The Challenge of Remembering Emergency Training

- Dental treatment is generally safe
  - (Health care offices common calls for EMS)
- Local anaesthetics are generally safe
- We’re not practiced at emergency response
- Pilots renew emergency procedures under supervision every 6 months

Remembering What To Do

- Unpublished study: USC
- Dental residents (endo, pros, perio, pedo, ortho and OMFS)
- Certified in BLS
- 6 months later, BLS written test:
  - Only 13% scored higher than 80%
  - Most unable to adequately perform one-rescuer CPR

Malamed: Oral Health, Feb, 2004

Do You Use Local Anaesthetics?

Dentists who use local anaesthetic agents should be well versed in diagnosis and management of emergencies which may arise from their use. Resuscitative equipment, oxygen and other resuscitative drugs should be available for immediate use.

Deaths in Dental Offices

Anecdotal Reported Statistics:

- 1 death every 2–3 wks. in U.S. dental offices*
- 1000 dental office deaths 2010 – 2015 in U.S.**
- After dental office death in Texas, a reporter extrapolated this to =

~ 1 dental office death every other day

*Laerdal Rep.
**ADSA Pulse, Mar 2016
**Most Common Emergencies in Kids**

Usually associated with drug administration:
- Local anesthesia overdose
- Over-sedation

Or
- Airway obstruction
- Asthma
- Allergy
- Seizures
- Hypoglycemia

All can lead to hypoxia

**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%

**EMERGENCY**

<table>
<thead>
<tr>
<th>Condition</th>
<th>n=30,608</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syncope</td>
<td>15,407</td>
</tr>
<tr>
<td>Mild Allergy</td>
<td>2,583</td>
</tr>
<tr>
<td>Angina</td>
<td>2,552</td>
</tr>
<tr>
<td>Postural Hypotension</td>
<td>2,475</td>
</tr>
<tr>
<td>Seizure</td>
<td>1,595</td>
</tr>
<tr>
<td>Bronchospasm (asthma)</td>
<td>1,392</td>
</tr>
<tr>
<td>Hyperventilation</td>
<td>1,326</td>
</tr>
<tr>
<td>Epinephrine Reaction</td>
<td>913</td>
</tr>
<tr>
<td>Hypoglycemia (insulin shock)</td>
<td>890</td>
</tr>
</tbody>
</table>

95%


**EMERGENCY INCIDENCE IN PRACTICE LIFETIME (40 YRS.)**

- Adverse Reaction to LA 7.0
- Grand Mal Seizure 1.52
- Angina 1.01
- Insulin Shock (hypoglycemia) 1 in 2
- Severe asthma 1 in 3
- Artificial ventilation 1 in 13
- CPR 1 in 17
- Stroke 1 in 20
- LA Anaphylaxis 1 in 60


**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
75% Of Dental Emergencies Are Related To Stress and Anxiety

Level of Dental Fear

<table>
<thead>
<tr>
<th>Question About Treatment</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not afraid at all</td>
<td>703</td>
<td>63.9</td>
</tr>
<tr>
<td>A little afraid</td>
<td>228</td>
<td>20.7</td>
</tr>
<tr>
<td>Somewhat afraid</td>
<td>108</td>
<td>9.8</td>
</tr>
<tr>
<td>Very afraid</td>
<td>22</td>
<td>2.0</td>
</tr>
<tr>
<td>Terrified</td>
<td>39</td>
<td>3.5</td>
</tr>
<tr>
<td>Did not know answer</td>
<td>1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Sources Of Endogenous Epinephrine
- Life stress
- Personality types
- Anxiety (dental phobia)
- Pain (inadequate local anaesthesia)

Epinephrine can ↑ 50 X during stress

Conundrum:
- Medical emergencies occur in dental offices
- Anxiety contributes to this & can change the path of the emergency
- People are fearful of dental visits
- We need LA with epi

What can we do?

Avoiding Medical Emergencies
1. Thorough med hx and vital sign assessment
2. Profound and Comfortable LA
3. Stress Reduction Protocol
4. Be prepared
   a) BLS+ EMS
   b) Office plan
   c) Emergency kit

The Medical History
Incomplete medical history evaluation increases the risk of a medical emergency

Chanpong et al Oral Health, Feb 2006
LA Allergy..... Or Is It?

Patient Reports Allergy:

Ask Questions

Allergy Symptoms

Rule Out Syncope

Rule Out Epi

Known Drug

Unknown Drug

Choose Different Amide, No Vasopressor

Refer To Allergist

Test LA's and Sulfites

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

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

Medical History Thoughts

- Updated drug handbook or online source
- Most common lie is about drug use
  - 11% of Canadians in 2013 used an illegal drug (cannabis, cocaine, speed, ecstasy…)*
- Medical fitness evaluation
  - MD advises risk of treatment
  - May do further tests
  - The buck stops where the treatment is performed

*Millar L, Oral Health, June 2016

ASA Physical Status Classification

ASA I Healthy

ASA II One mild systemic disease, lifestyle no change
  - Mild asthma
  - Controlled epilepsy
  - Extreme anxiety
  - > 60 years old
  - BP 140-160/90-95
  - Well-controlled NIDDM
ASA Classification

ASA III: Severe systemic disease limits activity, not incapacitating:
- Stable angina
- >6 months post MI/CVA no residual effects
- Well controlled IDDM
- Exercise-induced asthma
- BP 160-200/95-115

ASA IV: Incapacitating disease, a constant threat to life
- Unstable angina
- MI or CVA < 6 months ago
- Uncontrolled IDDM
- BP > 200/115
- Cannot walk up one flight of stairs

Remote Offices & ASA IV’s

- ↑ likelihood of need to treat in remote areas
- Fewer OMFS or DA offices
- Fewer hospital dental facilities
- Less or no access to OR time for OMFS
  - E.g. in the U.S.

