CALIFORNIA ASSOCIATION of
ORAL & MAXILLOFACIAL SURGEONS

Presents

OMSA Final Exam Review Course Syllabus

Developed by CALAOMS'
OMSA Committee

CALIFORNIA ASSOCIATION of
ORAL & MAXILLOFACIAL SURGEONS

Table of Contents

Autonomic Nervous System (ANS) Review

California Association of Oral & Maxillofacial Surgeons
Oral & Maxillofacial Surgery Assistant's Course

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Nervous System

Somatic

The part of the nervous system that controls the voluntary movements of the human body such as lifting a weight.

Autonomic

The part of the nervous system that controls the "automatic" functions of the human body such as the beating of your heart.

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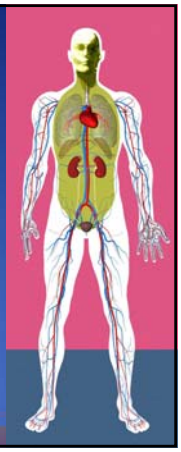
Autonomic system

- The autonomic nervous system exerts its action on many organs and systems:
  - Heart
  - Lungs
  - Stomach, intestines
  - Liver
  - Kidneys
  - Blood vessels
  - Pupils
  - Salivary glands



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Autonomic functions

The autonomic nervous system controls all the regulatory systems of the body.

Blood pressure
Heart rate
Respiratory rate
Temperature
Digestion
Metabolism
Water/electrolyte balance
Production of body fluids
Urination
Defecation

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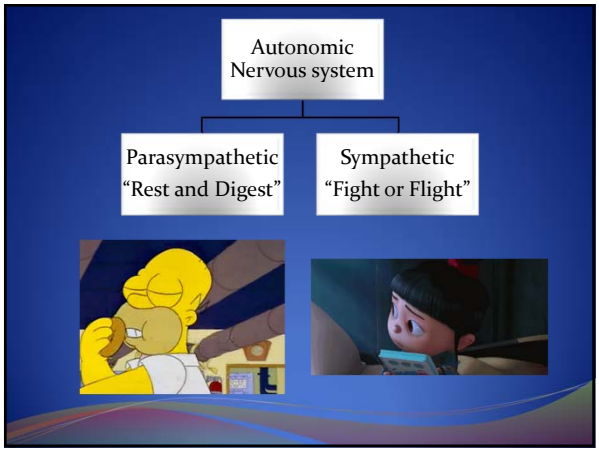

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Balance and Regulation of the Autonomic Nervous System

- The sympathetic and parasympathetic sides of the nervous system exert opposite functions on many of our organs. As one goes up the other goes down.

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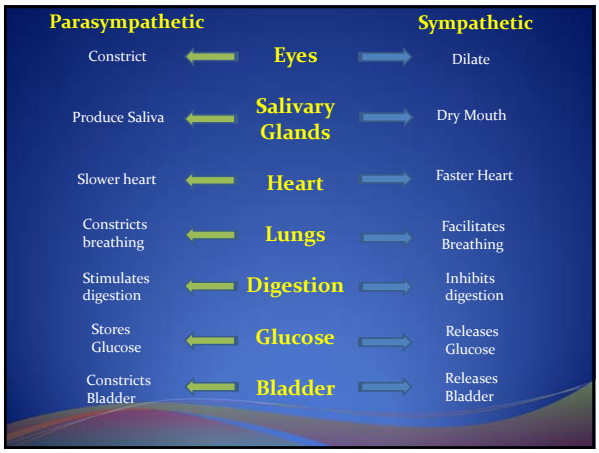

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Neurotransmitters

- These are chemical "messengers" that communicate within the autonomic nervous system
- Main chemicals:
  - Acetylcholine
  - Norepinephrine

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Chemical Transmitters

- Generally, the **Parasympathetic Nervous System** uses **Acetylcholine** and therefore it is sometimes called the **Cholinergic** System
- Generally, the **Sympathetic Nervous System** uses **Norepinephrine**. It is sometimes called the **Adrenergic** System
  - [Norepinephrine = Noradrenaline… Adrenaline → "adrenergic"]

