

**MEDICAL EMERGENCIES IN THE DENTAL OFFICE**

**Ontario Dental Association  
Annual Spring Meeting**

**April 18, 2024**

David Isen BSc, DDS  
[drisen@sleepfordentistry.com](mailto:drisen@sleepfordentistry.com)  
 416-498-8484

1



2

**TOPICS**

1. How to Avoid Medical Emergencies
2. P, ABC/ CAB and D
3. Emergency Drugs
4. Emergency Scenarios

3

**Standard of Care**

**“Dentists must be familiar with the appropriate, current recommended management of medical emergencies that may arise in a dental office”**

RCDSO Connect Newsletter, Winter Issue, 2024

4

**OVERDOSAGE**  
 Acute emergencies from local anesthetics are generally due to unintended sublingual or intravascular use of local anesthetics or to unintended sublingual or intravascular use of local anesthetics during therapeutic use of local anesthetics. The first consideration is to stop the administration of the anesthetic. Emergencies resulting from cardiovascular and respiratory depression following intravascular injection of a local anesthetic are life-threatening.

**CONTRAINDICATIONS**  
 Lidocaine is contraindicated in patients with known hypersensitivity to lidocaine or other amide local anesthetics.

**ADVERSE REACTIONS**  
 Adverse reactions following the administration of lidocaine are generally due to systemic toxicity. These reactions are observed with other amide local anesthetic agents. High plasma levels of lidocaine may result from high plasma levels of lidocaine and may result from high plasma levels of lidocaine.

**PRECAUTIONS**  
 General: The safety and effectiveness of lidocaine have been established in clinical trials. Adequate precautions should be taken for specific situations.

**“Lidocaine should only be used by those well versed in diagnosis & management of dose-related toxicity & other acute emergencies that might arise..... Immediate availability of oxygen, other resuscitative drugs, cardiopulmonary equipment & personnel needed for management of toxic reactions and related emergencies. ...delay in proper management ....can lead to death”**

5

**Furthermore.....**

- ✓ “Anticonvulsants (**IV barbiturate or benzodiazepine**)”
- ✓ “Atropine or ephedrine (**↑ pulse & BP**)”

“Should (or may) be available “

6

## Emergency Frequency in Dental Offices

### Anecdotal & Reported Statistics:

- One emergency every 1 – 2 yrs. per DDS: U.S. & Britain<sup>1,2</sup>
- 1000 dental office deaths: 2010 – 15: U.S.<sup>3</sup>
- DDS office death Texas. Reporter: 1 death every other day<sup>4</sup>
- 0.8 deaths / 1 mil. deep sed / GA dental cases in Ont.<sup>5</sup>

- Ellis et al, JADA, 1993
- Sin M, et al, Brit Dent J, Nov. 2023
- ADSA Pulse, May 2016
- Dallas Morning News, Dec. 2015
- Anes Prog, 66(3) 141-50, 2019

7

## Forgetting BLS Rescue Training

- Non-medical people begin forgetting in 2 months<sup>1</sup>
- MDs skills begin to decline in 1.5 months<sup>2</sup>
- Dentists “rapid” decline in skills in 5 months<sup>3</sup>
- Most grad dental students failed BLS test & could not do CPR after 6 months<sup>4</sup>
- Simulation training ↑s performance & learning<sup>5</sup>

- Einspruch E, et al, Resus 74:476-86, 2007
- Smith KK, et al, Resus 78:59-65, 2008
- Kentaro N, et al, Anes Prog 63:62-6, 2016
- Malamed S, Oral Health 2004
- Shimiza Y, et al, Anes Prog 68(2), 2021

8

## Survey of Dentists: Correct Use of Epinephrine

- Proportion who knew correct **dose** of epinephrine for anaphylaxis: **14%**
- Correct **route** of drug administration: **40%**
- Proper use of an epinephrine **autoinjector**: **27%**
- Which drug should be given first for anaphylaxis; **antihistamine, corticosteroid or epinephrine?**  
**Most said antihistamine then corticosteroid**

Goto T, Anes Prog, 70(2), 2023

9

## Ongoing Emergency CE Since School?

- 22%:** Have never taken an emergency course
- 24%:** Have never had office team emergency training
- Did dental / hygiene school teach you enough to be prepared for a medical emergency?  
**• 56%: Yes**

Wood J, et al, ADSA Pulse, Sept, 2021

10

## EMS Response Time, GTA

	2001	2002	2003	2004	2005	2006	2007
Toronto	11:29	11:15	11:16	11:31	12:17	11:56	11:58
Peel	11:03	11:13	11:43	11:23	11:50	12:15	12:10
York	11:58	11:36	12:21	11:48	12:25	12:35	13:04
Durham	11:34	11:25	10:56	10:41	10:33	10:30	10:34
Halton	9:51	10:01	10:11	9:56	10:05	10:20	10:30

11

## Emergencies In The Dental Office Survey

Emergency	n = 30608
Syncope	15,407
Mild Allergy	2,583
Angina	2,552
Postural Hypotension	2,475
Seizure	1,595
Asthma Attack	1,392
Hyperventilation	1,326
Epinephrine Reaction	913
Hypoglycemia	890

95%

Malamed S, et al, JADA 124:4-53, 1993

12

### Emergencies In The Dental Office Survey

Emergency	n = 30608
Cardiac Arrest	334
Anaphylaxis	304
Myocardial Infarction	289
Local Anaesthetic Overdose	204
Heart Failure	141
Unconscious Diabetic Emergency	109
Stroke	68
Adrenal Insufficiency	24
Thyroid Storm	4

5%

Malamed S, et al, JADA 124, 4-53, 1993

13

### Confidence Managing Emergencies

Emergency	Confidence (Out of 10)
Syncope	8.5
Angina	8.0
Cardiac arrest	7.9
Hypoglycemia	7.8
Hyperventilation	7.8
Asthma	7.8
Choking	7.7
Seizure	7.6
Anaphylaxis	7.5
Acute coronary syndrome	7.1
Adrenal crisis	5.1

Sin M, et al, Brit Dent J, 235, 721-6, 2023

14

- ### In Children
- Airway obstruction
  - Asthma
  - Allergy
  - Seizure
  - Hypoglycemia
- Practitioner mediated
- Local anaesthetic overdose
  - Sedation overdose
- All can lead to hypoxia

15

- ### When Do Emergencies Occur?
- Immediately before tx 1.5%
  - During or after LA 54.9%
  - During tx 22.0%
  - After tx 15.2%
  - After leaving office 5.5%
- Matsuura Anes Prog. 36:219-228, 1990

16

- ### Tx Performed During Emergency
- Extraction 38.9%
  - Root Canal 26.9%
  - Unknown 12.3%
  - C&B 7.3%
  - Restorative 2.3%
  - Incision 1.7%
  - Other 10.6%
- Matsuura, Anes Prog, 36: 219-228, 1990

17

75%

Of Dental Emergencies Are Related To Stress and Anxiety

18

## Level of Dental Fear

Question About Treatment	Frequency	%
Not afraid at all	703	63.9
A little afraid	228	20.7
Somewhat afraid	108	9.8
Very afraid	22	2.0
Terrified	39	3.5
Did not know answer	1	0.1

~15%

Chanpong et al Oral Health, Feb 2006

19

## Sources Of Endogenous Epinephrine

- Life stress
- Personality types
- Anxiety (dental phobia)
- Pain (inadequate local anaesthesia)

Endogenous epinephrine can ↑ 50 X during stress

20

## The Challenge:

- Some patients are anxious
- Some have health issues
- Dental treatment can be painful
- We may need LA with epi
- How can we be safe?

These can all ↑  
the risk of an  
emergency

21

## Avoiding Medical Emergencies

- Thorough med hx & assess vital signs
- Profound & comfortable LA
- Stress reduction protocol
- Being prepared
  - BLS + EMS
  - Office plan
  - Emergency kit

22

## 1. Medical History & Patient Evaluation



23

## The Medical History

Incomplete medical history evaluation increases the risk of a medical emergency.

How you ask the question, may change the answer you get.

24

ALL INFORMATION IS PRIVATE AND CONFIDENTIAL

Name: \_\_\_\_\_ Date of Birth: \_\_\_\_\_ Ht: \_\_\_\_\_ Wt: \_\_\_\_\_

Medical Doctor's Name, Address & Telephone \_\_\_\_\_

- Have you been hospitalized or had any operations? (Please list & date)
- Have you or your relatives had problems with sedation or anaesthesia, including malignant hyperthermia?
- List pills, medications, or non-prescription drugs/supplements (with dosage)
- Drug allergies or bad reactions (please list)
- Any other allergies (e.g. latex, eggs, metal, hayfever)



Dr. J. A. W. ... E. ...

Medication Reference:

Aspirin	81 mg	once daily
Statins	20 mg	once daily
Diuretics	12.5 mg	once daily
Beta-blockers	10 mg	once daily
ACE inhibitors	10 mg	once daily
Calcium channel blockers	30 mg	once daily
Insulin	10 units	twice daily
Antidepressants	20 mg	once daily
Antipsychotics	10 mg	once daily
Antibiotics	500 mg	twice daily
Antifungals	150 mg	twice daily
Antivirals	100 mg	twice daily
Anticoagulants	5 mg	once daily
Anticancer drugs	100 mg	once daily
Other	...	...

27% of adults over age 65 take more than 5 medications daily

Saunders, D. ODA Webinar Sept, 2018

25

26

Heart problems/Angina/irregular heartbeat	Sleep Apnea
High/Low blood pressure	Bleeding disorder or anemia
Diabetes/Hypoglycemia	Dizziness, nervous disorders
Asthma, Persistent cough, Tuberculosis	Epilepsy, seizures or convulsions
Joint replacement	Mental health
Temporomandibular joint problems	Bruise easily
Hepatitis, Jaundice, Liver disease	Wear contact lenses
Kidney disorders	Recreational drugs
Thyroid disorders	Smoker? Yes / No ; How much?
Gastric issues/Stomach bleeding/Ulcers	Alcohol consumption



27

7. Do you have any condition that could affect your immune system? (e.g. AIDS, HIV, leukemia)

8. Women: Are you pregnant? Yes / No Are you nursing? Yes / No

9. May we discuss your medical/dental treatment with your spouse, physician, parents, etc., if necessary? Yes / No

PATIENT/GUARDIAN SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

REVIEWED BY: \_\_\_\_\_ BP: \_\_\_\_\_ HR: \_\_\_\_\_ SaO<sub>2</sub>: \_\_\_\_\_ % Resp. rate: \_\_\_\_\_ ASA: \_\_\_\_\_

OTHER FINDINGS: \_\_\_\_\_



28

### Who Is At Risk?

- Medical history "red flags":
  - Angina and/or MI history
  - Stroke history
  - Abnormal blood pressure or pulse
  - Asthma and chronic respiratory diseases
  - Diabetes
  - Seizure disorders
  - Allergy

29

### Medical History Considerations

- Need current medication reference book or online source
- Most common lie: Drug use
- Surgical fitness evaluation
  - MD advises tx risk
  - May require tests
  - Buck stops where tx occurs

30

## Lifetime Illicit Drug Use By Canadians

Drug	% Population
Cannabis	46.6
Hallucinogens	14.8
Cocaine / Crack	10.4
Ecstasy	7.6
Speed / Meth / Crystal Meth	3.7
Heroin	0.7

In 2017

Web source: Statista, Feb 2020

31

## Cannabis Study:

- Survey in hospital after MI or stroke
- Ages 40 – 60 yrs. who smoked cannabis:

5 X ↑ risk for an MI or stroke within 1<sup>st</sup> hour of use

Beth Israel Deaconess Medical Centre, 2001

32

## ASA Physical Status Classification

ASA I: Healthy

ASA II: One mild systemic disease, no effect on lifestyle:

- Mild asthma
- Well – controlled NIDDM
- Controlled epilepsy
- BP 140-160 / 90-95
- > 60 years old
- Anxiety

33

## ASA Classification

ASA III: Severe systemic disease, limits activity, not incapacitating:

- Exercise – induced asthma
- Well – controlled IDDM
- Stable angina
- > 6 months post MI or CVA, & no residual effects
- BP 160-200 / 95-115

34

## ASA Classification

ASA IV: Incapacitating disease, constant threat to life

- Uncontrolled IDDM
- Unstable angina
- MI or CVA < 6 months ago
- BP > 200 / 115
- Cannot walk up one flight of stairs

35

## Remote Offices & ASA IV's

- ↑ likelihood for GP treatment in remote areas:
- Fewer OMFS or DA offices
- Fewer hospital dental facilities
- Less or no access to OR time for OMFS

36

## ASA Classification

- ASA V: Moribund, won't survive 24 hrs.
- ASA VI: Brain – dead, a donor patient
- ASA E: Emergency operation of any kind; E precedes ASA #
- There is a "P" system
- "Standard of Care" for all sedation modalities

37

## Vital Signs

- Blood Pressure
- Heart Rate and Rhythm
- Respiratory Rate
- Temperature
- Height
- Weight

38

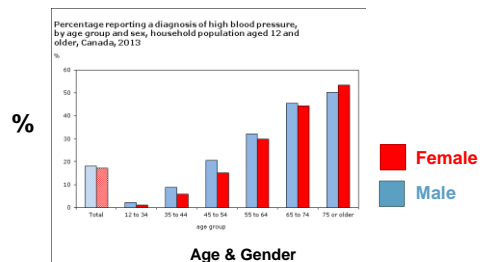
## I. Blood Pressure

- Worldwide prevalence ~ 1 billion
- Causes 7.1 million deaths / yr. worldwide
- ~45% of U.S. adults\*
- ~6 million Canadians are hypertensive (~20%)
- 5 million on BP meds

\*Yarows, SA., JADA 151(4), 239-44, Apr 2020

39

## Hypertension By Age & Gender In 2013



Statistics Canada Website, 2016

40

## Hypertension Risk Factors (Adults) & Kids

- (Smoking)
- (Excessive alcohol)
- Obesity
- Sedentary lifestyle
- Stress e.g. white coat syndrome / dental anxiety
- Cardiac disease
- Diabetes Mellitus
- Obstructive sleep apnea syndrome
- Uncontrolled kidney or thyroid disease

41

## Why Should A Dentist Check BP?

- 20-25% of Canadians have hypertension
- 40% don't know
- 40% aware but not controlled below 140/90
- ∴ only 20% aware & controlled well
- Frequency of DDS vs. MD visits, especially post - Covid

42

systolic: amount of work by heart  
diastolic: condition of heart

43

## Blood Pressure

Measuring the pressure required to collapse the brachial artery

BP >  $\frac{140}{90}$  = Hypertension\*

If diabetic use >  $\frac{130}{80}$

\*Hypertension Canada, 2017

44

## In U.S., Hypertension is 130/80. Why?

• If systolic goes from 120 to 130, risk of:

- Heart attack
- Stroke
- Heart failure
- Kidney failure

Doubles!

American Heart Assoc. Guidelines for Hypertension, Nov., 2017

45

## Current AHA Guidelines on BP

1. Critical emphasis on **nutrition & exercise**
2. Teaching proper **home monitoring**
  - Approved device
  - When & how to measure
  - How to calculate mean values

“With this, ~70% of newly diagnosed hypertension will be **manageable without medication**”

Am Heart Assoc. & Am College of Cardiology, Nov. 2017

46

## Current BP Classification

Category	Systolic BP	Diastolic BP
Normal	< 120 and	< 80
Prehypertension	120 – 139 or	80 – 89
Hypertension Stage 1	140 – 159 or	90 – 99
Hypertension Stage 2	> = 160 or	> = 100

US Department of Health and Human Services, 2011

47

## Explanation

- **Prehypertension**
  - Not a disease category
  - May be at risk for Stage 1
  - Lifestyle changes
- **Stage 1 Hypertension tx with one drug:** Usually thiazide diuretic
- **Stage 2 usually 2 drugs needed:** diuretic + a drug from another class

48



## BP Medications; Examples

- Thiazide Diuretics
  - chlorothiazide, microzide...
- Beta Blockers
  - corgard, inderal, tenormin...
- ACE Inhibitors
  - vasotec, accupril, altace...
- Calcium Channel Blockers
  - norvasc, cardizem, adalat...

