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## The Art of Dental Therapeutics

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### What's in Your Medical Emergency Kit and Why?

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**Our Clinician:**



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Dr. Donaldson has published numerous peer-reviewed works and textbook chapters. He currently serves on the Editorial Board for the Journal of the American Dental Association, is board certified in healthcare management and is the Past-President and current Regent of the American College of Healthcare Executives' Montana Chapter. Dr. Donaldson was named as the 2014 recipient of the Bowl of Hygeia for the state of Montana and is the 2016 recipient of the Dr. Thaddeus V. Weclaw Award. This award is conferred upon an individual who has made outstanding contributions to the art and science of dentistry and/or enhanced the principles and ideals of the Academy of General Dentistry.

## What's in Your Emergency Kit and Why

What is an Emergency? Any condition which if left untreated may lead to patient morbidity or mortality.

### **Why Should You Care About Emergencies?**

- In a survey of 2,704 dentists throughout North America, a total of 13,836 emergencies occurring within a 10-year period was reported.
- None of these emergencies were truly dental emergencies. They were potentially life-threatening medical problems that patients developed while they were in a dental office.
- Almost all medical emergencies that occur in a dental office are fear-related.
- If fear and apprehension are reduced, the chances of having a medical emergency are also reduced.
- Three-quarters of all of these medical emergencies developed as sequelae of pain (i.e., inadequate local anesthesia), the dentist's failure to recognize and treat a patient's fear of dental care, or both.

*Malamed SF. Managing medical emergencies. JADA 1993;124(8):40-53.*

<b>Medical emergencies reported by 2,704 dentists.*</b>	
<b>EMERGENCY SITUATION</b>	<b>NO. (%) OF EMERGENCIES REPORTED†</b>
<b>Syncope‡</b>	4,161 (30.1)
<b>Mild Allergic Reaction</b>	2,583 (18.7)
<b>Postural Hypotension</b>	2,475 (17.9)
<b>Hyperventilation‡</b>	1,326 (9.6)
<b>Insulin Shock (Hypoglycemia)</b>	709 (5.1)
<b>Angina Pectoris‡</b>	644 (4.6)
<b>Seizures‡</b>	644 (4.6)
<b>Asthmatic Attack (Bronchospasm)‡</b>	385 (2.8)
<b>Local Anesthetic Overdose</b>	204 (1.5)
<b>Myocardial Infarction</b>	187 (1.4)
<b>Anaphylactic Reaction</b>	169 (1.2)
<b>Cardiac Arrest</b>	148 (1.1)

\* Source: Malamed.<sup>1</sup>  
† A few emergencies with low numbers were omitted from the table.  
‡ Emergencies that potentially are stress related.

### **How Do You Manage Emergencies?**

The Best Preparation is Prevention:

- Know your patient: get a complete medical and pharmacological history.
- Review any problem areas.
- Take training.
  - Practice
  - Practice
  - Practice
- Manual - Simple with flow charts.
- Emergency Kit.
- Equipment - Less is better.
- Phone – Cell.
- Medication - Only what you will use and are comfortable using . . .

## Stress-Reduction Protocol

- ✓ Recognize medical risk.
- ✓ Consult patient's physician(s).
- ✓ Pharmacosedation, as indicated.
- ✓ Short appointments.
- ✓ Morning appointments.
- ✓ Excellent intraoperative pain control.
- ✓ Minimize waiting room time.
- ✓ Excellent post-operative pain control.

Rosenberg, M. *Preparing for Medical Emergencies: Essential Drugs and Equipment for the Dental Office.* J Am Dent Assoc 2010; 141;14S-19S.