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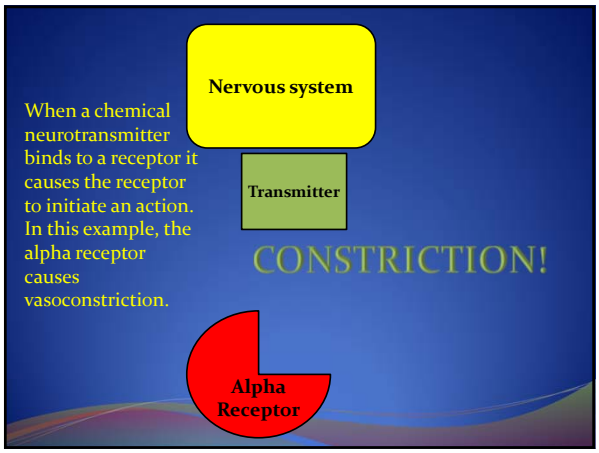

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Receptors of the Sympathetic Nervous System

- Types of sympathetic receptors: **alpha, beta 1 and beta 2**
  - Alpha receptors are on BLOOD VESSELS
  - Beta 1 receptors are in the HEART
  - Beta 2 receptors are in the bronchioles of the LUNGS

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Tricks to remember

- Alpha (α) = Arteries
- Beta 1 (β1) = 1 Heart
- Beta 2 (β2) = 2 lungs

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Effect of Alpha receptors on blood vessels:

- When stimulated (agonist):
  - Blood vessels CONSTRICT

- When blocked (antagonist):
  - Blood vessels DILATE

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Beta 1 Receptors in the Heart

- When stimulated: Heart rate and contractility increases

- When blocked: Heart rate and contractility decreases
- "Beta blockers"

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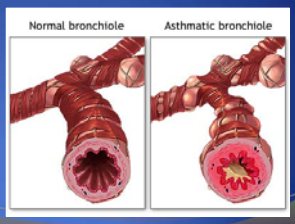
Beta 2 Receptors in the Lungs

- When stimulated: Bronchioles dilate (get bigger)
- Therefore, asthma medications are "beta agonists"
- When blocked: Bronchioles constrict



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The Vagus Nerve

- The **Vagus Nerve** is the 10th Cranial nerve. It supplies parasympathetic innervation to the heart.
- ***Stimulation of the Vagus nerve slows the heart rate.***

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The Vagus Nerve

- Excessive parasympathetic stimulation of the vagus nerve can cause a sudden drop in heart rate (bradycardia) and blood pressure (hypotension) that leads to a decrease in blood flowing to the brain, causing the patient to faint. This is called **Vasovagal syncope.**

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The Vagus Nerve

- Vasovagal syncope can be triggered by things like the sight of blood or extreme stress.
- Other causes: standing in place for extended periods of time, heat exposure, straining (like with a bowel movement).
- Episodes usually last less than a minute and resolve without treatment.

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The Vagus Nerve

- **Atropine** is a **parasympatholytic** drug, meaning it counters the effects of the parasympathetic system.
- Some oral surgeons administer atropine in low doses to decrease salivary secretions.
- But in higher doses or in susceptible patients, atropine can cause an increase in heart rate.

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This Concludes

Autonomic Nervous System (ANS) Review

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Cardiovascular System Review

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1

Cardiovascular

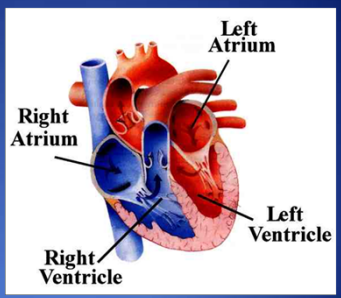
Anatomy of the Heart
Function of the heart
Cardiac Disorders:
- Heart Valve Conditions
- Coronary Artery Disease (CAD)
- Hypotension / Hypertension (HTN)
- Cerebral Vascular Accident (CVA)
- Congestive Heart Failure (CHF)

2

Heart Anatomy: 4 chambers

2 Upper chambers are the Atria / Atrium

2 Lower chambers are the ventricles



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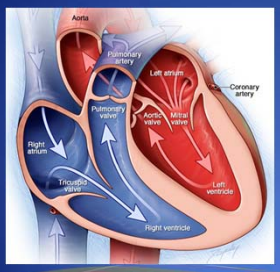
Heart Anatomy: 4 Valves

There are 2 valves between the Atria (top) & 2 between the Ventricles (bottom)



Think of valves as "saloon doors"

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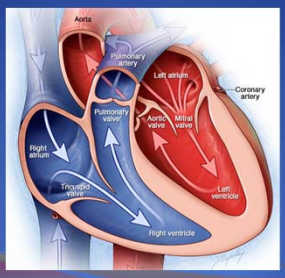
Tricuspid & Mitral Valves

Tricuspid Valve = between right atrium and right ventricle.

