain of swelling of his face and difficulty breathing. He looks dyspneic and frightened. His heart rate is 130 bpm, blood pressure 90/47 mmHg, and respiratory rate 28 breaths per minute and shallow. His face and lips are edematous, and he can barely open his eyes because of swelling. He is wheezing diffusely, and he has multiple raised urticarial lesions on his skin. An ambulance has been called.

**WHAT IS THE MOST IMPORTANT DATA ON THIS CASE?**

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- |                  |      |         |
|------------------|------|---------|
| • SHOCK          | ↓ BP | ↑ Pulse |
| • Vasovagal      | ↓ BP | ↓ Pulse |
| • Anxiety States | ↑ BP | ↑ Pulse |

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## Acute Hypertensive Crisis

- Defined as a blood pressure at or over 180/110-120 mmHg
- If they are asymptomatic, you can treat this (ER is just going to put them on BP meds and send them back to you)
- If other signs of chest pain and headaches this requires going to ER

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## Nitrate Rx:

- Nitroglycerin
  - SL-Tablets 0.3, 0.4 or 0.6mg
  - Remember HA are a side effect

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## Alpha-2 Agonist

### Clonidine - Clinical Pharmacology

- Clonidine stimulates alpha [2]-adrenoreceptors in the brain stem.
  - This action results in reduced sympathetic outflow from the central nervous system and in decreases in peripheral resistance, renal vascular resistance, heart rate, and blood pressure.
- Clonidine hydrochloride tablets act relatively rapidly. The patient's blood pressure declines within 30 to 60 minutes after an oral dose, the maximum decrease occurring within 2 to 4 hours.
  - Renal blood flow and glomerular filtration rate remain essentially unchanged. Normal postural reflexes are intact; therefore, orthostatic symptoms are mild and infrequent.

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## Calcium Channel Blockers

- Amlodipine (Norvasc)
  - 2.5, 5 and 10mg tablets
- Angina
  - 5 to 10 mg qd
- HTN
  - 2.5 to 5 mg qd
  - Maximum dose is 10 mg qd

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Arch Intern Med. 1986 Mar;146(3):586-9.

**Treatment of hypertensive emergencies and urgencies with oral clonidine loading and titration. A review.**

Houston MC.

**Abstract**  
Oral clonidine hydrochloride rapid titration or loading is a safe, effective method to control severe elevations of blood pressure in hypertensive crisis in many clinical situations. An initial oral dose of 0.1 to 0.2 mg of clonidine hydrochloride followed by hourly doses of 0.05 or 0.1 mg until goal blood pressure is attained that does not reduce perfusion to critical organs, or a total of 0.7 mg is given, will achieve a significant reduction in blood pressure in 93% of patients. A smooth, rapid, predictable reduction in blood pressure, patient comfort, lower overall cost, reduced requirement for close observation, intravenous lines, and hospitalization, and a small incidence of clinically significant side effects make oral clonidine rapid titration an attractive oral antihypertensive agent for patients with hypertensive urgencies and in some carefully selected patients with hypertensive emergencies. Immediate outpatient follow-up within 24 hours is mandatory in all patients who are not hospitalized to adjust the dose of antihypertensive medications.

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Atkin SH, et al. Oral **labetalol** versus oral **clonidine** in the emergency treatment of severe hypertension. Am J Med Sci. 1992 Jan;303(1):9-15. PMID: 1728876

This study was designed to compare the clinical efficacy and safety of oral clonidine and oral labetalol in the treatment of severe hypertension in an emergency department setting. Thirty-six patients with severely elevated blood pressure (mean baseline blood pressure 199/132 mm Hg) without acute end-organ dysfunction were treated with either oral labetalol or oral clonidine in a randomized double-blind prospective study.

**Labetalol was administered as an initial dose of 200 mg, followed by hourly 200 mg doses up to 1,200 mg.**

**Clonidine was administered as an initial dose of 0.2 mg, followed by hourly 0.1 mg doses up to 0.7 mg.**

... The authors conclude that oral labetalol was comparable to clonidine in efficacy, had a similar incidence of side effects, and offered the clinician a useful alternative for the treatment of severe hypertension in an emergency department setting. Further studies are indicated to determine appropriate dosing regimens for oral labetalol in the acute treatment of severe hypertension.

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Table 1. Parenteral Antihypertensive Agents Used in Hypertensive Emergencies<sup>1,2,3,10</sup>

Agent	Mechanism of Action	Dose	Onset	Duration	Adverse Effects	Contraindications/Cautions
<b>Vasodilators</b>						
Sodium Nitroprusside (SNP)	Nitric oxide donor; vasodilates arteriolar and venous smooth muscle	0.3 ug/kg/min; increase by maximum of 0.5 to 1.0 ug/kg/min. For doses > 0.5 ug/kg/min, start three-fold reduction to decrease risk of toxicity	Immediate	1-2 min	Hypotension and cyanide toxicity. Headache, vomiting, tachycardia, muscle spasm	• Contraindicated in high-risk cardiac failure and peripheral vascular disease. • Caution use with renal failure, anemia, liver disease, myocardial ischemia and increased intracranial pressure
Nicardipine	2nd generation dihydropyridine calcium channel blocker; arterial vasodilator	5 mg/hr; increase at 5 mg/hr increments to maximum of 15 mg/hr	5-15 min	2-6 hours	Tachycardia, flushing, headache, dizziness, local phlebitis	• Contraindicated in aortic stenosis • Caution with cardiac ischemia and acute heart failure
Clevidipine	3rd generation dihydropyridine calcium channel blocker; arterial vasodilator	1-2 mg/hr, with rapid titration to maximum of 15 mg/hr	1-2 min	5-15 min	Nausea	• Contraindicated in patients with allergies to soy or egg products and extensive drug metabolism
Fenoldopam	Peripheral Dopamine-1 agonist	0.1 ug/kg/min; increase by 0.1 ug/kg/min increments to max of 1.0 ug/kg/min	< 5 min	30 min	Nausea, headache, flushing, tachycardia, decreased increase in intracranial pressure	• Contraindicated in patients with glaucoma and those with allergy to sulfites • Caution in patients with increased intracranial pressure
Nitroglycerin	Nitric oxide donor; venodilator	5 ug/min; increase by 5 ug/min every 5 min to maximum of 200 ug/min	2-5 min	5-10 min	Headache, vomiting, orthostatic hypotension, reflex tachycardia, prolonged use	• Contraindicated in single-dose glaucoma and increased intracranial pressure • Caution when central or renal perfusion compromised
<b>Adrenergic Inhibitors</b>						
Labetalol	Alpha-1 and nonselective beta-adrenergic antagonist; non-arterial beta blocking ratio is 1:7	20 mg initial bolus, with incremental doses of 20-40 mg every 10 min Q4 hr; infusion 0.2-2 mg/min; 600 ug/kg loading dose followed by 80 ug/kg/min infusion titrated to maximum of 300 ug/kg/min	5-10 min	2-6 hours	Bradycardia, hypotension, nausea/vomiting, heart block	• Avoid in patients with severe reactive airway disease or COPD, acute systemic heart failure, bradycardia, heart block or hepatic dysfunction
Esmolol	Cardioselective beta-1-adrenergic antagonist	500 ug/kg loading dose followed by 80 ug/kg/min infusion titrated to maximum of 300 ug/kg/min	1-2 min	10-30 min	Bradycardia, nausea, hypotension, heart block	• See labetalol; clearance not dependent on renal or hepatic function
Phentolamine	Peripheral A1 and A2 antagonist	5-10 mg IV boluses	1-2 min	10-30 min	Tachycardia, flushing, headache	• Caution in patients with coronary artery disease

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## Hypertensive Tincture and other

