

Medical Emergencies: Are you really ready?

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Emergencies reported by 4,307 dentists in a 10-year period

Emergency	Incidence
Syncope	15,407
Allergy	2,583
Angina	2,552
Postural hypotension	2,475
Seizures	1,595
Acute asthma	1,392
Hyperventilation	1,326
Epinephrine reaction	913
Hypoglycemia	890

Malamud, SF. Managing Medical Emergencies. J Am Dent Assoc. 1993 Aug;124(8):40-53

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Database

- 29,133 total emergencies
- 4307 dentists
- Previous 10 years
- If a dentist practices 30 years:

The dentist will face 20 emergencies in their career

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Emergencies reported in the 12-month study period

	# Dentists who experienced emergency	Incidence of emergency
Vasovagal syncope	358	1238
Hypertensive crises	41	72
Seizure	42	46
Hypoglycemia	22	33
Asthma	24	26
Acute coronary syndrome	22	24
Anaphylaxis	7	9
Airway obstruction	5	5
Stroke	4	4
Cardiac arrest	2	2
Other emergencies	18	26

Emerg Med J 2008;25:296-300

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Medical Emergencies Managed/Witnessed

Emergency	Number of Participants
None	10
Other	10
Bronchospasm/Asthmatic Attack	10
Allergic Reaction	20
Airway Obstruction	15
Seizure	25
Angina	25
Cardiac Arrest	5
Hypoglycemia	55
Syncope	70

de Beudot, T, et al. JDE 2017;82(5):492-500

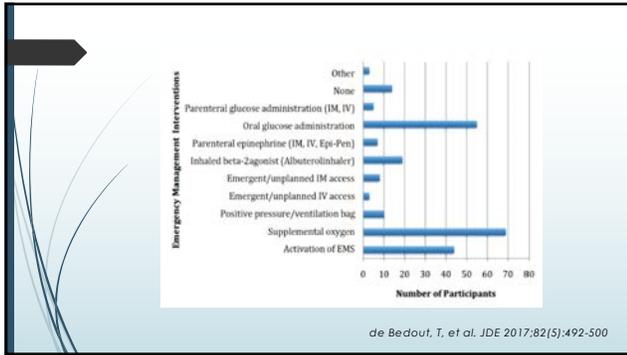
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When and where do emergencies occur?

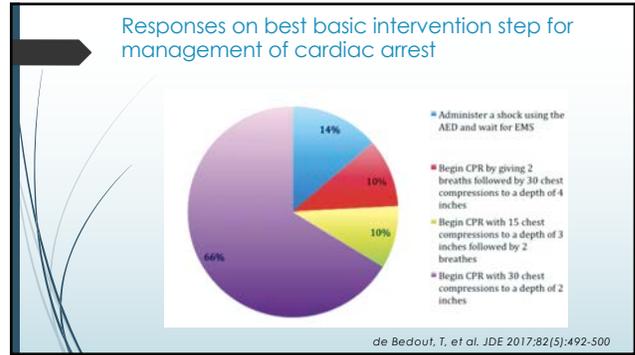
Where/when	Incidence (%)
In waiting room	1.5
During or immediately after local anesthesia	54.9
During treatment	22
After treatment/in office	15.2
After leaving office	5.5

Matsuura, H. Anesth Prog 36:219-228, 1990

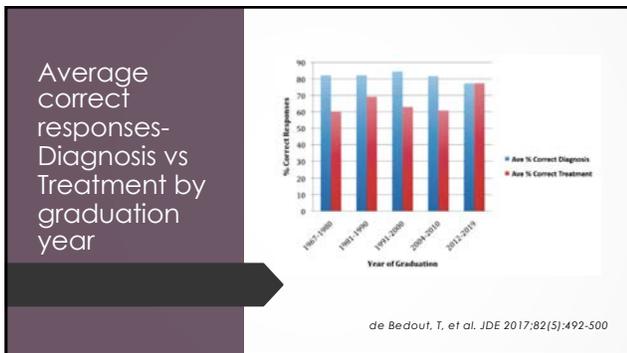
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What is the average response time for paramedics in your practice area?

