# Emergency Medicine

# -

# Back To Basics

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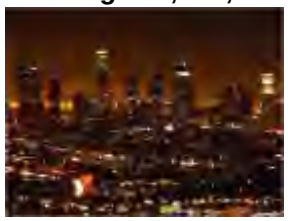



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## DISCLOSURE

**I am a paid consultant to:**

**Healthfirst Corporation**



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## Medical emergencies CAN and DO happen in the practice of dentistry



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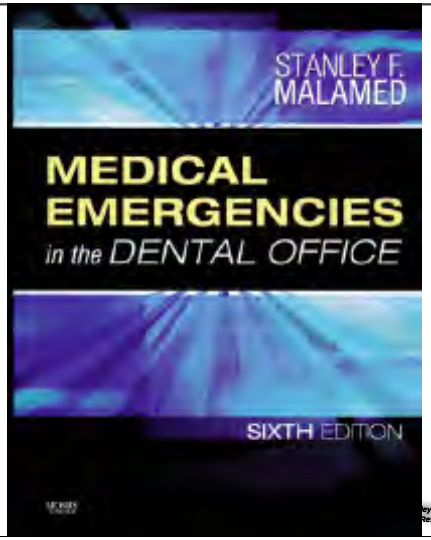
**PREPARATION**
**for**
**EMERGENCIES**



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| | |
|---|---|
| Syncope | 15,407 (50.3%) |
| Mild allergy | 2,583 (8.4%) |
| Angina Pectoris | 2,552 (8.3%) |
| Postural hypotension | 2,475 (8.1%) |
| Seizure | 1,595 (5.2%) |
| Asthmatic attack | 1,392 (4.5%) |
| Hyperventilation | 1,326 (4.3%) |
| Epinephrine Rxn | 913 (3.0%) |
| Hypoglycemia | 890 (2.9%) |



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| | |
|---|---|
| Cardiac Arrest | 331 (1.1%) |
| Anaphylaxis | 304 (1.0%) |
| Myocardial Infarction | 289 (0.9%) |
| L.A. Overdose | 204 (0.7%) |



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# Medical Emergencies
## Stage of Treatment

| Treatment Stage | Occurrence |
|---|---|
| Immediately before Tx | 1.5% |
| During or after local | 54.9% |
| During treatment | 22% |
| After treatment | 15.2% |
| After leaves office | 5.5% |



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# Medical Emergencies
## Treatment being performed

| Treatment | Occurrence |
|---|---|
| Tooth extraction | 38.9% |
| Pulp extirpation | 26.9% |
| Unknown | 12.3% |
| Other treatment | 9% |
| Preparation | 7.3% |
| Filling | 2.3% |
| Incision | 1.7% |



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# Preparation of the Office & Staff

1. *Basic Life Support training*
2. **Preparation of Dental Office Staff Members**
3. **Emergency Assistance**
4. **Emergency Drugs & Equipment**



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# BASIC LIFE SUPPORT
**(CPR, Resuscitation, Reanimation)**
**is THE single-most important step in the management of ALL medical emergencies**



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## The HEART is a PUMP




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## What happens when the heart stops *PUMPING* blood?



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**Blood pressure falls to zero**

**Pulse is not palpable**

**Consciousness is lost**

**Respirations cease**



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# DEAD

**UNCONSCIOUS**

**NO PULSE**

**NO BREATHING**

# DEAD



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## Sudden Cardiac Arrest

**In the absence of any treatment death is a certainty**





## Sudden Cardiac Arrest

**Doing 'something' gives the victim a chance at survival**





## At the moment the heart stops pumping, circulation of blood ceases.

- The victim 'looks' dead
- They are "CLINICALLY" DEAD
  - Clinical death may be reversable





## The goal of resuscitation is to prevent the *PERMANENT* death of the victim.

- Cells in the victims body will die when they use up all of the $O_2$ available to them
- BIOLOGICAL or CELLULAR death occurs
- Biological death is *irreversible*

**The time between the occurrence of**

**CLINICAL and BIOLOGICAL DEATH represents the period in which RESUSCITATION may be successful**



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Supplement to

# Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION

Volume 122 ■ Number 18 ■ Supplement 3
November 2, 2010

Editorial Board S639

2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science

**American Heart Association 2010 BLS changes**



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- **AHA Guidelines relate primarily to Sudden Cardiac Arrest - fortunately a rare event in the dental environment.**
- **Cardiac arrest occurs when the heart stops PUMPING blood, not - as some believe - when the heart stops BEATING.**



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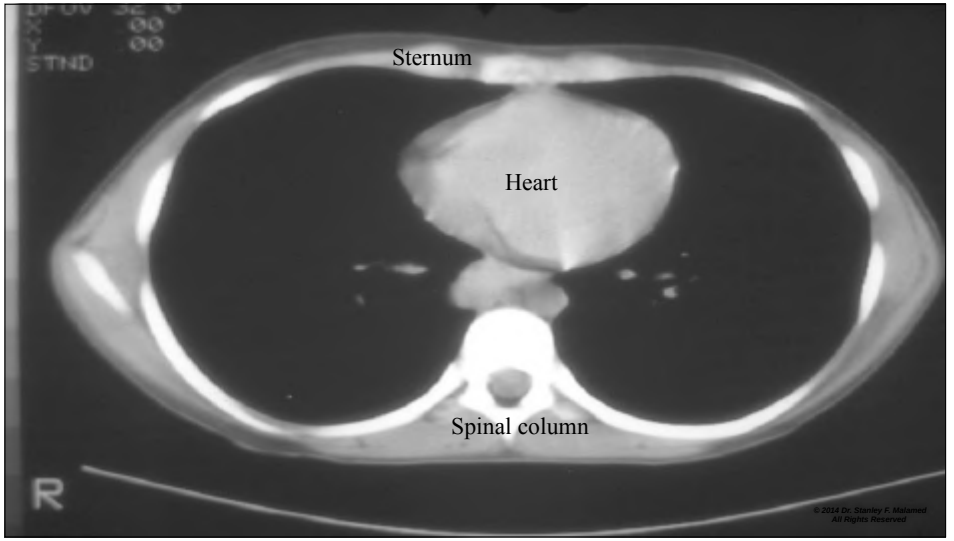




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## EMERGENCY MANAGEMENT ALGORITHM

# P - C - A - B - D

**Algorithm for**
**ALL**
**emergency management**



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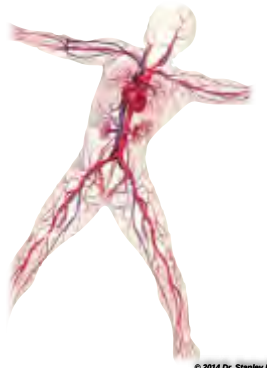
## At any given moment in your cardiovascular system:

- 65% of blood is in the venous circulation
- 5% of blood is in capillaries
- 30% of blood is arterial





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## Continued emphasis has been placed on high-quality CPR:

- Chest compressions of adequate rate and depth,
- Allowing complete chest recoil after each compression,
- Minimizing interruptions in compressions, and
- Avoiding excessive ventilation.



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## P - C - A - B - D

**So, Why the change in the algorithm?**

**At the moment the heart stops pumping circulation of blood ceases**

- the **5%** of blood found in capillaries will keep cells alive for a few minutes, depending upon that cells metabolic rate



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## Preventing Biological Death

- At the moment when blood flow ceases (cardiac arrest occurs) cells still have $O_2$ available (5% capillaries) and will remain alive until they use it up - then cellular death occurs.
- Cells with lower metabolic rates will survive longer
- Cells with higher metabolic rates will die faster



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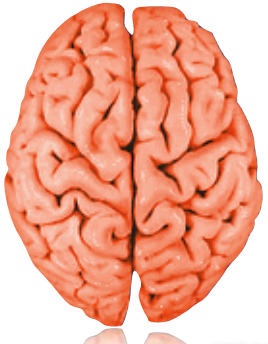
## Preventing Biological Death

- Neurons deprived of $O_2$ (anoxia) for approximately 3 minutes will demonstrate degrees of permanent damage





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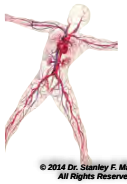
## P - C - A - B - D

- Arteries deliver oxygenated blood to capillaries.
- 30% of blood volume is found in arteries
- The new algorithm implies "Use up the $O_2$ in the arterial blood which is 'sitting' just a short distance away from capillaries before we ventilate."





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## BASIC LIFE SUPPORT

**(CPR, Resuscitation, Reanimation)**

**is THE single-most important step in the management of ALL medical emergencies**



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# Preparation of the Office & Staff

1. **Basic Life Support training**
2. *Preparation of Dental Office Staff Members*
3. **Emergency Assistance**
4. **Emergency Drugs & Equipment**





## Member #1

- 1st person on scene of emergency

- Stay with victim; yell for 'HELP'
- Administer BLS, as needed







## The DOCTOR

- Need *NOT* be the person 'rescuing' the victim.

- Duties CAN be delegated, however . . .
- the doctor is ultimately responsible for the actions of staff members







## Member #2, on hearing call for *HELP* . . .

**Obtains:**

- 1. Emergency drug kit;
- 2. Portable $O_2$ cylinder; and
- 3. AED

• . . . bringing them to site of emergency

## Members #3, #4 and on . . .
## Assigned ancillary tasks such as:

- **Monitoring vital signs (BP, heart rate & rhythm)**
- **Assist with basic life support**
- **Activate EMS**
- **Hold elevator in lobby while awaiting arrival of EMS**
- **Prepare emergency drugs for administration.**
- **Keep written time line record during emergency**







# TEAM Approach - Hospital






# Idea

- **Laminated cards for each member of the TEAM**
- **Listing duties during emergency**





# Preparation of the Office & Staff

1. **Basic Life Support training**
2. **Preparation of Dental Office Staff Members**
3. *Emergency Assistance*
4. **Emergency Drugs & Equipment**

# EMS Services

When the DOCTOR or other PERSON IN CHARGE feels it is necessary


NEVER HESITATE to seek help if you feel it is needed

**When?**



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# EMS



**9 1 1**



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# Preparation of the Office & Staff

1. **Basic Life Support training**
2. **Preparation of Dental Office Staff Members**
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4. *Emergency Drugs & Equipment*



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# Emergency drugs & equipment USA

**Numerous specialty organizations (AAP, AAOMS, AAPD, AGD) have developed Guidelines for their members and other dentists practicing that specialty**



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# Emergency drugs & equipment USA

**IF the doctor utilizes:**

**GENERAL ANESTHESIA**
**PARENTERAL SEDATION (IM, IV, IN)**
**ORAL SEDATION**

**Individual States have Regulations requiring a predetermined list of EMERGENCY DRUGS & EQUIPMENT**



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septocaine® with epinephrine 1:100,000
Septocaine® with epinephrine 1:200,000
articaine hydrochloride 4% (40 mg/mL) with epinephrine 1:100,000 or 1:200,000 injection)

For Infiltration and Nerve Block Anesthesia

WARNINGS
Accidental intravascular injection may be associated with convulsions, followed by central nervous system or cardiorespiratory depression and coma, progressing ultimately to respiratory arrest. Dental practitioners and/or clinicians who employ local anesthetic agents should be well versed in diagnosis and management of emergencies that may arise from their use. Resuscitative equipment, oxygen, and other resuscitative drugs should be available for immediate use.