- If diastolic is <115
- Tincture: (Can try dosing 2 droppers full every 10 minutes for 60 minutes)
  - Viscum Album (3 parts), Rauwolfia (1 part), Veratrum Viride (3 parts), and Crataegus (1 part).
- Homeopathics:
  - Aconite 1M PRN
  - Belladonna 30 c PRN
    - Album Sativa
    - Amyl Nitrosum

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## Endotoxin Reactions

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## Endotoxin Reaction

- Endotoxin is a biological toxin that is part of the outer membrane of some types of gram negative bacteria.
- Endotoxin causes a powerful inflammatory reaction in humans, especially at high doses, when it causes fever, flu-like symptoms, cough, headache and respiratory distress.
- Endotoxin in the indoor air is suspected of playing a significant role in "sick building syndrome." They are increased in situations where there is significant water damage or dampness. Stagnant water and sewage can contain very high levels of endotoxin and can be a source of high exposure. Adapted from: <http://www.nrdc.org/health/effects/katrinadata/endotoxin.asp>

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Figure 1: A Model for Diseases Potentially Associated with Bacteria/Endotoxin



<http://www.biostrategies.com/kpmgendo.pdf>

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## Endotoxin Reaction

- Many Sn/Sx are possible (see above)
  - Onset can be rapid
- A classic case report [PMID: 6829590] listed the most common signs and symptoms in one group:
  - Chills (75 percent)
  - Nausea and/or vomiting (30 percent)
  - Fever (90 percent)
  - Mean times of onset after starting infusion of:
    - 1.1, 1.6, and 3.6 hours, respectively

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## Endotoxin Reaction: Therapy

- Watch and Wait
- If truly an endotoxin reaction will be self limited EXCEPT IN FRAIL AND DEPLETED PATIENTS.

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## Endotoxin Reaction: Therapy

### • Supportive therapy:

- Hydration
- Anti-nausea medications
  - Oral anti-nausea meds (Part-2)
  - IV anti-nausea meds (Part-2)
- Low dose steroids
  - Oral:
    - Prednisone 30 mg / 20 mg / 10 mg 3 day taper
  - IV:
    - (IV or IM) Dexamethasone @ 5 mg
    - (IV) Solu-Cortef (Hydrocortisone) @ 100 mg
    - (IV) Solu-Medrol (Prednisone) @ 20 mg

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## Lymphedema

- Common in lymphatic cancers and post node biopsy.
- Relative contraindication to peripheral IV on the same side as the node biopsy.
- Progression can indicate node or other metastasis.
- Otherwise not a contraindication to IV therapy.

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## Ascites

- Common, and not generally a contraindication to IV therapy.
- Electrolytes and proteins must be monitored closely.
- Standard treatment is diuretic therapy and paracentesis if required.  
\*[http://www.uptodate.com/contents/malignancy-related-ascites?source=see\\_link](http://www.uptodate.com/contents/malignancy-related-ascites?source=see_link)
- In patients **with CVAD access** higher osmolarity IV's can help osmotically diurese\* the patient.  
\* Preliminary data – BIORC 'IVC effects on blood chemistry' interventional study.

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## Cerebral Edema

- Standard treatment is extensive and step-wise, based on presentation. It may involve steroids, anticonvulsants and many other therapies.
  - Osmotherapy is accepted as one such therapy (1), and is incidentally employed with most higher osmolarity IV solutions commonly used in cancer therapy.
  - In patients **with CVAD access** higher osmolarity IV's can help osmotically decrease intracranial pressure. The electrolytes must be monitored in these patients.(2)
- (1) Raslan A, Bhardwaj A. Neurosurg Focus. 2007;22(5):E12; 07/24/2007 © 2007 American Association of Neurological Surgeons  
(2) Preliminary data – BIORC 'IVC effects on blood chemistry' interventional study.

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## Fluid overload:

- Infusing an ISOTONIC solution too quickly.
- Watch the elderly and those with compromised kidney function and COPD
- Edema, Hypertension, Pulmonary edema (SOB & Crackles)
- Tx:
  - Slow fluid infusion
  - Heat to dilate peripheral circulation
  - O2 administration

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## IV Fluid Dynamics

	Isotonic	Hypotonic	Hypertonic
Effect on intravascular compartment (blood)	<b>Increases volume</b>	<b>Dehydrates</b> – moves fluid to cells	<b>Greatly increases volume – dehydrates cells</b>
Fluid overload potential Incr. in Ki / Li patients, and the elderly	<b>Moderate potential</b>	<b>No</b>	<b>High potential</b>
	[ D5W ] – – – →		

D5W (without other additives) starts Isotonic but can act hypotonic if the patient metabolizes the sugar quickly.

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## Fluid Limits in CHF – Elderly

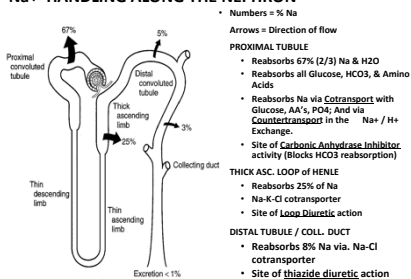
- Recall basis for fluid overload:
  - High volume / speed isotonic solution
  - Mid to high volume hypertonic solution
- Generally safe IV limits to start with:
  - Isotonic solutions 125 to 250 mL per hour
  - Hypertonic solutions (typically consider over 425-450 mOsm/L) 125 mL per hour
- If tolerated monitor closely and possibly expand volumes.
  - Clinically I have seen double the above limits tolerated.
  - All is based on patient response

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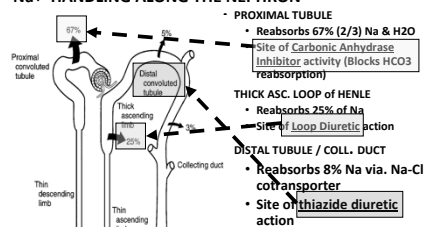
## Diuretics

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### Na<sup>+</sup> HANDLING ALONG THE NEPHRON



### Na<sup>+</sup> HANDLING ALONG THE NEPHRON

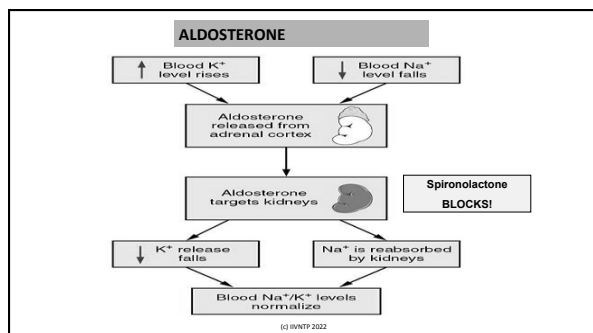


Antihypertensive/ Diuretics	MOA	Uses	Adverse Effects	Other
<b>Chlorothiazide</b> (Hydrochlorothiazide – HCTZ)	Inhibits sodium and chloride reabsorption in <b>distal tubule</b> resulting in a decrease in the glomerular filtration rate	HTN Edema	<b>Hypokalemia</b> , oliguria, anuria, GI disturbance, hypercalcemia, <b>hyperglycemia</b> , hyperuricemia, renal failure	C.I. in patients with hypersensitivity to thiazide or <b>sulfonamide drugs</b>
<b>Furosemide [Lasix]</b>	Loop diuretic, inhibits sodium and chloride reabsorption in the <b>Loop of Henle</b>	Edema, HTN	<b>Hypokalemia</b> , oliguria, anuria, GI disturbance, hypercalcemia, <b>hyperglycemia</b> , hyperuricemia, ototoxic, hypovolemia	