Take on  
treatment  
day

49

## Whose BP Should We Take?

- All new adult patients?  
**Or:**
- All visits for those with h<sub>x</sub>?
  - Hypertension
  - Cardiovascular disease
  - Stroke
  - Conditions where BP may be affected
    - e.g., obese, kidney disease, diabetes, anxiety, OSA...

50

## Would You Measure Her BP?

- 59 yrs. female, 120 lbs, ASA 1?
- Vitals: **BP 210/160, pulse 130**
- Previously not tachycardic or hypertensive
- Feels "heart racing"
- Goes to MD, cannot finish stress test
- Holter monitor
- MD says okay for dental tx (needs RCT)

Would you treat her?

51



52

## MD Standard BP Measuring Protocol

- Sitting, back straight, feet on floor
  - Difficult in dental chair?
- Correct size cuff
- Calibrated

Muntner P, et al, Hypertension, 73(5), 2019

53

## Precautions

- Arm at heart level & at rest
- Arms may differ **5 – 10 mm Hg (left higher)**
  - No more than that. Use higher #
- Sleeve forming tourniquet
- Rest before measuring (~ 5 min.)
  - No caffeine, exercise, stress: **30 min. before**
- Cuff too small: High readings
- Cuff too big: Low readings

54

## Summary: Can We Treat If Hypertensive?

- ⊙ Medical history (recent MI...)
- ⊙ Urgency of treatment
- ⊙ Are they on BP meds?
  - Did they take them on day of tx?
- ⊙ Last MD visit
- ⊙ Symptoms present
- ⊙ Functional capacity:

55

## Functional Capacity

### Can you:

- ⊙ Do light housework: Dusting, washing dishes...?
- ⊙ Climb a flight of stairs?
- ⊙ Walk one block?
- ⊙ Run a short distance?
- ⊙ Golf, bowl, dance, throw a baseball?

**YES to one: Can manage stress of dental visit**

Yarows SA., et al, JADA 151(4), 239-44 Apr, 2020

56

## Uncontrolled Chronic Hypertension vs. Hypertension Emergency?

- ⊙ Association with end-organ damage:
  - Cardiovascular
    - e.g. MIs, acute heart failure, aortic dissection
  - Brain
    - e.g. stroke
  - Kidney
    - e.g. acute renal insufficiency
  - Eyes
    - e.g. retinal hemorrhage

57

## In-Office BP Management

ASA	Blood Pressure	Management
I	< 140/90	No special care
II	140-160/90-100	Reassess at next visit Possible monitor BP, refer to MD
III	160-180/100-110	Refer to MD Monitor BP
III-IV	180-200/110-120	No elective tx, refer to MD ASAP Emergency care with BP monitored
IV	>200/120	MD stat 911 if symptomatic

58

## Letter to Physician

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Blood Pressure: \_\_\_\_\_

Arm: \_\_\_\_\_

Position: \_\_\_\_\_

Dr. David Isen 416-498-8484



59

## II. Heart Rate & Rhythm

HR < 60 Bradycardia

HR > 100 Tachycardia

Child: 60 - 110

Regular vs. Irrregular

60

## Pulse Locations

Central Pulses	Peripheral Pulses
Femoral	Radial
Brachial (infants)	Dorsalis pedis (top of foot)
Carotid (older kids & adults)	Posterior tibial (medial ankle)
Axillary	

61

## Tachycardia Causes:

- ⊙ Anxiety, stress, exercise
- ⊙ Infection, fever
- ⊙ Anemia
- ⊙ Dehydration, electrolyte imbalance
- ⊙ ↑ BP
- ⊙ Hyperthyroidism
- ⊙ Smoking, excess alcohol, caffeine, rec. drugs
- ⊙ Some medications
- ⊙ Abnormal congenital electrical pathways
- ⊙ Damage to heart from heart disease

62

## Bradycardia Causes

- ⊙ Athlete
- ⊙ Normal aging of the heart
- ⊙ Hypothyroidism
- ⊙ Medication side effect
- ⊙ Some inflammatory diseases (e.g., lupus)
- ⊙ Damage to heart from heart disease
- ⊙ Congenital heart disorder

63

## Cardiac Dysrhythmias

- ⊙ Medical consultation
- ⊙ **911** if associated with:
  - Dizziness
  - Light headedness
  - Syncope
  - Weakness

**No elective treatment**

64

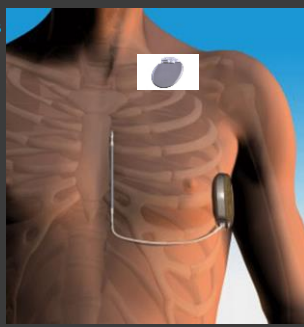
## Implantable Electronic Devices

### 1. Pacemaker

Brady - arrhythmias (e.g., heart block or bradycardia)

### 2. Cardioverter - Defibrillator

Tachy - arrhythmias (shock if V-tac or V-fib). Can also pace



65

## CIEDs

- ⊙ 500,000 in North America<sup>1</sup>
- ⊙ 21,000 placed in Canada 2014<sup>2</sup>
- ⊙ **Should be checked every 6 months**
- ⊙ Electrodes to heart or under skin
  - To 1 or multiple chambers
- ⊙ Device sends info remotely to manufacturer
- ⊙ Most have protective shield from electromagnetic interference

1. Roedig JJ, et al, JAMA, 141(5):521-6, 2016  
2. Globe & Mail, Apr, 2017

66

## Recommendations:

- Literature disagrees
- **Interfering devices can be cumulative**
- Turn off interfering devices if not needed
- EMI devices as far away as possible (at least 8 inches)
- **\*\*Epinephrine induced tachycardia can set off an ICD\*\***
- MD assessment before dentistry

67

## Can I Use A Vasoconstrictor?

Is epinephrine ever absolutely contraindicated?

**ASA III vs. ASA IV**

68

## Functions Of The Vasoconstrictor

- **Delays absorption** of LA
  - ↓ toxicity
  - ↑ duration
    - No advantage with more than 1:200,000
- **Surgical hemostasis**
  - ↑ concentration is advantageous

69

## Epinephrine Receptor Actions

	Strength	Action	Result
$\alpha$	+++	Vasoconstriction of local, small submucosal vessels	↑ SBP
$\beta_1$	+++	Cardiotropic: Stimulate receptors in SA node & heart muscle	↑ HR, Contractility & ↑ SBP
$\beta_2$	++	Vasodilation of large peripheral arteries (due to systemic absorption) & Bronchodilation	Slight ↓ DBP*

\*Minor change in MAP with smaller epi doses  
With large epi dose:  $\alpha$  predominates = ↑ DBP & SBP

70

## Epinephrine Drug Interactions

- **MAO Inhibitors**
- Cannabis
- Tricyclic Antidepressants
- Cymbalta
- Atomoxetine, Vyvanse
- Diet meds
- Decongestants
- Thyroxin
- Cocaine & Methamphetamines (for 24 hours)
- **Beta blockers**

71

## Beta Blockers

✓ Indications:

- Blood pressure
- Heart failure
- Angina
- Migraines
- Glaucoma
- Panic disorders

72

## Beta Blockers

- Cardioselective:
  - acebutolol: Monitan, Rhotral, Sectral
  - atenolol: Tenormin
  - metoprolol: Betaloc, Lopressor
- Noncardioselective (older agents):
  - nadolol: Corgard
  - oxprenolol: Trasicor
  - pindolol: Visken
  - propranolol: Inderol
  - sotalol: Sotacor
  - timolol: Blocadren, Timoptic

73

## Epinephrine + $\beta$ -Blockers

	Cardioselective	Non-cardioselective
$\beta_1$	<del>Cardiotropic</del>	<del>Cardiotropic</del>
$\beta_2$	Vasodilation	<del>Vasodilation</del>
$\alpha$	Vasoconstriction	Vasoconstriction

Severe **hypertension with reflex bradycardia** leading to potential stroke or cardiac arrest

74

## Vasoconstrictor Concentrations

- 1:100,000 means 1 g / 100,000 ml
- $$\frac{1 \text{ g}}{100,000 \text{ ml}} = \frac{1000 \text{ mg}}{100,000 \text{ ml}} = \frac{0.01 \text{ mg}}{1 \text{ ml}}$$
- 1.8 ml has **0.018 mg** of epinephrine (~20  $\mu\text{g}$ )
  - 1:50,000** has double (0.036 mg ~ 40  $\mu\text{g}$ )
  - 1:200,000** has half (0.009 mg ~ 10  $\mu\text{g}$ )

75

## Vasoconstrictor Maximum Dose

	mg/ml	mg/1.8ml	# Of Cartridges	
			Healthy	Cardiac Impaired
<b>1:20,000 Levo</b>	0.5	0.09	(11)	<b>Do not use</b>
1:50,000 Epi	0.02	0.036	5	1
1:100,000 Epi	0.01	0.018	(11)	2
1:200,000 Epi	0.005	0.009	(20)	4

Epi MRD for **healthy** 70 kg adult = **0.2 mg**  
 Epi MRD for **cardiac impaired** (ASA III) = **0.04 mg**

76

## Reasons To Limit Epi to 0.04mg

- Moderate – severe hypertension
- Hyperthyroidism**
- Uncontrolled, symptomatic dysrhythmias
- Angina
  - ASA III vs. ASA IV**
- Recent MI, angioplasty, stents, bypass
- CHF
- Certain drugs
  - Tricyclics, Strattera,  $\beta$  blockers, Cymbalta**

77

## Final Word On Epinephrine

- Advantages usually outweigh side effects.**
- Use minimal possible dose
- Only absolute contraindication: Uncontrolled hyperthyroidism**
- Watch additive effect of **endogenous + injected** epi.
- Watch **levonordephrine**
- Avoid epi **retraction cords** in cardiac patients (Blood levels can exceed **0.2 mg**)\*

Santos L., Oral Health Feb, 2024

78

### III. Respiratory Rate

Normal rate:

12 – 20 breathes / min  
(children faster)

79

### Respiratory Considerations:

- ⊙ Anxiety, stress
- ⊙ Asthma
- ⊙ Smoking
- ⊙ Other respiratory disease: COPD, OSA...

80

### Respiratory Anatomy

- ⊙ Snoring
- ⊙ Tonsil hypertrophy
- ⊙ Obesity
- ⊙ Short, large neck
- ⊙ Anatomic airway shape
  - Retrognathic mandible, some genetic syndromes

\*Pare et al, Adv Cardio, 46:1-42, 2011

81

### Signs of Respiratory Distress

- ⊙ ↑ respiration rate (tachypnea)
- ⊙ ↑ or ↓ respiratory effort
  - Nasal flaring, chest retractions, body position
- ⊙ Use of abdominal muscles
- ⊙ Abnormal airway sounds
  - Stridor, wheezing, grunting
- ⊙ Tachycardia
- ⊙ Pale, cool, blueish skin or lips
- ⊙ Agitated → semi-conscious

82

### OSA Risk Assessment : STOP-BANG

OSA	Question
S	Do you Snore?
T	Are you Tired?
O	Do you have Obstructive breathing?
P	Do you have high blood Pressure?
B	Is your Body mass index (BMI) >35
A	Is your Age > 50?
N	Is your Neck size >16?
G	Is your Gender male?

83

### STOP BANG

Score:

- ⊙ 5 – 8 yes = high risk for OSA
- ⊙ 3 – 4 yes = moderate risk for OSA
- ⊙ 0 – 2 yes = low risk for OSA

84

## Avoiding Medical Emergencies

1. Thorough med hx & assess vital signs
2. **Profound and comfortable LA**
3. Stress reduction protocol
4. Be prepared
  - a) BLS+ EMS
  - b) Office plan
  - c) Emergency kit

85

## ↑ Numbness = ↓ Pain

- **Gauge** of needle
  - **Aspiration**, 30 gauge & breakage
- **Quality & re-used** needles
- **pH** of anaesthetic
  - Plain vs. vaso, buffering with Onset or Anutra
- **Speed & area** of injection

86

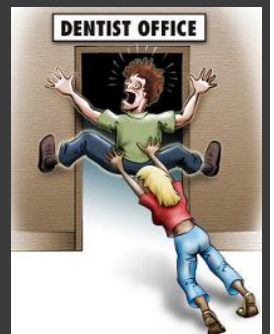
## Avoiding Medical Emergencies

1. Thorough med hx & assess vital signs
2. Profound and comfortable LA
3. **Stress reduction protocol**
4. Be prepared
  - a) BLS+ EMS
  - b) Office plan
  - c) Emergency kit

87

## 3. Stress Reduction Protocol

- Recognize signs of anxiety
- Minimize waiting
- Early morning appointment
- **Verbal anaesthesia**



88

- Get personal
- Easy, quick procedures first
- Go slow or go fast
- Hide scary instruments
- Tell – show – do?
- Distraction aids
- Refer? DA, OMFS, hospital



89

## Using Anxiolytics

- Ensure compliance with **Standards of Care**
- Must have appropriate reversal agents
  - Flumazenil & / or naloxone
- Understand pharmacology of agents including nitrous oxide, benzodiazepines, opioids

90

## Anxiolytics For Adults

- Nitrous oxide
- Alprazolam
- Diazepam
- Lorazepam
- Temazepam
- Triazolam

-Watch for drug interactions & liver function!  
-Beware of multi-dosing. Cannot exceed MRD

91

## Suggested Oral Dose (RCDSO)

### Adult ASA I & II

Minimal Sedation	Moderate Sedation
<b>Tx Less Than 2 Hrs:</b> triazolam 0.125 - 0.25 mg	<b>Tx Less Than 2 Hrs:</b> triazolam 0.375 - 0.5 mg
<b>Tx Longer Than 2 Hrs:</b> triazolam 0.25 mg OR diazepam 10 - 15 mg OR temazepam 15 mg	<b>Tx Longer Than 2 Hrs:</b> triazolam 0.5 mg OR diazepam 20 - 30 mg OR temazepam 30 mg
<b>Tx Longer Than 3 Hrs:</b> lorazepam 0.5 - 1 mg OR alprazolam 0.25 mg	<b>Tx Longer Than 3 Hrs:</b> lorazepam 2 - 3 mg OR alprazolam 0.50 mg

RCDSO Dispatch Nov/Dec 2014

92

## Anxiolytics For Children

- Nitrous oxide
- Oral midazolam (0.2 - 0.7 mg/kg, max 20 mg)
  - Shortest half - life
  - Intranasal (0.3 - 0.5 mg/kg)
  - 10% paradoxical reaction
- Hydroxyzine

93

## Hydroxyzine

- E.g. Atarax, Vistaril
- Antihistamine
  - Antiemetic, anti - sialogogue
- 1 mg/kg
- 30 - minute onset
- Half - life 2 hours

94

## Flumazenil (Benzodiazepine Antidote)

- An IV emergency drug given in incremental doses
- 0.2 mg IV per min. until overdose reversed. Max = 1 mg
- Shorter half-life than benzo. Onset 5 - 10 min.
- So, keep in office for 2 hrs.
- If no IV, try both deltoids. This is off - label. (No scientific evidence)
- Oxygen, airway, 911 paramount



95

## Flumazenil - Pediatric

- 1 - 17 yrs.
- Initial dose: 0.01 mg/kg IV (max is 0.2 mg)
- Repeat 0.01 mg/kg every min. (up to max 0.2 mg per min.)
- Total max cumulative dose 0.05 mg/kg (up to max 1 mg)
- Can we use each deltoid?