Suggested basic emergency drugs for the general dental office.			
INDICATION	DRUG	ACTION	ADMINISTRATION
<b>Bronchospasm (Severe Allergic Reaction)</b>	Epinephrine	$\alpha$ - and $\beta$ -adrenergic receptor agonist	Autoinjectors or preloaded syringes, ampules; 1:1,000 solution subcutaneously, intramuscularly or sublingually; adults, 0.3 milligram; children, 0.15 mg
<b>Mild Allergic Reaction</b>	Diphenhydramine	Histamine blocker	50 mg intramuscularly; 25 to 50 mg orally every three to four hours
<b>Angina</b>	Nitroglycerin	Vasodilator	Sublingual tablet: one every five minutes up to three doses; translingual spray: one spray every five minutes up to three times
<b>Bronchospasm (Mild Asthma)</b>	Bronchodilator such as albuterol	Selective $\beta_2$ - adrenergic receptor agonist	Two or three inhalations every one to two minutes, up to three times if needed
<b>Bronchospasm (Severe Asthma)</b>	Epinephrine	$\alpha$ - and $\beta$ -adrenergic receptor agonist (bronchodilator)	Autoinjectors or preloaded syringes, ampules; 1:1,000 solution subcutaneously, intramuscularly or sublingually; adults, 0.3 mg; children, 0.15 mg
<b>Hypoglycemia</b>	Glucose, as in orange juice	Antihypoglycemic	If the patient is conscious, ingest
<b>Myocardial Infarction</b>	Aspirin	Antiplatelet	One full-strength tablet (165-325 mg) chewed and swallowed
<b>Almost Anything</b>	<b>Oxygen</b>	<b>Respiratory Support</b>	<b>Ad Lib</b>

### **#1: Epinephrine 1:1,000 Injection**

- ✓ **Uses:** to reverse hypotension, bronchospasm, and laryngeal edema that result from an acute anaphylactoid type reaction. Also used to reduce bronchospasm resulting from an acute asthmatic episode that is refractory to inhaler therapy.
- ✓ **Pharmacology:** Causes vasoconstriction that in turn increases blood pressure, heart rate, and force of contraction. Also causes bronchial dilatation. Reduces the release of histamine. Can be ineffective if the patient is taking beta-blocker.
- ✓ **Adverse Effects:**
  - a) Cardiovascular: Tachycardia, Tachyarrhythmia's, and hypertension.
  - b) Central Nervous System: Agitation, headache, and tremors.
  - c) Endocrine System: Increased blood glucose.
  - d) Pregnant Female: Can decrease placental blood flow.
- ✓ **Dose:** Supplied in vials, ampules, or pre-loaded syringes in concentration of 1:1000 (1mg/mL). IV give 0.5-2.0mg (0.5ml-2.0ml) depending on severity of hypotension, titrate to effect repeat in 2 minutes if needed. IM give 0.3mg (0.3ml) repeat in 10-20 minutes as needed.

### #1: EpiPen Instead??

Stecher D, Bulloch B, Sales J, et al. Epinephrine Auto-injectors: Is Needle Length Adequate for Delivery of Epinephrine Intramuscularly? *Pediatrics* 2009;124:65-70

**CONCLUSION:** The needle on epinephrine auto-injectors is not long enough to reach the muscle in a significant number of children. Increasing the needle length on the auto-injectors would increase the likelihood that more children receive epinephrine by the recommended intramuscular route.



### #2: Diphenhydramine (Benadryl) 50mg Injection



- ✓ **Uses:** To reduce the affects of histamine release that is associated with allergic reactions, anaphylaxis, and acute asthma attack precipitated by exogenous causes.
- ✓ **Pharmacology:** An antihistamine that blocks the release of histamine in the body. It does not prevent the action of the histamine once released and thus must be given quickly. Prevents histamine responses such as bronchospasm, hypotension, rash, and edema.
- ✓ **Adverse Effects:**
  1. Cardiovascular: Tachycardia.
  2. Central Nervous System: CNS depression (sedative effects including drowsiness, lethargy, and mental confusion).
  3. Gastrointestinal: Xerostomia.
- ✓ **Dose:** 50-100mg IM or IV. For mild cases of pruritis, urticaria, or erythema an oral dose of 50mg every 6 hours can be used.

### #3: Nitroglycerin

If patients have a history of angina and you are considering giving them their nitro or yours (from the EMG kit), what MUST you know?

- For *Viagra* and *Levitra*, at least 24 hours should have elapsed since the last dose of a PDE5 inhibitor.
- For *Cialis*, allow at least 48 hours before using nitrates.

*J Am Coll Cardiol* 1999; 33:273-82  
*J Am Coll Cardiol* 2003; 42:1855-60



- ✓ **Uses:** Used to relieve or eliminate chest pain associated with angina pectoris, to differentiate between angina and a myocardial infarction.
- ✓ **Pharmacology:** A coronary and peripheral vasodilator and as such helps increase the flow of oxygenated blood to the heart muscle.