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Antihypertensive/ Diuretics	MOA	Uses	Adverse Effects	Other
<b>Triamterene</b>  (Often in combination with HCTZ as "Maxzide")	Potassium sparing diuretic acts on <b>distal tubules</b>	Edema, HTN	<b>Hyperkalemia</b> , nausea, vomiting, diarrhea	May turn urine blue Folic Acid Base
<b>Spironolactone</b>	<b>Aldosterone antagonist</b>	Edema HTN Some endocrine uses (PCOS...)	<b>Same</b> , plus breast deformity and tenderness	Multiple toxicities

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**Diuretics**

- **HCTZ**
  - 12.5mg capsules; 25, 50, and 100mg tablets
    - Edema: 50-100 mg qd until edema resolved
      - Short term only
      - Max Dose 200 mg acutely
    - HTN:
      - 12.5 – 50 mg qd
- **HCTZ / Triamterene**
  - 25mg / 37.5mg - Maxzide; 50mg / 75mg – Maxzide-25
- **Furosemide**
  - 20, 40, and 80mg Tablets
    - Edema: 80 mg qd (may increase as required up to 600 mg total daily)
    - HTN: 40 mg bid

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**Angina**

- Coronary spasms
- Hypoxia due to narrowing in coronary vessel
- Electrolyte imbalance

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Anti-anginal drugs	MOA	Uses	Adverse Effects	Other
Nitroglycerin	Increases blood supply to heart; decreases preload and afterload	Angina	Headache, dizziness, hypotension, tachycardia, bradycardia, rash	
Calcium Channel And Beta Blockers	See above	Angina HTN Arrhythmia		
Papaverine HCl	"Cardiac vessel dilation"	Angina	Similar to Nitro.	No longer used
Amyl Nitrate	Unknown, thought to be dilation of arterial and venous system	Angina	Throbbing headache, dizziness, hypotension, tachycardia, bradycardia,	Antidote for cyanide poisoning

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**Nitrate Rx:**

- **NTG**
  - SL-Tablets 0.3, 0.4 or 0.6mg
  - Acute angina:
    - Dose 1 SL tablet up to 1 tablet every 5 minutes for 3 doses
- Other dose forms available:
  - Spray, Cream, Long Acting Capsules

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**Angina Rx:**

- **L-Arginine PO dose**
  - 1000 – 2000 mg bid
- **Magnesium Glycinate PO dose**
  - 100-300 mg bid
- **Zinc PO dose**
  - 20-50 mg bid (taken in the middle of a meal to decrease nausea!)

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## Anaphylaxis

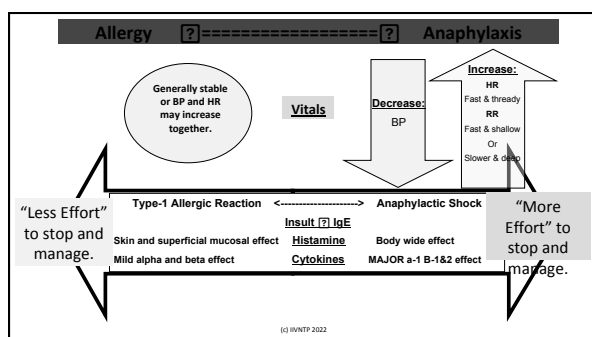
- Initial Sx / Sx:
  - Apprehension / urticaria / edema / throat sensation
- Severe cases:
  - Hypotension
  - LOC
  - Mydriasis
  - Incontinence
  - Convulsion
  - Sudden Death
- If you are giving an IV at the time
  - STOP the infusion but DO NOT D/C THE LINE!!!
  - Change Bag and Line to NS, LR or D5W infusion and run in

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## Anaphylaxis

- Lie them down and prop up feet.
- Decide** if it is an:
  - Allergic / type-1 OR Anaphylactic / shock presentation**
    - Assess ABC's
      - Airway must be patent – insert airway if needed
      - Is Stridor, Angioedema or other UR-LR Sx present?
        - Oral ('Berman') airways commonly used
        - If patient not breathing, administer 'Ambu' or Rescue breaths
      - Pulse and BP [WHAT are we looking for with Pulse and BP????]
        - If away from equipment: assess peripheral (emergency) blood pressure
          - Radial pulse = AT LEAST 80 Systolic
          - Femoral pulse = AT LEAST 70 Systolic
          - Carotid pulse = AT LEAST 60 Systolic

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## Anaphylaxis / Type-1 Reaction

- Treat:
  - BENADRYL: 50 mg (1ml) IV stat**
    - Note: this is not normally done before Epi.
  - Monitor and if needed:
    - Epinephrine: **KNOW THE CONCENTRATION!!!!!!**
    - 1:1000 is IM / SQ and Intratracheal ONLY!!**
      - Use 0.3 to 1 mL IM / SQ Immediately if this is the type you have
    - 1:10,000 is the IV form**
      - IV administer 1 - 3 mL and wait. May give all 10 cc.
  - Oxygen High Concentration (~15 L / min) by mask. (3 L / min in COPD)

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## Anaphylaxis / Shock

- Treat:
  - Epinephrine: **KNOW THE CONCENTRATION!!!!!!**
    - 1:1000 is IM / SQ and Intratracheal ONLY!!**
      - Use 0.3 to 1 mL IM / SQ Immediately if this is the type you have
    - 1:10,000 is the IV form**
      - IV administer 1 - 3 mL and wait. May give all 10 cc.
  - BENADRYL: 50 mg (1ml) IV stat**
    - Note: this is not normally done before Epi.
  - Oxygen High Concentration (~15 L / min) by mask. (3 L / min in COPD)

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## Epinephrine: IM or SQ?

Debra Hughes, Determining an effective route of administration for epinephrine: What is the evidence? April 30, 2011. <http://www.oncologynurseadvisor.com/determining-an-effective-route-of-administration-for-epinephrine-what-is-the-evidence/article/201867/>

- An evidence-based practice team initially identified 26 different hospital protocols and order-sets containing epinephrine with various routes of administration, including intravenous (39%), subcutaneous (SQ; 23%), intramuscular or intravenous (8%), or no route specified (30%), said Marie E. Swisher, MSN, RN, OCN®.
- The IM route cannot currently be considered superior to the SQ route, as there are no known studies focusing on IM versus SQ (auto-injector) injection in women, Swisher noted. A limited body of research evidence supports IM only as the most effective route to administer epinephrine. No known studies have demonstrated inferior results using SQ epinephrine. Finally, a large body of anecdotal evidence supports SQ or IM routes for epinephrine dose delivery.**

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## Anaphylaxis (either)

- **Steroids** – Stabilize cytokine storm:
  - (IV or IM) Dexamethasone @ 10-20 mg (2.5 to 5 mL)
  - (IV) Solu-Cortef (Hydrocortisone) @ 100 – 500 mg
  - (IV) Solu-Medrol (Prednisone) @ 30-60 mg
- Albuterol or short acting beta a respiratory administration:
  - Only beneficial for B-2 receptors and local respiratory effect

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## Oral / At Home Meds

- **Histamine Blockade:**
  - H-1 Blocker (i.e. Benadryl 25-50 mg PO q 4-6 hrs or Loratadine 10-20 mg QD-BID)
  - H-2 Blocker (i.e. Ranitidine 150 QD to BID) PMID: 18201437
- **Steroids:** Stabilize cytokine storm:
  - Medrol Dose-pack (Rx 1 pack which is an automatic taper over 6 days)
  - Prednisone 30 – 80 mg followed by a taper over 4-7 days
- **“SABA”:** Albuterol or short acting beta a respiratory administration:
  - For respiratory-asthmatic Sx (Rx as usual)

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## Airway Management Anaphylaxis

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## Assessment of Respiratory and Shock signs:

Assess ABC's: (Airway – Breathing – Circulation)

→ [\* Remember, only CPR-BLS uses “CAB”] ←

- Airway must be patent
- Breathing is then important
- Assess peripheral circulation (blood pressure)

**\*\*[If your office is in a war zone then it is Hemorrhage – ABC]**

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## ABC's

- Keep you on track with most important physical factors
- Keep your mind focused on the correct patient foci
- Keep your therapies appropriate
- Keep your transport and EMS calls to only those absolutely necessary

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## Response:

- **\* [PRIMARY GOAL: Stop death if possible.]**
- Response based on presence or absence of shock signs:
  - If NO Respiratory or Cardiac **shock** signs:
    - **Allergy** base treatment.
  - If Respiratory compromise and or CV **shock:**
    - **Anaphylaxis** treatment.