96



## Flumazenil Contraindications

- Chronic benzodiazepine therapy
- Seizure disorders
- Alcoholics (could cause withdrawal symptoms)
- Panic disorders
- Age < 18 y.o.
  - "The safety & effectiveness of flumazenil on those under 18 yrs. has not been established"

\*Flumazenil product monograph - Roche

97

## Naloxone (Opioid Antidote)

	IV	IM / SC
Onset	2 min	10 min
Duration	30 min	1 – 4 hrs
Adult Dose	0.1 mg q 2–3 min	0.4 mg q 5 min x2

- Supplied as 0.4 mg/ml or 1 mg/ml
- Nasal spray available (4 mg dose)
- 911 and ABC / CAB



98

## Intranasal Naloxone. Single dose



99

## Naloxone or Flumazenil First?

- Respiratory depression usually caused by opioid
- Naloxone better reverses respiratory depression
- \*\*\*Give Naloxone first

100



101

## TOPICS

- PATIENT ASSESSMENT
- P, ABC / CAB, D
- EMERGENCY DRUGS
- EMERGENCY ALGORITHMS

102



103

**ADSA App:  
Ten Minutes Saves a Life**



- Can be a practice tool
- Calculates drug dose by wgt.
- Dexterity with hand – held devices

104



105



106

**Basic Life Support**

- o SCA most likely to occur at home (on Sunday night)
- o So, rescue is likely on someone familiar
- o But **only 30%** bystanders try a rescue!
- o Why?

107



108

## Bystander Apathy

- Fear of hurting someone
- Don't know what to do, panic
- Embarrassed in a crowd
- HCP: Fear of catching something

109

## SCA In Women: ↓ Survival

- Females less likely to be resuscitated with an AED by a bystander
- Females less likely to receive chest compressions by a bystander
- Shockable rhythms disappear faster in women
- Elderly females more likely to live alone

Tan, H., European Heart J, May 2019

110

## Cardio - Pulmonary Resuscitation

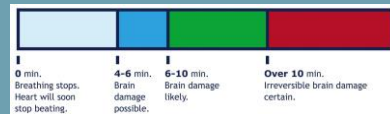
- THE PURPOSE:
  - Not to revive the patient
- 1. Chest compressions + AED, ASAP
- 2. Prevent cerebral hypoxia
- 3. Buy time until EMS arrives

111

## What Happens Without O<sub>2</sub>

- When heart stops, oxygen is not circulated
- Within 4 min. brain damage begins (clinical death)
- Within 10 min. brain death occurs (biological death)

How long will EMS take to arrive?



112

## Cardiac Arrest Likely Due To:

- Adults: Secondary to coronary artery disease
- Children: Secondary to respiratory failure leading to shock (poor tissue perfusion) which then causes cardiac arrest (H's & T's) (ABC better in kids)
- E.g., dehydration, infection, anaphylaxis

113



1. Immediately recognize arrest & EMS activation
2. Early CPR: Emphasize chest compressions
3. Rapid defibrillation
4. Effective advanced life support
5. Integrated post-cardiac arrest care

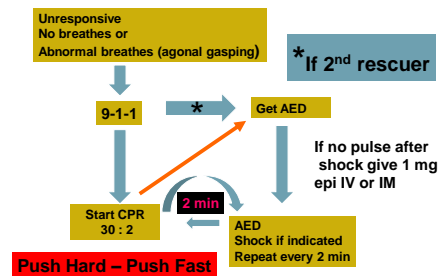
114

## Visual Signs of Cardiac Arrest

- Diaphoresis
- Cold skin
- Pale, grey colour
- Blue lips
- Agonal breathing
- Reflex movements
- Good clues for those not checking pulse

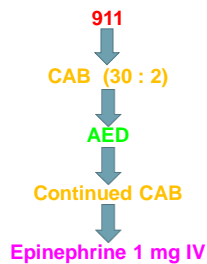
115

## Simplified Adult BLS



116

## Simplified Cardiac Arrest Algorithm



117

## AHA BLS Guidelines, 2020 Changes

	Old	New
Compression Rate	At least 100 / min.	100 – 120 / min.
Depth	5 cm or 1/3 AP chest thickness	5 – 6 cm or 1/3 AP chest thickness
Assessment	Breathing & pulse check separate	HCP check pulse & breathing same time
When To Call EMS	Witnessed: Right away Unwitnessed: After 1 round of CAB	With cell phone simultaneous to rescue. Try to remain on scene

118

## ABC or CAB?

### Rationale:

- What saves lives in adult SCA?  
Chest compressions + early defib
- CAB = faster delivery of compressions
- B delay minimal: Only ~20 sec (after 1<sup>st</sup> 30 compressions)
- Residual O<sub>2</sub> in lungs?
- Over – inflate lungs: ↓ compression effectiveness
- Similar hospital discharge survival:
  - Compressions only vs. compressions + ventilations

119

## ABC or CAB in Pediatric Rescues

- Cardiac arrest in pediatric emergencies usually due to respiratory arrest
- B is more important in children

120

## C Circulation

- Carotid pulse:
  - Groove between trachea & neck muscles
  - Use 2 or 3 fingers
  - Same side
- Only Health Care Providers
- Start chest compressions ASAP



121

## Landmark

- No longer using rib cage
- Expose chest, look for **lower half of sternum**
- In some people, between nipples
- From armpits, slide hand across to midline

122

## C Ratio of Compressions : Breaths

**30:2**

Adult, child & infant

Unless 2 HCP rescuers for child & infant.  
Then **15:2**

123

## C High Quality Compressions: Depth

	Adult	Child	Infant
Old	1.5 – 2 inches	1 – 1.5 inches	0.5 – 1 inch
New	1/3 A – P chest thickness (5 - 6 cm)	1/3 A – P chest thickness	1/3 A – P chest thickness

**1/3 chest thickness for everyone**

124

## Maximize Compression Effectiveness

- Hard surface
- Palm on lower 1/2 of sternum, elbows locked
- Compression rate **100 – 120 / min. Rate ap.**
- Correct depth
- Chest fully recoils**
- Avoid fatigue, rotate compressors every 2 minutes
- Do not over – ventilate**
- ~60% of rescue should be on C**
- Minimize **C** interruptions

125

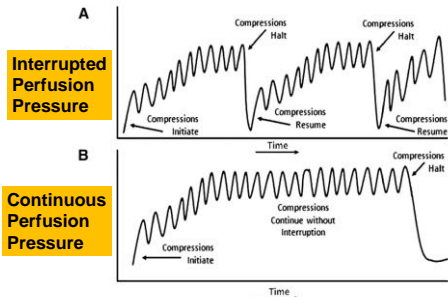
## Muscle Fatigue During Chest Compressions

- Electromyography study on back muscles
- Young healthy subjects
- Muscle fatigue starts in **2 minutes**
- Impairment mostly in **depth**, not frequency

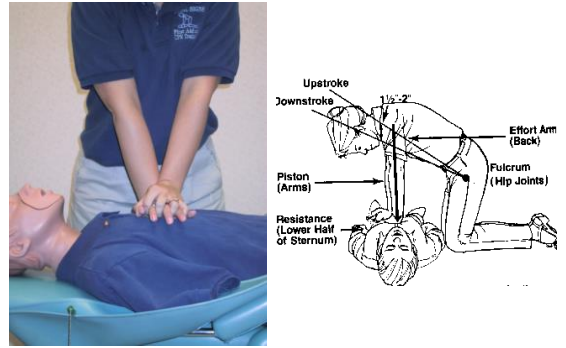
Cobo-Vázquez et al, Anes Prog, 65(1), 30-7, 2018

126

Perfusion During Cardiac Arrest with Chest Compressions



127



128



129

**Position For (2<sup>nd</sup>) & 3<sup>rd</sup> Trimester**

In supine, uterus pushes on **aorta & inferior vena cava**. This could ↓ venous return to heart & ↓ BP.

- "Left lateral displacement"
  - Pillow under right hip
  - Raise ~ 10 – 12 cm or ~ 30°
  - More effective compressions

130

**Child:**

One or two hands?

- Size of child
- Strength of rescuer
- 1 or 2 rescuers
- 30:2 or 15:2



131

**Child & Infant Chest Compressions**

- Normal pulse child 4 – 8 yrs: ~ 80 – 120 bpm
- < 60 is bradycardia
- Unstable child & pulse < 60, must do chest compressions:
  - Hypotension if: **Systolic is < 70 + (age x 2)**
  - AMS
  - Signs of shock
- Cardiac arrest is imminent
- Watch out for athletic children

132

## Two Thumb – Hand – Encircle Technique

Suggested when **2 rescuers**

↑ blood supply to heart

Better control of depth & force

Less fatigue



133

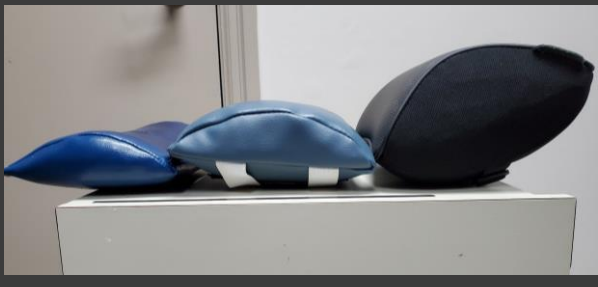
## A Airway

● **Check:** Shake and Shout

● **Do:** Head – tilt – chin – lift

134

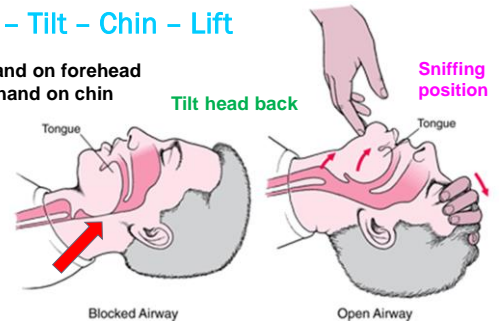
## Neck (Airway) Support



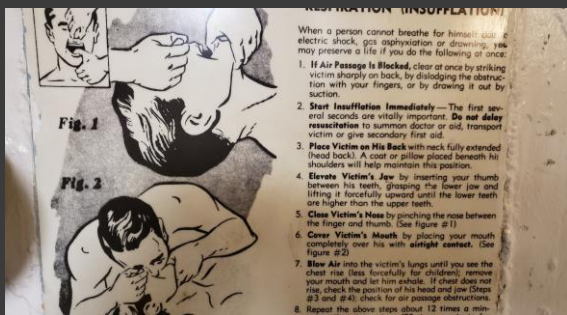
135

## Head – Tilt – Chin – Lift

- One hand on forehead
- Other hand on chin



136



137

## B Breathing

● **Check:** Used to be: Look, listen and feel  
Now: **Look for chest rise & fall**

● **Do:** Used to be: Give 2 breathes  
Now: **Start chest compressions**

138

## Choking

- "We are built to choke"
- We are the only primates that can breathe & eat through same tube
- 5000 people choke to death on food every year (U.S.)
- 4<sup>th</sup> highest cause of accidental death
- Numb tissue, ↑ risk of choking

Bryson, B., "The Body", 2019

139

## Airway Obstruction

- Dental instruments
- Restorative materials, crowns
- Teeth
- Blood
- Vomitus
- Water
- Anaphylaxis
- Asthma



140

## Conscious, Mild Obstruction

- Breathing and talking:
- Encourage coughing

141

## Conscious, Severe Obstruction

- No breathe sounds, can't talk:
- Abdominal thrusts (Heimlich Manoeuvre)
- Back blows only for infant
  - (They work for adult but awkward)



142

## Conscious, Severe Obstruction Adult Abdominal Thrusts (Heimlich):

- Lean person back
- Rescuers leg between victims
- Fist with thumb tucked in
- Forearms between iliac crest and rib cage
- Turn fist in towards umbilicus
- Cup other hand over fist
- Inwards (not J) abdominal thrusts
- Repeat until not choking or unconscious

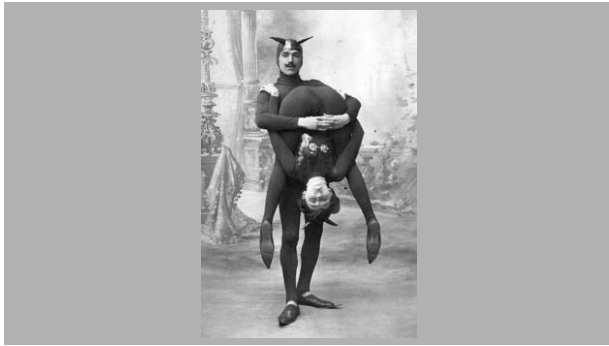
143



© 2018 Healthline

144





145

**Conscious, Severe Obstruction:**  
**Special Considerations**

- ◉ **Alone, choking**
  - Back of chair
  - Hard object
- ◉ **Pregnant**
  - Victim, back against wall, **compress chest**
- ◉ **Victim too large / rescuer too small**
  - Wrap arms around victim's chest instead
  - Victim back against wall, **compress abdomen**

146

**Conscious, Severe Obstruction Child**  
**Abdominal Thrusts (Heimlich):**

- ◉ Rescuer kneels
- ◉ Lean child back
- ◉ Fist with thumb tucked in
- ◉ One forearm between **iliac crest & rib cage**
- ◉ Turn fist in towards umbilicus
- ◉ Inwards abdominal thrusts
- ◉ **Repeat until not choking or unconscious**

147



148

**Conscious, Severe Obstruction Infant**

- ◉ Get close to floor (baby may drop)
- ◉ Cradle infant, head pointing down
- ◉ Two fingers on sternum, do **5 chest thrusts**
- ◉ Flip baby over (hold tight) – head still down
- ◉ **5 back blows**
- ◉ **Repeat until not choking or unconscious**

149



150

## Age

- ◉ Infant: Birth to 1 yr. old
- ◉ Child: 1 yr. old to puberty
- ◉ Adult: Puberty and older



151

## Unconscious Choking Adult

- ◉ 911
- ◉ Slowly slide victim down
- ◉ Protect head & your back
- ◉ Check mouth: Remove object if visible
- ◉ 1 breath
- ◉ Reposition head – 2<sup>nd</sup> breath
- ◉ 30 chest thrusts, same as chest compressions
- ◉ Check mouth
- ◉ Try 2 breaths with reposition
- ◉ Repeat until air into lungs or EMS arrives
- ◉ If air goes in, check pulse. Then CAB

152

## Unconscious Choking Child

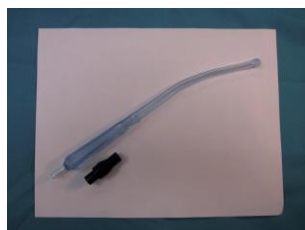
- ◉ 911
- ◉ Same steps as adult
- ◉ Heel of one hand only for chest thrusts
- ◉ Repeat until air into lungs or EMS arrives
- ◉ If air into lungs, check pulse. Then ABC

153

## Unconscious (Limp) Choking Infant

- ◉ 911
- ◉ 5 back blows
- ◉ 5 chest thrusts
- ◉ Check mouth
- ◉ Try 2 breaths (with reposition)
- ◉ Repeat until air goes in, or EMS arrives
- ◉ If air goes in, check pulse. Then ABC

154



Vented &  
Non-vented



155

## LifeVac

- ◉ Patented, FDA & HC approved
- ◉ If abdominal thrusts fail
- ◉ One-way valve, negative pressure, sucks out blockage

“PLACE, PUSH, PULL”



156

## LifeVac

- Home kit ~\$100 Amazon
- Adult & pedo sized masks
- Can be self-administered
- Disposable



157

## D: Definitive Diagnosis

### CHECK:

Render a **D**agnosis

### DO:

**D**rugs and / or **D**efibrillation

158

## Sudden Cardiac Arrest

- Sometimes no signs or symptoms (adults)
- Hypertension** before SCA may be asymptomatic
- Sometimes **angina** or **MI** previously
- Remember agonal breathing and muscle contractions

159

## Sudden Cardiac Arrest

- 400,000 die of SCA in U.S., 40,000 in Canada
- Every 7 min.** a death from SCA or stroke in Can.
- 60-70% occur outside of a hospital
- Surviving SCA outside hospital **~8% (with CPR)**
- Immediate shock: Chance of survival ~73%**
- Survival **↓ 10%** every minute shock is delayed
- After shock, start CPR immediately**

160

## SCA Survival Rate vs. Defib Delay

Time to Defibrillate (min.)	% Survival
1	90
2	80
3	70
4	60
5	50
6	40
7	30
8	20
9	10
10	0