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**Proprietary Emergency Kits**
**Advantage: Convenience; Drug updates**
**Disadvantage: Complacency; $ $ $**



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# Critical drugs & equipment

# THE BASIC SEVEN



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# Epinephrine (Adrenaline)


**Single most important drug in emergency medicine**




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# Epinephrine


- 1:1,000 AND 1:2,000
  - Autoinjector
  - 1:2,000 up to 30 kg weight
  - 1:1,000 if more than 30 kg

- INDICATION: Anaphylaxis
- CONTRAINDICATIONS: None



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# Histamine-Blocker

- Diphenhydramine HCl injectable
  - Benadryl
- 50 mg/mL


- INDICATION: Anaphylaxis, Mild Allergy
- CONTRAINDICATIONS: None



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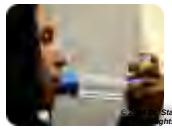
# Bronchodilator


## Albuterol

- Proventil, Ventolin, ProAir

- Bronchospasm (asthma)

- NO CONTRAINDICATIONS
- Spacer recommended for younger patients





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## Coronary artery VASODILATOR

### Nitroglycerin

- Nitrolingual spray (USD$200+)
- Nitrostat sublingual tablets (USD$50/100tabs)
- 0.4 mg/dose

- INDICATION: Angina pectoris; Prehospital management of cardiac pain
- CONTRAINDICATION:
  - Hypotension





## Antihypoglycemic


- Non-diet soft drink
- Orange juice
- Tube of concentrated glucose
  - InstaGlucose

For oral administration

- INDICATION: Hypoglycemia
- CONTRAINDICATION: Unconsciousness





## Thrombolytic

### Aspirin (ASA)


- 325 mg
- Powdered or
- Chewable

- INDICATION: Suspected myocardial infarction
- CONTRAINDICATION: Allergy





## Oxygen

The 2nd most important drug in emergency medicine

# Oxygen

- **'E' cylinder + delivery system**
- **INDICATION: Any medical emergency**
- **CONTRAINDICATION: None ***

*** Hyperventilation**





# Equipment

- **Disposable face masks (pediatric & adult for ventilation with supplemental $O_2$)**





# Equipment

- **Automated External Defibrillator (ED)**

Why *YOU* want *2* AED's





# Sudden Cardiac Arrest

- **70% of out-of-hospital SCA occur in the HOME of the victim.**
- **As dentists we have TWO homes:**
  - **The one in which we live**
  - **The one in which we work**

# Automated External Defibrillator

- **Defibrillation has been a component of Healthcare Provider Basic Life Support since 2000**
- **Survival from Out-Of-Hospital Sudden Cardiac Arrest is related to the elapsed time from collapse of the victim to defibrillation**







- **44 of 50 states in the USA mandate successful BASIC LIFE SUPPORT training to maintain DENTAL LICENSURE**
- **12 states (as of December 2013) mandate presence of an AED on-site**
  - **Florida, Colorado, Arkansas, Georgia, Louisiana, Massachusetts, Michigan, Maryland, Tennessee, North Carolina, West Virginia, and Wisconsin**







# Note

**The doctor is expected to be knowledgeable of, and able to use, any drug or piece of emergency equipment contained in the emergency kit.**





# BASIC MANAGEMENT of MEDICAL EMERGENCIES

# EMERGENCY MEDICINE

# P - C - A - B - D



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## Emergency Management

# P - Position



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# P - Position

- **CONSCIOUS**
  - **responds to sensory stimulation** (e.g. “shake & shout”)
  - **blood flow to brain is** (minimally) **adequate**
  - **ANY POSITION the victim desires is appropriate**



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# P - Position

- **UNCONSCIOUS**
  - **lack of response to sensory stimulation**
    (e.g. “shake & shout”)
  - **< blood flow to brain most common cause of unconsciousness**
- **SUPINE with feet elevated slightly**
  - **increases blood flow to brain**
  - **does NOT compromise breathing**



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# P - Position

- **UNCONSCIOUS**
  - **Lack of response to sensory stimulation**
    **(e.g. “shake & shout”)**
  - **Quickly assess for presence of respiratory efforts & circulation**
    - **If NO then immediately start C-A-B sequence**
    - **If YES then continue with A-B**







# C - Circulation





# C - Circulation

- **UNCONSCIOUS**
  - **Palpate peripheral pulse: CAROTID recommended [adult]**
  - **Palpate peripheral pulse: BRACHIAL recommended [child]**
- **Palpate with index / middle fingers; NOT thumb**
  - **Not more than 10 seconds**
  - **If NO pulse or QUESTIONABLE pulse, begin CHEST COMPRESSION**





# C - Circulation

- **CONSCIOUS**
  - **responds to sensory stimulation (e.g. “shake & shout”)**
  - **blood flow to brain is (minimally) adequate**
  - **peripheral pulse WILL be palpable (e.g. radial, brachial, carotid)**
  - **Assisted circulation (e.g. chest compression) is NOT necessary**

## Emergency Management

# A - Airway



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# A - Airway

- CONSCIOUS
  - If patient can speak:
  - Airway is open, breathing is, at minimum, adequate
  - Airway management is NOT necessary



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# A - Airway

- UNCONSCIOUS - breathing & pulse
  - Skeletal muscles RELAX with LOC
  - Tongue (a large skeletal muscle) falls back into airway
  - Tongue is the PRIMARY cause of airway obstruction
  - HEAD TILT - CHIN LIFT



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## Emergency Management

# B - Breathing



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# B - Breathing

- CONSCIOUS
  - If patient can speak:
  - Airway is open, breathing is, at minimum, adequate
  - Ventilation is NOT necessary



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# B - Breathing

- UNCONSCIOUS - respiratory efforts & pulse
  - "Look, Listen, Feel" = No longer recommended by AHA
  - Quick evaluation of breathing.



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# B - Breathing

- UNCONSCIOUS - Respiratory efforts & pulse
  - See chest rise does NOT mean patient is breathing
    - Breathing is exchange of air
    - Chest rise means victim is TRYING to breath
    - Airway may be obstructed (tongue, foreign body) and chest will still rise.



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# B - Breathing

- UNCONSCIOUS - Pulse, no respiratory efforts
  - In absence of spontaneous respiratory efforts (e.g. chest not rising), ventilation is necessary:
  - 2 full ventilations, seeing chest rise with each
  - Maintain head tilt - chin lift
  - Seal nose



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# P - C - A - B

## Keep the victim alive

**Ensuring that the victim's BRAIN is receiving an adequate supply of blood that contains OXYGEN**



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**Emergency Management**

# D - Definitive Care



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# D - Definitive Care

- **Diagnosis**
- **Drugs**
- **Defibrillation**



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**Management of Specific Medical Emergencies**

**Altered Consciousness**
**Respiratory Distress**
**Drug-Related Emergencies**
**Chest 'Pain'**



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# Altered Consciousness

# EMERGENCY MEDICINE



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## The brain requires a constant supply of blood containing both oxygen and glucose in order to function properly

**Deprivation of blood, $O_2$ or sugar produces alterations in CNS functioning:**

**Altered consciousness**

**Unconsciousness**



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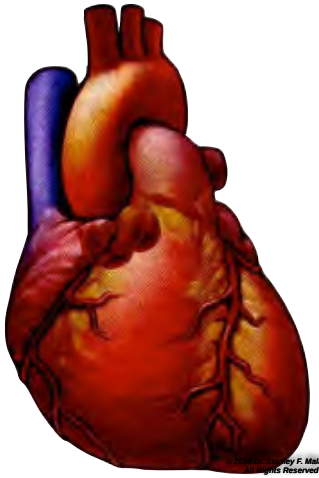
*Percentages of Cardiac Output Distributed to Different Organ Systems*

| Region | % of CO |
|---|---|
| Kidney | 22 |
| GI system, Spleen | 21 |
| Skeletal Muscle | 15 |
| Brain | 14 |
| Skin | 6 |
| Liver | 6 |
| Bone | 5 |
| Myocardium | 3 |
| Other | 8 |

Adapted from Mohrman DE, Heller LJ. Cardiovascular physiology, ed 7, New York 2010. Lange Medical Books/McGraw Hill





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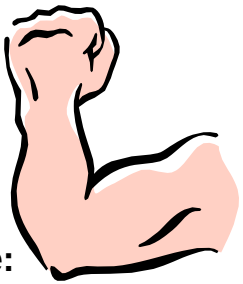
**Brain:**

- **2% of body weight**
- **14% of cardiac output**

**Muscle:**



- **50% of body weight**
- **15% of cardiac output**



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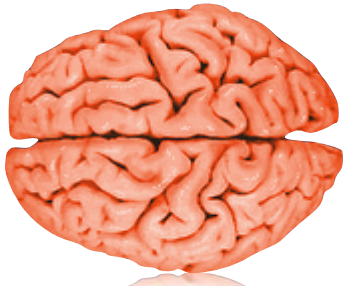
# Hyperglycemia



# Hypoglycemia



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# Diabetes mellitus

**Most likely candidate for HYPOGLYCEMIA = Type 1 Diabetic**


## Hyperglycemia

## Hypoglycemia



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## Type 1

**Less common**
**Juvenile onset**
**Severe**
**Insulin - all**

TABLE 17-2 Comparison of type 1 and type 2 diabetes mellitus

| Factor | Type 1 | Type 2 |
|---|---|---|
| Frequency (% of total diabetic population) | 10% | 90% |
| Age at onset (years) | 15 | >40 |
| Body build | Normal to thin | Obese |
| Severity | Severe | Mild |
| Use of insulin | Almost all | 20–30% |
| Response to oral hypoglycemic agents | Very few respond | 90% respond |
| Ketoacidosis | Common | Uncommon |
| Complications | 80% in 15 years | Less common than type 1 |
| Role of clinical onset | Rapid | Slow |
| Stability | Unstable | Stable |
| Family history of diabetes | Common | Less common than type 1 |
| HLA and abnormal autoimmune reactions | Present | Not present |
| Insulin receptor defects | Usually not found | – |

HLA, human lymphocyte antigen.



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## Type 2

**More common**
**Adult onset**
**Mild**
**Insulin - 20% - 30%**

# Hyperglycemia

**Will NOT be an**
**acute medical emergency**
**in the dental office environment**



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# Hypoglycemia

- 2nd leading cause of loss of consciousness
- 1st is HYPOTENSION (low blood pressure)
  - Decreased $O_2$
  - Decreased 'sugar'



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# Hypoglycemia

- Can happen to anyone but . . .
- Most likely to occur in a type 1 diabetic
  - IDDM
  - 'Juvenile onset'





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*Causes of HYPOGLYCEMIA in diabetic patients*

**TABLE 17-4** Causes of 240 consecutive cases of hypoglycemia in diabetic patients*

| Cause | % |
|---|---|
| Inadequate food (carbohydrate intake) | 66 |
| Excessive insulin dose | 12 |
| Sulfonylurea therapy | 12 |
| Strenuous exercise | 4 |
| Ethanol intake | 4 |
| Other (kidney failure, liver failure, decrease in corticosteroid dose) | 2 |

*Patients were observed at Grady Memorial Hospital Emergency Clinic from 1973 to 1975.
Modified from Davidson JK: Hypoglycemia. In: Schwartz GR, Safar P, Stone JH, et al, editors: *Principles and practice of emergency medicine*. Philadelphia, WB Saunders, 1978.

66%



95

# Hypoglycemia

**Determine if . . .**

- Patient has eaten recently
- Taken insulin recently
- Consider administering "sugar"



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# Hypoglycemia

**Classic S&S**

**Cold** (moist skin)
**Sweating** (diaphoresis)
**Tremor** (shaking)
**Mentally disoriented** (< CNS)



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# Hypoglycemia

**Conscious**

**P . . .**

**C . . .**

**A . . .**

**B . . .**

**D . . .**



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# Hypoglycemia

**Administer 'sugar"**

- **Glucose gel**
- **Fruit juices**
  - **Orange preferred by many**
- **Hard candy**
- **Soft drinks [non-diet]**



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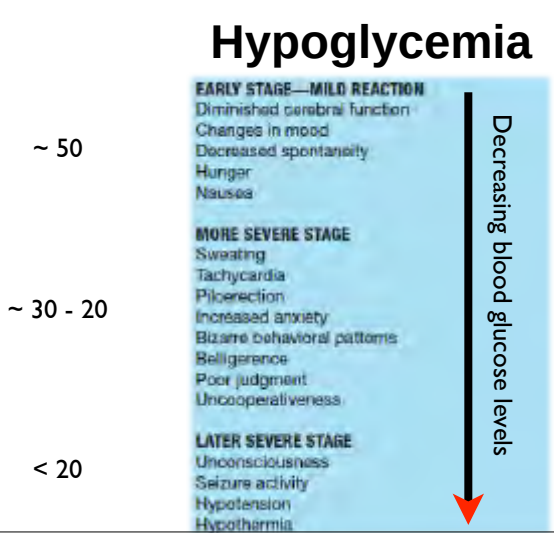
# Hypoglycemia



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# Hypoglycemia - unconscious

P . . .

C . . .

A . . .

B . . .

D . . .





# Hypoglycemia - unconscious

P . . . Supine

- To increase blood flow to brain

C . . . Pulse present, BP 'normal'

A . . . Head tilt - chin lift necessary

B . . . Spontaneous ventilation present





# Hypoglycemia - unconscious

P, C, A, B . . . Victim remains unconscious in spite of adequate blood flow to brain & $O_2$.

At this juncture we have ruled out:

- Syncope (fainting) and
- Cardiac arrest





# Hypoglycemia - unconscious

P, C, A, B . . . Victim remains unconscious in spite of adequate blood flow to brain + oxygen.