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## AED



## CPR RsQ



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## Emergency oxygen should be considered if:

- An adult is breathing fewer than 12 breaths per minute or more than 20 breaths per minute.
- A child is breathing fewer than 15 breaths per minute or more than 30 breaths per minute.
- An infant is breathing fewer than 25 breaths per minute or more than 50 breaths per minute.

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## O2 - Flow Rates for Devices:

- **Nasal cannula:**
  - flow rate 1-6 LPM, 24-44 percent oxygen concentration, breathing victims only
- **Resuscitation mask:**
  - flow rate 6 -15 LPM, 35-55 percent oxygen concentration, breathing and non-breathing victims
- **Non-rebreather mask:**
  - flow rate 10-15 LPM, 90+ percent oxygen concentration, breathing victims only
- **BVM:**
  - flow rate 15 LPM or more, 90+ percent oxygen concentration, breathing and non-breathing victims

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Definitions: [http://faculty.deanza.edu/donahuemary/stories/storyReader\\$2412](http://faculty.deanza.edu/donahuemary/stories/storyReader$2412)

- A **nasal cannula** is a plastic tube with two small prongs that are inserted into the victim's nose. This device is used to administer oxygen to a breathing victim with minor breathing problems.
  - Oxygen is normally delivered through a nasal cannula at a low flow rate of 1 to 6 LPM.
  - Nasal cannulas also can be used if the victim does not want a mask on his or her face.
- A **resuscitation mask** with an inlet valve may be used with emergency oxygen to give rescue breaths to breathing and nonbreathing victims.
  - The recommended flow rate when using a resuscitation mask is 6 to 15 LPM.

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Definitions: [http://faculty.deanza.edu/donahuemary/stories/storyReader\\$2412](http://faculty.deanza.edu/donahuemary/stories/storyReader$2412)

- A **non-rebreather mask** is an effective method for delivering high concentrations of oxygen to a breathing victim.
  - Non-rebreather masks consist of a face mask with an attached oxygen reservoir bag and a one-way valve, which prevents the victim's exhaled air from mixing with the oxygen in the reservoir bag. Flutter valves on the side of the mask allow exhaled air to escape freely. As the victim breathes, he or she inhales oxygen from the bag.
  - Because young children and infants may be frightened by a mask being placed on their faces, consider a blow-by technique. The rescuer, parent or guardian should hold a non-rebreather mask approximately 2 inches from the child's or infant's face. This will allow the oxygen to pass over the face and be inhaled.
  - The **reservoir bag** should be sufficiently inflated (about two-thirds full) by covering the one-way valve with your thumb before placing it on the victim's face. If it begins to deflate when the victim inhales, increase the flow rate of the oxygen to refill the reservoir bag.
  - The flow rate when using this device is 10 to 15 LPM.
  - A **non-rebreather mask** can deliver an oxygen concentration of 90 percent or more.
- A **BVM – Bag-Valve Mask** - can deliver up to 100 percent oxygen to a breathing or non-breathing victim when attached to emergency oxygen.
  - Squeezing the bag as the victim inhales helps deliver more oxygen. BVM flow rates should be set at 15 LPM or more.

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## Summary

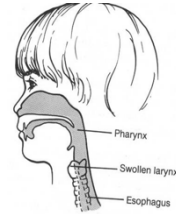
- Always assess quickly and fully
- Respond as quickly as reasonable
- Respond based on stage of emergency and expand from there
- Have your supplies on hand and practice
- Use EMS when required and not when not...

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## Airway Emergencies:

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### Croup – inflammation of the larynx, trachea, and bronchi



- Usually between 3 months and 3 years
- Usually while asleep
- Complication of viral infection
- Difficulty breathing
- Crowing sound on inspiration (inspiratory stridor)
- Seal-like barking cough
- Breath cool moist air for 5 minutes
  - If no improvement after 5 minutes continue to monitor
  - If condition worsens transport to hospital

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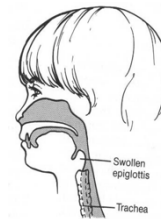


**Steeple sign in Croup (acute laryngotracheobronchitis) seen on AP radiographs of the neck or chest and neck demonstrates uniform narrowing of the subglottic airway.**

<http://onradiology.blogspot.com/2010/06/croup-acute-laryngotracheobronchitis-on.html>

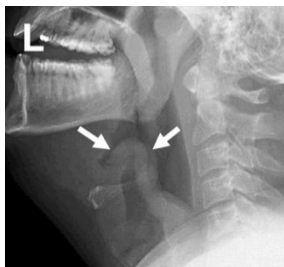
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### Epiglottitis



- Usually between 3 –10 years
- Caused by H. influenza (or occasionally a beta hemolytic Strep) infection
- High fever / Toxic Child
- Difficulty breathing
- Inspiratory stridor
- Drooling
- Try moist air breathing
- Will need antibiotics and Airway management!
- Do not move neck or open mouth
- EMS Transport to ER

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**Thumbprint Sign in Epiglottitis:**

[http://esocdn.bestpractice.bmj.com/best-practice/images/bp/en-gb/452-1-highlight\\_default.jpg](http://esocdn.bestpractice.bmj.com/best-practice/images/bp/en-gb/452-1-highlight_default.jpg)

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## Autonomic Agents

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## Physiologic Actions (Just a reminder)

- **Prefix recognition:**
  - **Cholinergic:** Acetylcholine receptor.  
Found at postsynaptic parasympathetic locations
  - **Muscarinic**
  - **Nicotinic**
  - **Adren... "Adrenal acting" (Epi. N.E.) acting receptor:**
  - **Beta 1&2** Cardio-pulmonary postsynaptic sympathetic
  - **Alpha 1&2** GI, Vascular, CNS presynaptic sympathetic
- **Suffix recognition:**
  - **\_mimetic:** Mimics / acts like the physiologic substance.
  - **\_lytic** Blocks the action of the physiologic substance.
  - **\_lytic** I.e. Parasympatholytic substances
- **Receptor activity:**
  - **Agonist:** Stimulates that receptor to action.
  - **Antagonist:** Blocks that receptor from action.