- A. 2 minutes
- B. 4 minutes
- C. 6 minutes
- D. 8 minutes
- E. 10 minutes

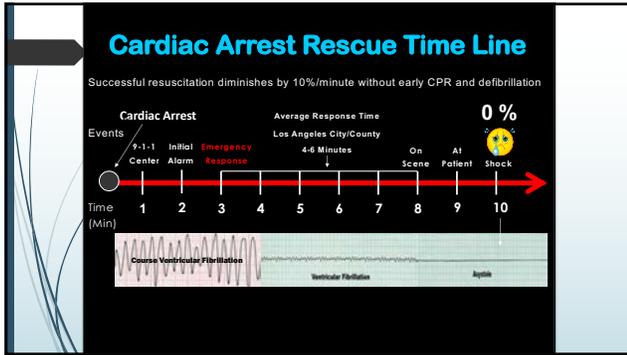
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Prehospital Care: Medical Emergencies

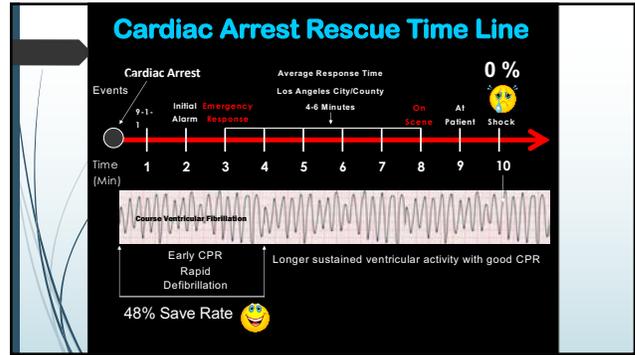
What Happens When You Call for Help?

Thanks to:
 Tom Stafford
 Fire Captain and Paramedic
 LA City Fire Department
 President, Superior Life Support
 for the following two slides

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When Not To Quit: Man Revived After 96 Minutes

Reported 2011 10:01 AM

Howard Siroky's heart stopped beating for 96 minutes last January. First responders didn't give up on him, thanks in part to ultrasonography, a technology that let them know Siroky still had a chance of coming back.

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Prevention of and preparation for medical emergencies

- Patient evaluation
 - Medical history
 - Systems review
 - Medications
 - Dental anxiety
 - Physical evaluation
 - Vital signs
 - Physician consultation
 - Laboratory tests
- Office preparation
 - Emergency kit
 - Emergency protocols
 - Emergency practice

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Situational Awareness Errors

- Perception –
 - failure to gather information via history, chart, exam, or monitoring
 - failure to seek information and failure to receive information
- Comprehension –
 - failure to understand available information
- Projection –
 - failure to predict future outcomes based on chosen plan
 - poor contingency planning
 - poor or absent back-up plan

Schultz, et al. Anesthesiology 2017; 127:326-337

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Medical consult

- Which patient needs a consult
- What medical information is relevant
- How should this request be written

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Objectives of a medical consult

- Determine and reduce peri- and postoperative medical risk
- Determine and lessen or prevent the effects of the proposed procedure on any medical illness
- Ensure that the patient's underlying medical condition is being treated optimally

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Types of consults

- Opinion
 - Example – you may want advice from patient's cardiologist as to the exact nature of the cardiac murmur so that **you** can decide if AB prophylaxis is needed.
- Opinion and treatment of a specific problem
 - Example – need an opinion from the hematologist as to the value of desmopressin for a patient with von Willebrand's disease needing an extraction

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Does this patient need a medical consult?

- 6-year-old male
 - Type 1 diabetes
- Medication
 - Lantus
 - Humalog

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Does this patient need a medical consult?

- 16 year-old female
 - Autistic spectrum disorder
 - Seizure disorder
 - Food allergies
- Medication
 - Levetiracetam (Keppra)
 - Vitamin B-12 injections

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Does this patient need a medical consult?

- 77 year-old male
- Past medical history positive for:
 - Hypertension
 - Prostate cancer
 - By-pass surgery
 - Stent placement
 - GI bleed
 - Gout
- Medication
 - Lisinopril
 - ASA

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Does this patient need a medical consult?

- 70 year-old female
- Past medical history positive for:
 - Atrial fibrillation
 - CVA
- Medications
 - Apixaban (Eliquis)

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Does this patient need a medical consult?