- ✓ It also causes venous pooling of blood decreasing venous return to the heart thus improving the pumping efficiency of the heart. Because of this improved efficiency myocardial oxygen demand is decreased.
- ✓ Adverse Effects:
  - a) Cardiovascular: Rapid heart rate, facial flushing, and orthostatic (Postural) hypotension.
  - b) Central Nervous System: Dizziness and headache.
- ✓ Dose:
  - a) Tablet: 1 tablet sublingually repeat after 2 minutes if no relief up to 3 doses.
  - b) Metered Dose Spray: 1 spray sublingually repeat after 2 minutes if no relief up to 3 doses.

## Angina



**Symptoms/Signs:** chest pain

Position     **comfortable**  
 Airway       **N/A**  
 Breathing    **N/A**  
 Circulation   **check pulse, monitor BP**

**Definitive Treatment**

1. Let patient take their nitro
2. Administer O<sub>2</sub> or O<sub>2</sub> with N<sub>2</sub>O
3. Chew one aspirin tablet (81mg or 325mg)
4. Call 911
5. Terminate appointment

## M.I. "Heart Attack"



**Symptoms/Signs:** Crushing sensation in chest, tingling or numbness of left arm or hand, rapid breathing, sweating, ashen color, may be nauseated and vomit. Clenched fist on chest is 80% predictive!     **Call 911!**

Position       **Comfortable**  
 Airway        **Monitor**  
 Breathing     **Assist if they stop breathing**  
 Circulation    **Check pulse, monitor BP**

**Definitive Treatment:**

1. Call 911
2. Administer O<sub>2</sub>
3. Chew one aspirin tablet 81 or 325mg
4. Monitor and record vital signs
5. Be prepared to administer CPR

Called "remote ischemic preconditioning," the procedure developed by Toronto's Hospital for Sick Children was found to significantly limit the amount of damage to the heart muscle caused by a blockage in a cardiac blood vessel.

Ischemic preconditioning involves using the device to interrupt blood flow in the arm, off and on over a period of 35 to 40 minutes: the cuff is inflated for five minutes, then deflated for five minutes, with the procedure being repeated consecutively four times.

<http://www.cbc.ca/health/story/2010/02/26/heart-attack-blood-pressure-cuff.html#ixzzogfLoHNbP>

### #4: Oxygen

**Bag-Valve Concentrations:**

- Without oxygen - 21%
- With oxygen, no reservoir - 60%
- With oxygen and reservoir - 90 to 95%
- With demand valve attachment - 100%

## M.I. "Heart Attack"



### Women are different !

Most frequent symptoms:

<u>Prodromal</u>	<u>During Acute MI</u>
71% unusual fatigue	58% short of breath
48% sleep disturbance	55% weakness
42% shortness of breath	43% unusual fatigue
39% indigestion	39% cold sweat
35% anxiety	39% dizziness
> 30% had chest pain	

43% did not have chest pain during Acute MI  
95% knew their symptoms were new and different a month or more prior to the Acute MI.

## M.I. "Heart Attack"



1. **Call 911**
2. **M.O.N.A has changed!**  
**Morphine for pain control**  
**O<sub>2</sub> Administration**  
**Nitroglycerine 1 dose q5min to max of 3.**  
**Ask both men and women if they have had Viagra in the last 24 hr.**  
**No nitro if yes as it can lead to dangerously low BP.**  
**ASA Chew one tablet (81mg ~~325mg~~ 325mg).**  
**This is as important as nitroglycerin.**
3. **Be prepared to administer CPR.**
4. **The sooner they get to the hospital the better for dilation of vessels or fibrinolysis.**

### #5: Aspirin (for Acute Coronary Syndromes)

- ✓ **Pharmacology:** Irreversibly inhibits cyclooxygenase-1 and 2 (COX-1 and 2) enzymes, via acetylation, which results in decreased formation of prostaglandin precursors; irreversibly inhibits formation of prostaglandin derivative, thromboxane A<sub>2</sub>, via acetylation of platelet cyclooxygenase, thus inhibiting platelet aggregation; has antipyretic, analgesic, and anti-inflammatory properties.
- ✓ **Uses:** Treatment of mild-to-moderate pain, inflammation, and fever; prevention and treatment of myocardial infarction (MI), acute ischemic stroke, and transient ischemic episodes; management of rheumatoid arthritis, rheumatic fever, osteoarthritis, and gout (high dose); adjunctive therapy in revascularization procedures (coronary artery bypass graft [CABG], percutaneous transluminal coronary angioplasty [PTCA], carotid endarterectomy), stent implantation.
- ✓ **Precautions:**
  - Bleeding disorders: Use with caution in patients with platelet and bleeding disorders.
  - Dehydration: Use with caution in patients with dehydration.
  - Ethanol use: Heavy ethanol use (>3 drinks/day) can increase bleeding risks.
  - Gastrointestinal disease: Use with caution in patients with erosive gastritis or peptic ulcer disease.
  - Hepatic impairment: Avoid use in severe hepatic failure.
  - Renal impairment: Use with caution in patients with mild-to-moderate renal impairment (only at high dosages); avoid in severe impairment.