- Do we know what the cause of LOC is?
  - If NO . . . activate EMS

# Hypoglycemia - unconscious

**P, C, A, B . . . Victim remains unconscious in spite of adequate blood flow to brain + oxygen.**

- **Do we know what the cause of LOC is?**
  - **If YES, but cannot treat . . . activate EMS**





# Hypoglycemia - unconscious

**P . . .**
**C . . .**
**A . . .**
**B . . .**

**D . . . Activate EMS (9.1.1)**





# Hypoglycemia - unconscious

**P . . .**
**C . . .**
**A . . .**
**B . . .**

**D . . . Do not put anything that might liquefy in the mouth of an unconscious patient**





# Hypoglycemia

**D**efinitive management:

- **50% or 25% Dextrose [30 ml] IV**
- **1 mg glucagon IV or IM**


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# Seizure

**Convulsion, 'Fit'**

**Definition:**
**A paroxysmal episode, caused by abnormal electrical conduction in the brain, resulting in the abrupt onset of transient neurologic symptoms such as involuntary muscle movements, sensory disturbances and altered consciousness. Also called convulsion.**



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# Damaged cells

**What happens to cells when they are DEAD?**
**NOTHING - they are dead**




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# Damaged cells


**What happens to cells when they are DAMAGED?**



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# Damaged cells

**When cells are damaged, hypoxic or anoxic, they become *hyperexcitable***


- **Ingrown nail = an 'OWIE'**

- **Bronchi = BRONCHOSPASM**
- **Myocardium = DYSRHYTHMIAS**





# Damaged cells

**When cells are damaged, hypoxic or anoxic, they become hyperexcitable**

- **Brain (CNS) = SEIZURES**






# Causes of seizures in the dental environment

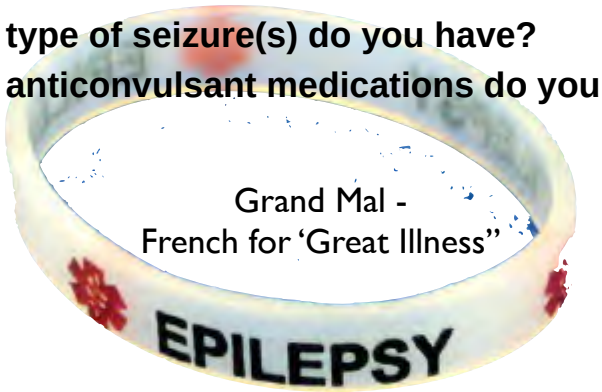
- **Epileptic patients**
  - **Stress induces seizures**
- **Cerebral hypoxia**
  - **Syncope + inadequate airway**
- **Hypoglycemia**
- **Local anesthetic overdose**





# Seizures - Dialogue history

- **What type of seizure(s) do you have?**
- **What anticonvulsant medications do you take?**

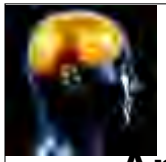


# Seizures - Dialogue history

- What type of seizure do you have?
- What anticonvulsant medications do you take?
- How well controlled are your seizures?
- **What is your aura?**
  - Generalized tonic-clonic







*Epileptic AURA*

- **An epileptic aura precedes an epileptic seizure and may involve visual disturbances, dizziness, numbness, or any of a number of sensations which the patient may find difficult to describe exactly.**





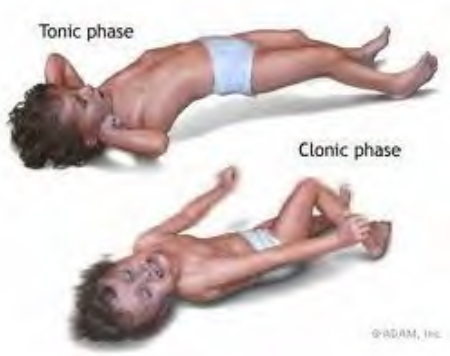
*Epileptic AURA*

- **In epilepsy the aura serves a useful purpose in that it warns of an impending attack and gives the patient time to seek privacy and a safe place to lie down before the seizure actually begins.**





# Seizure management



# Seizure management

**Remove any/all items of dental equipment from the patients mouth**

**Prepare the patient for the seizure:**
**Remain in dental chair**
**Loosen tight clothing**





# Generalized tonic clonic seizure

## GTCS, 'Grand Mal'

- **Are self-limiting**
- **(most) SEIZURES STOP**
- **Last not more than 2 to 5 minutes**
- **Do *NOT* require anticonvulsant therapy**
- **Do *NOT* result in injury**





# Generalized tonic clonic seizure

## GTCS, 'Grand Mal'

- **In a generalized tonic clonic seizure . . .**
- **During the *ictal* phase:**

- **CNS stimulation** **Bad**
- **Respiratory stimulation** **OK**
- **Cardiovascular stimulation** **So-So**





**Ictal** **refers to a physiologic state or event such as a seizure. The word originates from the Latin ictus, meaning a blow or a stroke. In electroencephalography (EEG), the recording during an actual seizure is said to be "ictal". There are four ictal states which include pre-ictal, ictal, post-ictal, and inter-ictal.** **Pre-ictal** **refers to the state immediately before the actual seizure, stroke, or headache, though it's recently come to light that some of characteristics of this stage (such as visual auras) are actually the beginnings of the** **ictal** **state.** **Post-ictal** **refers to the state shortly after the event.** **Inter-ictal** **refers to the period between seizures, or convulsions.**

# Generalized tonic clonic seizure

## GTCS, 'Grand Mal'

- In a generalized tonic clonic seizure . . .
- During the *ictal* phase:

- CNS stimulation Bad
- Respiratory stimulation OK
- Cardiovascular stimulation So-So





# Generalized tonic clonic seizure

## GTCS, 'Grand Mal'

**P . . .**

**C . . .**

**A . . .**

**B . . .**

**D . . .**





# Seizure management - TONIC

- Chair is narrow
- Victim may fall from chair
- Keep victim in the dental chair





# Seizure management - CLONIC

**Protect victim from injury:**
**Rescuer 1: arms . . .gently!**
**Rescuer 2: legs . . . gently!**
**Rescuer 3: airway**
**remove "pillow" or "donut" from headrest of chair**
**↓**
**Summon EMS ?????**

# DO NOT PUT ANYTHING INTO THE MOUTH OF A CONVULSING PERSON





# Seizure management

- **In a generalized tonic clonic seizure . . .**
- **During the *post-ictal* phase:**

- **CNS depression Bad**
- **Respiratory depression Bad**
- **Cardiovascular depression Bad**





**The postictal state is the altered state of consciousness that a person enters after experiencing a seizure. It usually** *lasts between 5 and 30 minutes***, but sometimes longer in the case of larger or more severe seizures and is characterized by drowsiness, confusion, nausea, hypertension, headache or migraine and other disorienting symptoms. Additionally,** *emergence from this period is often accompanied by amnesia or other memory defects.* **It is during this period that the brain recovers from the trauma of the seizure.**





# Post-ictal phase

**Reassess: P . . .**

**C . . .**

**A . . .**

**B . . .**

**D . . .**

# Post-ictal phase

- CAB as needed
  - Airway, if snoring
  - Breathing, circulation - usually not necessary
- Patient is disoriented, sleeping
- Position: turn on side, if at all possible
  - Minimizes risk of aspiration of vomitus
  - Aids in airway maintenance,
- Dental chair: turn on side, if at all possible
  - If not: Supine & maintain airway prn





# Why consider EMS?

Determine disposition of patient following seizure:

- Hospitalization, if not oriented to space & time:
  - Where are you?
  - What day is it?
- Discharge home in company of companion if oriented to space and time

Management of status epilepticus





# GTCS (Grand mal) status

R U really going to wait 30 minutes?

Status epilepticus is defined as:

A medical emergency characterized by continuous seizures lasting more than *30 minutes* without interruption. Status epilepticus can be precipitated by the sudden withdrawal of anticonvulsant drugs, inadequate body levels of glucose, a brain tumor, a head injury, a high fever, or poisoning.

Mosby's Medical Dictionary, 8th edition. © 2009, Elsevier.





# Management of Grand Mal Status

- Terminate dental procedure
- Position patient
- Activate EMS
- Protect patient from injury
- BLS, prn
- Administer oxygen
- Monitor vital signs

## Management of Grand Mal Status

EMS

- Venipuncture (adult or larger child [> 30 kg])
- Anticonvulsant drug - titrated to effect IV
- Administer 50% dextrose

- Definitive management:
  - Stabilize & transport to hospital ED



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## Management of Grand Mal Status

EMS

- Smaller pediatric patient (< 30 kg)
- Anticonvulsant drug - 0.2 mg/kg IN
- Administer 25% dextrose

- Definitive management:
  - Stabilize & transport to hospital ED



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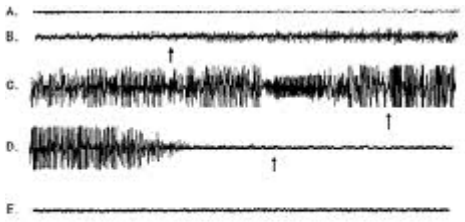
## GTCS (Grand mal) status

Administer anticonvulsants:

- Administered IV or IN
- IV benzodiazepines:
  - Midazolam



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## Unconsciousness

**Lack of response to sensory stimulation**





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# Unconsciousness

## Etiologies

- Drop in blood pressure
  - Lack of blood/oxygen . . . syncope
  - Lack of sugar . . . hypoglycemia
  - Postural hypotension
- Seizures
- CNS depressant overdose
- Local anesthetic overdose
- Cardiac arrest
- Anaphylaxis
- Cerebrovascular accident





# Syncope

**Vasodepressor syncope, Vasovagal syncope, Common faint**







**PSYCHOGENIC FACTORS**
Fright
Anxiety
Emotional stress
Receipt of unwelcome news
Pain, especially sudden and unexpected
Sight of blood or surgical or other dental instruments (e.g., local anesthetic syringe)

**NONPSYCHOGENIC FACTORS**
Erect sitting or standing posture
Hunger from dieting or a missed meal
Exhaustion
Poor physical condition
Hot, humid, crowded environment
Male gender
Age between 16 and 35 years





# Presyncope

- 'Fight or flight' response to stress:
  - > blood flow to arms + legs
- If patient moves:
  - Muscle contraction
  - Blood returns to heart
  - Cerebral blood flow maintained
- If patient remains still:
  - Decreased blood return to heart
  - Decreased cardiac output

# Presyncope

- Decreased cardiac output
- Decreased blood pressure (hypotension)
- Decreased cerebral circulation:
  - Diminished CNS functioning
    - S&S of 'feeling faint'





# Presyncope

- Decreased BP and cerebral blood flow lead to . . .
- Reflex increase in heart rate [tachycardia] resulting in . . .
- Transient maintenance of adequate blood pressure
  - Low, but near baseline





# Presyncope - S&S

**EARLY**
Feeling of warmth
Loss of color; pale or ashen-gray skin tone
Heavy perspiration
Reports of "feeling bad" or "feeling faint"
Nausea
Blood pressure at baseline level or slightly lower
Tachycardia

**LATE**
Pupillary dilation
Yawning
Hyperpnea
Cold hands and feet
Hypotension
Bradycardia
Visual disturbances
Dizziness
Loss of consciousness





# Presyncope Management

- Position patient supine
  - Increase blood pressure
  - Maintain cerebral circulation
- Administer $O_2$
- Administer aromatic ammonia
  - Stimulates movement . . .
  - Increases return of blood to heart - *IF* supine

# Presyncope Management



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# Presyncope

**Dental treatment may continue . . .**

***IF*** **both the doctor and patient**

**are comfortable.**

**Determine reason for episode and manage**



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**Healthy young children**

*DO NOT*

**faint**

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**In the pediatric dental environment**

**it is the parent**

**(usually the father)**

**who is most likely to faint**



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# Syncope

**Vasodepressor syncope, Vasovagal syncope, Common faint**

- **In the absence of treatment**
- **Decompensation [fatigue] occurs:**
  - **Severe bradycardia develops**
    - **HR between 0 and 20 (Periods of asystole)**
- **Blood pressure & cerebral blood flow diminish**
- **Consciousness is lost**





# Syncope

- **In the presence of continued cerebral hypoxia . . . anoxia**
  - **Muscle twitching to GTCS may develop**
- **Prevented or terminated by:**
  - **Positioning**
  - **Airway maintenance**