New Physical Status Classification System

- P1: Healthy
- P2: Mild systemic disease
- P3: Severe systemic disease
- P4: Severe systemic disease, life threat
- P5: Won’t survive operation
- P6: Brain dead

“Standard of Care” for all sedation modalities

Vital Signs

I. Blood Pressure
II. Heart Rate and Rhythm
III. Respiratory Rate
IV. Temperature
V. Height
VI. Weight

1. Blood Pressure

**Purpose:**

Measure the pressure required to collapse the brachial artery

BP > 140 = Hypertension
90
systolic: amount of work by heart
diastolic: condition of heart

Why Check BP? Overall Health
- 20-25% of Canadians have hypertension
- 40% are unaware
- 40% aware but not controlled below 140/90
- .. only 20% aware and controlled well

Consequences of Chronic ↑BP
- CAD
- Heart failure
- Renal failure
- Retinopathy
- Stroke

Dental Office Consequences of ↑BP
- Patient may visit DDS more often than MD
- Intraoperative high BP =
  - ↑ risk for:
    - Angina
    - MI
    - Stroke

Risk Factors For ↑BP
- Smoking
- Lack of exercise
- Diabetes Mellitus
- Obesity
- Stress  
  - dental anxiety!!
    - White coat syndrome
- Excessive alcohol
- Cardiac disease
- Obstructive Sleep Apnea Syndrome
- Uncontrolled kidney or thyroid disease

Whose BP Should We Check?
- All new adult patients?
- At all visits for those with hypertension?
  - Hypertension
  - Cardiovascular disease
  - Stroke
  - Conditions where BP may be affected
    - Eg, obese, kidney disease, diabetes, anxiety, OSA…
Remember: Overall Cardiovascular Effect of Epinephrine in LA

- ↑ BP
- ↑ stroke volume
- ↑ cardiac output
- ↑ heart rate
- More forceful cardiac compressions
- ↑ myocardial O$_2$ demand

Reasons To Limit Epi to 0.04 mg

- Angina (ASA III vs. ASA IV)
- Moderate – severe hypertension
- Recent MI
- Recent bypass
- Uncontrolled dysrhythmias
- CHF
- Uncontrolled hyperthyroidism
- Certain drugs
  - Tricyclics, Strattera, β blockers, Cymbalta

How Do We Take Blood Pressure?

Automatic BP Monitors: Features

- Accurate
- One-size-fits-all cuff or 2 cuffs included
- Error message if cuff not well fitting
- Easy to use, good directions
- Recognizes irregular pulses
- Used by many medical clinics

Withings Blood Pressure Monitor

- Download app
- Approved for medical use in Canada and U.S.
- Good accuracy
Precautions

- Arm at level of heart and at rest
  - (this is why wrist & finger devices less accurate)
- Arms may differ 5-10 mm Hg (left higher)
  - Use the higher value
- Sleeve forming tourniquet
- Rest before measurement (5 min)
  - Avoid caffeine, exercise, stress... 30 min before
- Cuff too small = elevated readings
- Cuff too big = decreased readings

Current BP Classification

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic BP</th>
<th>Diastolic BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120</td>
<td>&lt; 80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120 – 139</td>
<td>80 – 89</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>140 – 159</td>
<td>90 – 99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>≥ 160</td>
<td>≥ 100</td>
</tr>
</tbody>
</table>

US Department of Health and Human Services, 2011

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

BP Medications; Examples

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

In Office BP Management

- < 140/90
  - No special care
- > 140-160/90-100
  - Reassess at next visit. If elevated refer to MD
- >160-180/100-110
  - Monitor BP during appointment. Refer to MD
- >180-200/110-120
  - No elective dentistry. Refer to MD ASAP
- >200/120
  - See MD stat. If symptoms call 911 or go to hospital

BP Letter to Physician

Name:
Date:
Blood Pressure:
Arm:
Position:
Dr. David Isen 416-498-8484
II. Heart Rate & Rhythm

- HR < 60  Bradycardia
- HR > 100  Tachycardia

Regular vs. Irregular

Tachycardia Causes:
- Anxiety, stress, exercise
- Infection
- Fever
- Anemia
- ↑ BP
- Smoking, excess alcohol, recreation drugs
- Some medications
- Hyperthyroidism
- Electrolyte imbalance
- Abnormal congenital electrical pathways
- Damage to heart from heart disease

Bradycardia Causes
- Athlete
- Normal aging of the heart
- Medication side effect
- Hypothyroidism
- Obstructive sleep apnea
- Some inflammatory diseases (e.g. Lupus)
- Damage to heart from heart disease
- Congenital heart disorder

1. Radial pulse
2. Brachial pulse
3. Carotid pulse

Cardiac Dysrhythmias
- Medical consultation
- 911 if associated with:
  - dizziness
  - light headedness
  - syncope
  - weakness

No elective treatment

Implantable Cardiac Devices
- Pacemaker
  - Brady-arrhythmias (heart block)
  - Tachy-arrhythmias (e.g. PSVT)
- Implantable cardioverter-defibrillator (ICD)
  - At risk for sudden death from V-tac or V-fib
  - Inside chest, electrodes through vessels to heart
  - Clavicle area
Subcutaneous Implantable Cardioverter Defibrillator (S-ICD)

- On side of chest
- Less visible than traditional ICD
- Electrodes only in skin, not through vessels
- Less risk of blood clots & other side effects

Which Devices Interfere With ICDs?

- **YES?**
  - Ultrasonic scaler? – old devices
  - Ultrasonic cleaning devices?
  - Apex locators?
- **NO:**
  - Piezo scalers
  - Electric toothbrush
  - Electrosurgical unit
  - Electric pulp tester
  - Handpieces
  - Amalgamator
  - Lasers

Study: Electronic Interference

Tested electronic interference emitted from various endodontic instruments on 3 different ICDs

<table>
<thead>
<tr>
<th>Device</th>
<th>Biotronik PM</th>
<th>Medtronic PM</th>
<th>Medtronic ICD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Optical Microscope</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Endo Rotary Motors</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Gutta-percha Gun</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Gutta-percha Heat Carrier</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Apex Locator</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Closer device is to ICD = ↑ interference

Electromagnetic Interference

- **ADA statement:**
  - “Ultrasonic scalers or instrument cleaning systems could interfere with some ICDs”
- New ICDs have protective shields
III. Respiratory Rate

Normal respiratory rate:

12-20 breathes / min

Respiratory Considerations:

Disorders

- Anxiety
- Asthma
- Smoking
- Respiratory disease
- Fever

Respiratory Considerations:

Anatomy

- Snoring
- Tonsil hypertrophy
- Obesiy
- Obstructive sleep apnea
  - 3-7% males, 2-5% females*
- Anatomic airway abnormalities
  - Retrognathic mandible


OSA Risk Assessment: STOP-BANG

<table>
<thead>
<tr>
<th>OSA</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Do you Snore?</td>
</tr>
<tr>
<td>T</td>
<td>Are you Tired?</td>
</tr>
<tr>
<td>O</td>
<td>Do you have Obstructive breathing?</td>
</tr>
<tr>
<td>P</td>
<td>Do you have high blood Pressure?</td>
</tr>
<tr>
<td>B</td>
<td>Is your Body mass index (BMI) &gt;35</td>
</tr>
<tr>
<td>A</td>
<td>Is your Age &gt; 50?</td>
</tr>
<tr>
<td>N</td>
<td>Is your Neck size &gt;16?</td>
</tr>
<tr>
<td>G</td>
<td>Is your Gender male?</td>
</tr>
</tbody>
</table>