### #6: Albuterol Inhaler (bronchodilator)

- ✓ **Uses:** Used during acute asthma or Anaphylaxis to reduce or control bronchospasm.
- ✓ **Pharmacology:** A  $\beta_2$ -adrenergic drug that relaxes the bronchial smooth muscle. It has rapid onset and duration of action of up to 6 hours. Also reduces the stimulation of mucous production.



- ✓ Albuterol and Beta-Blockers tend to inhibit each other.
- ✓ Adverse Effects:  
Should be used with caution in patients with cardiovascular disorders especially coronary artery disease, arrhythmias, and hypertension.
- ✓ Dose:  
2 puffs every 2 minutes to a maximum of 20 puffs. Hold inhaler about 2 inches from mouth. Have patient take two deep breaths and then exhale forcefully. Dispense one puff on slow deep inhalation. Hold breath for 10 seconds and repeat.



### **#7: Glucose (for hypoglycemia)**

- ✓ Symptoms:
  - Appears confused
  - Cool, moist skin
  - May be hungry
  - May seem “drunk” but not alcohol breath odor
  - Slurred speech
- If patient becomes unconscious or does not respond readily after sugar/carbohydrate administration, activate EMS. They will give IV treatment.
- Never give unconscious patient anything orally!



### **Should I Have Other Drugs?**

- Midazolam (Versed®)?
- Flumazenil (Romazicon®)?
- Nitrous Oxide?
- Corticosteroids?
- Aromatic Ammonia?
- Naloxone (Narcan®)?

**Do Not Get Yourself Locked Into A Serious Drug Collection!**

## **#8: Midazolam (Versed®) for Seizures**

- ✓ **Uses:** For seizures, since it can be injected IM or subcutaneously or swallowed (orally). Realistically you want to call 911 if the seizure lasts more than a minute or if it is the first seizure for a patient.
- ✓ **Pharmacology:** A short-acting hypnotic-sedative drug with anxiolytic and amnesic properties. It is used in dentistry, cardiac surgery, endoscopic procedures, as preanesthetic medication, and as an adjunct to local anesthesia. The short duration and cardiorespiratory stability makes it useful in poor-risk, elderly, and cardiac patients.
- ✓ **Dose:** Inject 1-1.5mg (1-1.5mL) into buccal fold and repeat after a minute or two if the seizure has not stopped. If buccal fold is too difficult due to patient clenching inject IM on upper arm.
- ✓ **Beware:** Midazolam is also available as a 5mg/mL vial in which case 5mL would be 25mg: too much!!



## **#9: Flumazenil (Romazicon®) for Benzodiazepine Sedation Reversal**

- ✓ **Uses:** Selectively blocks benzodiazepine receptors, reversing sedation and respiratory depression
  - ✓ **Preparation:** 0.1 mg/ml, in 5 ml and 10 ml MDV
  - ✓ **Dose:** IV or sublingual, 0.2 mg every 1 minutes up to 5 doses
- ✓ “Respiratory depression mediated by benzodiazepines can be reversed using the specific antagonist flumazenil (Romazicon). It can be titrated intravenously or injected sublingually in 0.2 mg increments every 2-3 minutes, up to 1 mg. Flumazenil should not be administered to patients with a history of seizure disorder or dependence on benzodiazepines.”

*Dionne R, Phero J, Becker D; Management of Pain and Anxiety in the Dental Office. WB Saudners 2002;18:289*

*Oliver F, Sweatman W, Unkel J, et al. Comparative pharmacokinetics of submucosal vs. intravenous flumazenil (Romazicon) in an animal model. American Academy of Pediatric Dentistry; 2002:26*

## **#10: Corticosteroids for Acute Adrenal Insufficiency**

The adrenal cortex produces over 25 different steroids. These steroids are broken into three groups: sex steroids, mineralocorticoids, and glucocorticoids. Of primary concern in dentistry are the glucocorticoids. A physiologic dose of approximately 20mg/day of cortisol is produced. This plays a key role in the body's



ability to adapt to stress. Cortisol provides a chemical link within the cells of the body allowing regulation of vital functions including blood pressure and glucose utilization.