Heart & Stroke Foundation, 2015, ACLS Manual

161

## Automated External Defibrillator

- AED
- Automated:** Device reads heart rhythm
- External:** Electrodes on outside of chest
- Defibrillator:** Takes away fibrillation
  - Work best in conjunction with CPR
  - Fully automatic vs. semi-automatic

162

## Defibrillators In Dentistry

- Several states have passed laws requiring AEDs in dental offices
- Dental magazines advertise different AED models
- Costco

163

## Defibrillation Sequence

- CAB: Chest compressions ASAP
  - (If **VF**, **initial compressions** may give heart O<sub>2</sub> + energy. ↑ chance AED will work)
- Retrieve AED ASAP
- Attach leads: Shock if indicated
- **Resume CPR**
- Repeat every 2 minutes

164

## ECG Tracings With No Pulse

1. Asystole (flat line)



2. Pulseless electrical activity (PEA)

- From major blood loss, hypothermia (**H's and T's**)

More common in children



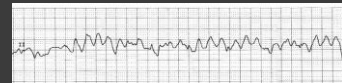
165

## Rhythms With No Pulse

3. Pulseless ventricular tachycardia



4. Ventricular fibrillation



166

## AEDs

- Reputable company, good warranty (5 – 7 yrs.)
- Non-proprietary batteries with long shelf life
- Easy to use
- Adult & child use (pedo pads for 1 – 8 yrs.)
- Metronome guide compression rate, 100/min
- Recommended by RCDSO
  - **Only mandatory Quebec**
- About 1000x the energy of a taser

167

### Heart Start



### Power Heart



### Heart Stream



### Zoll



Price range  
\$800 - \$4000

168

## Using An AED

- Drone delivery?
- Remove from **wet** surfaces, snow & ice okay
- Beware of **metal** surfaces
- Open and turn on
- Place pads:

169

## Prepare The Chest

- Remove or cut off clothing
  - Bra wire conducts electricity
- Shave? **Need shaver**
- Remove jewellery, medication patches?
- Dry skin. **Need rag**
  - Diaphoresis common in cardiac arrest
- Avoid direct contact with ICDs but use is OK

170

## Pad Placement

- Recorders & shock delivery
- Metal foil & sticky gel (can dry out)
- 1. **Upper right sternal boarder:**  
Directly below clavicle
- 2. **Lateral & below left nipple:**  
Top of pad below axilla
- Adult & pedo size



171

## AEDs In Children

- Not usually needed in pediatric cardiac arrest
  - Kids don't have CAD. **Vfib & pVT are rare**
  - Usually **PEA or asystole (H's & T's)**
  - After 1<sup>st</sup> shock, **chest compressions important**
- Children 1 – 12 yrs.
- Pediatric pads **or**
- Dose attenuator (**reduces dose by ~ ⅓**) **or**
- Pads anterior – posterior

172

## Pediatric Pads

- 1 to ~ 12 years old
- 10 kg → 25 kg
- Most go A – P (check diagram)
- If no pedo pads, use adult A – P
- Pads no closer than **2 inches**

Infant may need manual defib



173

## AED Maintenance

- AEDs perform daily, weekly **self-checks**
- Owner's manual (keep with device)
  - Dictates maintenance required
- Battery
  - **Shelf-life** date on battery
  - 2 – 5 yrs. Replace after that
- Pads
  - **Shelf-life** date on package
  - 2 – 4 yrs. Replace after that
  - Have spare pads

174

## Other Situations To Contemplate

- ⦿ Fire
  - Smoke detectors, exit, using extinguisher
- ⦿ Power failure
  - Battery operated suction, monitors
- ⦿ Angry, hostile patient
- ⦿ Drunk, drug induced behavior
- ⦿ Incapacitated team leader

175

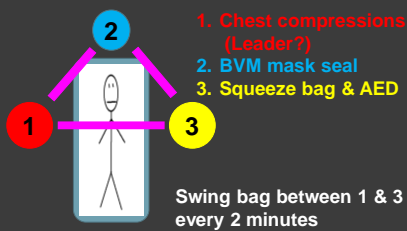
## Practiced Emergency Plan



- Leader
- 9-1-1 Caller
- Ambulance Greeter
- Emergency kit, AED retrieval
- Airway / Breathing Rescuer
- Circulation Rescuer
- Drugs (IV)
- Fire safety

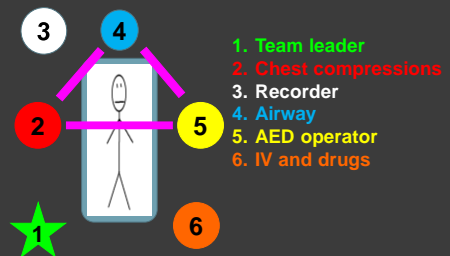
176

## Positions For 3 Rescuer Team



177

## Positions For 6 Rescuer Team



178

## Team Roles During Emergency

### Front Desk Staff:

- ⦿ Call 911. Give address, describe emergency
- ⦿ Watch reception area
- ⦿ Update people in reception area about delay
- ⦿ Victim's family members
- ⦿ Greet and usher EMS

179

## Team Roles During Emergency

### Assistants:

- ⦿ Retrieve crash cart, O<sub>2</sub>, drug kit, AED
- ⦿ Watch patients in other ops
- ⦿ A & B rescuer
- ⦿ Record drugs given & time

180

## Team Roles During Emergency

### RN:

- ⦿ Establish IV access
- ⦿ Get emergency drugs ready
- ⦿ Apply O<sub>2</sub>
- ⦿ A & B person
- ⦿ Open AED, apply leads
- ⦿ Record drugs given & time

181

## Team Roles During Emergency

### Dr.

- ⦿ Team leader
- ⦿ Chest compressions
- ⦿ Administer drugs
- ⦿ Use AED
- ⦿ Follow-up
- ⦿ PLP

182

## Team Roles: Based On Arrival To Scene

- ⦿ **Rescuer # 1:**
    - First arrives on scene, stays with patient
    - Yells for help
    - CAB until others arrive
  - ⦿ **Rescuer # 2:**
    - Bring O<sub>2</sub>, drug kit, AED
  - ⦿ **Rescuer # 3:**
    - All other staff. Perform all other roles (e.g. EMS activation...)
- 1, 2 & 3 could be any staff member  
- When dentist arrives, they are in charge

183

## EMS: 9-1-1

- ⦿ Do not hesitate
- ⦿ Know office address
- ⦿ Average urban response time is 9 min.
- ⦿ 15 min. if rural
- ⦿ Irreversible brain damage in 4 – 8 minutes
- ⦿ Surviving SCA ↓ 10% for each minute defibrillation is delayed

184

## RCDSO Standard of Care:

- ⦿ All dental staff are BLS – trained
- ⦿ All staff aware of their role during emergency
- ⦿ Written emergency protocol exists
- ⦿ Protocol is periodically reviewed

185



186

## TOPICS

1. PATIENT ASSESSMENT
2. P ABC/CAB D
3. EMERGENCY DRUGS
4. EMERGENCY ALGORITHMS

187

## Must Haves

1. Oxygen
2. Epinephrine
3. An antihistamine (e.g., diphenhydramine)
4. Salbutamol (**inhaled aerosol**)
5. Nitroglycerine
6. ASA (**non-enteric coated**)
7. Glucose
8. Flumazenil and / or naloxone

188

## Other Drugs

- ⊙ Atropine and ephedrine
- ⊙ Diazepam or midazolam
- ⊙ A corticosteroid
- ⊙ Aromatic ammonia (smelling salts)

189

## RCDSO Standard of Care:

Only after the **ABC / CAB's** have been assessed should one consider the use of an emergency drug.

**ABC.....D**

190

## Standard of Care:

- ⊙ Drugs should not be expired
- ⊙ Kit easily portable
- ⊙ Stored with an organized system
  - Labelled trays or bags
  - Purchased, pre-filled, appropriate kit

191

## 1. Oxygen

Exceptions:

- ⊙ Hyperventilation
- ⊙ COPD?
- ⊙ Cancer tx with bleomycin?
  - **May have lung damage from this drug**
- ⊙ Risk of fire

Current ACLS protocol: **Oxygen if SpO<sub>2</sub> < 94%**

192



## Oxygen

**E cylinder** 622 L – Good portable O<sub>2</sub> size  
 (30 minutes needed)  
 -Gives ~ 1.5 hrs. @ 5 – 6 l/min

**H cylinder** 6900 L – large O<sub>2</sub>

193



194

## When Should Tank Be Replaced?

Cylinder Size	Full Volume	Full Pressure	Conversion Factor (f)
E	622 L	2200 psi	L/psi = 0.28
H	6900 L	2200 psi	L/psi = 3.14

Time left in tank =  $\frac{\text{current psi} \times f}{\text{flow L/min}}$

Becker et al, Anes Prog, 61:78-83, 2014

195

## When Should Tank Be Replaced?

- Example:  
 • 500 psi on pressure gauge & flow rate at 10 l/min

$$\frac{500 \times 0.28}{10} = 14 \text{ min. of O}_2 \text{ flow E tank}$$

$$\frac{500 \times 3.14}{10} = 157 \text{ min. of O}_2 \text{ flow H tank}$$

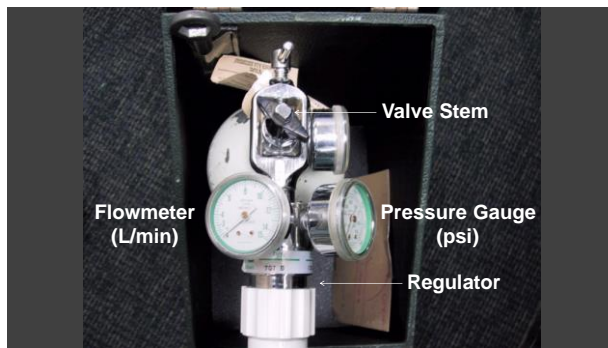
196

## Reservoir Bag

- Rubber or silicone
- 3 liters
- Gas reserve
- Monitor RR
- Monitor O<sub>2</sub> need



197



198



199



Corrugated adaptor


200

### Oxygen Delivery Breathing Patient

Delivery System	% Oxygen
Room Air	21%
Nasal Cannula	24 – 44%
Face Mask	40 – 60%
Face Mask + O <sub>2</sub> Reservoir (With Non-Rebreather NRB)	> 60% at 6 l/min ~100% at 10 l/min (NRB)

201

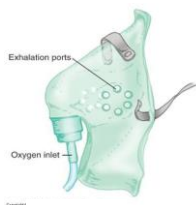
### Nasal Hood



- Have 3 sizes
- Pre – attach for high-risk people
- Anterior procedures?
- What happens if LOC and mouth breather?

202

### Full Face Mask



### Non-Rebreather Mask



203

### Non - Rebreathing Mask

- ↑ delivery of O<sub>2</sub>
- Exhaled air leaves the mask
- ↓ re-breathing of CO<sub>2</sub>
- Fill up reservoir bag before putting on face

204



205

### Oxygen Flow Rate

	Flow Rate (LPM)
Child at rest	2
Adult at rest	5 - 6
NRB Mask	10 - 15
BVM	15

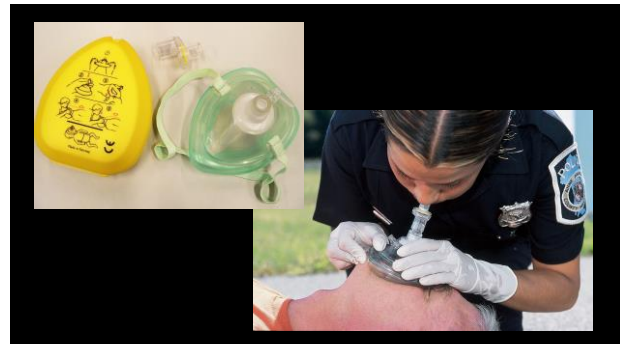
Children: Adjust flow to avoid over-oxygenation  
(8 lpm for NRB and 10 lpm for BVM)

206

### Oxygen Delivery If Not Breathing

	Normal Breathes / Minute	One Breath Every:
Infant	20 - 30	2 - 3 seconds
Child	16 - 20	3 - 4 seconds
Adult	10 - 12	5 - 6 seconds

207



208

### Bag Valve Mask (Manual Resuscitator)

- ◉ BVM without supplemental  $O_2 = 21\% O_2$
- ◉ Crimp bag to fill reservoir first
- ◉ Valve makes it **one way flow**
- ◉ Mask transparent, soft



209



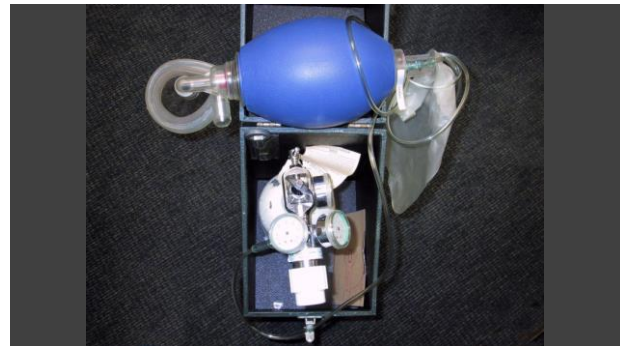
210

## Ease of Use: BONES\*

- ⦿ **B**: Beard
- ⦿ **O**: Obesity, OSA, tongue
- ⦿ **N**: Neck limited mobility, retrognathic
- ⦿ **E**: Elderly, Edentulism
- ⦿ **S**: Stiff lungs, Subglottic stenosis
  - Restrictive lung diseases e.g. pulmonary fibrosis, URTI

\*Matsui R, et al, Oral Health, 10-14, Feb, 2020

211



212

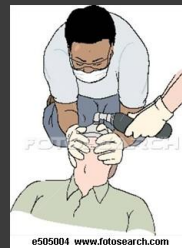
## One Rescuer BVM



- “E – C” hand position
- “E”: 3 fingers thrust jaw
- “C”: Thumb & index finger seal mask

213

## Two Rescuer BVM



### “Double E – C”

- Thumb & index seal mask
- Other fingers thrust jaw

Pressing too hard in soft area:  
Tongue presses into hard palate & blocks airway

214

## O<sub>2</sub> Not Getting To Lungs?

Problem	Solution
<b>Chest not rising:</b>	<ul style="list-style-type: none"> <li>• Ensure mask seal</li> <li>• Ensure airway is open                             <ul style="list-style-type: none"> <li>-Head-tilt-chin-lift, jaw thrust</li> </ul> </li> <li>• 2 rescuers</li> <li>• Airway adjuncts</li> </ul>
<b>Stomach rises*:</b>	<ul style="list-style-type: none"> <li>• Ensure airway is open                             <ul style="list-style-type: none"> <li>-Head-tilt-chin-lift, jaw thrust</li> </ul> </li> <li>• Give less air</li> <li>• 2 rescuers</li> </ul>

\*O<sub>2</sub> in stomach can cause vomiting & aspiration

215

## A Cautionary Tale About O<sub>2</sub>

- ⦿ O<sub>2</sub> and N<sub>2</sub>O are flammable
- ⦿ Rare occurrence: Fire

1. Spark (from handpiece bur)
2. Gas (O<sub>2</sub> and / or N<sub>2</sub>O)
3. Fuel (skin, hair, rubber, gauze...)



216



Busack et al, JADA 147(8), 661-6, 2016

217

## 2. Epinephrine

↓

	Strength	Action	Result	When To Use
$\alpha_1$	+++	Vasoconstriction of local, small submucosal vessels	↑ SBP	Cardiac Arrest Anaphylaxis
$\beta_1$	+++	Cardiotropic: Stimulates receptors in SA node & heart muscle	↑ HR, Contractility & ↑ SBP	Cardiac Arrest Anaphylaxis
$\beta_2$	++	Vasodilation of large peripheral arteries (due to systemic absorption) & Bronchodilation	Slight ↓ DBP*	Anaphylaxis Life-threatening Asthma

218

### Epinephrine

- Light sensitive
- Store at room temperature
- 1 – 2 year shelf life
- Contains sodium metabisulfite
- Half-life is 1 – 3 minutes
- Can give every 5 – 15 minutes