- 31 year-old female
 - 4 months pregnant
 - Allergic to penicillin
- Medication
 - Prenatal vitamins

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Medications Commonly Prescribed by Oral Health Professionals

Agent	FDA Category	Teratogenic Risk	Quality of Evidence	Lactation Concerns
Penicillins				
Penicillin and derivatives	B	None	Good	None
Ampicillin / clavulanate	B	Unlikely placental passage if clavulanate limited	Fair	None
Erythromycin	B	Minimal	Fair	None
Clarithromycin	B	Unlikely	Fair to limited	None
Fluorquinolones	C	Unlikely, avoid in pregnancy due to toxicity to developing cartilage in animal studies	Fair	Possible concentration in milk
Tetracycline and doxycycline	D	Dental staining, moderate nephrotoxicity, urinary	Good	Fair to good
Fluoroquinolones				
Acetaminophen	B	None to minimal	Fair to good	None
Ibuprofen	B	Minimal, limit use to short courses and avoid use before 12 weeks and after 28 weeks	Fair to good	None
Naproxen	B	Minimal, limit use to short courses and avoid use before 12 weeks and after 28 weeks	Limited to fair	None
Oxycodone / hydrocodone (Percocet)	B	Undetermined, small risk cannot be excluded	Limited	Short courses not associated with adverse effects
Cocaine (also cocaine / ephedrine)	C	Unlikely	Fair to good	Short courses not associated with adverse effects
Hydrocodone / acetaminophen (Vicodin)	C	Undetermined, small risk cannot be excluded	Limited	Short courses not associated with adverse effects, possible infant sedation with higher doses
Aspirin	C	Minimal, limit use to short courses and avoid use before 12 weeks and after 28 weeks	Good	Avoided, possible association with metabolic acidosis and Reye's syndrome
Lidocaine and related local anesthetics	B	None	Fair	Does not enter milk when administered for local anesthesia

Adapted from TORO (www.dentalevidence.org) and Harvati, RPDHOFK (www.repro.org). CDA Journal, Sept 2010

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Which patient needs the consult?

- Unclear medical history
- May require change in normal daily medication
- Cardiac patients (selected)
- Chronic disease that may affect dental care
- Poorly controlled chronic disease

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Medical consult

- When asking the opinion of a physician about the medical management of your patient it is useful to include a description of the dental care in lay terms.
- Include anticipated stress, bacteremia, bleeding, NPO requirements, anesthetic technique and expected postoperative course.

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What would you like in return?

- Clarification of patient's medical history
- Ability to tolerate stress of the procedure
- Any medical contraindications to receiving proposed dental care
- Pertinent test results, i.e.
 - A1c
 - INR
 - Echo report

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Prevention of and preparation for medical emergencies

- Patient evaluation
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 - Systems review
 - Medications
 - Dental anxiety
 - Physical evaluation
 - Vital signs
 - Physician consultation
 - Laboratory tests
- Office preparation
 - Emergency kit
 - Emergency protocols
 - Emergency practice

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"...having an appropriate emergency drug kit and equipment often plays an integral role in the course and outcome of emergency treatment."

Rosenberg M. Preparing for medical emergencies. JADA 2010;141(5 suppl):145-195

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- ADA recommendation
- Epinephrine
 - Histamine blocker
 - Oxygen with positive pressure device
 - Nitroglycerin
 - Bronchodilator
 - Sugar
 - Aspirin

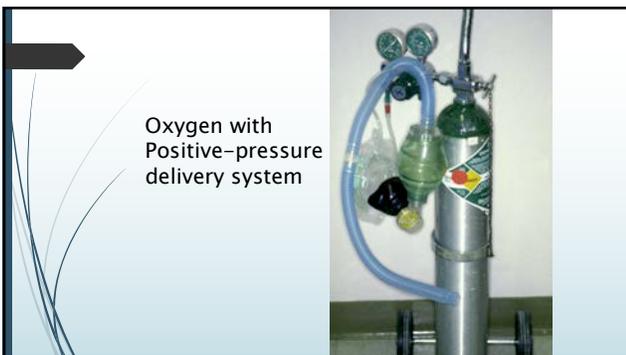
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- Also need to include...
- Ammonia
 - BP monitoring equipment
 - Pocket mask
 - Syringes and needles
 - Tourniquets
 - High volume suction and aspiration tips or tonsillar suction