Mitral Valve = between left atrium and left ventricle



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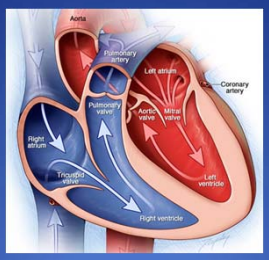
Pulmonic & Aortic Valves

The Pulmonic Valve lies in the Pulmonary Artery



The Aortic Valve lies in the Aorta

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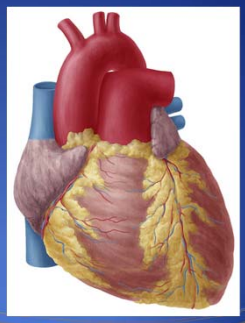
Function of the heart

What does the heart do ?



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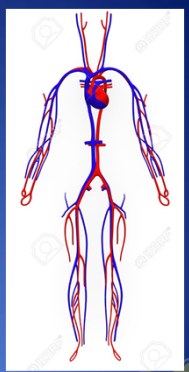
Function of the heart

The heart is a muscle which pumps blood through blood vessels to provide the body with oxygen.



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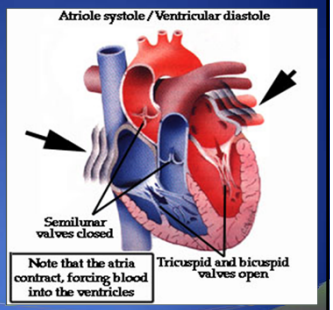
How does the heart pump ?

Atrial Contraction

The Atria squeeze the blood into the ventricles

Tricuspid & mitral valves open

Aortic & pulmonic valves close



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How does the heart pump ?

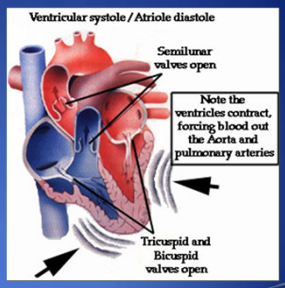
Ventricular Contraction

Both ventricles are filled with blood

Ventricles squeeze blood into the pulmonary artery and the aorta

Pulmonic & Aortic valves open

Tricuspid & Mitral Valves close



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Let's follow the pathway of blood through the heart

Superior and inferior vena cava

Right atrium

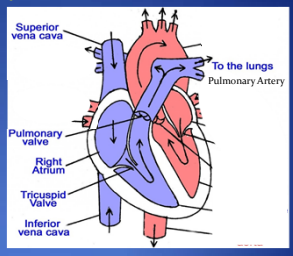
Tricuspid valve

Right ventricle

Pulmonic valve

Pulmonary artery

To the LUNGS where blood becomes oxygenated



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Let's follow the pathway of blood through the heart

Pulmonary Vein

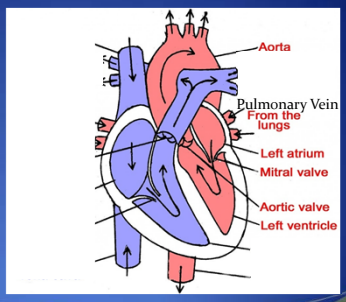
Left atrium

Mitral Valve

Left ventricle

Aortic Valve

Aorta to the rest of the body



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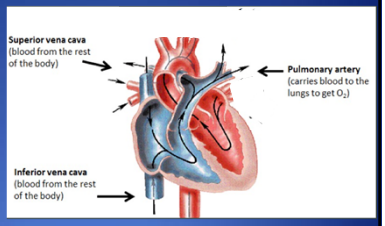
Blood flow through the heart

Superior & Inferior Vena Cava bring deoxygenated blood from body to right atrium

Pulmonary artery takes deoxygenated blood from right ventricle to lungs



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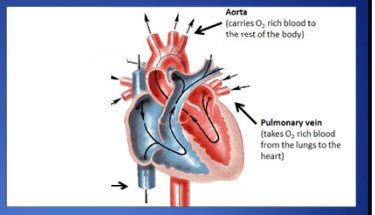
Blood flow through the heart

The Pulmonary Vein takes newly oxygenated blood from the lungs to the left atrium

The Aorta takes oxygenated blood from left ventricle to the rest of the body



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Let's do that blood flow again…