219

### Epinephrine Formulations

Device	Dose / Injection	# of Doses	Weight
Ampoule 1:1,000 1 mg/ml	Variable	Multiple	0.01 mg/kg*
Adult Auto-Injector	0.3 mg	1	> 30 kg (66 lbs.)
Pediatric Auto-Injector	0.15 mg	1	15 – 30 kg (33-66 lbs)

\*Use dose of 0.01 mg/kg for children < 15 kg

220

### Doses of Epinephrine

Pediatric Dose: 0.01 mg/kg **IM**

Anaphylaxis: 0.3 – 0.5 mg **IM**

Asthma: 0.3 – 0.5 mg **IM**

Cardiac Arrest: 1.0 mg **IV**

Repeat IM dose every 5 – 15 minutes

221

### Anaphylaxis

- 35% of attacks need 2<sup>nd</sup> dose of epi.
- Need for multiple doses related to severity of rxn.
- However, some mild cases require a 2<sup>nd</sup> dose
- Anaphylaxis Canada & WHO recommend:  
**Always have 2 doses**

Korenblat et al Allergy & Asthma Proc, Nov-Dec, Vol 20(6), 1999

222




1:1000 epinephrine (1 mg/ml)




223

### IM Safety Needle Examples

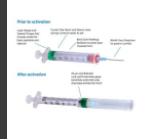
Gauge: 22 or 25  
 Length: 25 mm (1 inch)  
 Volume: 1 or 3 ml




1 ml tuberculin syringe, needle pre-attached



BD Eclipse Safety Needle



BD Safety-Lok



Integra Safety Syringe

224



Gauze  
 Break tip away from you

225

### Auto-Injectors

- First developed for U.S. military in 1959: Administer atropine for nerve gas poisoning
- 30 – 70% do not carry their devices\*
- Even healthcare workers may use incorrectly\*

\*Simons FER, J Allergy Clin Immunol, 121:S402-S407, 2008

226

### How to Use Auto-Injector

- Specific instructions
- Never put thumb over one end
  - Hold like a microphone
- Swing arm like pendulum
- Push (consider larger patients)
- Leave in muscle for 10 seconds

227

### Auto-Injector Precaution

Study:

- Ultrasound measured distance skin to vastus lateralis in children 1 – 12 yrs.
- 12% of children less than 30 kg: Distance skin to muscle > length of needle on EpiPen Jr. (½ inch)

Stecher, D et al, Pedtr, 124:65, 2009

228

## Using Auto-Injectors

Study: 50 users, trained & given written instructions.

- 58% injected incorrectly
- 28.6% did not remove safety cap
- 19% used it upside-down
- 19% injected wrong area
- 100s of cases / yr. health care workers injecting thumb (ischemic tissue necrosis?)

Lombardelli S., Euro Ac Aller Clin Immun, Abstract 1599, Jun 2010

229

## Where Does Needle Emerge From?



230

## EpiPen

- Single or “2 – pak”
- \$100 – \$200
- If you have adult & pedo devices = ~ \$400?
- Good directions on device



231

## Using An EpiPen

- Take off yellow cap & remove from tube
- Blue to sky, orange to thigh
- With orange tip down, remove blue safety cap
- Orange end into thigh – swinging motion
- Inject perpendicular to thigh
- Push firm against outer thigh until it clicks
- Leave in for 10 seconds
- Message area

232

## Emerade



233

## Emerade Advantages

- Longer needle
- Three different doses
  - < 30 kg, use 0.15 mg
  - 30 kg to 60 kg, use 0.3 mg
  - > 60 kg, use either 0.3 or 0.5
  - Use 0.5 for heavier people
- Hole only on one end
- 5 second injection

234

## Comparing Autoinjectors

	Needle Length (mm)	Epinephrine Dose (mg)
EpiPen Jr. & Allerject Pedo	13	0.15
EpiPen & Allerject	16	0.3
Emerade 150	16	0.15
Emerade 300	23	0.3
Emerade 500	23	0.5

61% kids & 54% ♀: Epinephrine goes SC not IM  
May need 30 mm to reach muscle

235

## Allerject (Auvi-Q)

- Same size as playing card (5/8 inch thick)



236

## Allerject

- Voice prompt (eng or french) when opened
- During injection there is click & hiss
- 5 second injection
- Needle goes back into device after injection
- Voice prompt counts while injecting
  - Most common error: Not holding device in muscle long enough
- Pedo & adult version (blue vs. orange)



237

## I.M. Injection Locations

- Gluteus medius
- Vastus lateralis
- Deltoid
- PSA block for pterygoid plexus of veins?
- Ventral surface of tongue or floor of mouth
  - May close airway by lifting tongue
- Onset of action 2 min.
- Peak plasma concentration for IM is ~8 min.
- Peak plasma concentration for SC is ~34 min.

238

## IM Injection Locations

	Deltoid	Vastus Lateralis	Gluteus Medius
Volume Allowed	1 ml	2 ml	3 ml
Depth of Injection <sup>1</sup>	~15 - 25 mm	~25 - 40 mm	Variable
Advantages	<ul style="list-style-type: none"> <li>Easy access</li> <li>Fewer injuries</li> <li>Fast uptake<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Injury to nerves or vessels unlikely</li> <li>Fast uptake<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>Widely taught technique</li> </ul>
Disadvantages	<ul style="list-style-type: none"> <li>Small volume</li> </ul>	<ul style="list-style-type: none"> <li>Remove pants?</li> <li>Fat may make muscle hard to enter</li> </ul>	<ul style="list-style-type: none"> <li>Possible injury to sciatic nerve or superior gluteal artery</li> <li>Slower drug uptake due to fatty muscle</li> </ul>

1: Depth varies based on patient size & fat  
2: Studies disagree which muscle has fastest uptake

239

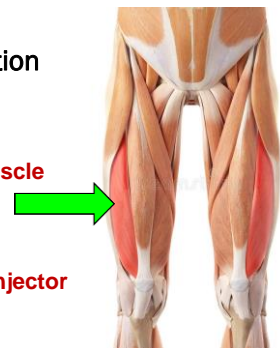
## Vastus Lateralis Injection

Lateral thigh

Quadriceps = largest muscle

Good arterial supply

Good location for auto-injector

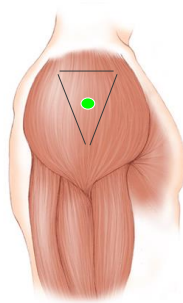


240



## Deltoid Injection

Target: 2 – 3 finger widths (2 – 3 cm) below bony part of shoulder (acromion process)



241

## Steps Deltoid Injection

- ⊙ Prepare drug & syringe
- ⊙ Expose deltoid area
- ⊙ Clean with alcohol & dry
- ⊙ Patient relaxes muscle, arm supported
- ⊙ Stretch skin over muscle
  - Do not pinch skin together
- ⊙ Hold syringe like a dart: Insert 15 – 25 mm
- ⊙ Perpendicular to skin
- ⊙ Aspirate (must avoid IV for epi)
- ⊙ Inject

242

## Ampoule vs. Auto-Injector

	Ampoule	Auto-Injector
Multiple doses	Yes	No
Risk of operator injury	Yes	Yes
Possible incorrect use	No?	Yes
Needle length	Can choose 1 - 2 inches	5/8 or 1/2 inch
Must draw drug	Yes	No
Must calculate dose	Yes	No
Shelf life	2 years	1 year
Cost	~\$1	~\$100

243

## 3. Nitroglycerin

- ⊙ Relaxes smooth muscle in arteries & veins
- ⊙ ∴ ↓ venous return to heart due to peripheral pooling (↓ pre-load)
- ⊙ Dilates coronary arteries so ↑ O<sub>2</sub> to heart
- ⊙ ∴ ↓ myocardial O<sub>2</sub> demand
- ⊙ ↓ BP
- ⊙ Limits cardiac damage following MI

For angina or MI

244

## Nitroglycerin Protocol

- ⊙ Bottles now smaller. Less light & oxygen sensitive. Store in dark, close lid.
- ⊙ Tablet under tongue, dissolves into vessels in floor of mouth, not swallowed
- ⊙ Spray on or under tongue, not inhaled
- ⊙ Taken 3 X, 5 min. intervals, if pain persists
- ⊙ 911 if pain persists
- ⊙ 911 ASAP if unstable angina or suspected MI

245

## Nitroglycerin Contraindications

- ⊙ BP < 90/60 & / or pulse < 50 | Put this on bottle
- ⊙ Suspected stroke
- ⊙ Taking phosphodiesterase inhibitors:
  - Within 24 hrs. for sildenafil (Viagra) or vardenafil (Levitra)
  - Within 48 hrs. for tadalafil (Cialis)
  - Or if taking these drugs daily

246

## Sublingual Tablets

- Nitrostat™: 0.3, 0.4 or 0.6 mg
- q 5 min. x 3 doses
- 100 tablets per container
- Less stable

Label:  
Pulse > 50  
BP > 90  
60



247

## Sublingual Spray

- Nitrolingual® Spray
- 1 metered doses (0.4 mg – 0.8 mg)
- Three doses, q 5 min. prn
- On or under tongue
- Mouth closed - not inhaled
- 200 metered doses / bottle
- Shelf life 2 years

Label:  
Pulse > 50  
BP > 90  
60



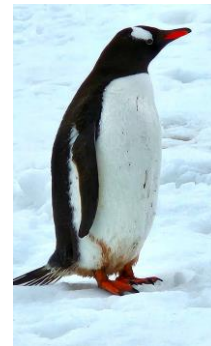
248

## Emergency Drugs Summary #1

Drug	Use	Adult Dose	Child Dose
Oxygen	Most Emergencies	5 – 10 lpm	2 – 5 lpm
Epinephrine	Anaphylaxis Asthma Cardiac Arrest	0.3-0.5 mg IM <sup>*</sup> 0.3-0.5 mg IM <sup>*</sup> 1 mg IV	0.01mg/kg
Nitroglycerin	Angina MI	0.4 mg tablet 0.4 mg spray	N/A

\*IM dose can be given as a sublingual injection

249



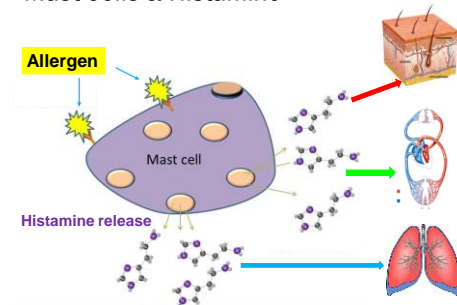
250

## 4. Antihistamines

- H<sub>1</sub> Antihistamines:
  - Bind to H<sub>1</sub> receptors: Mast cells, smooth muscle & skin
  - Used to treat allergy, asthma, nausea, vomiting
- H<sub>2</sub> Antihistamines:
  - Bind to H<sub>2</sub> receptors in gut
  - Used to treat peptic ulcers & gastric reflux

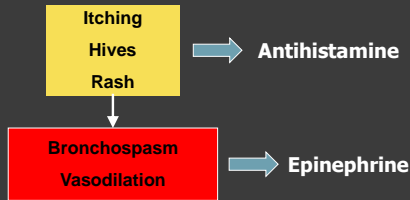
251

## Mast Cells & Histamine



252

## Allergy and Anaphylaxis



253

## H<sub>1</sub> Antihistamines: 1<sup>st</sup> Generation

- Older group, many drugs
- PO, IM, IV
- Good anti – allergy effect
- Bind to **central (cross BBB) & peripheral** H<sub>1</sub> receptors
- Not for very old or very young**
- Have strong anticholinergic effects:
  - Sedation, ↑ HR, ↓ BP, ↓ RR, dry mouth

254

## DiphenhydrAMINE

- Many formulations

Injectable: 1 ml vial with 50 mg dose

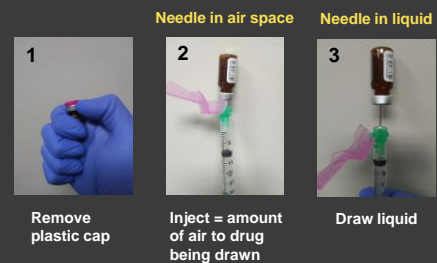
Capsules: 25 or 50 mg

Elixir: 12.5 mg / 5 ml



255

## Removing Liquid From A Vial



256

## H<sub>1</sub> Antihistamines: 2<sup>nd</sup> Generation

- Newer drugs
- Mostly PO**
- Weaker anticholinergic effect
- Only bind to **peripheral** H<sub>1</sub> receptors
  - i.e. do not cross BBB easily so little CNS effect
- Good anti-allergy, **no sedation (usually)**

257

## H<sub>1</sub> Antihistamines, Examples

1 <sup>st</sup> Generation	2 <sup>nd</sup> Generation
Diphenhydramine (e.g., Benadryl)	Cetirizine (e.g., Reactine)
Hydroxyzine (e.g., Atarax)	Loratadine (e.g., Claritin)
Promethazine (e.g., Phenergan)	Fexofenadine (e.g., Allegra)
	Desloratadine (e.g., Alerius)

All have multiple trade names  
2<sup>nd</sup> gen. pediatric chewables, melts, syrup.... available

258

## Management of Non-Anaphylactic Allergy

- Diphenhydramine
    - 50 mg IM for adults
    - 1 mg/kg IM for children to 50 mg max.
- Histamine can be released for 72 hours so:
- Benadryl 50 mg qid for adults (drowsiness)
  - Benadryl 25 mg qid for children (drowsiness)
  - Or a non-drowsy 2<sup>nd</sup> gen. antihistamine

259

## 5. Salbutamol

- Trade name: Ventolin®
- Bronchodilation via  $\beta$ -2 stimulation
  - Direct action relaxing bronchial smooth muscle
- 1 puff = 100  $\mu$ g
  - Adult: 2 puffs q 2 minutes x 2
    - First puff may loosen airway for next puff
  - Child: 1 puff
- Onset: 5 – 15 minutes
- Duration: 3 – 6 hours

260

## Using the Inhaler

- Shake vigorously for 5 – 10 seconds
- Remove blue cap
- Empty lungs (blow out)
- Put inhaler in mouth & push top down
- Inhale drug
- Hold for 2 – 3 seconds



261

## Aero Chamber



4 puffs into chamber

262

## 6. ASA

- Inhibits platelet aggregation
- ↓ thrombus formation in coronary arteries after MI
- 23% ↓ in mortality when used after MI\*
- Prevents ischemia → injury → infarction

\*Bennet JD et al. "Medical Emergencies in Dentistry", 2002

263

## ASA

- Give stat or up to 24 hrs. after MI
- CHEW, SWISH & SWALLOW
- Dose 160 – 320 mg
- Baby aspirin is sweet, not enteric coated
- Bitter taste might ↑ nausea / vomiting
- Have at home

264

## Why Chew?

- Swallow: Max blood levels of ASA: **26 minutes**
- Chew: Max blood levels of ASA: **14 minutes**



265



266

## NSAID Contraindications

- Allergy
- Active or recent GI bleed
- NSAID exacerbated respiratory disease
- Prior MI on antithrombotic therapy

JADA 147(2), 98-109, 2016

267

## Emergency Drugs Summary #2

Drug	Use	Adult Dose	Child Dose
Salbutamol	Asthma	2 puffs 100µg/puff	1 puff
Diphenhydramine	Allergy	50 mg IV/IM	1 mg/kg
ASA (non-enteric coated)	MI Thrombolytic	162 to 325 mg	N/A

268

## 7. Oral Glucose

- Simple glucose better for GI absorption
- Carbonation helps GI absorption
- Poorly absorbed through oral mucosa
- Patient awake enough to swallow
- Adult 20 grams
- Child 15 grams

269

## Oral Glucose

Source	Grams of Glucose
350 ml. Can of Cola (not diet!!)	39
Insta – Glucose	30
200 ml. Apple Juice Box	21
Glucose Tablet	15
Sugar Packet	4
1 LifeSaver	2