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- Suggested basic emergency equipment for the dental office.
- Portable oxygen cylinder (E size) with regulator
 - Supplemental oxygen delivery devices
 - Nasal cannula
 - Nonrebreathing mask with oxygen reservoir
 - Nasal hood
 - Bag-valve-mask device with oxygen reservoir
 - Oropharyngeal airways (adult sizes 7, 8, 9 centimeters)
 - Magill forceps
 - Automated external defibrillator
 - Stethoscope
 - Sphygmomanometer with adult small, medium and large cuff sizes
 - Wall clock with second hand
- Rosenberg M. Preparing for medical emergencies. JADA 2010;141(5 suppl):145-195

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WARNINGS
 LIDOCAINE HYDROCHLORIDE INJECTION, FOR INFILTRATION AND NERVE BLOCK, SHOULD BE EMPLOYED ONLY BY CLINICIANS WHO ARE WELL VERSED IN DIAGNOSIS AND MANAGEMENT OF DOSE-RELATED TOXICITY AND OTHER ACUTE EMERGENCIES THAT MIGHT ARISE FROM THE BLOCK TO BE EMPLOYED AND THEN ONLY AFTER ENSURING THE IMMEDIATE AVAILABILITY OF OXYGEN, OTHER RESUSCITATIVE DRUGS, CARDIOPULMONARY EQUIPMENT, AND THE PERSONNEL NEEDED FOR PROPER MANAGEMENT OF TOXIC REACTIONS AND RELATED EMERGENCIES (See also **ADVERSE REACTIONS** and **PRECAUTIONS**). DELAY IN PROPER MANAGEMENT OF DOSE-RELATED TOXICITY, UNDERVENTILATION FROM ANY CAUSE AND/OR ALTERED SENSITIVITY MAY LEAD TO THE DEVELOPMENT OF ACIDOSIS, CARDIAC ARREST AND, POSSIBLY, DEATH.

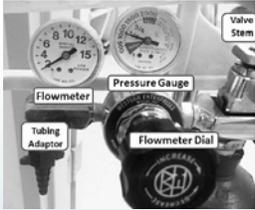
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Oxygen Cylinder

- All basically the same
 - Valve stem at the top that opens counterclockwise to release O₂ into the attached regulator
 - A full tank has a pressure of 2200 psi
 - Offices typically have E- and H-cylinders
 - Full E-cylinder contains 660L O₂
 - Full H-cylinder contains 6,900L O₂

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Regulator components




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What about an AED?

- Early defibrillation is an integral part of the BLS chain of survival



- Part of our training as a healthcare provider
- Some States require
- ADA Council on Scientific Affairs recommends offices have AED's



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Oral Pharyngeal Airway Placement

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Magill Forceps

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Basic Emergency Drugs

- Oxygen
- Epinephrine
- Diphenhydramine
- Nitroglycerin
- Aspirin
- Bronchodilator
- Glucose
- Aromatic ammonia
- Midazolam?

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Oxygen

- Important in any emergency where there may be hypoxemia
- Maintain peripheral oxygenation
- Untreated hypoxemia leads to anaerobic metabolism and metabolic acidosis
 - Decreases the efficacy of pharmacologic interventions

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Epinephrine

- Most important injectable drug in the emergency kit
- Endogenous catecholamine
 - Mixed α - and β -adrenergic receptor agonist
- Used in management of anaphylaxis symptoms by alleviating allergen-induced inflammatory and physiologic effects

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Epinephrine: α -adrenergic effects

- Vasoconstriction
 - Reverses vasodilation, alleviating hypotension and reducing erythema, urticaria and angioedema

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Epinephrine: β -adrenergic effects

- β_1 – increases the force of myocardial muscle contraction and heart rate
 - Resulting in an increase in cardiac output
- β_2 – dilate bronchial airways
 - Relieving bronchospasm
- Attenuates the severity of IgE-mediated reactions via receptors on mast cells

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Epinephrine

- Available as:
 - 1 mg/mL (1:1000)
 - 1 mL ampule, vial or syringe
 - 1 mg/10mL preloaded syringe
- Dose
 - Adults – 0.3 mg IM
 - Children – 0.15 mg IM
0.01 mg/kg up to 0.3 mg total dose

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EpiPen®
 Each auto-injector contains: 2 mL epinephrine injection 1 mg/mL and is designed to deliver a single dose of 0.3 mg epinephrine in 0.3 mL.
 Nonmedicinal ingredients: Each mL contains: sodium chloride 6 mg, sodium metabisulfite 1.67 mg and hydrochloric acid to adjust pH.