Cortisol production is triggered by real or threatened “stress” such as trauma, illness, fright, and anesthesia. In a patient with suppressed adrenal function a failure of this cortisol production eliminates the chemical link to regulate vital functions resulting in sudden shock and possibly death. Suppressed adrenal function or Adrenal Failure is classified as either Primary (Addison’s disease caused by Disease states such as TB, Bacteremia, Carcinoma, and Amyloidosis.) or Secondary (caused by Pituitary disorders, Hypothalamic disorders, or Steroid Therapy).

Steroid therapy suppresses the function of the adrenal cortex reducing the production of natural cortisol. Because of this suppression patient’s who have been on long term steroid therapy lose their ability to respond to stress. If these patients are stressed symptoms of acute adrenal insufficiency may result.

### **Signs and Symptoms of Acute Adrenal Insufficiency:**

1. Mental confusion.
2. Muscle weakness.
3. Fatigue.
4. Nausea and vomiting.
5. Hypotension.
6. Intense pains in abdomen, lower back, and/or legs.
7. Mucocutaneous pigmentation.
8. Hypoglycemia.
9. Hyperkalemia.
10. Increase heart rate, decreased blood pressure.

### **Dental Treatment Considerations**

For patients with a history of glucocorticoid therapy use stress reduction protocols. The following guidelines can be used to determine if replacement therapy is indicated but it is always a good idea to get a medical consult in such cases.

If the patient has undergone supraphysiologic (more than 20mg/day) glucocorticoid therapy that was discontinued more than 30 days prior to the planned dental treatment no supplementation is required.

If the patients has undergone supraphysiologic glucocorticoid therapy within 30 days of the planned dental procedure considered the patients suppressed and provide steroid supplementation equivalent to 100mg of cortisol.

If the patient has undergone or is undergoing alternate day dosing schedule glucocorticoid therapy no supplementation is required but it is best to provide dental treatment on the off day of the patient’s dose schedule.

If the patient is currently receiving daily glucocorticoid therapy at a supraphysiologic level (more than 20mg) supplementation is required. If the daily dose is subphysiologic supplementation is not required.

### **Equivalent Doses of Corticosteroids**

Cortisone	25mg
Hydrocortisone	20mg
Prednisolone	5mg
Prednisone	5mg
Methylprednisolone	4mg
Triamcinolone	4mg
Dexamethasone	0.75mg
Betamethasone	0.6mg

### **Fundamentals of Emergency Preparation**

- Training (BLS, ILS, ACLS, PALS).
- Development and implementation of an emergency plan.
- Purchase and maintenance of emergency equipment and drugs.
- Periodic mock emergency drills.
- Training new staff members.
- Monitoring and Patient Assessment.

## What drugs do you use in the office?

### Mechanism of Action

- LA block the sensation of pain by interfering with the propagation of impulses along peripheral nerve fibers
- This is accomplished by:
  1. A reduction in the permeability of the nerve cell membrane to sodium ions
  2. A decreased rate of rise in the depolarization phase of the action potential
  3. Failure of a propagated action potential to develop

Hersh EV. Local Anesthetics. In: Fonseca RJ. Oral and Maxillofacial Surgery, 2000.

### Principles of Local Anesthetics

Relationships between lipid solubility and clinically effective LA concentration		
Drug	Lipid Solubility	Concentration (%)
Articaine	40	4
Mepivacaine	42	2-3
Prilocaine	55	4
Lidocaine	110	2
Bupivacaine	560	0.5
Etidocaine	1853	1.5

Adapted from: Jastak JT et al. Local Anesthesia of the Oral Cavity, 1995.

The major determination of potency for LA is their intrinsic lipid solubility.

More lipid solubility = More potency

Therefore, agents with lower solubility are generally marketed at higher concentrations.

Increased protein binding allows anesthetic molecules to be more firmly attached to proteins at receptor sites.

Increased protein binding = longer duration of action

### Principles of Local Anesthetics

Protein Binding Characteristics and Duration of Action		
Agent	Approx. Protein Binding	Duration of action (mins)
Prilocaine	55	40-220
Lidocaine	65	60-190
Mepivacaine	75	25-165
Etidocaine	94	30-470
Bupivacaine	95	40-440
Articaine	95	60-220

Adapted from: Malamed SF. Handbook of Local Anesthesia, 1990. and Jastak JT. Local Anesthesia of the Oral Cavity, 1995.