Cake icing: 20 grams / 2 TBSPs

270

## Insta-Glucose



- Thick syrup
- Twist off cap
- Adult whole tube (30 g), half for child

271

## Cost of Emergency Drugs

Drug	~Cost	Shelf Life
Epinephrine Ampoule	\$42 / 10 amps	2 years
Epi-Pen	\$100	1 year
Nitro Tablets	\$15 / 100 tablets	6 months
Nitro Spray	\$10	2 years
Benadryl Vial	\$45	2 years
Ventolin Inhaler	\$10	1 year
ASA	\$5 / 24 tablets	2 years

272

## Other Emergency Drugs

Drug	Use	Dose & Route
Atropine	Bradycardia, hypotension, pulse > 50 (Symptomatic)	0.5 – 1 mg IM or SL
Corticosteroid	Anaphylaxis Adrenal insufficiency	IV, in hospital
Anti-Epileptic (diazepam or midazolam)	Seizure > 5 min	IV best. Midazolam ok IM 5 mg midazolam
Ammonia spirits	Unconsciousness	

273

## Atropine

- For symptomatic bradycardia and symptomatic hypotension
- When impairment of coronary perfusion is a concern
- ↓ vagal tone will ↑ HR
- ↑ firing of SA to AV node
- (Therefore, not indicated if prior MI)



274

## Corticosteroids For Anaphylaxis

- Dexamethasone, hydrocortisone, prednisolone
- Reduces inflammation
  - Stabilizes mast cells to ↓ histamine release
- Given after epi & antihistamine
- Not for acute emergency phase – onset 1 hr.
- Best emergency route is IV + 1 – 2 wk. course of oral steroid after emergency (PO, IM, IV)

275

## Adrenal Insufficiency: Emergency Drugs

	Adult IM Dose	Adult IV Dose	Pedo IM Dose	Pedo IV Dose
Dexamethasone	8 mg	0.5 - 9 mg	0.03 - 0.15 mg/kg	0.02 - 0.3 mg/kg
Hydrocortisone	100 - 200 mg	100 mg	4 - 8 mg/kg	1 - 2 mg/kg

- Clue is hypotension and steroid use
- No best recommended steroid (CPS recommends hydrocortisone)
- Dose differs from various sources

276

### Aromatic Ammonia

- Smelling salts
- A vaporole
- Noxious odor when cracked or crushed
- Irritates airway to stimulate breath
- No data that they shorten syncope episode\*
- May cause nosebleed, vomiting, trigger asthma

\*Goodchild JH et al, Gen Dent, Nov-Dec, 10-13, 2016

277



278

### Contents of Kit

	QTY	Standard	Deluxe
Epi auto-injector Adult 0.3 mg (Epi-Pen)	1	*	*
Epi auto-injector Child 0.15 mg (Epi-Pen)	1		*
Epi ampoule back-up 1:1000, 1 mg/ml	2	*	*
Diphenhydramine 50 mg/ml	2	*	*
Salbutamol inhaler	1	*	*
Nitroglycerine spray 0.4 mg/spray (60 doses)	1	*	*
Aspirin 81 mg	1	*	*
Flumazenil 0.5 mg/5ml (optional)	1	*	*
Naloxone 0.4 mg/1ml (optional)	1	*	*

279

### Contents of Kit

	QTY	Standard	Deluxe
<b>Atropine (0.6 mg/ml)</b>	2	*	*
Oral glucose gel (30 g)	1	*	*
Aromatic ammonia	3	*	*
IM disposable syringes	2	*	*
Alcohol prep swabs	4	*	*
CPR pocket mask	1	*	*
Color-coded instructions	1	*	*
Drug product monographs		*	*
LEAP refill program		*	*
Online video training		*	*

LEAP = Lighthouse Emergency Assurance Program

280

### Emergency Equipment: Monitors

- Automatic BP cuff
  - Two size adult cuffs
  - Pedo cuff or auto device?
- Pulse oximeter
- Glucometer
- Wall clock with second hand
- AED

281

### Emergency Equipment: Tools

- Clear masks for passive and positive pressure O<sub>2</sub> delivery
  - Various sizes
- Yankauer suction (non-vented)
  - High volume suction adapter
- Emesis basin
- Oropharyngeal airways

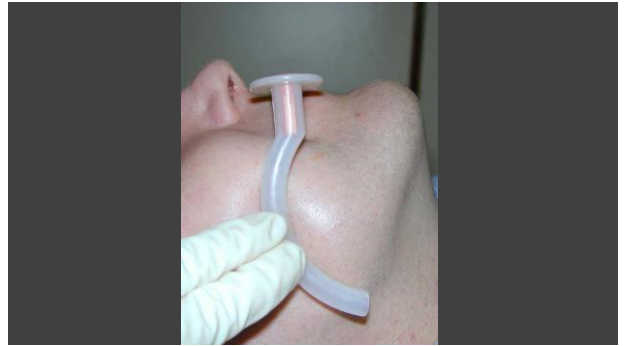
282

## Oropharyngeal Airways

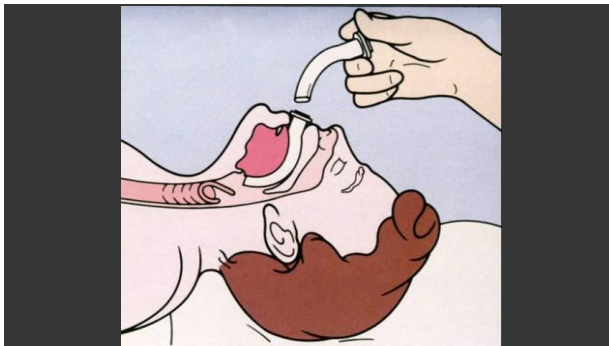
- ⦿ Prevents tongue from covering epiglottis
- ⦿ Size: **Corner of mouth to angle of mandible**
- ⦿ Insert upside-down, then turn 180°
- ⦿ Then place BVM or face mask



283



284



285



286

## TOPICS

1. PATIENT ASSESSMENT
2. P ABC/CAB D
3. EMERGENCY DRUGS
4. EMERGENCY ALGORITHMS

287

## Medical Emergency Response

1. **P: Position**  
↓
2. **ABC / CAB**  
↓
3. **D: Diagnose: Drugs, Defibrillate**

288



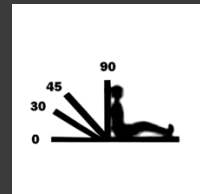
## Position

- ◉ If **conscious**: Comfort & then rescue
- ◉ If **unconscious**: Goals are:
  - Blood and O<sub>2</sub> to brain
  - Ability to rescue patient
  - Patient protection

289

## Positions

- ◉ Supine vs. Trendelenburg
- ◉ **Semi-Fowler (30°)**
- ◉ Semi-prone (recovery)
- ◉ Special considerations
  - **Obese**
  - **Pregnant**
  - **Vomiting**
  - **Seizures**



290

## Airway & Supine Position

- ◉ Cross section area of airway ↓ **23%** from upright to supine
- ◉ Chest weight on airway ↓ **lung volume** more in supine position
  - Especially concerning in obese

Memelman A. et al, J of Em Med Serv, 4, 2018

291

## Unconscious: Differential Diagnosis

- ◉ Orthostatic hypotension
  - Not associated with anxiety
- ◉ Vasovagal syncope
  - Pain, sight of blood, needle puncture, stress....
- ◉ Hypoglycemia (diabetic)
- ◉ Drug overdose (LA, cocaine, sedatives, beta blocker...)
- ◉ Stroke
- ◉ Cardiac arrest
- ◉ Adrenal insufficiency, hypothyroidism

292

## Syncope

- ◉ ~ 50 % of all dental emergencies
- ◉ **Sudden, temporary** loss of consciousness
- ◉ **Recovery in 1 – 2 min with correct care**
- ◉ Hypotension causing ↓ blood flow to brain (**protective**)
- ◉ Possible seizure especially if rescue delay

293

## Systemic Causes of Syncope

- ◉ Stress, anxiety
- ◉ Hypoglycemia (NPO status)
- ◉ Dehydration (NPO status)
- ◉ Hypotension
- ◉ Other cardiac: Blockage, irregular beats, heart defects
- ◉ Hypothyroidism

294

## Treatment – Related Causes of Syncope

- Sudden posture change
- Visual cues
- Injection / treatment pain
  - Most likely time is **during injection**
- Injecting patient who is not supine
- Intraosseous or inadvertent IV injection

295

## Who Faints?

- ♂ > ♀
- Children rare: Move, get upset = ↑ blood flow to brain
- Average age of people who faint is ~ 35
- Common scenario:
  - Young adult male
  - Anxious
  - Embarrassed, macho, stoic
  - Female dentist

296

## Signs & Symptoms

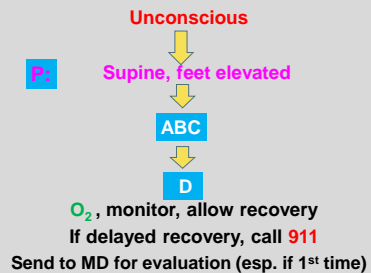
- Pre-syncope:
  - Feeling warm, fuzzy
  - Pallor
  - Diaphoresis
  - “Feeling faint”
  - Nausea, vomiting
  - Blurred or tunnel vision
  - ↓ BP and ↑ HR

**FIGHT  
OR  
FLIGHT**

This progresses to ↓ HR and LOC

297

## Syncope Algorithm



298

## Managing Hypotension Emergency

- (Use sedatives cautiously)
- Stop dentistry
- 911 if symptomatic
- Manage like syncope:
  - P: Supine, feet elevated
  - ABC
  - D: Oxygen if < 94%
  - ACLS: Atropine, IV fluids (H's and T's)

299

## Pediatric Hypotension

- Ominous sign. Impending cardiac arrest

Age	Systolic Blood Pressure
Infants (1 – 12 months)	< 70
1 – 10 years	< 70 + (age in years x 2)
> 10 years	< 90

PALS, 2015

300

## Managing Bradycardia Emergency

- ⦿ **P:** Supine feet elevated
- ⦿ **ABC**
- ⦿ **D:** O<sub>2</sub> if < 94%
- ⦿ **ACLS:** Atropine, pacing (H's and T's)
  
- ⦿ Symptoms: (chest pain, AMS, ↓BP, CHF): **911**

301

## Mild Hypoglycemia: Signs & Symptoms

↓ Blood glucose can cause:

- ⦿ **Warm, sweaty skin**
- ⦿ Anxiety
- ⦿ Confusion, irritability, can't concentrate, hallucinations
- ⦿ Tremors
- ⦿ Weakness
- ⦿ Hungry, nausea
- ⦿ ↑ HR, dysrhythmias

302

## Severe Hypoglycemia: Signs & Symptoms

- ⦿ Seizure
- ⦿ Semi-consciousness
- ⦿ Coma
- ⦿ Death

303

## Hypoglycemia Causes

- ⦿ Malnourished (NPO)
- ⦿ Stress, anxiety
- ⦿ ↑ activity level
- ⦿ Illness, infection
- ⦿ Alcohol
- ⦿ Diabetic took meds but no meal
- ⦿ Incorrect insulin dose

304

## Using A Glucometer

- ⦿ Inexpensive
- ⦿ Pharmacist will train you
- ⦿ Some need to be calibrated
- ⦿ Keep test strips & lancets with meter



305

## Blood Glucose Levels (mmol / L)

	Non-Diabetic	Diabetic (Target)
Before A Meal	4 – 6	4 – 7
2 Hrs. After A Meal	Up to 7.8	5 – 10 or 5 – 8*

- Adult: < 4 mmol / L = hypoglycemia
- Child: < 3.3 mmol / L = hypoglycemia

\*Adult poorly controlled, use 5 – 8 mmol / L as target

306

## Hypoglycemia Management: Conscious

- ⦿ P, ABC, D:
- ⦿ Oral glucose, swallowed
  - 15 g kids
  - 20 g adults
- ⦿ O<sub>2</sub> if < 94%
- ⦿ Stress reduction
- ⦿ 911?

308

## Oral Glucose

- ⦿ Patient is awake enough to swallow
- ⦿ Simple glucose better for GI absorption
- ⦿ Carbonation helps GI absorption
- ⦿ Poorly absorbed through oral mucosa

309

## Hypoglycemia Management: Semi or Unconscious

- ⦿ 911
- ⦿ P, ABC: Airway, O<sub>2</sub> then D:

Drug	Adult	Child
Glucagon	< 20 kg: 0.5 mg > 20 kg: 1 mg (SC, IM, IV, IN)	0.02 – 0.2 mg/kg* (SC, IM, IV)
Dextrose (D50W)	50% in Water IV 50 – 100 ml (25 - 50 g)	25% in Water (2 – 4 ml/kg up to 25 ml)

\*Wide dose variation from different sources

310

## Hyperglycemia

- ⦿ Symptoms develop over days / weeks

	mmol/L (Can.)	mg/dl (U.S.)
Fasting	> 7	> 126
2 Hrs. After Meal	> 11	> 200

311

## Hyperglycemia: Signs & Symptoms

### Early Signs:

- ⦿ Frequent urination
- ⦿ Thirsty
- ⦿ Blurred vision
- ⦿ Fatigue
- ⦿ Headache

### Late Signs:

- ⦿ Breath fruity smell
- ⦿ Nausea, vomiting
- ⦿ Abdominal pain
- ⦿ SOB
- ⦿ Dry mouth and skin
- ⦿ Confusion
- ⦿ Coma

911 P-ABC-D

312

## Emergency Management Hypo or Hyper?

- ⦿ Give glucose if not sure
- ⦿ Withholding glucose if hypo worse than giving glucose if hyper
- ⦿ Call 911
- ⦿ Insulin, fluids, electrolytes

313

## Avoiding A Glycemic Emergency

- 25% of adults > 65 are diabetic
- Know the patient's disease
- Morning appointment & take meds
- Good meal before tx
- Stress reduction protocol
- Watch patient. Be ready to stop
- Possible post-op antibiotics

314

## Managing Hypertension Emergency

- Stop dentistry (remove stressor)
- Stress reduction protocol, ↓ pain
- 911 if symptomatic
- P: Make comfortable
- ABC
- D: Oxygen & nitroglycerine if unstable?