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## Autonomic Nervous System Activity:

- **Sympathetic N.S.**
  - Generally stimulating
  - GI & GU Tract Depressing
- **Sympathomimetic**
  - Drug (i.e. Epinephrine) that acts at one or more sympathetic receptor site.
  - Actions of the drug mimic sympathetic activity to the extent that receptors are activated
- **Sympatholytic**
  - Drug (i.e. Reserpine) that blocks or otherwise decreases catecholamines. Thus **increasing some parasympathetic tone.**
- **Parasympathetic N.S.**
  - Generally relaxing
  - GI & GU Tract Stimulating
- **Parasympathomimetic**
  - Drug (i.e. Pilocarpine) that acts at one or more parasympathetic receptor site.
  - Actions of the drug mimic parasympathetic activity to the extent that receptors are activated
- **Parasympatholytic**
  - Drug (i.e. Atropine) that blocks one or more parasympathetic receptor sites.
  - Actions of the drug effectively block parasympathetic activity. Thus **increasing some sympathetic tone.**

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## ADRENERGIC (Epi. / NE) RECEPTORS



alpha 1	<ul style="list-style-type: none"> <li>• postsynaptic sympathetic</li> <li>• generally excitatory (vasoconstriction)</li> <li>• in GI tract inhibitory</li> </ul>
alpha 2	<ul style="list-style-type: none"> <li>• presynaptic sympathetic (decrease catecholamine release)</li> <li>• central nervous system (decrease sympathetic tone)</li> </ul>
beta 1	<ul style="list-style-type: none"> <li>• postsynaptic sympathetic (cardiac) excitatory (chronotropic, dromotropic, inotropic)</li> </ul>
beta 2	<ul style="list-style-type: none"> <li>• postsynaptic sympathetic (all others) inhibitory (vasodilation, bronchodilation)</li> </ul>

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Direct Sympathomimetics	MOA	Uses	Adverse Effects	Other
Epinephrine	Vasoconstriction of $\alpha 1$ receptors Vasodilation of $\beta 2$ receptors	Anaphylactic shock Used with local anesthetics.	Cerebral hemorrhage, CVA, hypertension, tachycardia, V Fib, shock, N/V, headache, drowsiness	Routes of Administration: IV, IM, SQ and inhalation
Methylxanthines	MOA	Uses	Adverse Effects	Other
Theophylline	Inhibits phosphodiesterase which results in relaxation of smooth muscle of the bronchial airways	Acute bronchospasm	Seizures, restlessness, dizziness, insomnia, nausea, vomiting, respiratory arrest	Do not double dose, intoxication may cause seizures. Treat OD with specic, activated charcoal and a cathartic

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General Sympathomimetics	MOA	Uses	Adverse Effects	Other
Amphetamines	Release NE, DOPA	ADD, Parkinson's disease, narcolepsy	Hypertension, anxiety, fever, tremor, restlessness.	
Ephedrine	Stimulates $\alpha 1$ receptors causing vasoconstriction	Bronchodilation: for asthma and nasal congestion, and narcolepsy	Similar to amphetamines but less toxic	
Oxymetazoline (Used as an OTC Nasal spray or Rx eye gtt).	Stimulates $\alpha 1$ receptors causing vasoconstriction	Congestion	Arrhythmia, anaphylaxis, asthmatic episodes, headache. <b>Do not use with MAO inhibitors!</b>	Do not use with severe hypertension

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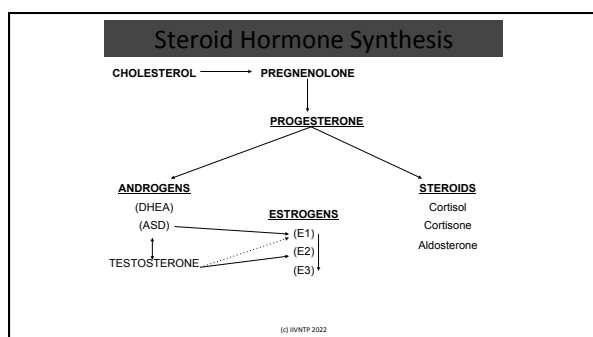
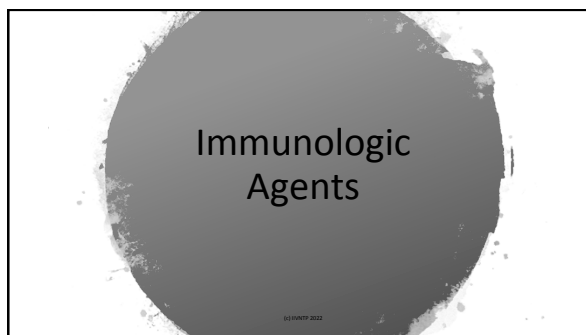
Phenylephrine hydrochloride	Stimulates $\alpha 1$ receptors causing vasoconstriction	Decongestant Hypotension	Arrhythmia, anaphylaxis, asthmatic episodes, headache. <b>Do not use with MAO inhibitors!</b>	Do not use with severe hypertension
Pseudoephedrine hydrochloride	Stimulates $\alpha 1$ receptors in respiratory tract causing vasoconstriction	Decongestant	Anxiety, nervousness, palpitations, headache and insomnia. <b>Do not use with MAO inhibitors!</b>	
Phenylpropanolamine	$\alpha 1$ Vasoconstriction	Decongestant	Anxiety, agitation, hallucinations and hypertension	<b>Off the US market now</b>

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Bronchodilators	MOA	Uses	Adverse Effects	Other
Metoprolerol [Alupent]	B2 adrenergic agonist that causes bronchodilation.	Acute Asthma Inhalation onset of action <5 min, duration 3-4 hours	Nervousness, tremor, tachycardia, cardiac arrest, vomiting, nausea,	May cause paradoxical bronchoconstriction with excessive use
Albuterol [Proventil, Ventolin]	B2 adrenergic agonist that causes bronchodilation.	Acute Asthma Inhalation onset of action <15 min, duration 3-4 hours	Nervousness, tremor, tachycardia, headache, palpitations, vomiting, nausea, bronchospasm	Avoid concomitant use with CNS stimulants
Epinephrine	Adrenergic agonist (causes bronchodilation, vasoconstriction, decrease secretions)	Severe bronchoconstriction and anaphylaxis	Cerebral hemorrhage, CVA, hypertension, tachycardia, ventricular fibrillation, shock, nausea, vomiting, nervousness, tremor, headache, and drowsiness	Contraindicated in patients with angle-closure glaucoma
Atropine	Muscarinic antagonist	Emergency bronchodilation	Dry mouth, tachycardia some CNS effects	

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**ADRENAL GLAND : MINERALCORTICOID**  
**ALDOSTERONE**

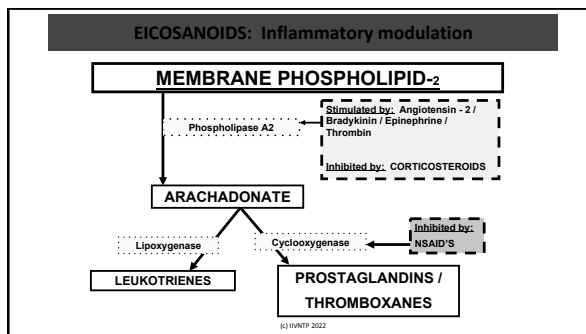
- SYNTHESIZED IN THE ZONA GLOMERULOSA
- SYNTHESIZED IN THE CORTICOSTERONE PATHWAY
- ACTS IN THE DISTAL TUBULE TO REABSORB Na+
- PUMPS K+ AND H+ OUT (into urine)
- STIMULATED BY:
  - ACTH
  - HYPERKALEMIA
  - ANGIOTENSIN - 2

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**ADRENAL GLAND : Glucocorticoids**  
**Cortisol - Cortisone**

- The principal glucocorticoid hormone in humans is cortisol.
- Glucocorticoids promote gluconeogenesis in the liver, which leads to increased blood glucose levels.
  - By raising plasma glucose levels, glucocorticoids provide the body with the energy required to respond to stressors, such as trauma, infection, and disease.
- The anti-inflammatory effects of glucocorticoids are related to decreased production of prostaglandins and leukotrienes.
- At the molecular level, glucocorticoids form complexes with specific receptors that migrate to the nucleus where they interact with selective regulatory sites within DNA.
  - This results in positive and negative modulation of several genes involved in inflammatory and immune responses, RBC and WBC production and cytokine production.