### Principles of Local Anesthetics

	Average Durations of Local Anesthesia after Intraoral Injection			
	Maxillary Infiltration		Inferior Alveolar Block	
	Pulpal	Soft Tissue	Pulpal	Soft Tissue
2% Lidocaine w/ 1:100K or 1:50k epi	60	170	85	190
3% Mepivacaine	25	90	40	165
4% Prilocaine	20	105	55	190
0.5% Bupivacaine w/ 1:200k epi	40	340	240	440
1.5% Etidocaine w/ 1:200k epi	30	280	240	470
4% Articaine w/ 1:100k or 1:200k epi	60	170	90	220

Jastak JT et al. Local Anesthesia of the Oral Cavity, 1995.

Duration of LA is based on several factors:

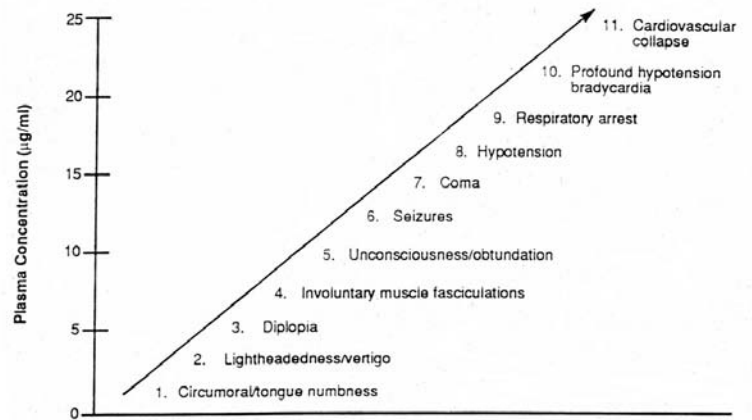
- Affinity of the LA to the nerve membrane (Lipid and protein components)
- Type of injection
- Presence or absence of vasoconstrictor
- Pulpal vs. soft tissue anesthesia?

## Principles of Local Anesthetics

Local Anesthetic	Elimination Half-life (hrs)
Lidocaine	1.6
Mepivacaine	1.9
Prilocaine	1.6
Bupivacaine	3.5
Etidocaine	2.6
Articaine	1.8 (Plasma: 27 mins)

Malamed SF. Handbook of Local Anesthesia. 4<sup>th</sup> Ed, 1997.  
Drug Information Handbook for Dentistry. 9<sup>th</sup> Ed, 2003.

Relationship Between Rising Plasma Concentrations and Toxic Effects.



## Overdose of Local Anesthesia

- |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>● Low / Moderate Overdose levels <ul style="list-style-type: none"> <li>● Confusion</li> <li>● Apprehension</li> <li>● Restlessness</li> <li>● Slurred speech</li> <li>● Muscular twitching / tremor of the face</li> <li>● Elevated HR, BP, RR</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>● Moderate / Severe Overdose Levels <ul style="list-style-type: none"> <li>● Seizures</li> <li>● Generalized CNS depression</li> <li>● Depressed HR, BP, RR</li> </ul> </li> </ul> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Wiltz M, 2003.

### Treatment

- Stop dental treatment
- Oxygen via a controlled airway
- Monitor vital signs
- Reassure patient, allow time for drug to distribute and be metabolized
- If patient becomes unstable, activate EMS and emphasize P,A,B,C's

### General Considerations:

- LA overdose can occur more easily in children, the elderly, and medically complex patients
- Remember the maximum recommended doses . . .

## Concentrations of Lidocaine

2% lidocaine  
 2 gm /100 ml  
 2,000 mg /100 ml  
 20 mg /1 ml  
 1 cartridge = 1.8 ml  
 20 mg /ml x 1.8 = 36 mg /cartridge

- Safest local anesthetic for children is lidocaine with 1:100,000 epinephrine
- Maximum dose is 1 cartridge per 20 pounds (~10kg)

## Principles of Local Anesthetics

Local Anesthetic	Maximum Dose	carp #
Lidocaine w/ epi (2% -36 mg)	7.0 mg/kg (500 mg)	11
Lidocaine w/o epi	4.5 mg/kg (300 mg)	8
Mepivacaine (3% - 54 mg)	6.6 mg/kg (400 mg)	5.5
Prilocaine (4% - 72 mg)	8.0 mg/kg (600 mg)	8
Bupivacaine (0.5% - 9 mg)	1.3 mg/kg (90 mg)	10
Etidocaine (1.5% - 45 mg)	8.0 mg/kg (400 mg)	15
Articaine (4% - 68 mg)	7.0 mg/kg (5.0 mg/kg Child) (MRD 500mg / 144mg)	7

Malamed SF. Handbook of Local Anesthesia. 4<sup>th</sup> Ed, 1997.