STOP BANG

Score:

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

↑ Numbness and ↓ Pain

- Gauge of needle
  - Aspiration, 30 gauge and breakage
- Quality of needle
  - Electron microscope
- Temperature of anaesthetic
- pH of anaesthetic
  - Plain vs. vaso, Onset and Anutra
- Speed of injection
3. Stress Reduction Protocol

- Recognize signs of anxiety
- Minimize waiting
- Early morning appointment

Stress Reduction Protocol

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

Sedative Dose Considerations

- ASA status
- Age
- Weight
- Medications that effect liver
- Medications that potentiate a sedative
  - E.g. fentanyl patch, sleeping aids, other pain meds
- OSA
- Have an office protocol
- Get RCDSO Standards of Care

Anxiolytics For Adults

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

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

Drug & Brand Name

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Brand Name eg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>alprazolam</td>
<td>Xanax</td>
</tr>
<tr>
<td>diazepam</td>
<td>Valium</td>
</tr>
<tr>
<td>lorazepam</td>
<td>Ativan</td>
</tr>
<tr>
<td>temazepam</td>
<td>Restoril</td>
</tr>
<tr>
<td>triazolam</td>
<td>Halcion</td>
</tr>
</tbody>
</table>

Comparing Benzodiazepines

<table>
<thead>
<tr>
<th></th>
<th>Diazepam</th>
<th>Lorazepam</th>
<th>Triazolam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset (min.)</td>
<td>45 – 90</td>
<td>45 – 120*</td>
<td>30 – 60</td>
</tr>
<tr>
<td>Duration (hr.)</td>
<td>2 – 4</td>
<td>4 – 6</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Active Metabolite</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>1/2 Life (hr.)</td>
<td>20 – 50</td>
<td>15</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Adult Sedative Oral Dose (mg)</td>
<td>5 – 20</td>
<td>1 – 3</td>
<td>0.125 – 0.5</td>
</tr>
<tr>
<td>Supplied (mg)</td>
<td>2, 5, 10</td>
<td>0.5, 1, 2</td>
<td>0.25 – 0.5</td>
</tr>
</tbody>
</table>

*Lorazepam disadvantage: Peak effect takes long to occur
**Suggested Oral Dose (RCDSO)**

**Adult ASA I & II**

<table>
<thead>
<tr>
<th>Minimal Sedation</th>
<th>Moderate Sedation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tx Less Than 2 Hrs:</strong></td>
<td></td>
</tr>
<tr>
<td>triazolam 0.125 - 0.25 mg</td>
<td>triazolam 0.375 – 0.5 mg</td>
</tr>
<tr>
<td><strong>Tx Longer Than 2 Hrs:</strong></td>
<td></td>
</tr>
<tr>
<td>triazolam 0.25 mg OR diazepam 10 – 15 mg OR temazepam 15 mg</td>
<td>triazolam 0.5 mg OR diazepam 20 – 30 mg OR temazepam 30 mg</td>
</tr>
<tr>
<td><strong>Tx Longer Than 3 Hrs:</strong></td>
<td></td>
</tr>
<tr>
<td>lorazepam 0.5 – 1 mg OR alprazolam 0.25 mg</td>
<td>lorazepam 2 – 3 mg OR alprazolam 0.50 mg</td>
</tr>
</tbody>
</table>

*RCDSO Dispatch Nov/Dec 2014*

---

**MRD (RCDSO) Adult ASA I or II**

<table>
<thead>
<tr>
<th>Drug</th>
<th>MRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>alprazolam</td>
<td>0.5 mg</td>
</tr>
<tr>
<td>diazepam</td>
<td>30 mg</td>
</tr>
<tr>
<td>lorazepam</td>
<td>4.0 mg</td>
</tr>
<tr>
<td>temazepam</td>
<td>30 mg</td>
</tr>
<tr>
<td>triazolam</td>
<td>0.75 mg</td>
</tr>
</tbody>
</table>

*Not product monograph recommendations*

*RCDSO Dispatch Nov/Dec 2014*

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**Anxiolytics For Kids**

- Nitrous oxide
- Oral midazolam (0.2–0.7 mg/kg, max 20 mg)
  - Shortest half-life
  - Intranasal (0.3 – 0.5 mg/kg)
- Hydroxyzine
  - (Choral hydrate)

**Hydroxyzine**

- E.g. Atarax, Vistaril
- Antihistamine
  - Antiemetic, antisialogogue
- 1 mg/kg (some use 2 mg/kg)
- 30 minute onset
- Half-life 2 hours

---

**TOPICS**

1. **PATIENT ASSESSMENT**
2. **THE P-CAB-D,s**
3. **EMERGENCY DRUGS**
4. **EMERGENCY ALGORITHMS**

**Basic Life Support**

- SCA most likely to occur at home
- So, likely doing BLS on someone familiar
- But, only 30% of bystanders try a rescue
- Why??
Bystander Apathy

- Fear of hurting someone
- Don’t know what to do
- Panic
- HCP: fear of catching something

Remembering What To Do

- Unpublished study: USC
- Dental residents (endo, pros, perio, pedo, ortho and OMFS)
- Certified in BLS
- 6 months later, BLS written test:
  - Only 13% scored higher than 80%
  - Most unable to adequately perform one-rescuer CPR

Malamed: Oral Health, Feb, 2004

Cardio Pulmonary Resuscitation

- THE PURPOSE:
  - Not to revive the patient
- THE PURPOSE:
  - Chest compressions + defib ASAP
  - Prevent cerebral hypoxia
  - Buy time until EMS arrives

What Happens Without O₂

- 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 does EMS take to get to you?

1. Immediately recognize arrest and EMS activation
2. Early CPR – emphasis on chest compressions
3. Rapid defibrillation
4. Effective advanced life support
5. Integrated post-cardiac arrest care
Position

- **Conscious vs.**
- **Unconscious**

**Latest AHA Guidelines - 2015**

- New guidelines every 5 years
- Based on review of resuscitation literature
- Debates by global experts
- De-emphasize step-by-step for 1 rescuer
- Emphasize team approach
- Try to activate EMS without leaving victim

**2015 Changes**

<table>
<thead>
<tr>
<th></th>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compression Rate</strong></td>
<td>At least 100 / min.</td>
<td>100 – 120 / min.</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>5 cm or 1/3 AP chest diameter</td>
<td>5 – 6 cm or 1/3 AP chest diameter</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Breathing and pulse check separate</td>
<td>HCP check pulse &amp; breathing same time</td>
</tr>
<tr>
<td><strong>When To Call EMS</strong></td>
<td>Witnessed: Right away Unwitnessed: After 1 round of CAB</td>
<td>With cell phone simultaneous during rescue</td>
</tr>
</tbody>
</table>

**Emphasis On Good Compressions**

- Compression rate 100 – 120 / min.
  - Used to be at least 100/min
- Let chest recoil
- Minimize compression interruptions
- Avoid excessive ventilation
- Differentiates untrained vs. trained rescuer
- HCP’s rotate every 2 minutes
- 60% of a rescue should be spent doing “C”

**Change From ABC to CAB**

**Rationale:**

- What saves lives in adult SCA? Chest compressions + early defib
- CAB = faster delivery of compressions
- Ventilation delay minimal: Only ~20 sec (after 1st 30 compressions)
- Residual $O_2$ in lungs?
- Over-inflate lungs ↓ compression effectiveness
Change From ABC to CAB

- Also studies show:
  
  Similar survival rates if compressions only vs. compressions + ventilations for out-of-hospital arrests.