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## Relative Strength of Corticoid Agents

- **Hydrocortisone** – if considered a “1” then:
- Cortisone – 0.8
- **Prednisone** - 4
- Prednisolone - 5
- Methylprednisolone - 5
- **Triamcinolone** - 5
- Paramethasone - 10
- **Dexamethasone** - 30
- Betamethasone - 35

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Steroids	MOA	Uses	Adverse Effects Long term:	Notes:
<b>Hydrocortisone</b> (Physiologic oral dose (35mg) Range = 25-80 mg.)	Act by binding to cortisol receptor sites	Inflammation	<ul style="list-style-type: none"> <li>• Adrenal suppression</li> <li>• Osteoporosis</li> <li>• Glucose intolerance,</li> <li>• Osteopenia</li> </ul>	Prednisone longer acting and less mineralocorticoid effect than hydrocortisone
<b>Prednisone</b> (Physiologic oral dose (7.5mg) Range = 5-20 mg.)		Adrenal insufficiency (replacement) Immunosuppression		

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## Histamine

- Release:
  - The most important mechanism for histamine release is in response to an immunological stimulus.
- Mast cells sensitized by surface IgE antibodies, degranulate when exposed specific antigen. Degranulation means liberation of the contents of the mast cell granules, including histamine. Degranulation is involved in the immediate (type I) allergic reaction.
  - Release regulation is present in most mast cells.
- Histamine Modulation is associated with the inflammatory responses.
  - Following local injury, histamine first produces a local vasodilation followed by an the release of acute inflammation mediators.
  - Inflammatory cells are involved in this process and include neutrophils, eosinophils, basophils, monocytes & lymphocytes.

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H1 Antihistamines Non-sedating	MOA	Uses	Adverse Effects	Other
Fexofenadine [Allegra]	H1 Receptor Antagonist	Seasonal allergic rhinitis	Non-sedating	Contraindicated with use of erythromycin, ketoconazole or itraconazole due to Fatal arrhythmias.
Desloratadine [Clarinetx] Loratadine [Claritin]	H1 Receptor Antagonist	Seasonal allergic rhinitis	Non-sedating	
Sedating	MOA	Uses	Adverse Effects	Other
Diphenhydramine [Benadryl] Chlorpheniramine [Chlortrimeton] Etc...	H1 Receptor Antagonist	Allergic reactions due to type I allergies or for insomnia.	Seizures, sedation, nausea, vomiting, dry mouth, epigastric distress, thrombocytopenia, agranulocytosis	Contraindicated with CNS depressants and MAO inhibitors.

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## H1 Blockers

- |  |   |
|--|---|
| <b>Non-Sedating</b> <ul style="list-style-type: none"> <li>• Loratadine (Claritin)               <ul style="list-style-type: none"> <li>• 5 and 10 mg</li> </ul> </li> <li>• Desloratadine (Clarinetx)               <ul style="list-style-type: none"> <li>• 2.5 and 5 mg</li> </ul> </li> <li>• Cetirizine (Zyrtec)               <ul style="list-style-type: none"> <li>• 5 and 10 mg</li> </ul> </li> <li>• Fexofenadine (Allegra)               <ul style="list-style-type: none"> <li>• 30, 60 and 180 mg</li> </ul> </li> </ul> | <b>Sedating</b> <ul style="list-style-type: none"> <li>• Diphenhydramine (Benadryl)               <ul style="list-style-type: none"> <li>• 12.5, 25 and 50 mg</li> </ul> </li> <li>• Levocetirizine (Xyzal)               <ul style="list-style-type: none"> <li>• 5 mg</li> </ul> </li> <li>• Promethazine (Phenergan)               <ul style="list-style-type: none"> <li>• 12.5, 25 and 50 mg</li> </ul> </li> <li>• Cyproheptadine               <ul style="list-style-type: none"> <li>• 4 to 32 mg total daily dose divided Q:8 hrs</li> <li>• Also blocks some Serotonin receptors</li> </ul> </li> </ul> |
|--|---|

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## Histamine in the Brain (Why do H1 blockers potentially cause sedation?)

- H-1 (Stimulating)
  - Causes increased depolarization in hypothalamic and limbic areas
- H-2 (Stimulating)
  - Slows potassium conductance, increasing excitation in the hippocampus, amygdala and basal nuclei
- H-3 (Inhibiting)
  - Blocks calcium channels in the basal nuclei decreasing histamine release
- “H-4” (Inhibiting)
  - Slows / modulates NMDA receptor complex

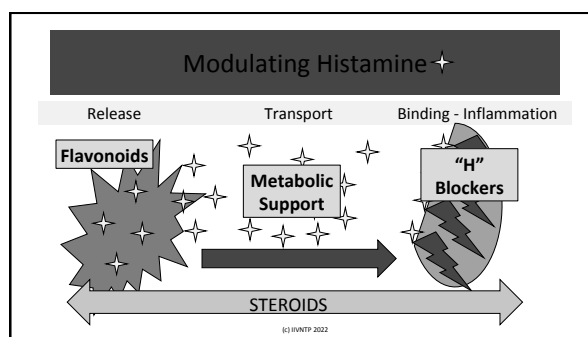
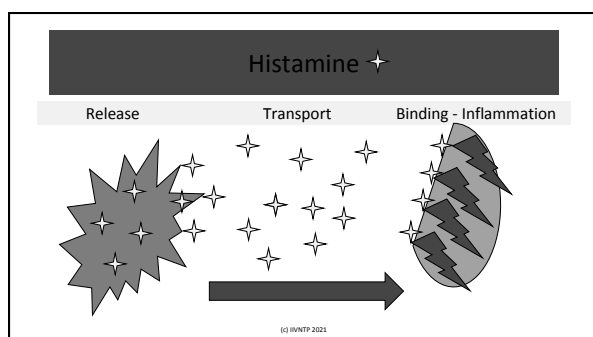
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H2 Blockers	MOA	Uses	Adverse Effects	Other
Cimetidine [Tagamet]	H-2 Blockade: Blocks histamine from activating cAMP pathway IN Parietal Cells (and elsewhere).	PUD, GERD Allergy	Small chemical so can cross the BBB, think of antihistamine side effects Also decreased libido, impotence and gynecomastia	Causes P450 system to accelerate THEN decelerate; Contraindicated with kidney or liver failure
Ranitidine [Zantac] The "idine"s Etc....	H-2 Blockade:		Less CNS and sexual effects than Cimetidine	Less inhibition of P450 system

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### Why are H-1 & 2 Agents Used Together?

- "Antihistamines" people usually think of are of the 'H1' type and only block that receptor.
  - Many reactions to histamine are mediated by the other known H receptors (H2,3,4) [PMID: 18172439, PMID: 20085595]. Especially skin which is more reactive to H2&4. [PMID: 15191551]
  - Problem with sensitive folks who react to H1 blockers is now you have **MORE histamine** to go to the H2,3,4 receptors and make more inflammatory trouble (such as skin and respiratory reactivity.)
  - This is why in "bad" allergic reactions the common practice is to mix H1 & H2 blockers as well as using steroids.
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### Emergency oxygen should be considered if:

- An adult is breathing fewer than 12 breaths per minute or more than 20 breaths per minute.
  - A child is breathing fewer than 15 breaths per minute or more than 30 breaths per minute.
  - An infant is breathing fewer than 25 breaths per minute or more than 50 breaths per minute.
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### Pulmonary embolism

sudden blockage of pulmonary artery or one of its branches

- Cause:
    - Blood clot or fatty clot
  - Symptoms:
    - Sudden onset of severe unexplained dyspnea
    - Chest pain
    - Tachycardia
    - Hypotension
  - Treatment:
    - Call 911
    - Keep patient sitting up right
    - Give oxygen by mask
    - Maintain IV access
    - Transport to hospital.
  - Check all tubing connections and tape if needed
  - Use of Luer lock connections
  - Use of 22 micron air eliminating filter
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### Air Embolism:

#### Cause:

- Allowing IV bag to run dry with a pump continuing to infuse
- Infusing air from tubing into patient usually requires some mechanism greater than gravity to push it in
- Loose tubing connection to catheter into patient, allowing air to enter
- **Symptoms/Signs:**
- Palpitations, lightheadedness, weakness
- Dyspnea, cyanosis, expiratory wheeze, tachypnea, pulmonary edema
- Weak thready pulse, tachycardia, hypotension, substernal chest pain, jugular vein distention
- Confusion, anxiety, seizure, coma

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#### Treatment:

- Place patient in left lateral decubitus position (Trendelenburg position) with head down
- Oxygen
- Vital signs
- Transfer to hospital contact ER doc (doc to doc)
- Prevention:
- Clear air from tubing, avoid letting the tubing run dry

### Catheter Embolus

#### Cause:

- In an over the needle system that has a part of the cannula nicked and sheared off

#### Symptoms:

- Sudden sharp pain at IV site
- Cyanosis
- Hypotension
- Weak rapid pulse

#### Treatment:

- Stop infusion
- Apply tourniquet above IV site
- Start a new IV in other arm
- Arrange for an x-ray
- **Prevention:**
- **Never** re-insert a stylet (needle) in a catheter after it has been removed
- Always use radiopaque catheter so that the catheter can be detected by x-ray
- Withdraw needle and catheter together if unsuccessful venipuncture

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### Cardiac Arrest

Know signs and symptoms

CALL EMS!

- Chew 325 mg Aspirin
- AED/Defibrillator
- Check pulse
- No Pulse
- CPR
- AED

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### Stroke

- Call EMS!
- Monitor vitals and ABC's
- Check and maintain airway
- May give 5L/min oxygen
- Check Blood sugar
- Check for Hypertensive crisis

Consider: Aconite 1M or Belladonna 30c  
Glutathione

\*\*\*\*Remember this can be ischemic or hemorrhagic DON'T give aspirin until patient has had CT\*\*\*\*

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### Seizure

- Do NOT restrain patient
- Has the patient had a seizure before?
- If ANY of the following is YES then need to be transported with EMS.**
- Difficult breathing or waking after seizure?
- Seizure last longer than 5 minutes?
- Repeated seizures?
- Person has health condition like diabetes, CVD or pregnant?

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### Seizure Continued

- Monitor vitals when safe
- Check blood sugar
- Maintain airway
- Know medications patient has taken
- Give Oxygen

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## Poisoning

- Medical history
- What substance was taken?
- Contact poison control center 1-800-222-1222 and/or 911(EMS)

Mainstay treatment for most oral poisonings is charcoal alone or following gastric emptying. 1-2 g/kg for children and adults as single dose with a cathartic like ipecac 10 ml children, 15 ml adolescents and 30 ml adults. **NOT to be given for alcohol, caustics and petroleum distillates**

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## Head Trauma

### Concern: Hemorrhage and edema

#### Concussion:

- Loss of consciousness
- Pupillary reflexes intact
- No hemiplegia, decorticate, or decerebrate
- rigidity
- No signs of increased intracranial pressure

Tx: Full Neurologic exam and vitals, watch for signs of disorientation, drowsiness, fatigue or stupor for 24-48 hours.  
Arnica 30c

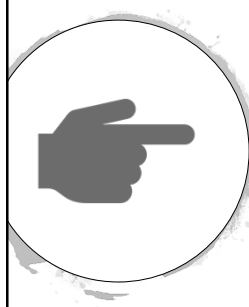
#### Cerebral Edema:

- Call 911
- Elevate the head to 30 degrees and assure open airway
- Oxygen if necessary
- Neuro Exam
- Start IV D5W
- Arnica 30c

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## Interventions

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- 1) All personnel will become familiar with the location of the emergency equipment within the clinic.
- 2) Know what each personnel's role is during an emergency.

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## Inspection of Emergency Kit:

- The emergency kit will be inspected once a month. Each staff doctor will be assigned to inspect the kit on a rotating basis. This will ensure that all staff doctors are familiar with the kit contents.
- A label will be placed on the outside of the gray tackle box. The label will contain the inspection date, expiration dates of supplies and the inspector's initials.
- The O2 tank will be checked every month and refilled as needed.

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## Procedure for use of oxygen:

### Procedure for turning on tank:

- a. Turn valve on top of tank counter-clockwise to open tank.
- b. Turn green knob on side of tank to "on" position (indicated by arrows) to regulate.
- c. Flow should be greater than or equal to 5 liters/min. Caution with emphysema
- d. Face mask or nasal cannula hose is attached to tank

### To turn tank off:

- a. Turn valve on top of tank clockwise until it stops.
- b. Turn green knob off.

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### Management of oxygen in your clinic:

- Monthly inspection of oxygen equipment should take place.
  - a. Volume of O<sub>2</sub> in tank
  - b. Clean unused mask and nasal cannula are available
  - c. Documentation of assessment
  - d. Assign a staff person to this duty

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### INCIDENT/ ACCIDENT REPORT

1. Check all that apply: incident \_\_\_ accident \_\_\_ injury \_\_\_ illness \_\_\_ theft \_\_\_  
Property destruction \_\_\_ death \_\_\_ other \_\_\_
2. Date of occurrence: \_\_\_\_\_ time of occurrence: \_\_\_\_\_
3. Events/ Activities prior to incident: \_\_\_\_\_  
\_\_\_\_\_
4. What happened during the incident? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. List any staff, faculty, patients, or others involved in or witnessing the incident: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. What response was made to the incident? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
7. Additional comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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### One set of recommendations – So: What should you have?

**Table 2. Suggested Emergency Supplies for Family Practice Offices**

#### Equipment

Bag mask ventilator (two sizes, three mask sizes)  
Blood pressure cuff (all sizes)  
Glucose meter  
Intravenous needle (18 and 16 gauge)  
Intravenous catheter/butterfly needles (24 to 18 gauge)  
Intravenous extension tubing and T-connectors  
Nasal airways (one set)  
Nasogastric tubes  
Nebulizer or metered dose inhaler spacer and face mask  
Non-rebreather (three sizes)  
Oxygen mask (three sizes)  
Oxygen tank and flow meter  
Portable suction device and catheters, or bulb syringe  
Pulse oximeter for child and adult usage  
Resuscitation tape (tooth-coded)  
Universal precautions (latex-free gloves, mask, eye protection)

#### Medications

Acetaminophen (rectal suppositories)  
Albuterol (Proventil)  
Aspirin  
Carfloxacin (Rocephin)  
Corticosteroids, parenteral  
Dextrose 25%  
Diazepam, parenteral (Valium)  
Diphenhydramine, oral and parenteral (Benadryl)  
Epinephrine (1:1,000, 1:10,000)  
Flumazenil (Romazicon)  
Lorazepam, sublingual (Ativan)  
Morphine (MS Contin)  
Naloxone (Narcan)  
Nitroglycerine spray  
Saline, normal

Adapted with permission from Toback S. Prepare your office for a medical emergency. Contemp Pediatr 2002;19:107.

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### Our Clinic Emergency Supplies

- Benadryl (IV/IM form and PO)
- Epinephrine 1:10,000 PFS
- Epinephrine 1:1,000 AMP's
- SoluMedrol SDV
- D-50 PFS and SDV
- Oral Glucose
- Phenergan IV
- Zofran IV
- PO Tylenol
- Calcium Chloride 1 gram PFS
- O<sub>2</sub> tanks / Regulators and Masks
- O<sub>2</sub> concentrator
- AED
- Ambu Bag and BVM
- Berman oral airway set
- Vitals equipment
- IV Sets and equipment
- Syringes and butterfly sets/ catheters
- O<sub>2</sub> & Glucose meters
- And more...