# Syncope

**P . . .**

**A . . .**

**B . . .**

**C . . .**

**D . . .**







# Syncope management

**P . . . Position**
- **Supine with feet elevated 10-15 degrees**

**C . . . Assess, compress chest . . . not necessary**

**A . . . Assess, maintain usually necessary**
- **Oxygen, prn**

**B . . . Assess, ventilate . .. usually not necessary**

# Syncope management

**Following the return of consciousness**

**Manage symptomatically:**
- **Oxygen**
- **Cool compress**

**Permit recovery**

**Determine cause of episode**
- **Consider future Tx modifications**

**Discharge in custody of responsible adult**



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# Respiratory Distress

# EMERGENCY MEDICINE



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# HYPERVENTILATION



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# Hyperventilation


**An anxiety-induced situation in which the victim loses control over their breathing.**



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# Hyperventilation

**The hyperventilating person is breathing:**
**(1) extremely rapidly [tachypnea]**
**(2) either shallow or deep**





# Hyperventilation

**In the pediatric dental environment, hyperventilation will almost always be a manifestation of**
*ACUTE ANXIETY*







# Hyperventilation

**S&S of hyperventilation are produced by the LOSS of $CO_2$ from the blood leading to HYPOCAPNEA.**





| System | Signs and symptoms |
|---|---|
| Cardiovascular | Palpitations |
| | Tachycardia |
| | Precordial "pain" |
| Neurologic | Dizziness |
| | Lightheadedness |
| | Disturbance of consciousness |
| | Disturbance of vision |
| | Numbness and tingling of the extremities |
| | Tetany (rare) |
| Respiratory | Shortness of breath |
| | Chest "pain" |
| | Dryness of mouth |
| Gastrointestinal | Globus hystericus |
| | Epigastric pain |
| Musculoskeletal | Muscle pain and cramps |
| | Tremor |
| | Stiffness |
| | Carpopedal tetany |
| Psychological | Tension |
| | Anxiety |
| | Nightmares |

# HYPERVENTILATION

**Clinical manifestations**

# Hyperventilation

**Goals of treatment of hyperventilation:**

**(1) Calm patient**
**(2) Decrease respiratory rate**
**(3) Elevate $CO_2$ level**





# Hyperventilation

**The TREATMENT of HYPERVENTILATION is found at the END OF ONES ARMS**

**Victim cups their hands over their mouth & nose, rebreathing exhaled air, which contains high levels of $CO_2$**





# Hyperventilation

**Victim cups their hands over their mouth & nose, rebreathing exhaled air, which contains high levels of $CO_2$**

**Inhaled air = 0.03% $CO_2$**
**Exhaled air = 3.97% $CO_2$**





# Hyperventilation

**In the absence of adequate treatment CARPOPEDAL TETANY may develop**

# Hyperventilation

**P . . .**

**C . . .**

**A . . .**

**B . . .**

**D . . .**







# Bronchospasm

## Asthma
## Hyperactive Airway Disease





# Damaged cells

**When cells are damaged, hypoxic or anoxic, they become hyperexcitable**

## Bronchi = BRONCHOSPASM






## Asthmatic Triggers

**Box 13-1 Causative factors for acute asthma**

Allergy (antigen-antibody reaction)
Respiratory infection
Physical exertion
Environmental and air pollution
Occupational stimuli
Pharmacologic stimuli
Psychological factors

# Asthma

**What kind of asthma do you have?**

- **Allergic . . . non-allergic**

**Allergic: What precipitates an acute episode?**

- **Aspirin**
- **NSAID's**
- **Exercise-induced asthma**
- **(bi)Sulfites**
  - **Vasopressor-containing local anesthetics**





# Bronchospasm

**In the pediatric dental environment, bronchospasm will almost always be a manifestation of** *ACUTE ANXIETY*





# Asthma

**What drug[s] do you use for an acute episode?**

- **Your 'Rescue Drug'**

- **Beta agonists, such as:**
  - **Albuterol [Pro-Air, Proventil, Ventolin]**
  - **Metaproterenol [Alupent]**





# Asthma

**What drug[s] do you use to minimize/prevent acute episodes?**

- **Inhaled steroids (triamcinolone - Azmacort)**
- **Long-acting beta agonist (salmeterol – Serevent)**


# Asthma

**Have you ever been hospitalized for your asthma?**

**Status asthmaticus**

- **Bronchospasm that is refractory (resistant) to 2 doses of the 'rescue drug' (bronchodilator)**



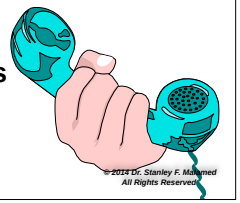


# Asthma

**Remind patient to bring their "rescue drug" with them to dental office**

**Treatment of asthma:**

- **Inhaled steroids . . . to prevent acute episodes**
- **Bronchodilator . . . to treat acute episodes**







# Signs & symptoms of acute bronchospasm

**Feeling of chest congestion**
**Cough: c/s sputum production**
**Wheezing**
**Dyspnea**
**Patient sits up**
**Use of accessory muscles of respiration**
**Increased anxiety**
**Tachypnea**





# Bronchospasm

**P . . .**

**C . . .**

**A . . .**

**B . . .**

**D . . .**

## Bronchospasm management


**Administer bronchodilator . . .**
**episode terminates**

**Subsequent dental care**

**Discharge of patient**






## Bronchospasm Management

**Summon EMS . . . if**

**patient requests**
**or**
**episode is refractory to**
**2 doses of bronchodilator**






## Status Asthmaticus

*Status asthmaticus* **is an acute exacerbation of asthma that remains unresponsive to initial treatment with bronchodilators.**





## Status Asthmaticus

- **If bronchospasm is not relieved, or**
- **If doctor is uncomfortable, or**
- **If parent or child wishes,**
- **ACTIVATE EMS STAT**

**Box 13-4 Clinical signs and symptoms of hypoxia and hypercarbia**

**HYPOXIA**
Restlessness, confusion, anxiety
Cyanosis
Diaphoresis (profuse sweating)
Tachycardia, cardiac dysrhythmias
Coma
Cardiac and/or renal failure

**HYPERCARBIA**
Diaphoresis
Hypertension (converting to hypotension, if progressive)
Hyperventilation
Headache
Confusion, somnolence
Cardiac failure



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# Status Asthmaticus


- If EMS delayed, or
- If situation deteriorates . . .

- IM epinephrine q5m
- Vastus lateralis
- 0.3 mg or 0.15 mg of 1:1000

**15 - 30 kg = 0.15 mg**
**>30 kg = 0.3 mg**



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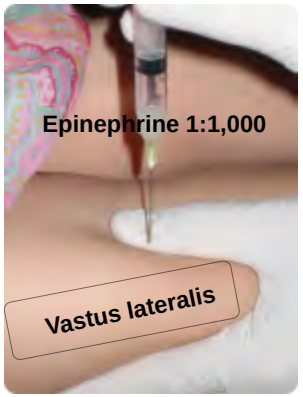
# Vastus Lateralis







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# Drug-Related Emergencies

# EMERGENCY MEDICINE



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# Systemic adverse drug reactions

- **The *TWO* systemic adverse reactions that *ALL* drugs can produce are:**
  - **ALLERGY**
  - **OVERDOSE (toxic reaction)**





# Overdose v. Allergy

**Dosage**

- **Drug OVERDOSE *IS* dose-related:**
  - **You have to give enough to produce a high blood level**
- **ALLERGY is *NOT* dose-related:**
  - **Allergy is an over-reaction to a foreign substance (allergen) by the immune system**





# Overdose v. Allergy

**OVERDOSE:** **Signs & Symptoms**

- **S&S are related to *NORMAL* pharmacology of drug**
- **S&S will *VARY* depending upon drug producing OD**
  - **ETOH . . . CNS depression (excessive depression)**
  - **Cocaine . . . CNS, CVS stimulation (excessive stimulation)**

**ALLERGY:**

- **S&S are *ALWAYS* the same regardless of etiology.**
- **Itching, hives, rash, bronchospasm, vasodilation**

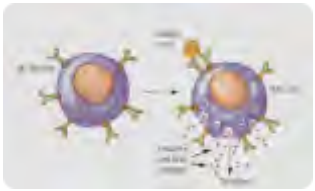




# DRUG RELATED EMERGENCIES

# Allergy

# Allergy



**Allergy represents an OVERREACTION by the bodies immune system to a foreign substance (allergen)**





# Allergic Reactions

## Diagnosis
## &
## Management





# Allergic Reactions

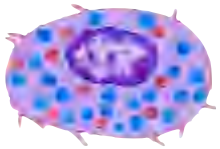
**Allergen**

⇩

**Mast cells & Basophils**

⇩

**Histamine**
**Leukotrienes**
**ECF – Anaphylaxis**
**Kallikreins**
**Prostaglandins**



⇩

**S&S of allergy**





# Histamine

## The Primary Mediator of the Allergic Reaction

**DISTRIBUTION:**

- **Everywhere, but higher amounts in lungs, skin and GI**
- **Rapidly stored in mast cells and basophils**

# Histamine

## The Primary Mediator of the Allergic Reaction

**RELEASE CONDITIONS:**

- **Type 1 hypersensitivity (allergy)**
- **Tissue injury**
- **Drugs & other foreign compounds,** e.g. meperidine (Demerol)





# Histamine

## The Primary Mediator of the Allergic Reaction

- **Heart rate = increases**
- **Blood pressure = decreases**
- **Small blood vessels = dilate**
- **Flushing**
- **Increased capillary permeability**





# Histamine

## Pharmacology - Summary

**Itching . . . Pruritis**

**Hives . . . Urticaria**

**Rash . . . Erythema**

**Bronchospasm**

**Vasodilation**





# Allergic Reactions

## Possible predictors of severity of the reaction

**Rapidity of *ONSET***

**of signs and symptoms**

***PROGRESSION***

**of signs and symptoms**

# Onset of S&S

**Delayed:**

- **S & S develop slowly [>60 min]**
- **Reaction involves skin**

**Immediate:**

- **S & S develop within minutes of exposure**
- **Reaction involves respiratory a/o cardiovascular systems**



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# Progression of S&S

**Usual: Starts as SKIN - does not progress**

**Stimulation of EXOCRINE GLANDS e.g. tearing, nasal discharge (runny nose)**

**Spasm of intestinal smooth muscle (e.g. cramping)**

**Bronchospasm**

**Vasodilation of blood vessels**



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- **P . . .**
- **C . . .**
- **A . . .**
- **B . . .**
- **D . . .**

# Delayed onset skin reaction

**S&S**
**> 1 hour after antigenic exposure**



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# Allergic Skin Reaction



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# Delayed Onset Skin Reaction

**Management:**

**D . . .**

**Parenteral histamine blockers:**

- **Diphenhydramine . . . IM (vastus lateralis)**
  - **50 mg adults**
  - **25 mg (< 30 kg)**



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# Delayed Onset Skin Reaction

**Management:**

**D . . .**

**Oral histamine blockers:**

- **Diphenhydramine**
  - **50 mg qid adults**
  - **25 mg qid < 30 kg**
  - **For 3 days**




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# ANAPHYLAXIS



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# Anaphylaxis

## Common etiologies

Stinging insects

Penicillin

Latex

Peanuts

Aspirin, NSAIDs

Shellfish



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# Anaphylaxis

**Definition: An acute and potentially life-threatening multi-system allergic reaction**

- **Respiratory compromise and cardiovascular collapse cause most deaths**
  - **Time to CV collapse: Food (25-35 min); Insect sting (10-15 min)**






16 January 2008





# Anaphylaxis . . . Management

**P . . . Based upon primary complaint:**

- **"Can't breathe" . . . upright**
- **"Feel faint" . . . supine, feet elevated**

**C . . . prn**

**A . . . prn**

**B . . . prn**





**The diagnosis and management of anaphylaxis practice parameter: 2010 Update**

**Lieberman P, Nicklas RA, Oppenheimer J, et al**

**Allerg Clin Immunol 126:477-480, 2010**

The diagnosis and management of anaphylaxis practice parameter: 2010 Update.
Lieberman P, Nicklas RA, Oppenheimer J, et al
Allerg Clin Immunol 126:477-480, 2010

**The more rapidly anaphylaxis develops, the more likely the reaction is to be severe and potentially life-threatening**



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The diagnosis and management of anaphylaxis practice parameter: 2010 Update.
Lieberman P, Nicklas RA, Oppenheimer J, et al
Allerg Clin Immunol 126:477-480, 2010

**Prompt recognition of signs and symptoms of anaphylaxis is crucial.**

**If there is any doubt, it is generally better to administer epinephrine**



214

The diagnosis and management of anaphylaxis practice parameter: 2010 Update.
Lieberman P, Nicklas RA, Oppenheimer J, et al
Allerg Clin Immunol 126:477-480, 2010

- **Epinephrine and oxygen are the most important therapeutic agents administered in anaphylaxis.**
- **Epinephrine is the drug of choice, and the appropriate dose should be administered promptly at the onset of apparent anaphylaxis**



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The diagnosis and management of anaphylaxis practice parameter: 2010 Update.
Lieberman P, Nicklas RA, Oppenheimer J, et al
Allerg Clin Immunol 126:477-480, 2010

**There is no absolute contraindication to epinephrine administration in anaphylaxis**



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## Anaphylaxis . . . Management