315

## Managing Tachycardia Emergency

- 911 if symptomatic
- P: Stress reduction protocol, ↓ pain, ABC
- D: O<sub>2</sub> if < 94%
- If pulse > 150 or symptoms: ACLS:
- Vagal maneuvers, adenosine, cardioversion

Symptoms: Chest pain, SOB, AMS, ↓ BP, CHF, AMI

316

## Vagal Maneuvers

- Bearing down (Valsalva maneuver)
- Blow into 10 cc syringe or straw
- Coughing, forceful & sustained
- Ice to forehead
- Gag reflex
- Carotid massage (MD only)

317

## Vomiting

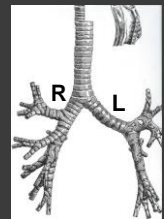


- Causes:
  - Choking – blocked airway
  - Nitrous oxide (hypoxia)
  - Drug overdose
  - Syncope (hypotension)
  - MI
  - Stroke
  - Anxiety
  - Illness

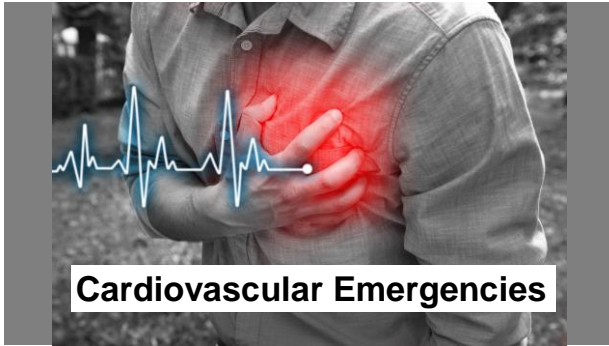
318

## Vomiting

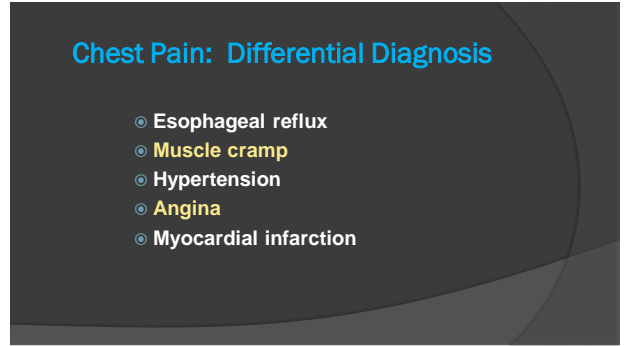
- Vomit in lungs is a medical emergency
- Management:
  - Level of consciousness
  - Position: Upright vs. right side prone
    - Left lung up
  - Suction: High volume, Yankauer



319



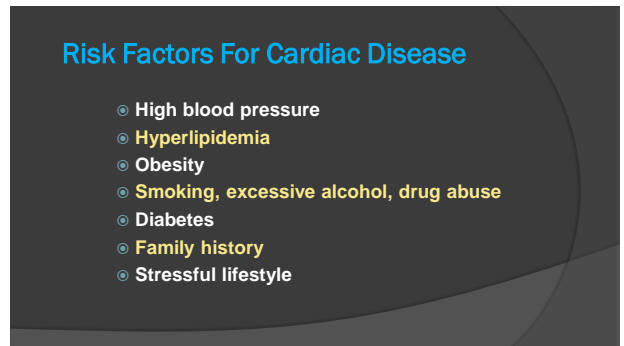
320



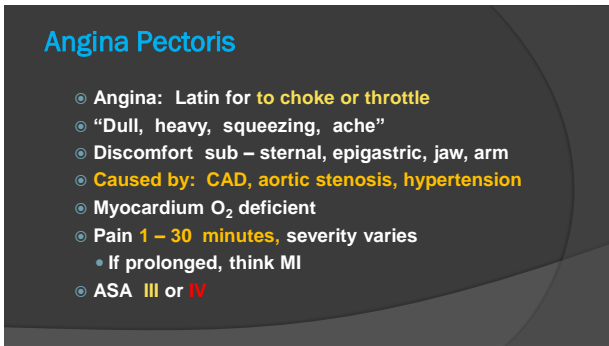
321



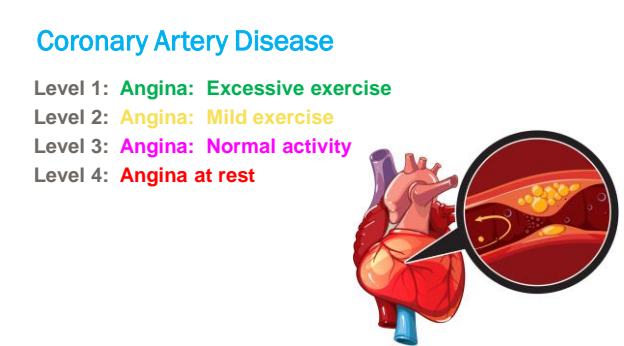
322



323



324



325

## Stable Angina (Effort Angina)

- Physical activity (not usually at rest)
- Temperature extremes
- Large meals
- Emotional stress, anxiety
- Caffeine, smoking (stimulants)
- Fever
- Characteristic pain alleviated with nitroglycerine
- ASA III

326

## Unstable Angina (Crescendo Angina)

- At rest or with minimal exertion
- Pain can last longer than 10 min.
- Pain differs in character, duration &/or severity
- Nitroglycerin may not work
- Within 3 mos., ~ 10 % die, ~ 20 % will have MI
- Severe obstructive CAD
- ASA IV

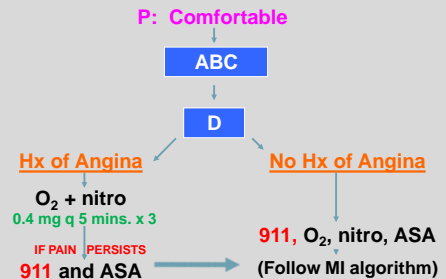
327

## Appointment Considerations

- Short appointments
- Supplemental O<sub>2</sub> or N<sub>2</sub>O?
- Sedatives?
- Minimize treatment pain
- Stress reduction protocol ★
- Do not treat?

328

## Chest Pain Algorithm



329

## Myocardial Infarction

- Infarction: Latin for "to plug or cram"
- Deficient blood to heart muscle = necrosis
- 1/3 die before reaching hospital
- If total artery block, must treat within 3 – 6 hrs. to avoid permanent cardiac damage
- 90% of MI's are due to CAD
- Know risk factors

330

## Signs and Symptoms

- ~ 25% are asymptomatic
- Pain, pressure, crushing – usually severe
- Radiates: Arms, neck, jaw, shoulders,
- Toothache
- Nausea and vomiting
- SOB
- Dizziness
- Diaphoresis
- Sense of doom

331

## Angina or MI?

### Angina

- Known condition
- Pain
- Pain is localized
- ↑ BP (due to pain)
- Relieved by nitro

### MI

- First time
- Severe pain &/or pressure
- Discomfort radiates
- ↓ BP (from cardiac damage)
- Nitro not effective

332

## MI Gender Differences

Symptom	
Pain	No difference
SOB	No difference
Right side chest discomfort	4.7 X more by men
Indigestion	3.7 X more by men
Recognize that symptoms are cardiac	3.7 X more by men
Discomfort	2.7 X more by men
Throat discomfort	12 X more by women
Pressing on chest	7.3 X more by women
Dull ache	3.9 X more by women
Vomiting	3.9 X more by women
Time to seek help	3 hrs. men & 4 hrs. women

University of Rochester

333

## MI History: Clinical Considerations

- Delay treatment for 6 months
- Medical consult?
- Take & monitor vital signs
- Stress reduction protocol
- Watch epinephrine

334

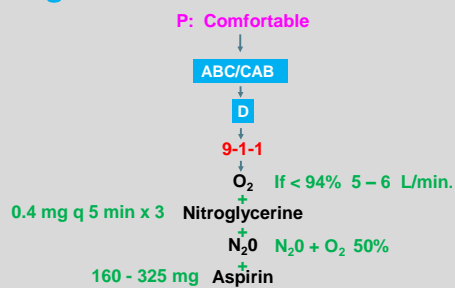
## Is MONA Helpful After An MI?

- M:** May ↑ risk of death if given after some MIs
- O:** Only use if  $\text{SaO}_2 < 94\%$ 
  - Over – oxygenate could cause recurrent MI or arrhythmia
- N:** Does not ↓ mortality after an MI
  - Benefit may be analgesia
- A:** 23% reduction in mortality after an MI

Kami MK, Oral Health, Feb 2024

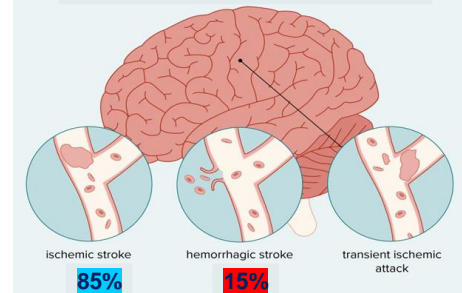
335

## M.I. Algorithm "N.O.N.A."



336

## Stroke



337



## Transient Ischemic Attack (TIA)

- ◉ “Mini or warning stroke”
- ◉ **Transient** blockage
- ◉ Symptoms last 1 – 5 min, usually reverse in 24 hr.
  - 20% will have a stroke in 3 months
  - 10% will have a stroke in 2 days
- ◉ **Therefore: EMS or go to ER**

338

## Stroke: Risk Factors

- ◉ Age
- ◉ **History of stroke or TIA**
- ◉ Hypertension
- ◉ **Hyperlipidemia**
- ◉ CAD
- ◉ Atrial fibrillation
- ◉ Diabetes
- ◉ **Smokers, excess alcohol**
- ◉ Obesity
- ◉ Inactivity
- ◉ Family history

339

## Treating Patients With Stroke Hx.

- ◉ Medical clearance
  - 1/3 of strokes recur in one month
  - ↑ stroke risk for 1 year
  - **Likely have poor cardiac health**
- ◉ Short appointments, stress reduction
- ◉ Mobility of patient
- ◉ **Manage airway** – swallowing deficits
  - Maybe unsafe sedation candidates

340

## Stroke: Signs & Symptoms

- ◉ **FAST:**
  - **F**ace droop on one side
  - Can't raise both **A**rms to same height
    - Do this with eyes closed
  - **S**peech is slurred or mumbled
  - **T**ime: 911 ASAP

341

## Stroke: Other Signs & Symptoms

- ◉ Weak or numb on one side, leg or arm
- ◉ **Dim or blurred vision one or both eyes**
- ◉ **Severe sudden** headache
- ◉ **Dizziness, sudden fall**
- ◉ Confusion

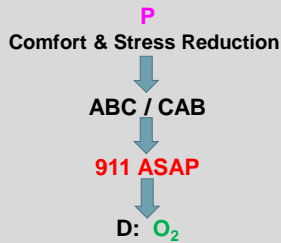
342

## Stroke Emergency Management

- ◉ **No ASA or nitroglycerine**
  - Ischemic or hemorrhagic??
  - ASA may ↓ chance of future 2<sup>nd</sup> stroke BUT
  - Does not dissolve present clot (if ischemic)
  - **ASA may ↑ bleed if hemorrhagic**
  - No evidence ASA sooner than 1 hr. after stroke will help
- ◉ NPO if swallowing deficit
- ◉ **911 & hospital thrombolytics ASAP**

343

## Stroke Algorithm



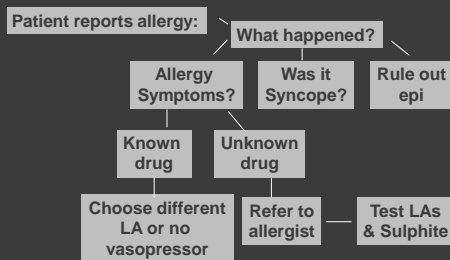
344

## Allergy



345

## LA Allergy..... Or Is It?



Adapted from Becker et al, Anes Prog 59:90-102, 2012

346

## Signs & Symptoms of Allergy (Variable)

- Skin
  - Red, itchy, swelling, blisters, rash, hives
- Lungs
  - Wheezing, cough, SOB
- Eyes
  - Red, itchy, swollen, watery
- GI
  - Cramps, nausea, vomiting, diarrhea
- Headache

347

## Anaphylaxis

- Usually occurs immediately (seconds – minutes)
- 20% occur (or recur) from 1 – 72 hrs.
- 96% of fatalities occur in 1<sup>st</sup> hour
- ~ 1% result in death
- Sense of doom and feeling unwell

348

## Signs & Symptoms of Anaphylaxis

Skin & mucosa	Itchy, rash, flushed, hives, swelling, running nose, tears
Gastrointestinal	Abdominal pain, nausea, vomiting, diarrhea, incontinence, dysphagia
Respiratory	Bronchospasm, wheeze, cough, nasal itch, sneezing, SOB
Cardiovascular	↓ BP, ↑ HR, chest pain, cardiovascular shock, syncope, irregular pulse, arrest

349

## Factors Related To Death

- ◉ Delay in epinephrine administration
- ◉ Prior **history** of anaphylaxis
- ◉ Comorbidity with **asthma**
- ◉ **Tree nuts** (not peanuts) are the allergens

350

## Common Causes Of Anaphylaxis

- ◉ Insect stings (especially wasps)
- ◉ **Foods (more in kids)**
  - Nuts, shellfish, milk, eggs
- ◉ **Medications, e.g. penicillin (more in adults)**
- ◉ Latex

351

## Most Common Drugs Causing Anaphylaxis

Survived Episode	Death
1. Antibiotics	1. Antibiotics
2. Monoclonal Antibodies	2. Radiocontrast Agents
3. NSAIDs & Acetaminophen	3. Intraoperative Agents

FDA Adverse Events 1999 - 2019

Yu RJ, et al, J Clin Immun In Prac, 9(2), Sept, 2020

352

## Dental Office Allergens

- ◉ Latex
  - ◉ Esters vs. amides (topical LA)
    - True amide allergy = 1% of all LA adverse systemic reactions. Very rare.
  - ◉ **Sodium metabisulfite**
  - ◉ PABA (& methylparaben)
  - ◉ Other drugs, (e.g., chlorhexidine, formaldehyde , sodium hypochlorite)
  - ◉ Impression materials
  - ◉ Gelfoam (porcine)
- Allergy hx = ↑ likelihood of allergy to dental allergens**

\*Mulmani P., Br Dent J, 222:954-61, 2017

353

## Dental Sources of Latex

Gloves  
 Bite block  
 Prophy cup  
 Rubber dam  
 Ortho elastics  
 Rubber rings on hand tools  
 Saliva ejectors  
 Adhesive tape  
 LA cartridge?

354

## Sodium Metabisulfite

- ◉ **Preservative & antioxidant** in foods & medications
  - Stops food from browning, epinephrine from oxidating...
- ◉ Prolongs **shelf-life** of anaesthetic  
 (Plain solutions have ↑ shelf life)
- ◉ **1 – 7%** of population have sulphite allergy (↑ in asthmatics)\*

\*Santos L, Oral Health, Feb 2024

355

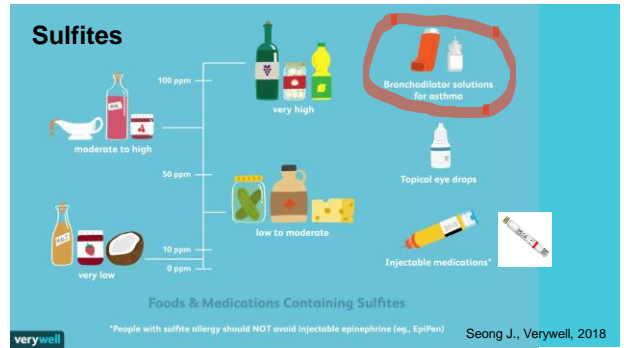
## Sulf....

**Sulfur:** Chemical, mineral, essential for life

**Sulfa:** Class of antibiotics

**Sulfite:** Found in foods & drugs as preservative

356



357

## Septanest Product Monograph:

“Allergic reactions, acute asthma attacks... may occur in patients with bronchial asthma due to hypersensitivity to sulfite.”

~ 5% asthmatics have a sulfite allergy.  
Sulfite – induced asthma attack more likely in those with severe, uncontrolled asthma

358

## Management of Non-Anaphylactic Allergy

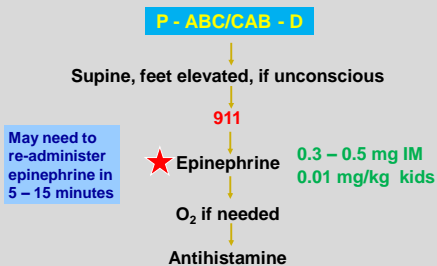
- Diphenhydramine
  - 50 mg IM for adults
  - 1 mg/kg IM for children to 50 mg max.

Histamine can be released for 72 hours so:

- Benadryl 50 mg qid for adults (drowsiness)
- Benadryl 25 mg qid for children (drowsiness)
- Or a non-drowsy antihistamine like Reactine

359

## Anaphylaxis Algorithm



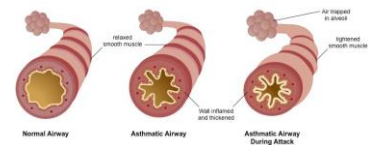
360

## Asthma

- Most common disease in kids (~15%)
- Extrinsic (allergy mediated) or intrinsic

• 3 ways airway can be affected:

- Bronchoconstriction
- Mucosal edema
- Mucous plugging



361

## Pre-Operative Evaluation

- ◉ What precipitates attack?
- ◉ Frequency of attacks?
- ◉ Severity of attacks?
- ◉ Medication used & effectiveness?
  - $\beta_2$  stimulators & / or corticosteroids?
- ◉ Current asthma status?