EpiPen Jr®
 Each auto-injector contains: 2 mL epinephrine injection 0.5 mg/mL and is designed to deliver a single dose of 0.15 mg epinephrine in 0.3 mL.
 Nonmedicinal ingredients: Each mL contains: sodium chloride 6 mg, sodium metabisulfite 1.67 mg and hydrochloric acid to adjust pH.

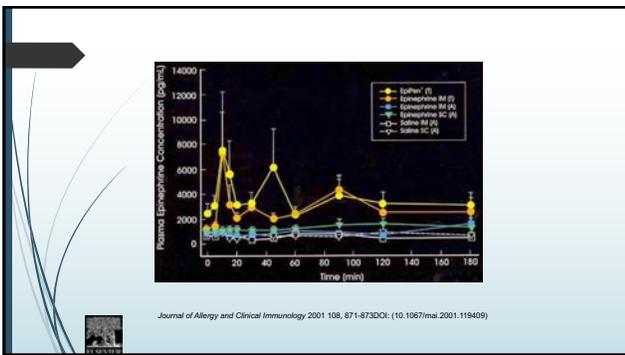
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Subcutaneous injection Intramuscular injection



The image shows two hands with 'N' and 'O' written on them, representing needle length. To the right, two diagrams illustrate injection techniques: one for subcutaneous injection (needle angled, shallow) and one for intramuscular injection (needle perpendicular, deep).

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How do you use this?



EPiPEN^{Jr} (Epinephrine) Auto-Injector 0.15mg
 BECAUSE EVERY SECOND COUNTS

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<https://youtu.be/DzGM7thSYEA>

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Tsai et al. Allergy, Asthma & Clinical Immunology 2014, 14:39
 http://www.aacijournal.com/content/14/1/39

ALLERGY ASTHMA & CLINICAL IMMUNOLOGY

RESEARCH Open Access

Auto-injector needle length may be inadequate to deliver epinephrine intramuscularly in women with confirmed food allergy

Gina Tsai¹, Laura Kim², Immaculate FP Nevils³, Arunmuchi Dominic⁴, Ryan Potts⁵, Jack Chi⁶ and Harold L Kim^{1,3*}

- Needle length 15.2mm
 - Not long enough to deliver IM epi in 19% of individuals (all women) in this study

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TB syringe – inadequate needle length



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Intramuscular injection



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Diphenhydramine

- Histamine blocker
- Used for patients with mild or delayed-onset allergic reaction
 - Not for first line treatment of anaphylaxis
 - Time to 50% reduction of cutaneous signs
 - IM – 52 min
 - Oral – 80 min

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Diphenhydramine (Benadryl)

- 50 mg/mL
- 1 mL ampules, vials
- 25-50 mg IM;
- 25-50 mg orally every 3-4 hrs



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Bronchodilator

- Albuterol
- β_2 -adrenergic receptor agonist
- Bronchial smooth muscle relaxation and inhibition of chemical mediators released during hypersensitivity reactions

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Nitroglycerin

- Relaxes vascular smooth muscle
- Dilates systemic venous and arterial vascular beds
- Decreases preload and afterload
- Reduces myocardial oxygen consumption
- Used for acute chest pain

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Nitroglycerin



Dose-0.4 mg (sublingual tab or spray) if systolic BP \geq 90 mmHg

Can repeat every 5 min if pain not relieved



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Contraindications to NTG

- Hypotension
 - Systolic BP < 90 mm Hg
- Use of ED meds
 - Sildenafil, tadalafil...
- Combination may lead to profound hypotension and unconsciousness