The _____ and the _____ bring deoxygenated blood to the _____ atrium

It goes through the _____ valve

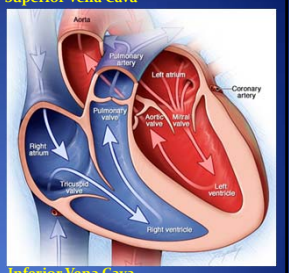
Into the _____ ventricle

Then it passes through the _____ valve

Into the _____ artery

Which leads it to the where it picks up oxygen

Superior Vena Cava



Inferior Vena Cava

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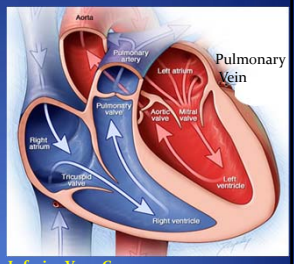
Keep Going…

The blood, newly oxygenated, comes back from the lungs through the _____ vein
Into the _____ atrium
Through the _____ valve
Into the _____ ventricle
Through the _____ valve
Into the_____ (hint: BIG artery)
Which pumps the oxygenated blood to the rest of the body

Superior Vena Cava



Inferior Vena Cava

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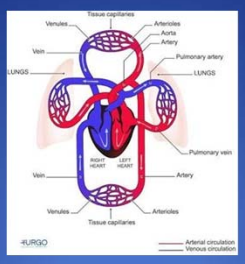
How do Arteries & Veins Connect ?



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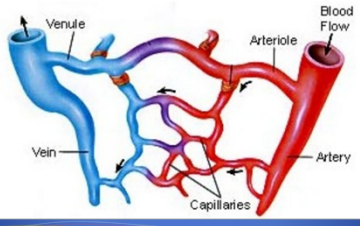
How do Arteries & Veins Connect ?

How Blood Travels thru Vessels

heart → artery → arteriole → capillary → venule → vein → heart



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How do Arteries & Veins Connect ?

How Blood Travels thru Vessels

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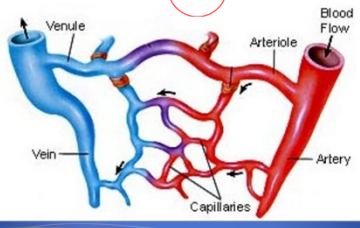

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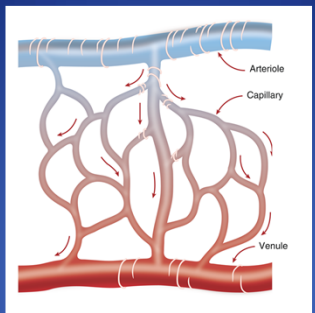
What happens in a capillary ?



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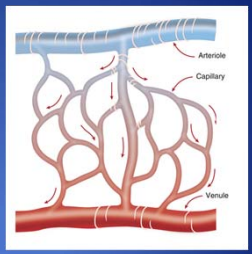
What happens in a capillary ?

As the blood moves

Oxygen (O2) is
off dropped
and
Carbon dioxide (CO2)
Is picked up



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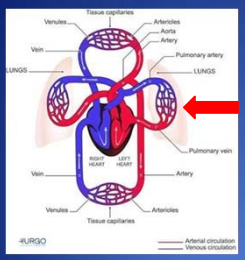
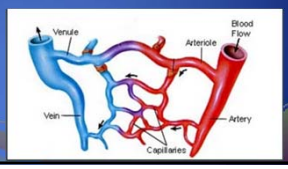
How do Arteries & Veins connect ?



In the *LUNGS* the blood
moves thru Capillaries,
pick up oxygen (02)
&
drops off
carbon dioxide (CO2)



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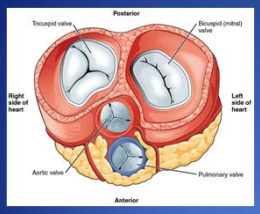
Heart Valve Conditions



Heart Valves can be
- "Stiff" – Stenotic
- "Bulge" – Prolapse
- "Insufficient" – Regurgitate

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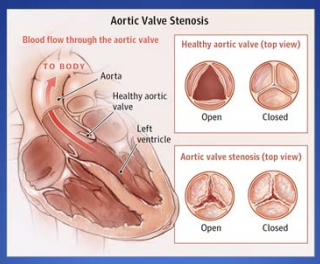
Heart Valve Conditions

Aortic Stenosis = Aortic Valve is "stiff"



The valve is stiff - blood has to force its way through.