### D . . . Definitive care

- Epinephrine
  - As soon as possible
  - Every 5 minutes until
    - Victim recovers
    - Help (9.1.1) arrives





## Anaphylaxis . . . Management

### D . . . Definitive care

- Epinephrine
- Basic life support, as needed
- Oxygen
- EMS (9.1.1)





## Anaphylaxis . . . Management


**0.3 mg/dose = adult**
**0.15 mg/dose = child (15 - 30 kg)**





# OXYGEN

**“E” cylinder**

**portable delivery system**

# Anaphylaxis: How do patients die?

## Vasodilation

- Increased vascular permeability may shift 35% - 50% of intravascular volume to the extravascular space within 10 minutes





# Anaphylaxis . . . Management (1)

- Assess C, A, B's
- Epinephrine 0.3 - 0.5 mg of 1:1,000 IM *thigh* (adult); 0.15 mg of 1:1,000 IM *thigh* (child). Give quickly and repeat every 5 - 15 minutes as needed
  - Classically, adult dose is given to children >30 kg, but may also give to 25 kg
- Give as soon as possible



# Anaphylaxis . . . Management (2)

- Position supine, feet elevated. This position is equivalent to infusion 1 - 2 liters in the central vascular compartment (1)





# Anaphylaxis . . . Management (3)

- Diphenhydramine: 25-50 mg IV (adults); 1 mg/kg children (up to 50 mg)
- Prednisone 0.5 mg/kg/day orally - will have NO ACUTE EFFECT

## Anaphylaxis . . . Management (4)

- Oxygen - for patients with prolonged reactions, are short of breath, experiencing chest pain
- Call 9.1.1. ~~prn~~





- According to the 2010 practice parameter update on anaphylaxis, measures to take in order of importance:
  - Epinephrine
  - Patient position
  - Oxygen
  - IV fluids
  - Nebulized therapy
  - Vasopressors
  - Antihistamines, steroids & other agents





## Epinephrine in Anaphylaxis

- There are NO absolute contraindictions to using epinephrine in anaphylaxis
- Up to 23% of patients with anaphylaxis who receive epinephrine are reported to receive a 2nd dose because of ongoing S&S or a biphasic reaction

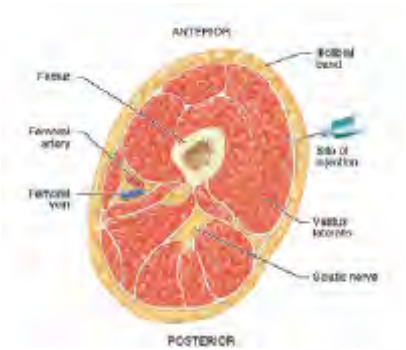




## Epinephrine - Thigh or Deltoid

- IM injection in the thigh has been shown to provide more rapid absorption and higher plasma levels in asymptomatic patients.
  - Not studied in patients with active anaphylaxis
- Obese patients - IM injection in thigh may be unrealistic. NO data that SC or IM dose in the deltoid fails in anaphylaxis

# Vastus lateralis = Thigh






# Epinephrine - Alternative routes

- **Alternative routes for epinephrine injection such as SC, sublingual or inhalation are NOT recommended because they do not achieve the necessary high, rapid plasma concentrations.**





# Why epinephrine?

**Reverses 2 components of anaphylaxis which lead to death:**

- **Bronchospasm . . . Epi is bronchodilator**
- **Hypotension . . . Epi is vasopressor**

- **Epi, through its vasoconstrictive actions can reverse edema, but only if administered PROMPTLY**

**Works fast**

- **IM vastus lateralis w/l ± 2 minutes**





# Anaphylaxis . . . Management

## Goal: short-term survival

- **Keep the victim alive until**
  - **They recover**
  - **Help arrives on scene**

## Anaphylaxis . . . Management

### Goal: short-term survival

- Epi . . . Epi . . . Epi
- BLS, prn
- Oxygen
- EMS





## Anaphylaxis . . . Management

### Recovery:

- Relief of bronchospasm
- Elevation of blood pressure





## Anaphylaxis . . . Management

### Recovery:

- Epinephrine:
  - Rapid onset - GOOD
  - Short duration - BAD





## Anaphylaxis . . . Management

**Once life is out of danger . . .**

### Histamine blocker IM (1 mL)

- Diphenhydramine HCl 50 mg
  - 25 mg - up to 30 kg

## Anaphylaxis . . . Management

### Histamine blockers IV

### Corticosteroids IV

- Decadron, Solu-Cortef, Solu-Medrol
- Slow onset, long duration
- Stabilize cell membranes
  - Prevent edema, vasodilation





## Anaphylaxis . . . Management

### Hospitalization

- ED . . . several hours - observation
- Hospitalized . . . overnight - observation
- Hospitalized . . . several days





## Anaphylaxis

- Represents the only emergency situation which requires the immediate administration of a drug, epinephrine, in order for the victim to have a chance of survival.
- The more rapidly epinephrine is administered at onset of anaphylaxis the greater the chance of survival
- Absent epinephrine, survival from anaphylaxis is less likely





### Since allergy has the potential to be life-threatening . . .

### How can a doctor prevent an allergic reaction?

# Alleged allergy

**When confronted with 'alleged' allergy:**

*ALWAYS BELIEVE THE PATIENT!*

**Do *NOT* administer or prescribe the drug in question until all doubt has been erased from the mind of both the doctor and the patient**





# Alleged LA allergy

What to ask your patient?

**(1) Describe your 'allergic' reaction:**

- ***TRUE* allergy: 'Itching, hives & a rash', bronchospasm (wheezing), Drop in BP (hypotension)**
- ***NOT* allergy: dizzy, lightheaded, faint, shaking, palpitations**





# Alleged LA allergy

What to ask your patient?

**(2) How was your 'allergic' reaction managed:**

- ***TRUE* allergy: Epinephrine, Histamine-blocker (diphenhydramine [Benadryl]), Corticosteroid**
- ***NOT* allergy: Nothing (it got better), Oxygen, "Smelling salts" (aromatic ammonia vaporole)**





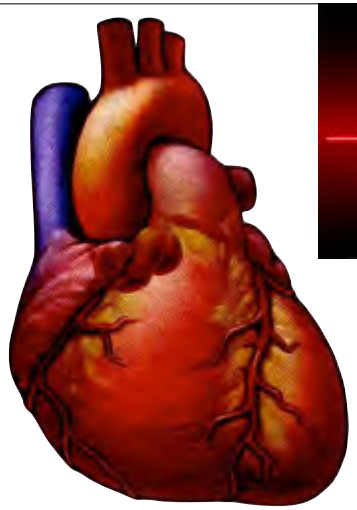
# Allergy

**. . . Cannot always be prevented.**

**. . . May occur even with prior history of no adverse response to a drug.**

**. . . Must always be prepared for.**

Chest
'Pain'



Chest
'Pain'



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- **Heart muscle - MYOCARDIUM contracts, squeezing blood out of the heart into the pulmonary artery (right side of heart) or aorta (left side of heart)**
- **To continue to function the myocardium requires its own blood supply**
- **Myocardial blood supply is from *CORONARY ARTERIES***



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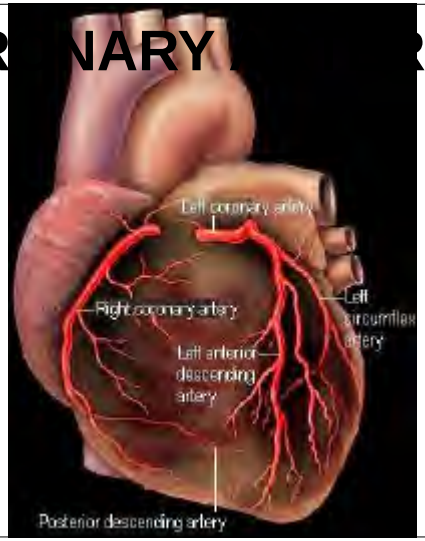
**COR NARY RIES**



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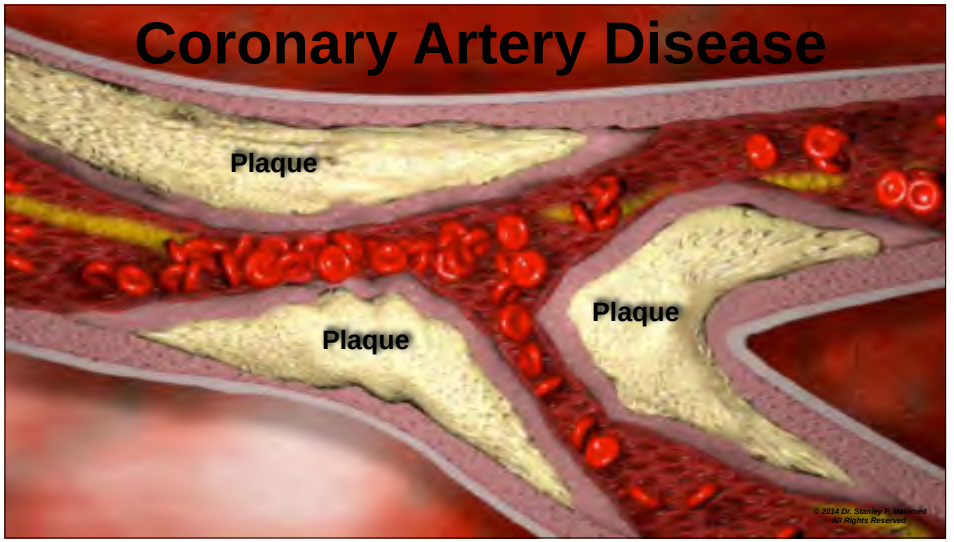




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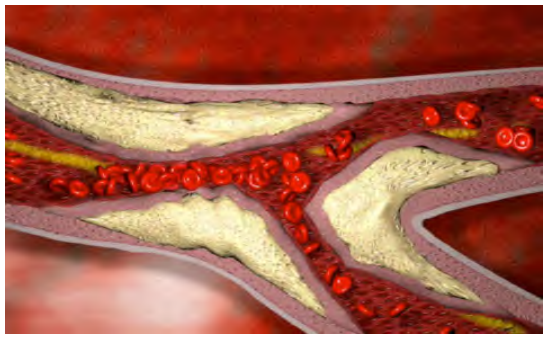
# Coronary Artery Disease



The deposition, over time, of a lipid-rich plaque (LDL) within the walls of coronary arteries





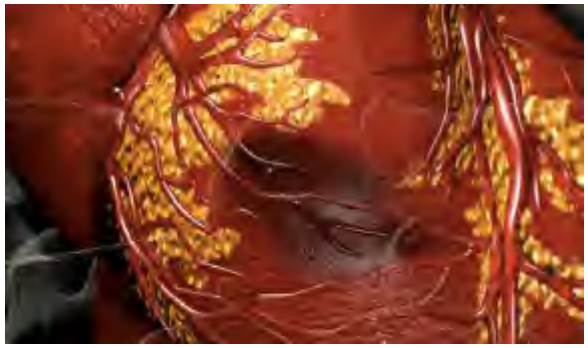
# Coronary Artery Disease

When the workload of the heart increases (e.g. stress = pain, fear), myocardium needs an increased blood flow which cannot be met by narrowed coronary artery





# Transient Myocardial Ischemia = Angina Pectoris



Myocardium not receiving an adequate blood supply becomes ischemic, leading to the onset of anginal 'pain'





# Angina Pectoris


With rest or administration of nitroglycerin the myocardial workload decreases and the chest 'pain' dissipates

# Angina pectoris and dentistry

**The only time ANGINA should be considered as a diagnosis in acute chest pain is where the patient (victim) has a PREEXISTING HISTORY of ANGINA**







# Consider myocardial infarction when:

**In anginal patient when:**

- **'Pain' worse than usual**
- **3 doses of nitroglycerin fail to relieve discomfort**
  - **doses every 5 minutes**
- **Nitroglycerin relieves 'pain', but 'pain' returns.**





# Consider myocardial infarction:

**ALWAYS**
**when there is no prior history**
**of**
**cardiovascular disease**





## Prolonged Myocardial Ischemia

RUPTURE of the PLAQUE into the lumen of the coronary artery terminates blood flow to an area of myocardium

Prolonged myocardial ischemia leads to damage and then death (infarction) of myocardium



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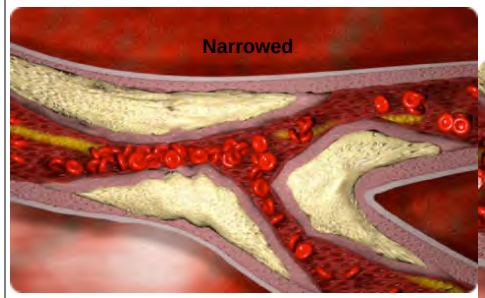
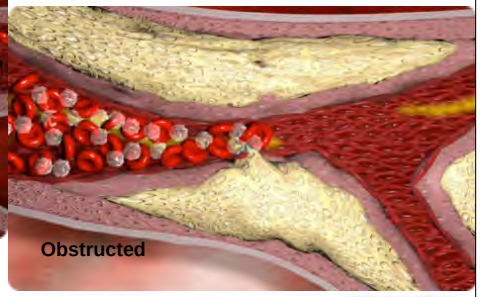
# Acute Coronary Syndrome




Angina Pectoris

Acute Myocardial Infarction



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# First Time Chest 'Pain"

P . . .