Simplified Cardiac Arrest Algorithm

1. 911
2. CAB (30:2)
3. AED
4. Continued CAB
5. Epinephrine 1 mg

Simplified Adult BLS

Unresponsive
No breathes
Abnormal breathes (agonal gasping)

*If 2nd rescuer

9-1-1
Get AED
If no pulse after shock give 1 mg epi IV or IM
Start CPR 30 : 2
AED check rhythm
Shock if indicated
Repeat every 2 min

Push Hard – Push Fast

Circulation:

Check carotid pulse
Health care providers only
Begin chest compressions ASAP
PUSH HARD AND PUSH FAST

CPR: Cerebral oxygenation is only ~25%

Visual Signs of Cardiac Arrest

- Diaphoresis
- Cold to the touch
- Pale, grey colour
- Blue lips
- Agonal breathing

- Good clues for those not checking pulse

Landmarking

- No longer using rib cage
- Expose chest, look for lower half of sternum
- In some people, between nipples
- Or: Find armpits and slide hand across to midline
Ratio of Compressions : Breaths

30:2

Adult, child & infant

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

C

High Quality Compressions: Depth

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>Adult</th>
<th>Child</th>
<th>Infant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old</td>
<td>1.5-2 inches</td>
<td>1-1.5 inches</td>
<td>0.5-1 inch</td>
</tr>
<tr>
<td>New</td>
<td>(\frac{1}{3} A-P) diameter of chest (5 - 6 cm)</td>
<td>(\frac{1}{3} A-P) diameter of chest</td>
<td>(\frac{1}{3} A-P) diameter of chest</td>
</tr>
</tbody>
</table>

C

Chest Compressions

<table>
<thead>
<tr>
<th></th>
<th>Adult (1 - 8)</th>
<th>Child (1 - 8)</th>
<th>Infant (&lt;1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio 1 rescuer</td>
<td>30:2</td>
<td>30:2</td>
<td>30:2</td>
</tr>
<tr>
<td>2 rescuers</td>
<td>30:2</td>
<td>15:2 (HCP)</td>
<td>15:2 (HCP)</td>
</tr>
<tr>
<td>Hands</td>
<td>Heel of hand, over other hand</td>
<td>Heel of one hand or same as adult</td>
<td>2-3 fingers</td>
</tr>
<tr>
<td>Area Of Compression</td>
<td>Lower ½ of sternum (between nipples)</td>
<td>Lower ½ of sternum (between nipples)</td>
<td>Lower ½ of sternum, just below nipple line</td>
</tr>
<tr>
<td>Depth</td>
<td>2 in, 5-6cm</td>
<td>At least ½ chest thickness</td>
<td>At least ½ chest thickness</td>
</tr>
<tr>
<td>Rate / Minute:</td>
<td>100 - 120</td>
<td>100 - 120</td>
<td>100 - 120</td>
</tr>
</tbody>
</table>

Maximize Compression Effectiveness

- Correct hand position
- Correct rescuer body position
- Correct depth
- Hard surface
- Complete recoil of chest
- Rotate rescuers every two minutes to avoid fatigue
- 60% of rescue should be compressions
A  Airway
- **Check:** Shake and Shout
- **Do:** Head – tilt – chin - lift

B  Head-Tilt-Chin-Lift
- One hand on forehead
- Other hand under chin
- Tilt head back

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

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

Conscious - Mild Obstruction
- Encourage coughing
Conscious – Severe Obstruction

<table>
<thead>
<tr>
<th></th>
<th>Adult</th>
<th>Child</th>
<th>Infant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back</td>
<td>5 back blows</td>
<td>5 back blows</td>
<td>5 back blows</td>
</tr>
<tr>
<td>Blows</td>
<td>5 abdominal</td>
<td>5 abdominal</td>
<td>5 chest</td>
</tr>
<tr>
<td>thrusters</td>
<td>thrusts</td>
<td>thrusts</td>
<td>thrusts</td>
</tr>
</tbody>
</table>

**Abdominal Thrusts (Heimlich): Conscious Choking Adult**

- Lean person back
- Rescuers leg between victims
- Make a fist with thumb tucked in
- Forearms over iliac crest
- Turn fist in towards umbilicus
- Cup other hand over fist
- In and up “J” 5X
- Then:

**Back Blows, Conscious Choking Adult**

- Stand facing victim’s side
- Reach across their chest for support
- Bend victim forward by pushing on back
- Hit victim between scapula 5X
- Repeat 5 abdominal thrusts + 5 back blows until they breathe or unconscious

**Abdominal Thrusts (Heimlich): Conscious Choking Child**

- Rescuer kneels
- Lean child back
- Make a fist with thumb tucked in
- One forearm over iliac crest
- Turn fist in towards umbilicus
- In and up “J” 5X
- Then back blows 5X
- Repeat until not choking or unconscious
**Age**
- Infant: Birth to 1 yr. old
- Child: 1 yr. old to puberty
- Adult: Puberty and older

* Look at body size

**Conscious Choking Infant**
- Get close to floor in case baby drops
- Cradle infant in arms, head pointing down
- Two fingers on sternum, do 5 chest thrusts
- Flip baby over (hold tight) – head still down
- Do 5 back blows
- Repeat until not choking or unconscious

**Conscious Choking Modifications**
- You’re alone and choking
  - Back of chair
  - Hard object
- Pregnant
  - Victim’s back against wall, compress chest
- Victim too large, rescuer too small
  - Rescuer wrap arms around victim’s chest instead
  - Victim stands against wall, compress abdomen

**Unconscious Choking Adult**
- 911
- Slowly slide victim down
- Protect head and your back
- Check mouth: remove object if visible
- 1 breath
- Reposition head – 2nd breath
- 30 chest thrusts, same as chest compressions
- Check mouth
- 2 breaths
- Repeat until air into lungs or EMS arrives
- If air into lungs, check pulse. Then CAB
**Unconscious Choking Child**
- 911
- Same steps as adult
- Heal of one hand only for chest thrusts
- Repeat until air into lungs or EMS arrives
- If air into lungs, check pulse. *Then CAB*