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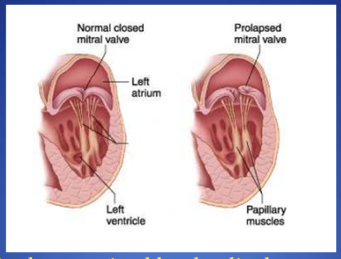
Heart Valve Conditions

Mitral Valve Prolapse = "Bulge"



This is characterized by the displacement of an abnormally thickened mitral valve during systole.

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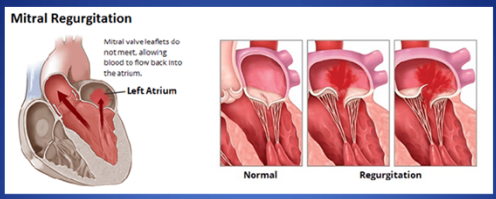
Heart Valve Conditions

Mitral Valve Regurgitation = "Insufficiency"



Mitral valve does not close properly so when the heart pumps out blood, blood flows back into the chamber.

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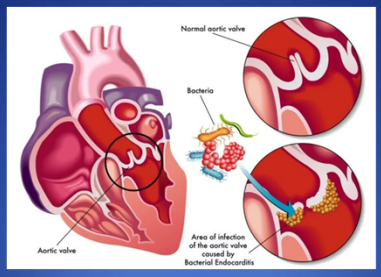
Consequences of Heart Valve Conditions

Heart Valve Problems are risk for infections of the heart



What is that called ?

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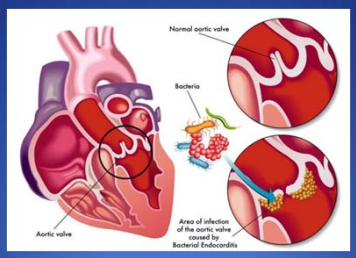
Consequences of Heart Valve Conditions

Bacterial Endocarditis



Infection of the heart valves

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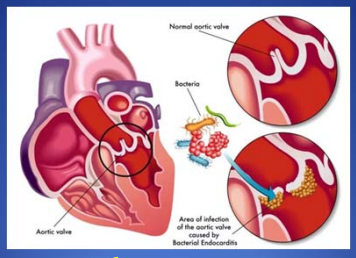
Consequences of Heart Valve Conditions

Why do we care about Bacterial Endocarditis?



What causes it ?

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Consequences of Heart Valve Conditions

Bacterial Endocarditis

Bacteria gets into the blood stream and lodges in the heart valve.

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Consequences of Heart Valve Conditions

Who needs to be pre-medicated with antibiotics prior to dental procedures ?

- History of endocarditis
- Prosthetic heart valve
- Heart transplant

- Cyanotic congenital heart disease (birth defects)
- Repaired congenital heart disease with residual defect

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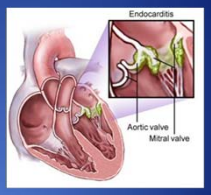
Prevention of bacterial endocarditis

Premedication of Antibiotics Prior to Dental Procedures

Amoxicillin 2 grams - 1 hour prior

Penicillin Allergy

Clindamycin 600 mg
or
Azithromycin 500 mg 1 hour prior



The most common bacteria = Streptococcus

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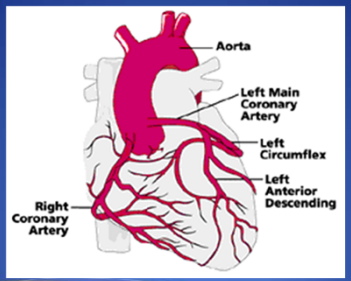
Cardiac Disorders

What do the coronary arteries do?



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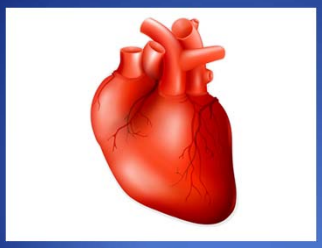
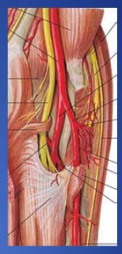
Cardiac Disorders

Coronary Arteries deliver blood to the heart muscle





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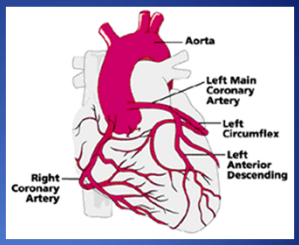
Cardiac Disorders

Coronary arteries

Are the first branches from the aorta and give the blood supply to the heart itself.