## Principles of Local Anesthetics

### Maximum Recommended Dosages of Vasoconstrictors

	Concentration		Maximum Recommended Dosage		
	mg/mL	Parts / Thousand	mg	mL	# of Carps
Epinephrine	0.02	1:50,000*	0.2	10	5
	0.01	1:100,000	0.2	20	11
	0.005	1:200,000	0.2	40	11†
Levonordefrin	0.05	1:20,000	1.0	20	11

\* 1:50,000 should be reserved for local hemostasis

† Max no. of carpules is limited by the LA

## Principles of Local Anesthetics

### Pregnancy Risk Classification of Local Anesthetics

Drug	Pregnancy Category
Lidocaine	B
Mepivacaine	C
Prilocaine	B
Bupivacaine	C
Etidocaine	B
Articaine	C

Jastak JT et al. Local Anesthesia of the Oral Cavity, 1995.  
 Drug Information Handbook for Dentistry. 6<sup>th</sup> Ed, 2001.

Calculating Local Anesthetic doses can be accomplished in two ways:

1. Proportionally
2. The "Rule of 20":  
 A maximum of 1 carpule of anything per 20 lbs of bodyweight (up to 150 lbs)  
 Much more conservative, usually yields 70-75% of MRD

## Calculating Doses

- Example: 120 lb (55 kg)
- Proportionally:
  - 4 Carps of 2% Lido w/ 1:100k epi  
4 Carps = 144 mg (36 mg/carp x 4 carps)  
MRD for 55 kg = 385 mg Lido (7mg/kg)  
4 Carps Lido = 37.5% of MRD
  - 3 Carps of 4% Prilocaine  
3 Carps = 216 mg (72 mg/carp x 4 carps)  
MRD for 55 kg = 440 mg of Prilocaine (8mg/kg)  
3 Carps Prilocaine = 49% of MRD
  - **COMBINED: 86.5% OF MAXIMUM**

## Calculating Doses

- Example: 120 lb (55 kg)
- Proportionally:
  - 4 Carps of 2% Lido w/ 1:100k epi  
4 Carps = 144 mg (36 mg/carp x 4 carps)  
MRD for 55 kg = 385 mg Lido (7mg/kg or 11 carps)  
4 Carps Lido = 37.5% of MRD
  - 6 Carps of 4% Prilocaine  
6 Carps = 432 mg (72 mg/carp x 6 carps)  
MRD for 55 kg = 440 mg of Prilocaine (8mg/kg)  
6 Carps Prilocaine = 98% of MRD or 8 carps
  - **COMBINED: 135.5% OF MAXIMUM**

## Calculating Doses

- Example: 120 lb (55 kg)
- "Rule of 20"
  - 4 Carps 2% Lido w/ 1:100k epi  
4 Carps = 144 mg (36 mg/carp x 4 carps)  
MRD for 55 kg = 385 mg Lido (7mg/kg or 11 carps)  
4 Carps Lido = 37.5% of MRD
  - 2 Carps 3% Mepivacaine  
2 Carps = 108 mg (54 mg/carp x 2 carps)  
MRD for 55 kg = 360 mg Mepivacaine (6.6mg/kg or 5.5 carps)  
2 Carps Mepivacaine = 30% of MRD
  - **COMBINED = 67.5% OF MRD**

## Vasoconstrictor Cautions

- Maximum dosage of epi for CV patients:

0.04 mg

- 1 carpule of 2% lido w/ 1:50k epi
- 2 carpules of 2% lido w/ 1:100k epi
- 4 carpule of 2% lido w/ 1:200k epi
- 2 carpules of LA w/ 1:20k levo (1/5 potency of epi)

Hersh EV. Local Anesthetics.  
In: Fonseca RJ. Oral and Maxillofacial Surgery, 2000.