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Aspirin

- Antiplaetlet effect further prevents clot formation when given to patient with evolving MI
- Contraindications
 - Allergy
 - Severe bleeding disorder
- Usage
 - Patient should chew the ASA and swallow
 - 160-325 mg tablet (non-enteric coated)

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Glucose

- Treat hypoglycemia
 - Either from fasting or an imbalance between insulin and CH₂O in diabetic patient
- If patient is conscious give oral CH₂O
- If unconscious – no oral medications
 - Could consider glucagon
- It is important to document hypoglycemia prior to treating
 - Glucometer

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Parenteral anti-hypoglycemics

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New glucagon formulations

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Midazolam

- Benzodiazepine - anticonvulsant
- For patients with seizures
- Controlled medication
 - Schedule IV



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Midazolam

- Dose
 - 0.05-0.15 mg/kg IV or IM, up to 10 mg
- Or intranasally – need atomizer
 - 0.2 mg/kg up to 10 mg



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What should your emergency kit look like?



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Office Preparedness

- Have some sort of cognitive aid



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- Practice Drills
- Keep emergency drugs up to date
- Keep emergency equipment in ready-to-go state
- Everyone in the office must know where emergency equipment is

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Scenarios

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Scenario 1

- Patient: 58-year-old male, 215 lb, 5'8"
- History: stable angina, HTN
- Medications: nadolol, lisinopril, nitroglycerin
- Procedure: crown preparation of #18
- Baseline vital signs: BP – 142/82, HR – 68
- Local anesthesia: 2 cartridges 2% lidocaine, 1:100,000 epi + buccal infiltration 1 cartridge 4% articaine, 1:100,000 epi

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Scenario 1 follow up (1)

- S & S: sweating, nausea, jaw pain
- Vital signs
 - BP – 192/95
 - HR – 49
- Patient now suddenly loses consciousness

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Scenario 1 (treatment)

- Position patient
- Call 911
- Begin CPR
- Place AED as soon as available

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Table 1
Summary of Key BLS Components for Adults, Children, and Infants*

Component	Recommendations		
	Adults	Children	Infants
Recognition	Unresponsive for all ages		
	No breathing or no normal breathing (ie, only gurgling)	No breathing or only gasping	No breathing or only gasping
	No pulse palpated within 10 seconds for all ages (AEC only)		
CPR sequence	C-A-B		
Compression rate	At least 100/min		
Compression depth	At least 2 inches (5 cm)	At least $\frac{1}{2}$ AP diameter (About 2 inches (5 cm))	At least $\frac{1}{4}$ AP diameter (About 1.5 inches (4 cm))
Chest wall recoil	Allow complete recoil between compressions HCPs: rotate compressions every 2 minutes		
Compression interruptions	Minimal interruptions to chest compressions Attempt to limit interruptions to <10 seconds		
Airway	Head-tilt-chin-lift (HCP) expected to be used for most		
Compression-to-ventilation ratio (not advanced airway device)	30:2 1 or 2 rescuers	30:2 Single rescuer	30:2 2 HCP rescuers
Ventilations: when resuscitation is not indicated or treatment is not indicated	Compressions only		
Ventilations with advanced airway device	1 breath every 6-8 seconds (8-10 breath/min) Asynchronous with chest compressions About 1 second per breath Tidal volume 6-7 mL		
Defibrillation	Attach and use AED as soon as available. Minimize interruptions to chest compressions before and after shock, resume CPR beginning with compressions immediately after each shock.		

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What happened to the patient?

Vasoconstrictor overdose leading to cardiac arrest

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Drug interactions with epinephrine and levonordefrin

- Nonselective β -blockers
 - Nadolol (Corgard)
 - Propranolol (Inderal)
 - Sotalol (Betapace)
 - Timolol
- Interaction may result in increased BP
- Reduced use of vasoconstrictor is warranted

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Non-selective β -blocker interaction

- α_1 – increased blood pressure
- ~~β_1 – increased heart rate~~
- ~~β_2 – Decrease blood pressure~~
- Hypertension & Reflex Bradycardia
- “Unopposed” alpha constriction with both epinephrine and levonordefrin
- No interaction likely with cardio-selective β_1 agents or combined α and β blockers (e.g., labetalol)

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Scenario 2

- Patient: 47-year-old male
- History: Bacterial endocarditis 2010; past IV drug abuse
- Procedure: Dental prophylaxis and minimal sedation with N₂O-O₂ sedation
- 2 g amoxicillin 1 hour prior to the procedure

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- Seated in dental chair complaining of malaise, wheezing and difficulty swallowing



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What happened to the patient?