**Unconscious (Limp) Choking Infant**
- 911
- 5 back blows
- 5 chest thrusts
- Check the mouth
- Try 2 breaths
- Repeat until air into lungs or EMS arrives
- If air into lungs, check pulse. *Then CAB*

**D: Definitive Diagnosis**

**CHECK:**
Render a Diagnosis

**DO:**
Drugs or Defibrillation

**Defibrillation - SCA**
- 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

**SCA**
- Sometimes no signs or symptoms
- Hypertension before SCA which is also usually silent
- Sometimes angina or MI previously

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

- Several states have passed laws requiring AEDs in dental offices
- Dentistry Today regularly advertises different AED models
- Costco

The Mikey Network

- Promotes AEDs in public places and dental offices
- Registered charity
- Buy AED through this program, $ given to The Mikey Network

Defibrillation Sequence

- CAB, chest compressions ASAP
  - If VF for a few min, initial compressions can give heart O₂ + energy and ↑ chance shock will work
- Retrieve AED ASAP
- Attach leads and shock if indicated
- Resume CPR
- Repeat every 2 minutes

Rhythms With No Pulse

1. Asystole (flat line)

2. Pulseless electrical activity (PEA)
   - From major blood loss, hypothermia....

Rhythms With No Pulse

3. Pulseless ventricular tachycardia

4. Ventricular fibrillation

Defibrillation

- Stops all electrical activity
- Allows for normal pacemakers to take over
  - Jump starts the heart
**Good 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

**Using An AED**
- Expose chest – cut clothes
- Turn AED on
- Beware of wet surfaces
- Beware of metal surfaces
- Place pads:

**Preparing Chest**
- Shave
- Remove jewellery, medication patches
- Dry skin
  - Diaphoresis common in cardiac arrest
- Avoid direct contact with ICDs but use in these people is ok

**Pad Placement**
- Recorders and shock delivery
- Metal foil and sticky gel (can dry out)
  1. Upper right sternal boarder, directly below clavicle
  2. Lateral & below left nipple with top of pad below axilla
- Adult and pedo size

**AED Use In Children**
- Not usually needed in pediatric emergencies
- Children 1 – 8 yrs.
- Pediatric pads or
- Pediatric attenuator or
- Or place pads anterior – posterior
- Do 1 min. of BLS in pulseless child before calling EMS

**Stroke: Signs & Symptoms**
- **FAST:**
  - Face droop on one side
  - Can’t raise both Arms to same height
    - Do this with eyes closed
  - Speech is slurred or mumbled
  - Time: 911 ASAP
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
- Do not give ASA or nitroglycerine

Designated Emergency Plan
- Team leader
- 9-1-1 caller
- Ambulance greeter
- Emergency kit and AED retrieval
- Airway and Breathing person
- Circulation person
- Drugs
- Fire safety
- Incapacitated DDS

EMS: 9-1-1
- Do not hesitate
- What is office address??
- Average urban response time is 9 min
- 15 min rural
- Irreversible CNS damage in 4-8 minutes
- Survival rates of SCA ↓ 10% for each minute defibrillation is delayed

Other Concerns
- Patients in the reception area
- Patients in other ops
- Family members
- Follow-up
- PLP

RCDSO Standard of Care:
- All dental staff BLS-trained
- Written emergency protocol in place
- Each staff member aware of role during emergency
- Protocol is periodically reviewed
Must Haves
1. Oxygen
2. Epinephrine
3. An antihistamine (e.g. diphenhydramine)
4. Salbutamol
5. Nitroglycerine
6. ASA
7. Glucose
8. Flumazenil and/or naloxone

Other Drugs
- Atropine
- Diazepam or midazolam
- A corticosteroid
- Aromatic ammonia

RCDSO Standard of Care:
It is only after the basic CAB’s have been assessed should one consider the use of an emergency kit.

RCDSO Standard of Care:
- Drugs should not be stale-dated
- Easily portable
- Stored in an organized system
  - Labelled trays / bags or
  - Purchased, organized and appropriate kit

1. Oxygen
   For all emergencies
   Except:
   **Hyperventilation**

Timely or prophylactic use of O₂ may prevent cardiac or respiratory arrest
**Oxygen**

**E cylinder** 622 L - Good portable O₂ size (30 minutes) -Gives ~1.5 hrs. @ 5-6 l/min

**H cylinder** 6900 L - large O₂

---

**When Should Tank Be Replaced?**

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

  \[
  500 \times 0.28 = 14 \text{ min. of } O₂ \text{ flow E tank} \\
  \frac{500 \times 3.14}{10} = 157 \text{ min. of } O₂ \text{ flow H tank}
  \]

---

**Conversion of Factors:**

<table>
<thead>
<tr>
<th>Cylinder Size</th>
<th>Full Volume</th>
<th>Full Pressure</th>
<th>Conversion Factor (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>622 L</td>
<td>2200 psi</td>
<td>L/psi = 0.28</td>
</tr>
<tr>
<td>H</td>
<td>6900 L</td>
<td>2200 psi</td>
<td>L/psi = 3.14</td>
</tr>
</tbody>
</table>

Time left in tank = current psi x f flow L/min

Oxygen Delivery
Breathing Patient

<table>
<thead>
<tr>
<th>Delivery System</th>
<th>% Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room Air</td>
<td>21%</td>
</tr>
<tr>
<td>Nasal Cannula</td>
<td>24 – 44%</td>
</tr>
<tr>
<td>Face Mask</td>
<td>40 – 60%</td>
</tr>
<tr>
<td>Face Mask + O₂ Reservoir (With Non-Rebreather NRB)</td>
<td>&gt; 60% at 6 l/min ~100% at 10 l/min (NRB)</td>
</tr>
</tbody>
</table>

Nasal Hood

- Rubber or silicone, no metal
- Anterior procedures?
- Variety of sizes
- Disposable, flavoured
- 1 – 4 attachments for tubing
- Exhale valve with wafer on top of hood
- What happens if LOC and mouth breather?

Full Face Mask  Non-Rebreather Mask

- Exhale valve with wafer on top of hood
- What happens if LOC and mouth breather?