### **OraVerse® (phentolamine mesylate)**

- Approved by the FDA in May 2008, made available in early 2009
- Accepted uses: local anesthetic reversal, treatment of hypertension
- Other brand names: Regitine®, Rogitine®
- Mechanism of Action: competitively blocks alpha-adrenergic receptors to produce brief antagonism of circulating epinephrine and norepinephrine. Resulting in vasodilatation when applied to vascular smooth muscle.
- Bioavailability: 100%
- Tmax: 10-20 mins
- T<sub>1/2</sub>: 2-3 hrs
- Price: Approximately \$12.50 per cartridge

Amount of Local Anesthetic Administered	Dose of OraVerse [mg]	Dose of OraVerse [Cartridge(s)]
½ Cartridge	0.2	½
1 Cartridge	0.4	1
2 Cartridges	0.8	2

**EpiPen 2-Pak 0.3mg/0.3mL  
(contains 2 Adult pens)**

**Inject one pen into front outside of thigh. Ok to repeat if needed after 3-5 minutes.**

**Call 911 Call 911 Call 911.**

Used for anaphylaxis: severe, rapid onset (less than 1 hour) allergic reaction, swollen throat, tongue, or lip or if patient has difficulty breathing - allergic reaction - or if patient has difficulty breathing with slow onset allergic reaction. Note that the EpiPen is expensive at \$120 for the 2 pens if you see children you must also carry the EpiPen Jr 2-pak 0.15mg/0.3mL.

**Epi 1:1000 ampule 1mL  
(contains 1mg epinephrine)**

**Inject into front outside of thigh. 0.2mL to 0.5mL repeat every 5 minutes or more often.  
(USE 0.1mL for kids each injection to max of 3 injections).**

Used for anaphylaxis: severe, rapid onset (less than 1 hour) allergic reaction, swollen throat, tongue, or lip or if patient has difficulty breathing - allergic reaction - or if patient has difficulty breathing with slow onset allergic reaction

**Call 911 Call 911 Call 911**

**Other Notes or Questions to Ask:**

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## **Benadryl Injectable 50mg/mL vial**

**Inject 1mL (for kids aged 1-7 use 0.5mL) IM in upper arm.** Used for moderate, slow onset (takes one hour or more) allergic reaction: Itching throat, swollen tongue, or lip.

*Be ready for anaphylaxis if breathing difficulty starts.*

*Observe for 1 hour to ensure recovery*

*Terminate appointment*

*Refer to MD for oral antihistamine or steroids for 3 days*

## **One bottle of nitroglycerine spray**

**Pump to prime (you should see a mist come out) then spray 1-2 doses into the floor of mouth.**

**May repeat every 5 minutes up to 3 times.**

**Call 911 if chest pain does not resolve.**

Used for angina. Prime the pump and check to be sure no Viagra or Levitra within the last 24 hours (48 hours for Cialis) before giving the nitro.

### **Other Notes or Questions to Ask:**

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**A bottle of Aspirin (325mg tabs)**

**In the case of angina or a heart attack the patient is to chew one tablet while the staff calls 911.**

**A can of non-diet soda**

**Have patient drink 5 oz per minute until can is empty.**

**Hypoglycemia in a diabetic patient** is best treated with this. The carbonation gets it through the stomach faster than any uncarbonated source of sugar. It is absorbed from the small intestine.

*This requires a CONSCIOUS and oriented patient.*

**Do not forget a source of portable, positive-pressure oxygen and a bag-valve-mask (BVM) with different size masks for different patients.**

**Other Notes or Questions to Ask:**

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## **One Albuterol inhaler**

**Shake dispenser, have patient exhale, spray as they inhale.**

**May repeat every 30 seconds.**

**Call 911 if no relief after 1 minute.**

Used for asthma, bronchial spasm.

## **2 vials Naloxone 0.4 mg/mL (1 mL)**

**Give 0.4-2 mg I.V., I.M. or SubQ; may need to repeat doses every 2-3 minutes; after reversal, may need to readminister dose(s) at a later interval (i.e., 20-60 minutes) depending on type/duration of opioid. If no response is observed after 10 mg total, consider other causes of respiratory depression.**

## **2 vials Flumazenil 0.1mg/mL**

**Give 1-2mL in floor of mouth off midline adjacent to bicuspid/cuspid area. Observe effect for 5 minutes. Repeat if needed.**

*Patient must be kept in office for 2 hours to see if they resedate.*

Used to reverse BZDs including Triazolam, Midazolam, Diazepam, Alprazolam, Lorazepam and at least one non-BZD, Zaleplon.