C . . .

A . . .

B . . .

D . . .




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# Consider Myocardial Infarction:

**ALWAYS**
**when there is no prior history of cardiovascular disease**



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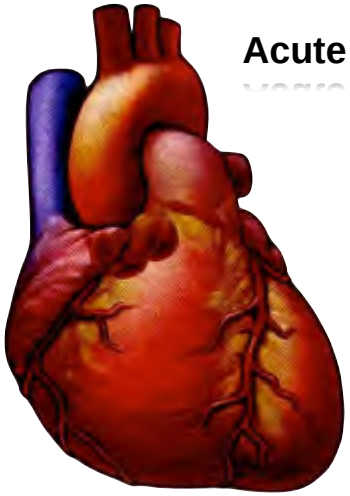
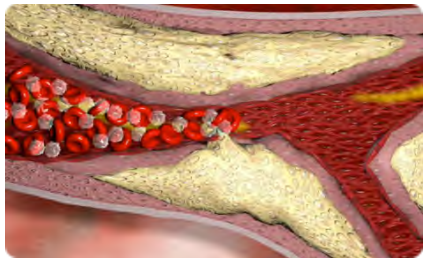
## Acute Myocardial Infarction







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## Acute myocardial infarction

**P . . . Position**
**C . . . Circulation**
**A . . . Airway**
**B . . . Breathing**
**D . . . Definitive care**
**MONA**



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# MONA

**Acronym for the** *PRE-HOSPITAL MANAGEMENT OF A SUSPECTED MYOCARDIAL INFARCTION*



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# MONA

**D . . . Definitive care**

**"Greet the ambulance at the door to the emergency department with MONA"**



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# MONA

**M**orphine

**O**xygen

**N**itroglycerin

**A**spirin







## Acute Myocardial Infarction

**P . . . Position**
**C . . . Circulation**
**A . . . Airway**
**B . . . Breathing**
**D . . . Definitive care**

**MONA = NONA**





MONA = NONA

**M**orphine = $N_2O$-$O_2$

**O**xygen

**N**itroglycerin

**A**spirin







## Nitrous Oxide - Oxygen

**50% - 50%**

**As analgesic as IV morphine**
- **Separates pain from suffering**

**Sedative**
- **Relaxes scared patient**

**50% $O_2$**
- **2.5 times ambient air**

# Aspirin
## in Myocardial Infarction


- 325 mg. chewed, swallowed - POWDERED, if available
  - 20 minute onset
- Prevents blood clot (thrombosis) from increasing in size
- Increases chances of primary balloon angioplasty being successful

Prehospital management of suspected MI 269



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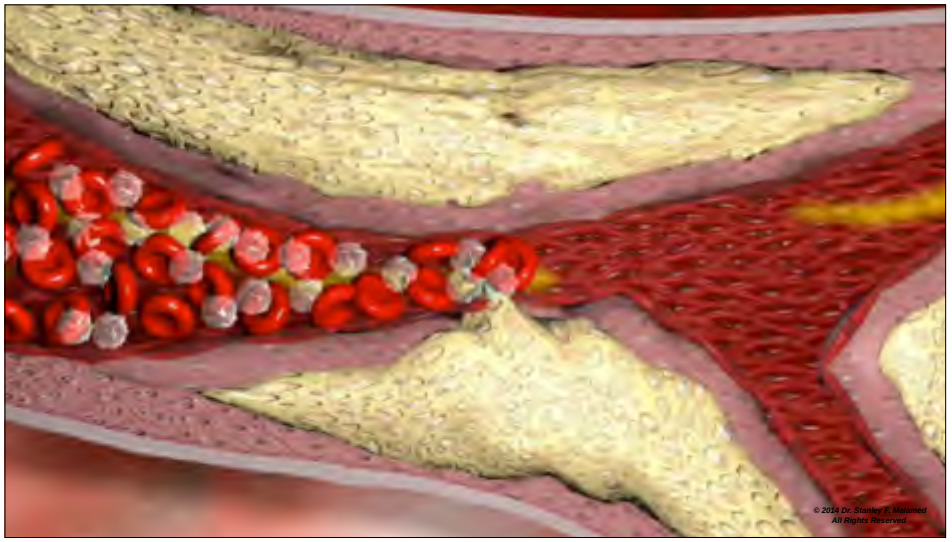



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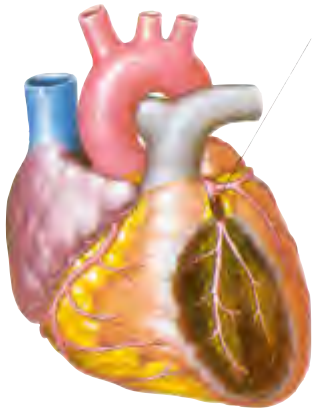
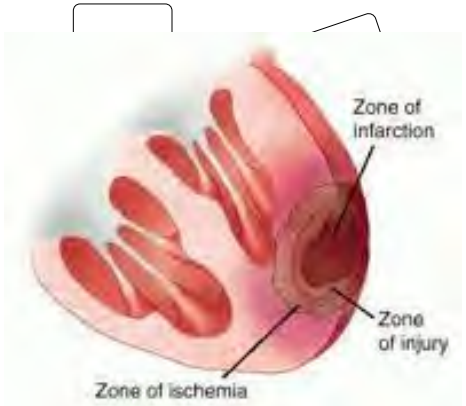
# Acute Myocardial Infarction





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# Acute Myocardial Infarction




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# Acute Myocardial Infarction

## SILENT MI

- Women (up to 50%)
- Elderly
- Diabetics

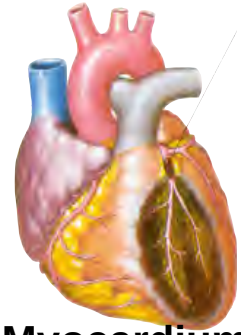
- Do not present with classic signs & symptoms

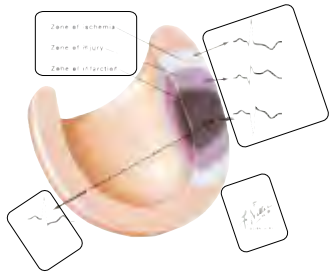




# Acute Myocardial Infarction

**When cells are damaged, hypoxic or anoxic, they become hyperexcitable**






**Myocardium = DYSRHYTHMIAS**





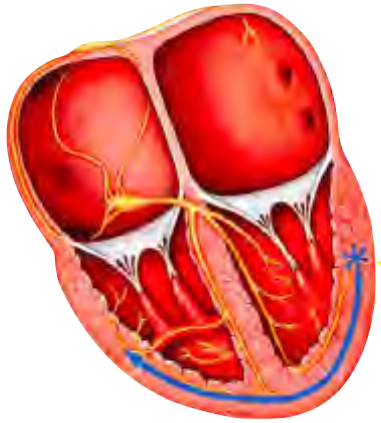
# Arrhythmia or Dysrhythmia

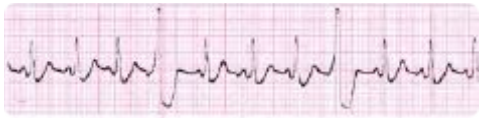
- **Arrhythmia: A = 'not' or "without'**
  **Therefore, an arrhythmia implies NO beat or a 'flat line'.**
- **The only true arrhythmia is asystole (no contraction)**
- **Dysrhythmia: Dys = abnormal**
  **'An abnormal cardiac rhythm'**





# Premature Ventricular Complexes
## Monomorphic (Unifocal)





**ALL PVC's look alike**

**Area of ischemic myocardium**



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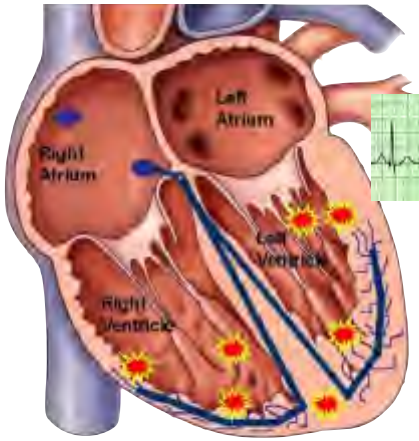
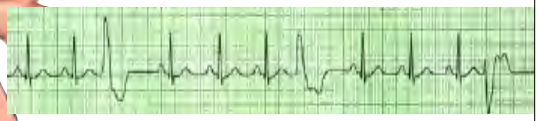
# Premature Ventricular Complexes
## Polymorphic (Multifocal)



**PVC's vary in size & shape**

**MORE CLINICALLY SIGNIFICANT!**



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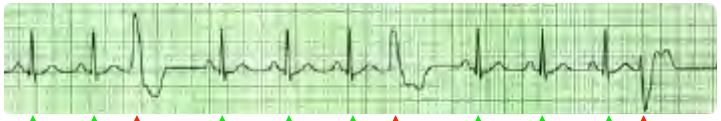
# Premature Ventricular Contractions
## PVC's



**Patient is CONSCIOUS**
**8 of 11 contractions (systoles) are normal, ejecting blood into the systemic circulation.**

**Output of blood is 73% of normal**



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# Premature Ventricular Contractions
## PVC's

**Patient is CONSCIOUS**
**yet demonstrating S&S of decreased blood flow to periphery:**

- **Cyanotic mucous membranes**
- **Ashen gray skin color**
- **Diaphoresis**
- **Generalized feeling of fatigue**



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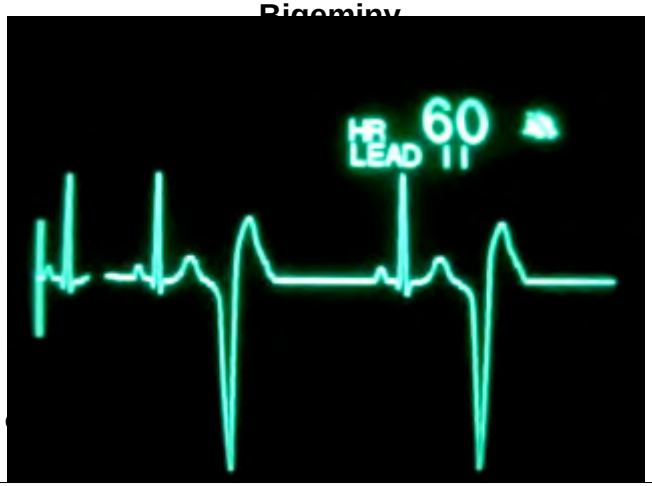
**Premature Ventricular Contractions**
**Bigeminy**




**Cardiac**





**The dentist's objective in a medical emergency situation**

**Keep the victim alive until:**

**(1) Recovery occurs or**

**(2) Help arrives to take over management**





**So, what exactly has been done prior to EMS arrival to PREVENT the occurrence of cardiac arrest?**

**Morphine ($N_2O$-$O_2$)**
**Oxygen**
**Nitroglycerin**
**Aspirin**





**NOTHING**

**Ischemic myocardiam still exists;**
**Dysrhythmias still occurring;**
**But the pump - though damaged - is still pumping**

**We have been LUCKY**

# Acute Myocardial Infarction

↓

## Cardiac Arrest

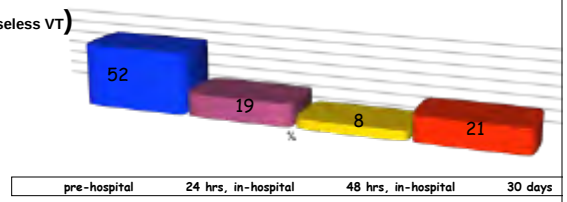
**Most OOH-SCA are related to acute dysrhythmias (VF/ pulseless VT)**