Non-Rebreather Mask

<table>
<thead>
<tr>
<th>Delivery System</th>
<th>% Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth-To-Mouth</td>
<td>16%</td>
</tr>
<tr>
<td>Mouth-To-Mask + Supplemental O₂</td>
<td>~50%</td>
</tr>
<tr>
<td>Bag-Valve-Mask + Supplemental O₂</td>
<td>100%</td>
</tr>
</tbody>
</table>

Oxygen Flow Rate Volume

<table>
<thead>
<tr>
<th>Flow Rate (LPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child at rest</td>
</tr>
<tr>
<td>Adult at rest</td>
</tr>
<tr>
<td>NRB Mask</td>
</tr>
<tr>
<td>BVM</td>
</tr>
</tbody>
</table>

Oxygen Delivery Rate If Not Breathing

<table>
<thead>
<tr>
<th>Normal Rate / Minute</th>
<th>One Breath Every:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>20 – 30</td>
</tr>
<tr>
<td>Child</td>
<td>16 – 20</td>
</tr>
<tr>
<td>Adult</td>
<td>10 – 12</td>
</tr>
</tbody>
</table>
Bag Valve Mask

• BVM without supplemental O\textsubscript{2} gives \textasciitilde21\% O\textsubscript{2}
• Crimp bag to fill up reservoir first
• Valve makes this a 1 way flow
• Mask transparent
• Beards?

One Rescuer BVM

“E – C” Finger Position
C = Thumb and index finger: Seals mask
E = Other 3 fingers: Jaw thrust

Two Rescuer BVM

Thumb and index seal mask
Other fingers thrust jaw
Pressing too hard in soft area: Tongue pressed into hard palate & blocks airway

O\textsubscript{2} Not Getting To Lungs?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest not rising:</td>
<td>• Ensure mask seal</td>
</tr>
<tr>
<td></td>
<td>• Ensure airway is open</td>
</tr>
<tr>
<td></td>
<td>• Head-tilt-chin-lift, jaw thrust</td>
</tr>
<tr>
<td></td>
<td>• 2 rescuers</td>
</tr>
<tr>
<td></td>
<td>• Airway adjuncts</td>
</tr>
<tr>
<td>Stomach rising* :</td>
<td>• Ensure airway is open</td>
</tr>
<tr>
<td></td>
<td>• Head-tilt-chin-lift, jaw thrust</td>
</tr>
<tr>
<td></td>
<td>• Push less air</td>
</tr>
<tr>
<td></td>
<td>• 2 rescuers</td>
</tr>
</tbody>
</table>

*O\textsubscript{2} in stomach could cause vomiting & aspiration

2. Epinephrine

<table>
<thead>
<tr>
<th>Strength</th>
<th>Action</th>
<th>Result</th>
<th>When Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\alpha) ++</td>
<td>Vasoconstriction of local, small submucosal vessels</td>
<td>(\uparrow) SBP</td>
<td>Cardiac Arrest</td>
</tr>
<tr>
<td>(\beta) ++</td>
<td>Cardiotropic: Stimulates receptors in SA node and heart muscle</td>
<td>(\uparrow) HR, contractility &amp; (\uparrow) SBP</td>
<td>Cardiac Arrest Anaphylaxis</td>
</tr>
<tr>
<td>(\beta) ++</td>
<td>Vasodilation of large peripheral arteries (due to systemic absorption) &amp; Bronchodilation</td>
<td>Slight (\downarrow) DBP*</td>
<td>Anaphylaxis Life-threatening Asthma</td>
</tr>
</tbody>
</table>

*Minor change in MAP with smaller doses of epinephrine
* People on \(\beta\) blockers may have blunted effect

Epinephrine

- Light sensitive
- Store at room temperature
- 1 – 2 year shelf life
- Contains sodium metabisulfite
- Half-life is 2 – 3 minutes
**Epinephrine Formulations**

<table>
<thead>
<tr>
<th>Device</th>
<th>Dose / Injection</th>
<th># of Doses</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampoule 1:1,000</td>
<td>Variable</td>
<td>Variable</td>
<td>0.01 mg/kg*</td>
</tr>
<tr>
<td>Adult Auto-Injector</td>
<td>0.3 mg</td>
<td>1**</td>
<td>&gt; 30 kg</td>
</tr>
<tr>
<td>Pediatric Auto-Injector</td>
<td>0.15 mg</td>
<td>1**</td>
<td>15 – 30 kg</td>
</tr>
</tbody>
</table>

+ Use dose of 0.01 mg/kg for children < 15 kg
** Twinject has 2 doses

---

**Doses of Epinephrine**

- **Pediatric Dose**: 0.01 mg/kg
  - **Anaphylaxis**: 0.3 - 0.5 mg IM
  - **Asthma**: 0.3 - 0.5 mg IM
  - **Cardiac Arrest**: 1.0 mg IV

**Anaphylaxis**

- 35% anaphylactic rxns need 2nd dose of epi.
- Need for multiple doses directly related to severity of rxn.
- However, some mild cases require a 2nd dose
- Anaphylaxis Canada & WHO recommend always have 2 doses.

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

**Auto-Injectors**

- First developed for U.S. military in 1959: administer atropine – protection from nerve gas poisoning
- 30 – 70% do not carry their devices*
- Most healthcare workers unaware of proper use*


**How to Use Auto-Injector**

- Follow specific instructions
- Never put thumb over an end
- Swing arm like pendulum
- Push (consider larger patients)
- Leave in muscle for 10 seconds
- Contain sulphite
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?)


Auto-Injector Precaution
Study:

- Ultrasound measure distance from skin to vastus lateralis in children 1 – 12 yrs.
- 12% of children less than 30 kg, distance from skin to muscle greater than length of needle on EpiPen Jr. or Twinject Pedo (½ inch)


Recall (April 2017):

- Batch # 5GU763 (adult)
- Batch # 5GR765 (pedo)
- Needle failed to activate in some devices. (None in Canada)

New EpiPen
• Single or “2-Pak”
  • ~$100 - $200
  • If you carry adult and pedo version, ~$400?
  • Better directions on unit

Using the New EpiPen

- Take off yellow cap and remove from tube
- With orange tip down, remove blue safety cap
- Orange end into thigh – swinging motion
- Push firm against outer thigh until it clicks
- Leave in for 10 seconds
- Message area
Other Thoughts
- Never push orange end
  - If injected into finger by mistake??
  - If dropped, check for integrity
  - Should be perpendicular to mid-thigh
  - Do not inject into buttocks – sciatic nerve
  - When removed, orange cap covers needle

Sanofil (U.S.) Recall
- Both adult and pedo
- Delivers incorrect dose
- Lot #s 2299596 to 3037230

I.M. Injection Locations
- Gluteous medius
- Vastus lateralis
- Deltoid
- PSA block for pterygoid plexus of veins?
- Ventral surface of tongue or floor of mouth
  - Possible close airway by swelling tongue
- Onset of action 2 min.
- Peak plasma concentration for IM is ~8 min.
- Peak plasma concentration for SC is ~34 min.