Anaphylaxis to amoxicillin

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Scenario 2 (treatment)

- IM epinephrine – 0.3 mg in thigh
- Call 911
- Monitor vital signs
- Oxygen
- Administer albuterol inhaler
- IM diphenhydramine
- Be prepared to deliver 2nd dose IM epinephrine

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Scenario 3

- Patient: 76-year-old female
- History of atrial septal defect repair 3 years ago
- Medication: simvastatin
- Consult: cardiologist office moving and records are in disarray, no one can answer any questions
- Presents for hygiene appointment complaining of feeling very tired and a little light-headed

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Scenario 3 continued

- Seat patient and take vital signs
 - BP – 80/45
 - HR – 43
- You noticed that you could not feel a pulse for a stretch of time and then it would start up again



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What happened to the patient?

Symptomatic bradycardia

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Scenario 3
(treatment)

- Call 911
- Monitor vital signs
- Consider oxygen
- Be prepared to provide CPR

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Scenario 4

- Patient: 69-year-old male, 190 lbs, 5'9"
- History: Type 2 diabetes, Hip replacement 2016, DVT 2018
- Medication: Metformin, dabigatran (Pradaxa)
- Procedure: crown preparation #15
- Consult: A1c – 7.2 (1 month ago)

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Scenario 4 continued

- Local anesthesia: 1 cartridge 2% Lidocaine, 1:100,000epi
- Treatment proceeds uneventfully
- Patient asks question and speech is almost unintelligible.
- The patient tries to point to something on their face but cannot raise their arm

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What happened to the patient?

Cerebrovascular Accident (CVA)

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FAST

Face Drooping	Arm Weakness	Speech	Time to Call 9-1-1
Does one side of the face droop or is it numb? Ask the person to smile. Is the person's smile uneven or lopsided?	Is one arm weak or numb? Ask the person to raise both arms. Does one arm drift downward?	Is speech slurred? Is the person unable to speak or hard to understand? Ask the person to repeat a simple sentence.	If the person shows any of these symptoms, even if the symptoms go away, call 911 and get them to the hospital immediately.

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Scenario 4
(treatment)

- Call 911
- Monitor vital signs
- Consider oxygen
- Be prepared to provide CPR

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Scenario 5

- Patient: 45-year-old male, 170 lbs, 6'0"
- History: Type 1 diabetes, diagnosed 3 years ago
- Medication: insulin glargine (Lantus) and insulin lispro (Humalog)
- Procedure: Hygiene appointment (first appointment in the morning)
- Consult: Most recent A1c = 6.2, check BS prior to treatment

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Scenario 5 continued

- Pt seated and you tell him that you would like to check his blood sugar.
- He seemed very anxious and shaky, the patient excuses himself to use the restroom before you can check his blood sugar
- He is gone for a while but when he returns to the operatory he appears intoxicated.
 - Slurred speech and appears very drowsy

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What happened to the patient?

Hypoglycemia

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Scenario 5 (treatment)

- Monitor vital signs
- Check blood sugar
- Give one tube Insta-Glucose®
- Call family/friend to drive pt home

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Scenario 6

- 37-year-old female, 135 lbs, 5'7"
- Negative medical history
- No medications, no allergies
- Procedure: restorative tooth #19

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Scenario 6 continued

- Patient seated and baseline vital signs obtained
 - BP 135/74
 - HR 92
- Administered one cartridge 2% Lidocaine, 1:100,000 epi
- Patient became very distressed
 - Complained of difficulty breathing
 - Light-headedness
 - Chest pain

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Scenario 6 continued

- What is your intervention?
 - Calm patient
 - Obtain vital signs
 - BP 145/95
 - HR 140
 - RR 17

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What happened to the patient?

Epinephrine reaction

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Scenario 6
(treatment)

- Calm patient
- Monitor vital signs

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