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**Table 6. Sample Physician Office Emergency Protocol**

Staff	Role
Front desk	Identify patient in distress at check-in Periodically assess waiting room for patients in distress Alert waiting patients about potential delay
Medical assistants (runners)	Situate ill patient in designated resuscitation room Alert physicians and nurses of the emergency and the patient's location Bring all emergency equipment to the site of the emergency (if not already in the treatment room) Obtain initial set of vital signs If oxygen saturation is less than 93 percent, start oxygen by face mask
Staff nurses	Assist in code Act as medication nurse or code nurse in resuscitation
Physicians	Respond to call for assistance One physician to act as code team leader One physician to control airway One physician to assist in resuscitation and/or act as float physician
Checkout desk	When necessary, dial 9-1-1, give location and description of the emergency
Additional office staff	Keep flow of patients moving out of office

Adapted with permission from Toback S. Prepare your office for a medical emergency. Contemp Pediatr 2002;19:112.

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### If you call EMS:

- Be brief
- Be exact
- Have staff notify the REST of your clinic 'all is well' and EMS is coming
- Have list of interventions and doses given to send to ER
- Expect a WIDE variety of responses from the EMS personnel
- Call the ER later for collaboration and status
- Follow up with patient and family

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Table 5. Resources for Life Support Training

**American College of Emergency Physicians**Pediatric Emergency Medicine Resource: <http://www.apsonline.com>**American Heart Association**ACLS course: <http://www.heart.org/presenter.jshtml?identifier=3011972>Algorithms: <http://www.aha-channing-bete.com>

ACLS algorithm emergency cart card set (Item 80-1083)

PALS algorithm and flow chart posters (Item 80-1413)

Cardiopulmonary resuscitation guidelines: <http://www.americanheart.org/presenter.jshtml?identifier=3035517>CPR class: <http://www.americanheart.org/presenter.jshtml?identifier=3011764>PALS online course: <http://www.americanheart.org/presenter.jshtml?identifier=3031539>

ACLS = advanced cardiovascular life support; PALS = pediatric advanced life support;

CPR = cardiopulmonary resuscitation

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## More On EMERGENCY DRUGS

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### Epinephrine

**1:1000**

- For anaphylaxis
- Safe for **IM ONLY** unless you dilute.
- Give 0.3 ml at a time

**1:10000**

- For anaphylaxis
- Safe for **IV infusion**
- Give 3 ml at a time

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### EPI PEN



IM only have 1 use, some 2.

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**WARNING/ CAUTIONS:**

- Use with caution in the elderly, patients with diabetes mellitus, cardiovascular disease, thyroid disease, or cerebral arteriosclerosis.

**CONTRAINDICATIONS:** glaucoma, cardiac arrhythmia**ADVERSE REACTIONS:**

- Tachycardia, nervousness, restlessness, dizziness, chest pain, arrhythmia HA, hypertension, sweating, nausea, insomnia, increased O<sub>2</sub> demand of myocardium, urinary retention.

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### DIPHENHYDRAMINE CHLORIDE (BENADRYL)

- 50 mg/ml 25-50 MG CAPSULES
- **DOSAGE:**
- **ADULT-** oral/PO 25-50 mg every 4-6 hours  
IM-IV 10-50 mg in a single dose every 2-4 hours

Not to exceed 400 mg /day

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### Diphenhydramine

- For anaphylaxis (25-50 mg q4-8 hours,
  - Don't exceed 400 mg/24 hours
  - Children: 5 mg/kg q6-8 hrs in 24 hours
- Works well for nausea. Start with 25 mg.

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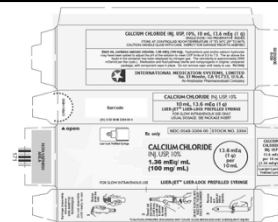
- |   |  |
|---|--|
| <p><b>• USE:</b></p> <ul style="list-style-type: none"> <li>• Symptom relief of allergies caused by histamine release.</li> </ul> <p><b>• CONTRAINDICATIONS:</b></p> <ul style="list-style-type: none"> <li>• Hypersensitivities to benadryl. Acute asthma attack</li> </ul> <p><b>• CAUTIONS:</b></p> <ul style="list-style-type: none"> <li>• Glaucoma, peptic ulcer, hyperthyroid, urinary obstruction. Some preparations</li> <li>• contains sodium bisulfate.</li> </ul> | <p><b>• ADVERSE REACTION:</b></p> <ul style="list-style-type: none"> <li>• Drowsiness, thickening of bronchial secretions, HA, fatigue, dry mouth, angio</li> <li>• edema, bronchospasm, urinary retention.</li> </ul> <p><b>• DRUG INTERACTIONS:</b></p> <ul style="list-style-type: none"> <li>• CNS depressants, anticholinergics, metronidazole &amp; chlorpropamide due to</li> <li>• disulfiram reaction secondary to alcohol content of some preparations.</li> </ul> |
|---|--|

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### CALCIUM GLUCONATE

- |  |  |
|--|--|
| <p><b>• USES:</b></p> <ul style="list-style-type: none"> <li>• Antidote to magnesium overdose</li> <li>• To reverse hypocalcemia</li> </ul> <p><b>• DOSE:</b></p> <ul style="list-style-type: none"> <li>• IV injection 10- 20 ml of a 10 % solution = 1-2 grams or 5-10 mEq</li> <li>• 2 min X3 then 1G in 500 ml NS</li> </ul> | <p><b>• STORAGE:</b></p> <ul style="list-style-type: none"> <li>• Calcium products are at risk for crystallization at lower temperatures. All calcium products should be stored at temperature ranges of 15-30 Celsius or 59-86 Fahrenheit.</li> </ul> |
|--|--|

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Calcium Chloride 10%

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### Rescue Remedy



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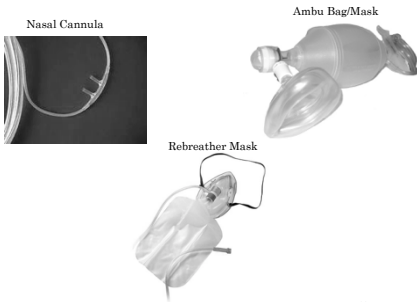


For anaphylaxis.  
For longer term allergy stabilization.  
Can get away without this if close to emergency room.

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## Oxygen Delivery Systems

### Nasal Cannula

- Easiest to wear, on demand or continuous
- Lowest flow rates-up to 6 lpm=20-40% O<sub>2</sub>

### Simple Mask

- 6-10 lpm gives approximately 40-60% O<sub>2</sub>

### Partial/Non Rebreather Mask

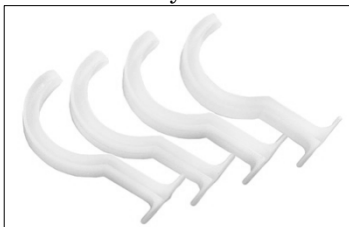
- Partial has air release valves, NRB-one way valve only
- For liter flows 60-100% O<sub>2</sub>
- Usually used in Acute Emergency situations

### Ambu Bag/Mask

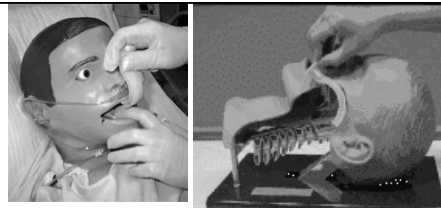
- For Emergency situations requiring manual ventilation of pt

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## Air Way



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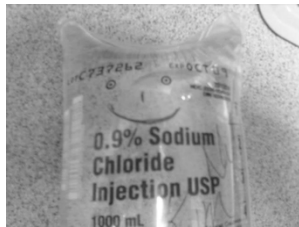
NEED EXTRA TRAINING Laryngoscope



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