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

Allerject
- Voice prompt (eng or french) when removed from case
- During injection there is click and 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 and adult version (blue vs. orange)

I.M. Injection Locations

<table>
<thead>
<tr>
<th></th>
<th>Deltoid</th>
<th>Vastus Lateralis</th>
<th>Gluteus Medius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume Allowed</td>
<td>1 ml</td>
<td>2 ml</td>
<td>3 ml</td>
</tr>
<tr>
<td>Depth of Injection</td>
<td>~15 - 25 mm</td>
<td>~25 - 40 mm</td>
<td>Variable</td>
</tr>
<tr>
<td>Advantages</td>
<td>Easy access</td>
<td>Fewer Injuries</td>
<td>Fastest drug uptake</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Slower uptake than thigh</td>
<td>Small volume</td>
<td>Injury to nerves or vessels unlikely</td>
</tr>
</tbody>
</table>

*Depth varies based on patient size and fat
Vastus Lateralis
- Lateral thigh
- Largest muscle in body
- Good arterial supply
- More rapid rise of epi in blood compared to deltoid
- Best with auto-injector
- Arrow shows injection site

Deltoid Injection
- Target is 2-3 finger widths (2-3 cm) below bony part of shoulder (acromion process)

Deltoid Injection
- Prepare drug and syringe
- Expose deltoid area
- Clean with alcohol and dry
- Patient relaxes muscle, arm supported
- Stretch skin over muscle
  - Do not pinch skin together
- Hold syringe like a dart & insert 15-25 mm
- Inject perpendicular to skin
- Aspirate
- Inject

IM Safety Needle Examples
- BD Eclipse Safety Needle
- BD Safety-Lok
- Integra Safety Syringe

Ampoule vs. Autoinjector

<table>
<thead>
<tr>
<th></th>
<th>Ampoule</th>
<th>Autoinjector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple doses</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Risk of operator injury</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Possible incorrect use</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Needle length</td>
<td>Can choose 1 - 2 inches</td>
<td>5/8 or ½ inch</td>
</tr>
<tr>
<td>Must draw drug</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Must calculate dose</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Shelf life</td>
<td>2 years</td>
<td>1 year</td>
</tr>
<tr>
<td>Cost</td>
<td>~$1</td>
<td>~$100</td>
</tr>
</tbody>
</table>

3. Nitroglycerin
- Relaxes smooth muscle in arteries & veins
- ↓ venous return to heart due to peripheral pooling (↓ pre-load)
- Dilates coronary arteries so ↑ O₂ to heart
- ↓ myocardial O₂ demand
- ↓ BP
- Limits cardiac damage following MI

For angina or MI
**Nitroglycerin Protocol**
- Tablets light & oxygen sensitive (open bottle shelf life 3 months). 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
- Call ASAP if unstable angina or suspected MI

**Nitroglycerin Contraindications**
- SBP < 60
- Suspected stroke
- Those taking drugs for erectile dysfunction:
  - **Within 24 hrs** for sildenafil (Viagra) or vardenafil (Levitra)
  - **Within 48 hrs** for tadalafil (Cialis)
  - Or for those who take these drugs daily

**Coronary Artery Disease**
- Level 1: Angina with excessive exercise
- Level 2: Angina with mild exercise
- Level 3: Angina with normal activity
- Level 4: Angina at rest

**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**

**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**

**Sublingual Tablets**
- **Nitrostat™**: 0.3, 0.4 or 0.6 mg
- q 5 min. x 3 doses
- 100 tablets per container
- Unstable
Sublingual Spray

- **Nitrolingual® Spray**
  - 1 - 2 metered-doses (0.4 mg - 0.8 mg)
  - q 5 min. x 3 doses
- On or under tongue
- Mouth closed - not inhaled
- 200 metered doses / bottle
- Shelf life 2 years

Emergency Drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Use</th>
<th>Adult Dose</th>
<th>Child Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>Most Emergencies</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>Anaphylaxis</td>
<td>0.3-0.5 mg IM*</td>
<td>0.01mg/kg</td>
</tr>
<tr>
<td></td>
<td>Asthma</td>
<td>0.3-0.5 mg IM*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cardiac Arrest</td>
<td>1 mg IV</td>
<td></td>
</tr>
<tr>
<td>Nitroglycerin</td>
<td>Angina MI</td>
<td>0.4 mg tablet</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4 mg spray</td>
<td></td>
</tr>
</tbody>
</table>

*IM dose can be given as a sublingual injection

4. Diphenhydramine

- An antihistamine
- Blocks histamine mediated reactions
- Available in many formulations
  - **Injectable** form: 1 ml vial with 50 mg dose
  - **Capsules** are 25 or 50 mg
  - **Elixir** 12.5 mg / 5 ml

Diphenhydramine

- Useful for:
  - Mild allergic reactions
  - Asthma
  - Nausea
  - Sedative
  - Local anaesthesia

Allergy Symptoms

- Itching
- Hives
- Rash
- Bronchospasm
- Vasodilation

Benadryl

Diphenhydramine Emergency Dose

- Adults 50 mg IM or IV
- Children 1 mg/kg IM or IV to a maximum of 50 mg

---

*IM dose can be given as a sublingual injection*
5. Salbutamol
- Trade name = Ventolin®
- Bronchodilation via β-2 stimulation
  - Direct action relaxing bronchial smooth muscle
- 1 puff = 100 µg
  - 2 - 4 puffs q 2 minutes x 2
    (first few puffs may loosen airway for subsequent puffs)
- Onset 5 - 15 minutes
- Duration: 3 - 6 hours

Using the Inhaler
- Shake inhaler vigorously for 5 - 10 seconds
- Empty lungs (blow out)
- Remove blue cap
- Put inhaler in mouth and press top down
- Inhale drug
- Hold for 2 - 3 seconds

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 exacerbate nausea / vomiting

6. ASA
- Inhibits platelet aggregation
- 23% ↓ in mortality when used after MI*
  - Prevents ischemia → injury → infarction

Why Chew?
- Swallow: max blood levels of ASA in 26 minutes
- Chew: max blood levels of ASA in 14 minutes

*Bennet JD et al. “Medical Emergencies in Dentistry”, 2002
NSAID Contraindications

- Allergy
- History of significant GI bleed
- Asthma
- NSAID exacerbated respiratory disease
- History of renal disease
- Prior MI on antithrombotic therapy

Emergency Drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Use</th>
<th>Adult Dose</th>
<th>Child Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salbutamol</td>
<td>Asthma</td>
<td>2 - 4 puffs 100μg/puff</td>
<td>2 - 4 puffs</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>Allergy</td>
<td>50 mg IV/IM</td>
<td>1 mg/kg</td>
</tr>
<tr>
<td>ASA</td>
<td>MI Thrombolytic</td>
<td>162 to 325 mg</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Emergency Drugs Cost