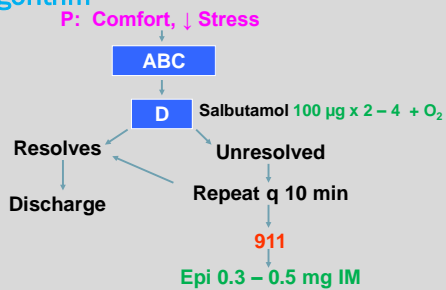
362

## Preventing Asthma Emergency

- ◉ Know their asthma
- ◉ ↓ pain & anxiety during tx
- ◉ Watch sulfites & NSAID's
- ◉ Have patient bring inhaler
- ◉ Prophylactic O<sub>2</sub>
- ◉ Watch aerosols, irritants (counter sprays, perfume...)
- ◉ Use rubber dam
- ◉ Delay tx if URT infection or bad asthma day

363

## Asthma Algorithm



364



365

## The Toxicity of Water

- ◉ Sacramento radio station contest
- ◉ Person who drinks most water without peeing

Wins a Wii...

- ◉ Single mom, 3 kids trying to win
- ◉ Goes home after contest & dies

366

## Topical Anaesthetic Toxicity

- ◉ Lidocaine, prilocaine, benzocaine, tetracaine
- ◉ FDA report: 2 deaths after large amounts of topical anaesthetic
- ◉ Used for laser hair removal
- ◉ Seizure – coma – death

367

## Local Anaesthetic Toxicity

Why are cartridges labelled in %?

Must change % to mg/ml

368

## What is 2% Lidocaine?

2% means  $\frac{2 \text{ g}}{100 \text{ ml}}$

This =  $\frac{2000 \text{ mg}}{100 \text{ ml}}$  or  $\frac{20 \text{ mg}}{1 \text{ ml}}$

$\frac{20 \text{ mg}}{1 \text{ ml}} = \frac{x \text{ mg}}{1.8 \text{ ml}}$

**x = 36 mg of drug / cartridge**

369

## Maximum Recommended Dose (mg)

	Vasoconstrictor	No Vasoconstrictor
Articaine	(500)*	-
Lidocaine	500	300
Mepivacaine	400	400
Prilocaine	500	500
Bupivacaine	90	-

- For "average", healthy 70 kg adult
- Must adjust for age and weight
- \*Anes. Prog. FDA only give mg / ml

370

## Maximum Dose By Weight

	MRD	Equivalent # of Cartridges
Articaine	7 mg/kg (up to 500 mg)	7
Bupivacaine	1.3 mg/kg (up to 90 mg)	10
Lidocaine	7 mg/kg (up to 500 mg)	13
Mepivacaine	6.6 mg/kg (up to 400 mg)	7 or 11*
Prilocaine	8 mg/kg (up to 500 mg)	7

\*7 for 3% and 11 for 2% mepivacaine  
For healthy 70 kg adult

371

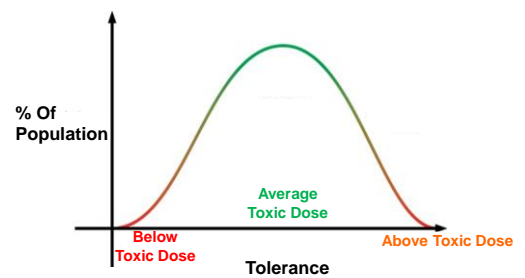
## Local Anaesthetic Toxicity

Three mechanisms:

- True systemic toxicity due to overdose
- Hypersensitivity
- Practitioner mediated (IV injection)

372

## Toxicity Dose Response Curve



373

## Toxicity: Other Factors

- ⦿ Rapid IV or IO injection
- ⦿ Plain solutions
- ⦿ Liver disease
- ⦿ < 6 or > 65 years old
  - Liver function declines 50% by age 65
- ⦿ Body weight
- ⦿ OD usually 5 – 40 min after LA injection

374

## Systemic Effects of LA Toxicity

- ⦿ Biphasic reaction: Excitation & then depression

Agitation → Seizure → Coma

- ⦿ CENTRAL NERVOUS SYSTEM
- ⦿ CARDIOVASCULAR SYSTEM

375

## Pediatric Considerations



shutterstock.com - 1360092845

376

## Pediatric Deaths From LA Overdose

- ⦿ Occur every year
- ⦿ Watch for sedation from LA
- ⦿ Most common used LA in deaths is:
  - 3% mepivacaine (plain)
- ⦿ It's used more in children
  - Try to ↓ numb lip
  - Mistaken belief it's less toxic since no epi

377

## Contributing Factors:

1. Co-operative child
2. Size & physiology
3. Pressure to maximize production
4. Complacency
5. Sedation
6. Bell Curve

378

## The Overdose Cascade

- ⦿ Too much LA in small child
- ⦿ Child becomes hypoxic & hyper – carbic
- ⦿ Seizure occurs in ~ 5 min.
- ⦿ Child loses airway
- ⦿ Airway not established & O<sub>2</sub> not given
- ⦿ Seizure threshold now ↓
- ⦿ 2<sup>nd</sup> seizure occurs in 2 – 3 min., longer more intense

379

## 15 kg. Child: Maximum Dose of LA

LA	mg / Cartridge	MRD (mg/kg)	Volume of LA (ml)	# of Cartridges
2% Lidocaine	36	7	5.2	2.9
2% Mepivacaine	36	6.6	4.8	2.7
3% Mepivacaine	54	6.6	3.2	1.8
4% Prilocaine	72	8	2.8	1.6
4% Articaine	72	7	2.5	1.4

380

## The Ideal Pediatric LA

- 2% with a vasoconstrictor
- Vasoconstrictor does not significantly change duration of soft tissue anaesthesia

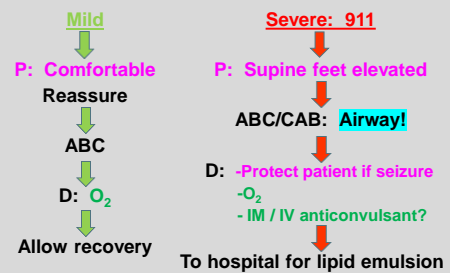
381

## Lipid Emulsion Rescue

- Developed in 2008, in hospital
- Lipid emulsion:
  - Soybean oil, egg phospholipid & anhydrous glycerol
- Reverses drug overdose: Barbiturates, tricyclic antidepressants, LAs....
- A lipid attraction that displaces LA from plasma
- Continuous IV during ongoing rescue
- May take up to 1 hour

382

## LA Toxicity Algorithm



383

## Seizures: Differential Diagnosis

- Epilepsy
- Hypoxia (syncope)
- Hypoglycemia
- Alcohol / drug withdrawal
- LA toxicity
- Anaphylaxis
- Fever or infection
- Stroke
- Benzodiazepine reversal

384

## Seizure Classification

- Petit mal / absence: Blank stare
- Myoclonic: Repetitive muscle jerking
- Atonic: Loss of postural tone, falls to the floor
- Grand mal: Most common, tonic – clonic (= rigid & shaking). 90% of all seizures

385

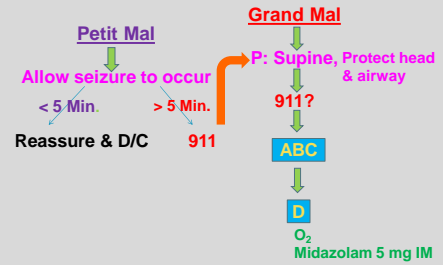


## Seizure Progression

1. Pre-ictal: Aura with mood alterations?
  2. Ictal: LOC and seizure
  3. Post-ictal: Regain consciousness, stupor, AMS
- Avoid things that provoke aura or seizure

386

## Seizure Algorithm



387

## Methemoglobinemia

- Fe atom normally 2 + charges
- Can change to 3 (methemoglobin)
- Methemoglobin can't carry O<sub>2</sub>
- Methemoglobin usually 1%, changes to > 20%
- Congenital: Enzyme deficiency, brown blood, blue people
- Acquired: Drug – induced e.g., prilocaine, benzocaine sulfonamides

388

## Methemoglobinemia: Signs & Symptoms

- Pallor
- Nausea
- Dizziness
- Cyanosis in lips, nail beds
- Respiratory distress, SOB
- Blood turns brown

Occurs a few hours after treatment.

389

## Recommendations

- Avoid benzo spray, prilocaine & articaine in susceptible
- Watch Oragel in small kids
- Young, lighter-weight, elderly are predisposed
- Use alternatives in those patients
- Be careful if inflamed & damaged tissue
- If MHb occurs: EMS
- O<sub>2</sub> will not help
- IV methylene blue or observation

390

## Adrenal Insufficiency

- Cannot produce cortisol during stress
- Due to:
  - Primary: Addison's disease; autoimmune adrenalitis (1 in 10,000 people)
  - Secondary: Atrophy of adrenal gland from inactivity of gland from taking glucocorticosteroids
- Can occur to those who are on or have been on steroid therapy
- Stressful procedures, anxious patients: ↑ risk

391

## Adrenal Insufficiency: Signs & Symptoms

- **Primary:** Patient may carry **hydrocortisone injection kit**
- Patient taking glucocorticosteroids
- **Abdominal pain**
- Nausea & vomiting
- **Hypotension\***
- Mental confusion
- LOC

392

## Adrenal Insufficiency: Patient Care

- Medical consultation?
  - Possible steroid supplement preoperatively
- Stress reduction protocol
- Sedatives?
- Pain-free treatment & manage post-op pain
- **Baseline vitals pre-op & continuous intra-operative BP monitoring**

393

## Adrenal Insufficiency: Management

- **P:** Supine, feet elevated
  - To manage hypotension
- **ABC**
- **D:** Oxygen if < 94% & steroid
- **911**

394

## Malignant Hyperthermia

- Genetic defect. Cannot control  $Ca^{2+}$  in skeletal muscle
- Genetic testing vs. muscle biopsy
- Triggered by:
  - **Inhalation GA gases**
  - **Succinylcholine**
  - **Strenuous exercise**
  - **Rarely, heat stress**
  - **Not local anaesthetics or nitrous oxide**
- ↑ prevalence in “Golden Horseshoe”

395

## Malignant Hyperthermia

- Occurs in ~ 1 / 100,000 hospital GA surgeries.
- Before 1979, mortality was **64%\***
- **Dantrolene sodium** prophylaxis & / or emergency management: Mortality rate is **5%\***
- **Dantrolene inhibits  $Ca^{2+}$  release**

Cornelius BW et al, Anes Prog, 66(4), 202-10, 2019

396

## Signs & Symptoms of MH

Clinical Sign	% of Patients Showing Sign
Hypercarbia	92
Sinus tachycardia	73
Rapidly increased temperature	65
Elevated temperature	52
Generalized muscle rigidity	41
Masseter spasm	27
Tachypnea	27
Sweating	18
Cola-coloured urine	14
Cyanosis	9
Skin mottling	6
Ventricular tachycardia	4
Ventricular fibrillation	2

Larach, MG, et al, Anesth Analg, 110, 498-507, 2010

397

## Treating the MH Patient

- ◉ Stress reduction protocol vs. refer
- ◉ Stocking dantrolene sodium?
  - MHAUS says if triggers eliminated, no need to stock dantrolene
- ◉ N<sub>2</sub>O + O<sub>2</sub> is safe
- ◉ LA is safe

398

## summary



399

## Avoiding An Emergency

- ◉ Take accurate medical history, assign ASA status
- ◉ Blood pressure – continuous?
- ◉ Contemplate referral if uncomfortable
- ◉ Minimize discomfort
- ◉ Reduce stress

400

## Be Prepared

- ◉ Practice scenarios
- ◉ Have current medical emergency kit
  - Practice with stale drugs
- ◉ Ensure current BLS training for all – annually
- ◉ Have a written, practiced, office emergency protocol
- ◉ Watch & engage your patient during their care

401

## If An Emergency Occurs

- ◉ Act quickly
  - Drug kit, AED...
- ◉ Don't delay EMS
- ◉ Remain calm: **P – CAB – D**
- ◉ Continue stress reduction protocol

402

“That’s all Folks!”



403

1. Which statement is true?

- a) Medical emergencies almost never happen in dental offices.
- b) Syncope accounts for approximately 50% of medical emergencies in dental offices.
- c) Allergies account for approximately 50% of medical emergencies in dental offices.

404

2. True or false: Oxygen & supine position should allow recovery from syncope?

- a) True
- b) False

405

3. Which blood pressure is considered hypertensive?

- a) 130/70
- b) 135/75
- c) 145/95

406

4. True or false: It is important to measure the regularity of a patient's pulse as well as the rate?

- a) True
- b) False

407

5. Which drug is considered essential to carry in a dental office medical emergency kit?

- a) Atropine
- b) Benadryl
- c) A corticosteroid

408

6. The dose of epinephrine for an anaphylactic reaction in an adult is?

- a) 0.3 mg of a 1:1000 solution
- b) 1 mg of a 1:1000 solution
- c) 5 mg of a 1:1000 solution

409

7. For a first-time chest pain episode, which of the following is true?

- a) One should assume the patient is having a myocardial infarction.
- b) One should assume the patient is having indigestion.
- c) One should assume the patient is having an episode of angina.

410

8. Which statement is true regarding AEDs?

- a) They are difficult to use.
- b) They can determine the patient's need for defibrillation.
- c) They will shock the patient if they are in asystole (flat line).

411

9. Which of the following is true about the use of an antihistamine?

- a) During anaphylaxis it should be used before epinephrine is given.
- b) It can be prescribed for three days following an allergic reaction
- c) The dose of diphenhydramine for an adult is 25 mg intramuscularly.

412

10. Which of the following is true about a dental office medical emergency kit?

- a) As long as it contains all required items, it does not need to be organized.
- b) One can either make up their own organized kit or purchase a pre-assembled kit.
- c) It is important to know where your kit is, what is in it and the expiry date of all contained drugs.
- d) Both (b) and (c)
- e) All of the above.

413

11. With regards to oxygen, at least how much is required to have on hand in order to be prepared to manage an emergency?

- a) One hour at a flow of 10 l/min.
- b) One half hour at a flow of 6 l/min.
- c) 15 minutes at a flow of 6 l/min.

414

12. A non-rebreather mask:

- a) Is for emergencies where the victim is not breathing.
- b) Stops ambient air from coming into the mask.

415

13. When performing ventilations during a rescue, if the rescuer notices that the victim's stomach is rising:

- a) The airway may not be properly opened.
- b) The rescuer may be giving too much air to the victim.
- c) Both (a) and (b).

416

14. Which statement is true regarding local anaesthetic allergies?

- a) Amides are more allergenic than esters.
- b) The most common allergen within the local anaesthetic cartridge is the preservative for the local anaesthetic.
- c) The most common allergen with the local anaesthetic cartridge is the preservative for the vasoconstrictor.

417

15. Regarding nitroglycerine, which of the following is true?

- a) The drug is given three times with 5-minute intervals as long as chest pain persists.
- b) It is best if it is swallowed.
- c) The tablets are very stable and have a two-year shelf life.

418

16. It is most important to call 911:

- a) After taking the time to assess as much information as possible. There is no rush
- b) If an emergency is suspected, as soon as possible.
- c) Anyone can randomly be assigned at the time of an emergency to call 911.

419

17. Which of the following are ways to reduce the risk of a medical emergency occurring?

- a) TLC.
- b) Reducing pain during treatment as much as possible.
- c) Taking detailed medical histories.
- d) All of the above.

420

18. Which factors increase endogenous epinephrine & as a result increase the risk of an emergency occurring?

- a) Dental anxiety.
- b) Life stress.
- c) Pain.
- d) All of the above.

421

19. When managing someone with chest pain:

- a) Always assume angina before assuming a myocardial infarction.
- b) Start chest compressions as soon as possible.
- c) Give an aspirin as soon as possible.

422

20. Regarding blood pressure, which of the following is true?

- a) The blood pressure cuff should be placed on the upper arm as tight as possible.
- b) Automatic blood pressure cuffs are not very accurate and should be relied on.
- c) It is important to allow someone to rest before taking their blood pressure.

423

### Answers to Quiz

- 1. B
- 2. A
- 3. C
- 4. A
- 5. B
- 6. A
- 7. A
- 8. B
- 9. B
- 10. D

424

### Answers to Quiz

- 11. B
- 12. B
- 13. C
- 14. C
- 15. A
- 16. B
- 17. D
- 18. D
- 19. C
- 20. C

425