**Most occur during the**

**1st hour**

**after symptom onset**

**52% of MI mortality**




Deaths from MI



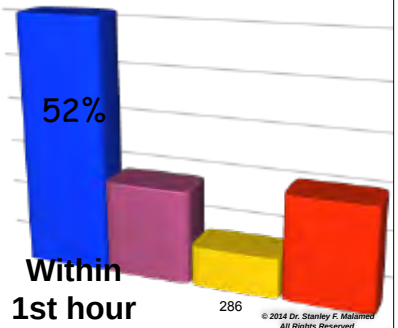


# Acute myocardial infarction

↓

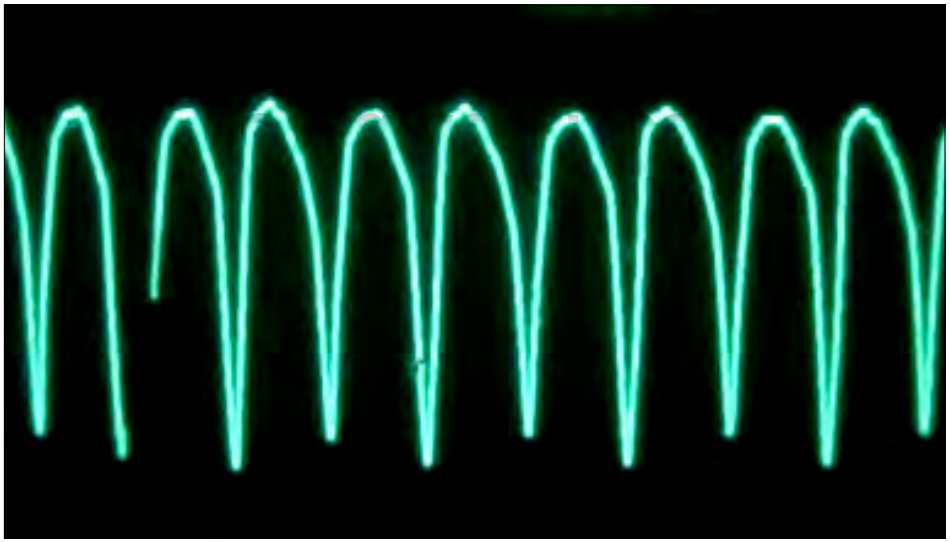
## Cardiac Arrest

**Getting into the 'system' (9.1.1) is *THE* most important thing that can be done for the victim of a 'suspected heart attack' (AMI)**









CARDIAC ARREST
occurs when the heart ceases to
PUMP BLOOD

In CARDIAC ARREST
the heart, usually, is still
BEATING
It is no longer PUMPING

CARDIAC ARREST
occurs when the heart ceases to
PUMP BLOOD

There are four rhythms that constitute cardiac arrest

(1) (pulseless) Ventricular Tachycardia
(2) Ventricular Fibrillation (coarse & fine)
(3) Asystole
(4) Pulseless Electrical Activity (PEA)



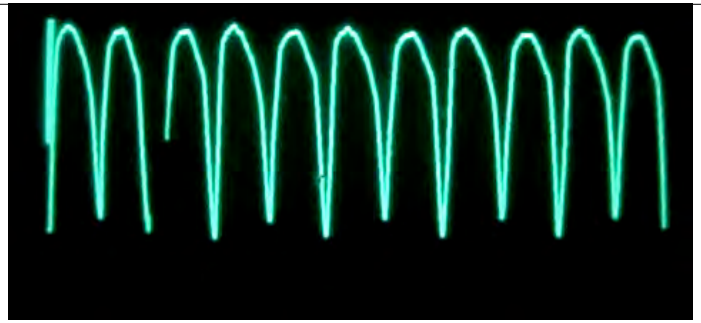


# Cardiac Arrest

- **Pulseless Ventricular Tachycardia**
- **Ventricular Fibrillation**
- **Asystole**
- **Pulseless Electrical Activity**





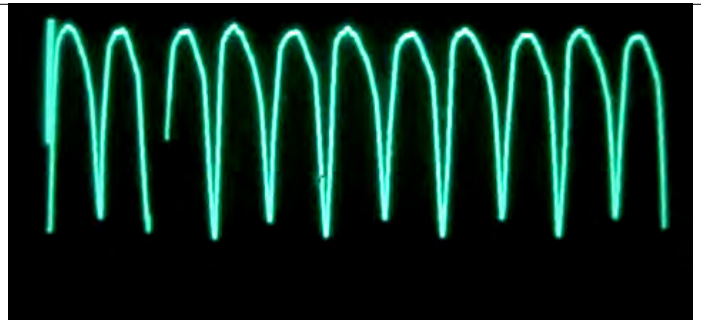


**VT with a pulse or pulseless VT**

The ischemic area of myocardium has taken control.
ALL beats are PVCs

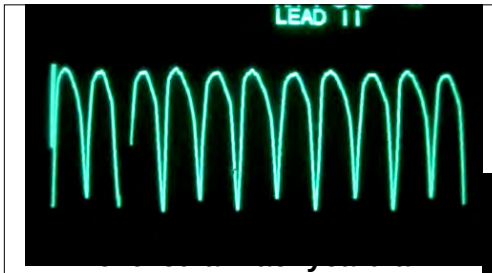




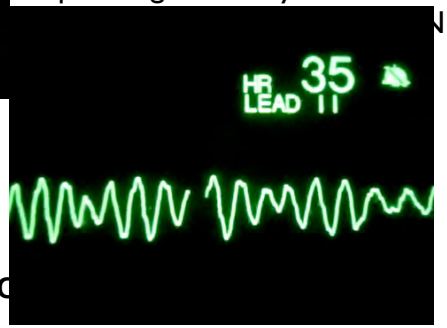


**VT with a pulse or pulseless VT**

VT is an organized rhythm (all beats similar)
Extremely rapid ventricular rate (~180 bpm)




VT degenerates into a CHAOTIC, unorganized quivering of the myocardium -



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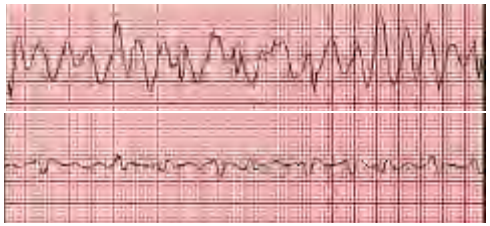
# Ventricular Fibrillation



**Common clinical findings**

- **Disappearance of pulse with VF**
- **Collapse, unconsciousness**
- **Agonal breaths** **apnea in < 5 minutes**
- **Onset of reversible death**



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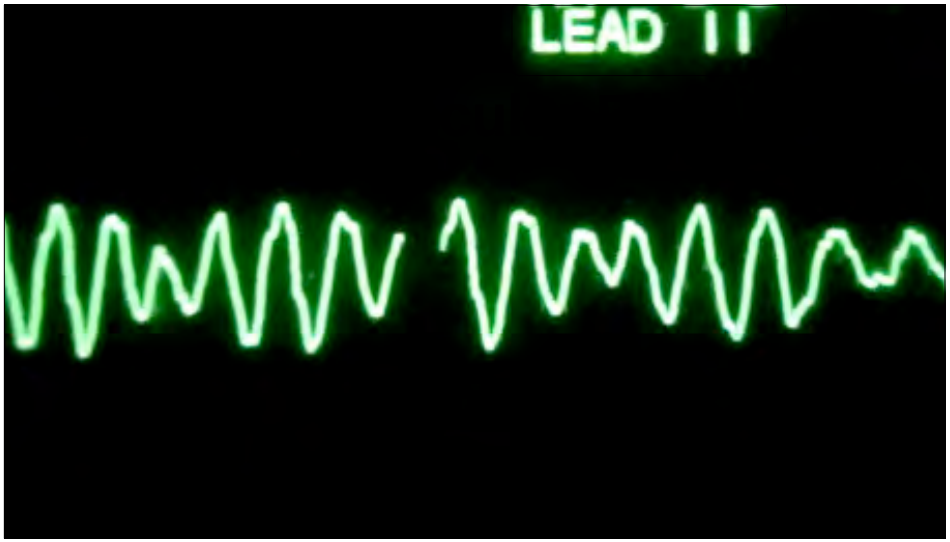
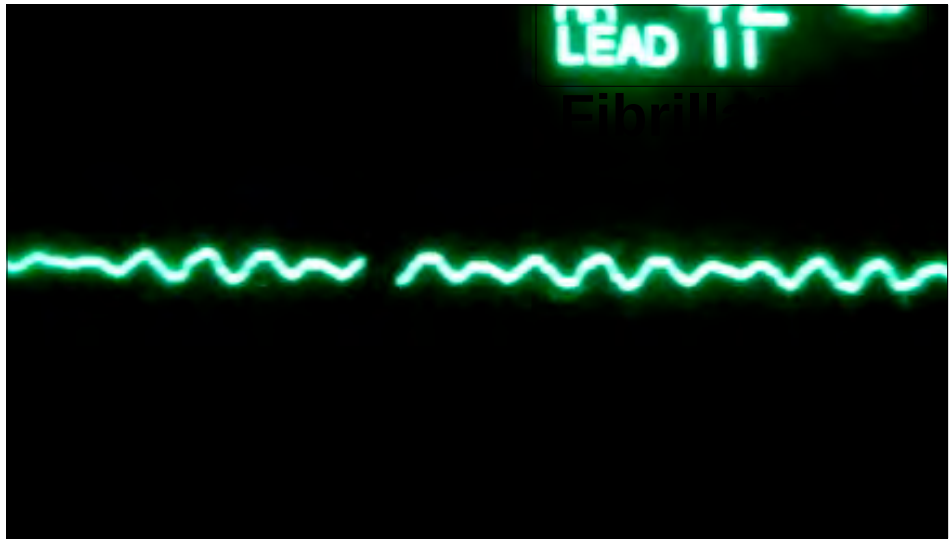



295

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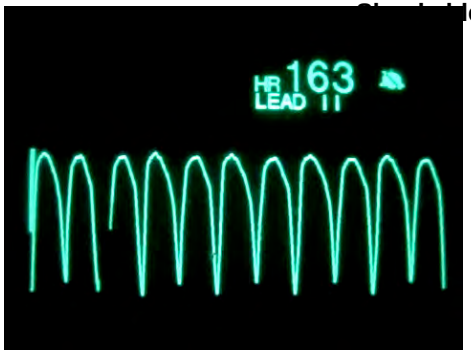
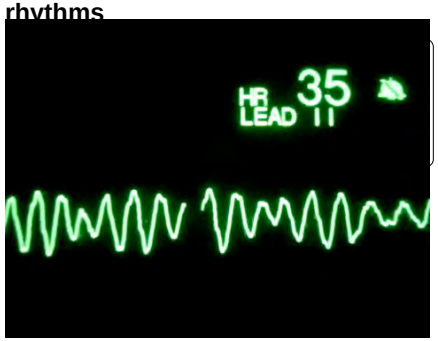
## CARDIAC ARREST

Shockable rhythms




Ventricular Tachycardia




Ventricular Fibrillation
coarse & fine



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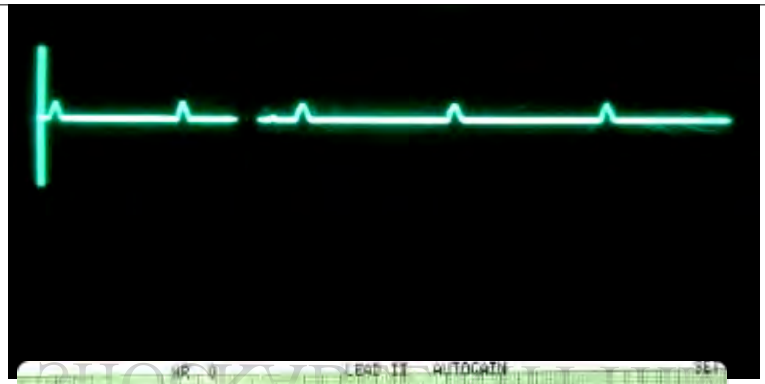

Asystolic Cardiac Arrest



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**What happens when the heart stops *PUMPING* blood?**



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**Blood pressure falls to zero,**

**Pulse isn not palpable,**

**Consciousness is lost, and**

**Respirations cease.**

**And the victim is . . .**



300

# DEAD

UNCONSCIOUS

NO PULSE

NOT BREATHING

# DEAD



301

What is the difference between
'Heart Attack' and Sudden Cardiac Arrest?