<table>
<thead>
<tr>
<th>Drug</th>
<th>~Cost</th>
<th>Shelf Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine Ampoule</td>
<td>$2</td>
<td>2 years</td>
</tr>
<tr>
<td>Epi-Pen</td>
<td>$100</td>
<td>1 year</td>
</tr>
<tr>
<td>Nitro Tablets</td>
<td>$12 / 100 tablets</td>
<td>6 months</td>
</tr>
<tr>
<td>Nitro Spray</td>
<td>$12</td>
<td>2 years</td>
</tr>
<tr>
<td>Benadryl Vial</td>
<td>$5</td>
<td>2 years</td>
</tr>
<tr>
<td>Ventolin Inhaler</td>
<td>$10</td>
<td>1 year</td>
</tr>
<tr>
<td>ASA</td>
<td>$4 / 24 tablets</td>
<td>2 years</td>
</tr>
</tbody>
</table>

7. Oral Glucose

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

Oral Glucose

<table>
<thead>
<tr>
<th>Source</th>
<th>Grams of Glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 ml. Can of Cola (not diet!!)</td>
<td>39</td>
</tr>
<tr>
<td>Insta-Glucose</td>
<td>30</td>
</tr>
<tr>
<td>200 ml. Apple Juice Box</td>
<td>21</td>
</tr>
<tr>
<td>Glucose Tablet</td>
<td>15</td>
</tr>
<tr>
<td>Sugar Packet</td>
<td>4</td>
</tr>
<tr>
<td>1 LifeSaver</td>
<td>2</td>
</tr>
</tbody>
</table>

Insta-Glucose

- Thick syrup
- Twist off cap
- Adult whole tube (30 g), child half
### Other Emergency Drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Use</th>
<th>Dose &amp; Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine</td>
<td>Hypotension, pulse less than 60 (if symptomatic)</td>
<td>0.6 mg IM or SL</td>
</tr>
<tr>
<td>Ephedrine</td>
<td>Hypotension, pulse greater than 60</td>
<td>25 mg IM or SL</td>
</tr>
<tr>
<td>Corticosteroid</td>
<td>Anaphylaxis</td>
<td>IV, in hospital</td>
</tr>
<tr>
<td>Anti-Epileptic (diazepam or midazolam)</td>
<td>Seizure &gt; 5 min</td>
<td>IV best but midazolam ok IM</td>
</tr>
<tr>
<td>Ammonia spirits</td>
<td>Unconsciousness</td>
<td></td>
</tr>
</tbody>
</table>

### Corticosteroids For Anaphylaxis
- Dexamethasone, hydrocortisone, prednisolone
- Helps reduce inflammation
  - Stabilize mast cells to ↓ histamine release
- Given after epi and antihistamine
- Not for acute phase – onset 1 hr.
- Best emergency route is IV but 1 – 2 wk. course of oral steroid after emergency (PO, IM, IV)
- Some corticosteroids contain sulphites

### Adrenal Insufficiency: Emergency Drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Adult IM Dose</th>
<th>Adult IV Dose</th>
<th>Pedo IM Dose</th>
<th>Pedo IV Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dexamethasone</td>
<td>8 mg</td>
<td>0.5 - 9 mg</td>
<td>0.03 - 0.15 mg/kg</td>
<td>0.02 - 0.3 mg/kg</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>100 - 200 mg</td>
<td>100 mg</td>
<td>4 - 8 mg/kg</td>
<td>1 - 2 mg/kg</td>
</tr>
</tbody>
</table>

- No best recommended steroid
  - CPS recommends hydrocortisone
- Dose differs from various sources

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

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

### Flumazenil (Anexate) Rescue Dose

**Adult**
- 0.6 – 1 mg IV total via 0.2 mg increments every minute
- Or 0.2 mg in each deltoid if IV not possible

**Child (1 – 17 yrs.)**
- 0.01 mg/kg IV up to max 0.05 mg/kg

***911 and CABs***
Sublingual Flumazenil Study

Adults given 3 incremental doses of 0.25 mg triazolam in 90 min. to induce deep sedation

0.2 mg of flumazenil given sublingually

Results: deep sedation was not totally reversed and reversal that did occur did not persist

Hosaka K et al, J Am Dent Assoc, 140(5):559-66, 2009

Naloxone

<table>
<thead>
<tr>
<th></th>
<th>IV</th>
<th>IM / SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset</td>
<td>2 min</td>
<td>10 min</td>
</tr>
<tr>
<td>Duration</td>
<td>30 min</td>
<td>1 – 4 hrs</td>
</tr>
<tr>
<td>Adult Dose</td>
<td>0.1 mg q 2–3 min</td>
<td>0.4 mg q 5 min x2</td>
</tr>
</tbody>
</table>

- Supplied as 0.4 mg/ml or 1 mg/ml
- Maximum dose is 0.8 mg
- Nasal spray available
- 911 and CAB

Naloxone or Flumazenil First?

- Respiratory depression usually caused by opioid
- Naloxone better at reversing respiratory depression

***Give Naloxone first

Pitfalls of Reversal Agents

- O₂ and 911 still paramount
- Reversal agent has shorter half life than sedative (1/2 hour)
  - Recurrence of sedation
  - Keeping patient in office for duration of reversal agent action (~ 1 hr.)
- IM use long onset (5 – 10 min.) and limited effectiveness

Emergency Equipment: Monitors

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

Emergency Equipment: Tools

- Clear masks for passive and positive pressure O₂ delivery
  - Various sizes
- Yankauer suction
  - High volume suction adapter
- Emesis basin
- Oropharyngeal airways

MedicalMart has purchasing program based on RCDSO sedation Standards of Care
Avoiding A Catastrophe: Practice

Perfect practice pays off:
- Practice emergency protocols
- Practice using emergency drugs
- Have a written office policy regarding emergency protocol
- Everyone knows their role

Avoiding a Catastrophe: Before Treatment

- Obtain a thorough medical history
- Assess vital signs
- Assign an ASA status
- Contemplate referral or MD consultation
- Stress reduction protocol

Avoiding a Catastrophe: During Treatment

- Continue stress reduction protocol
- Minimize treatment induced discomfort
- Be aware

Minimizing a Catastrophe: During An Emergency

- Emergency kit
  - organized, locatable, updated, algorithms
- BLS updated: know the P - CAB’s and D’s
- AED
- Institute office emergency plan and EMS access protocol

Emergency Bags

1. Syncope / hypoglycemia
2. Chest pain: Angina / MI
3. Cardiac arrest
4. Allergy / Anaphylaxis
5. Asthma