'Dead'


Alive



302

# Cardiac Arrest

UNCONSCIOUS

NO PULSE

NOT BREATHING

Clinical Death



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# Cardiac Arrest

UNCONSCIOUS

NO PULSE

NOT BREATHING

The victim 'looks' dead



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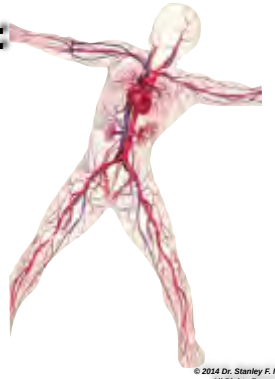
## At the moment of clinical death the heart stops pumping circulation of blood ceases:



- 65% of blood is in the venous circulation
- 5% of blood is in capillaries
- 30% of blood is arterial





## Our goal in resuscitation is to prevent the *PERMANENT* death of the victim.

- Cells in the victims body will die when they use up all of the $O_2$ available to them
- CELLULAR or BIOLOGICAL death occurs
- Biological death is *irreversible*





## The time between the occurrence of CLINICAL and BIOLOGICAL DEATH represents the period in which RESUSCITATION may be successful



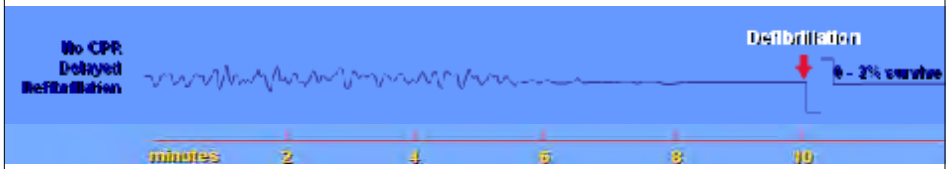


## Surviving Sudden Cardiac Arrest

Brain cells (neurons) have a high metabolic rate.

A degree of permanent neurologic deficit can be expected when neurons are deprived of $O_2$ for 3 or more minutes.

## No BLS
## Delayed EMS, Delayed BLS & Defibrillation:




# Death . . . or . . .



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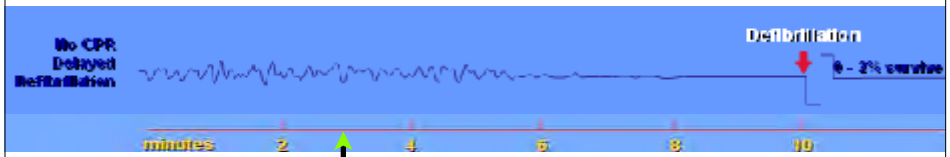
## No BLS
## Delayed EMS, Delayed BLS & Defibrillation:




Global Neurological Damage

Begin brain damage

# Severe brain damage



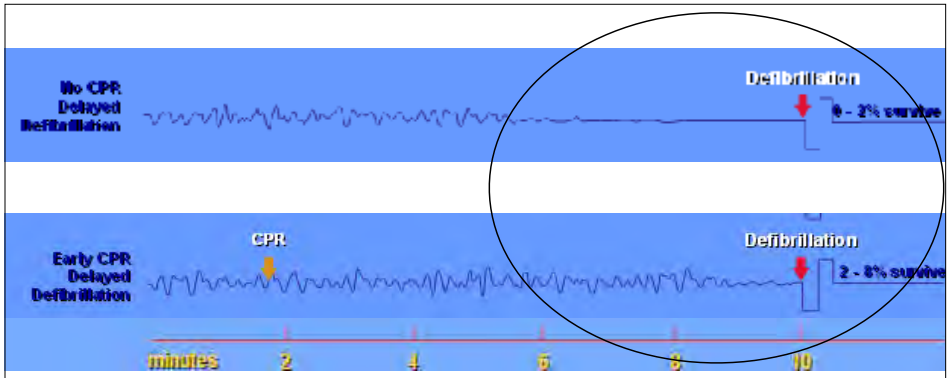
310

A very important fact about CPR (Basic Life Support):

- **Basic life support . . .**
  **Circulates oxygenated blood . . .**
  **Does NOT convert cardiac arrest into a functional rhythm (e.g. NSR)**
- **BLS simply increases the time during which the myocardium is still alive**



311

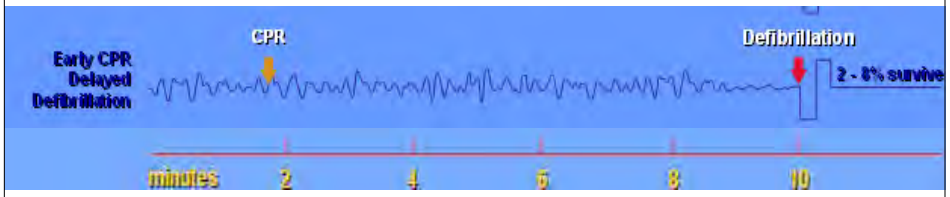



**Early BLS ↑ duration of VF (fine VF)**

**+ delayed defibrillation**



312




**Early BLS ↑ duration of VF** (fine VF)

**+ delayed defibrillation**

**2% - 8% survival**



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## Early BLS + early defibrillation (coarse VF)


**~20% survival**



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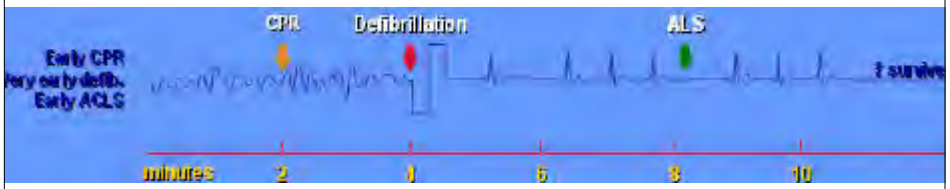
## Early BLS + very early defibrillation (coarse VF)



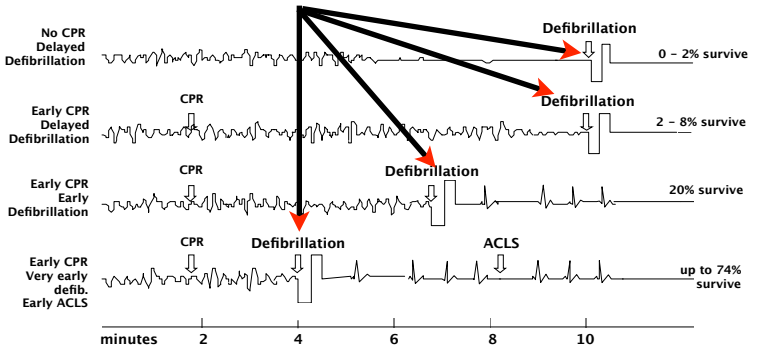

**Up to 74% in some situations**

**Neurological deficit unlikely**



315

## EMS arrival
## Survival Rates




**BYSTANDER INITIATED BLS**



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## How critical is response time to survival?

**For every minute a victim is in cardiac arrest the chance of survival decreases by between 7% and 10%.**

Survival to hospital discharge

**This assumes that BLS is being administered**



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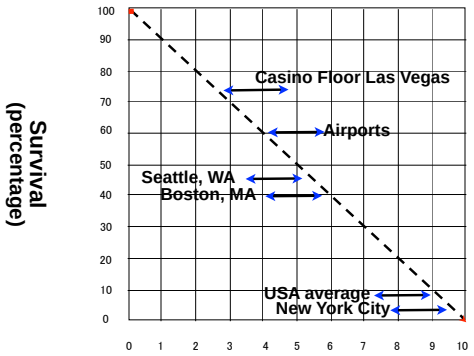
## How critical is response time to SURVIVAL?

Survival to hospital discharge




- LV casino . . . 74%
- Airports . . . 60%
- Seattle WA . . . 46%
- Boston MA . . . 40%
- San Francisco . . . 9%
- **USA average . . . 7.4%**
- New York City . . . 2%
- Los Angeles CA . . . 1.4%
- Chicago IL . . . 1%



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## Basic Life Support - 2010 AHA




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## Automated External Defibrillators

**(AED's)**



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## How to use an AED

- Simplistically, an AED is a battery operated computer which is capable of determining whether or not VF/VT is present.
  - VF/VT present:
    - 'SHOCK ADVISED"



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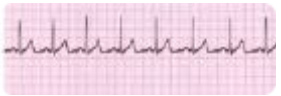
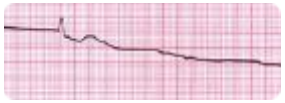
## How to use an AED





- Any rhythm other than VF/ VT
  - PEA, asystole, NSR
    - 'NO SHOCK ADVISED'
    - 'Check airway'
    - 'Check breathing'
    - 'Check pulse'
    - 'If no pulse, continue CPR'



322

## How an AED works

- VF . . . chaotic, uncordinated 'quivering' of myocardium

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## How an AED works

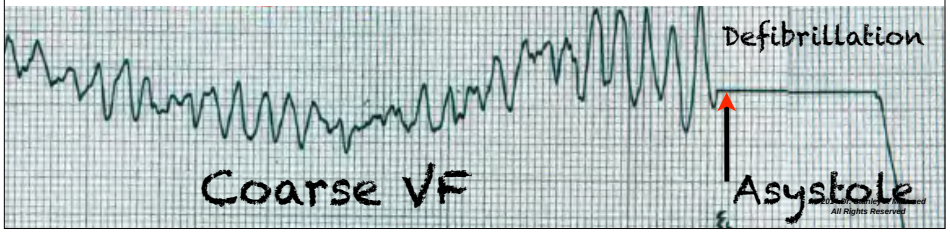
AED delivers a biphasic (2 shocks) shock across the chest - through the myocardium - depolarizing all myocardial cells at the same time.



324

## How an AED works

- AED delivers a biphasic (2 shocks) shock across the chest - through the myocardium - depolarizing all myocardial cells at the same time, producing . . .
- ASYSTOLE



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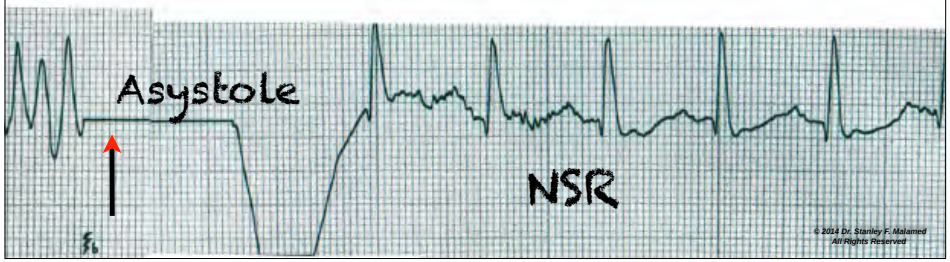
## How an AED works

- The more 'alive' the myocardium when depolarized the more likely it is that the SA node will spontaneously depolarize inducing a normal sinus rhythm.



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## How an AED works

REBOOT
the
HEART



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## Can the chest be compressed adequately with the victim in the dental chair?

# YES

Lepere AJ, Finn J, Jacobs I
Efficacy of cardiopulmonary resuscitation performed in a dental chair
J Australian Dental Association 48(4) 244-247, 2003 (December)



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# Rules to Remember

**The very first step in management of all medical emergencies is**

**BASIC LIFE SUPPORT,**

**as needed**





# And remember . . . "Stuff Happens"

| | |
|---|---|
| Syncope | 15,407 (50.3%) |
| Mild allergy | 2,583 (8.4%) |
| Angina Pectoris | 2,552 (8.3%) |
| Postural hypotension | 2,475 (8.1%) |
| Seizure | 1,595 (5.2%) |
| Asthmatic attack | 1,392 (4.5%) |
| Hyperventilation | 1,326 (4.3%) |
| Epinephrine Rxn | 913 (3.0%) |
| Hypoglycemia | 890 (2.9%) |

| | |
|---|---|
| Cardiac Arrest | 331 (1.1%) |
| Anaphylaxis | 304 (1.0%) |
| Myocardial Infarction | 289 (0.9%) |
| L.A. Overdose | 204 (0.7%) |





# Emergency Management

**non-Cardiac arrest**

**P . . . position**

**C . . . circulation**

**A . . . airway**

**B . . . breathing**

**D . . . definitive care**

**Drug therapy is ALWAYS secondary to basic life support**

**Cardiac arrest**

**P . . . position**

**C . . . circulation**

**A . . . airway**

**B . . . breathing**

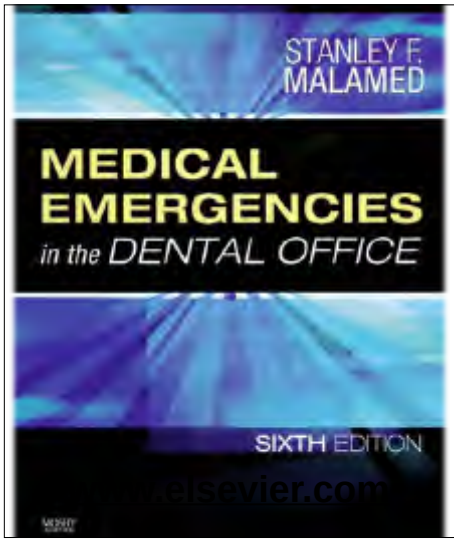
**D . . . defibrillation**





# P - C - A - B

## Keep the victim alive





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