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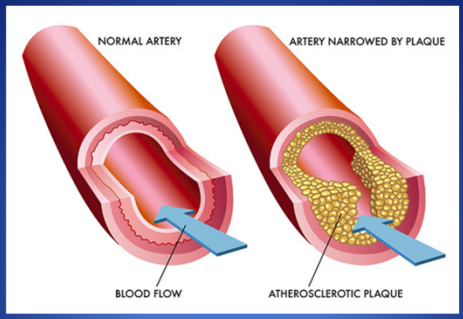
What is Atherosclerosis?



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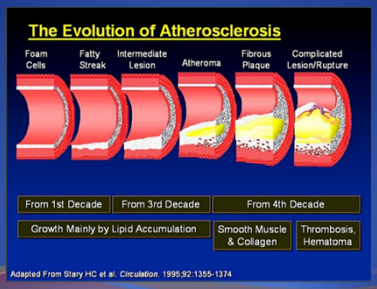
Pathophysiology of Atherosclerosis

A disease of the arteries where fat accumulates inside the artery



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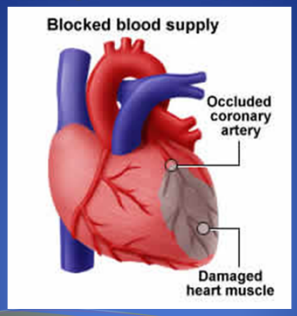
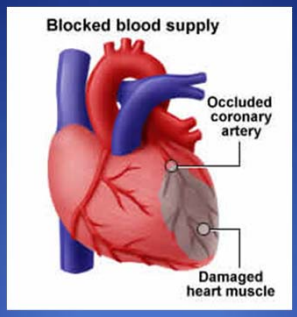
Atherosclerosis of the Coronary Arteries is called?



41

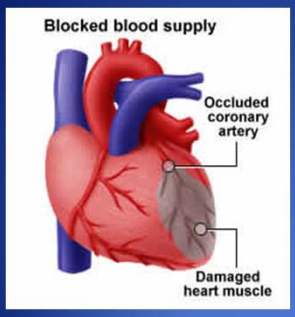
Atherosclerosis of the Coronary Arteries is called?



Coronary Artery Disease

42

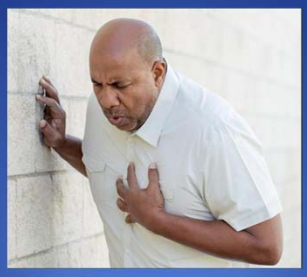
Why does chest pain occur ?



Chest pain - lack of blood flow through the coronary arteries to the heart (muscle)

43

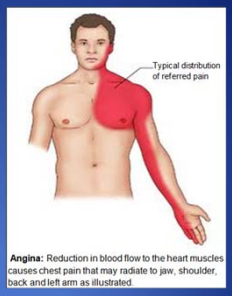
Where does chest pain usually radiate to ?



44

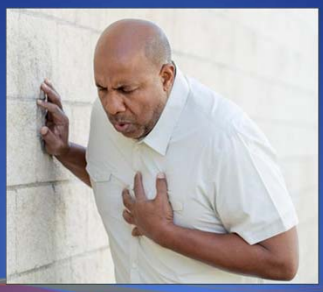
Where does the pain radiate ?

Pressure to chest
Left arm
Left Shoulder
Left jaw
Back



45

What is this called ? (chest pain)

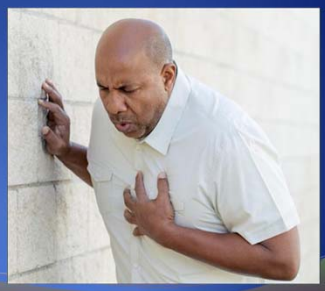


46

What is this called ? (chest pain)

Angina

Severe pain in the chest caused by an inadequate blood supply to the heart

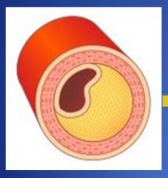


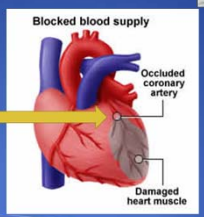
47

Why did this happen ?

What causes the lack of blood supply ?

In the coronary artery, plaque builds up & plugs the coronary artery. Stopping blood flow past that blockage.





48

How do you treat chest pain ? (Angina)

49

How do you treat chest pain ? (Angina)

M = Morphine
O =
N =
A =

50

How do you treat chest pain ? (Angina)

M = Morphine
O = Oxygen
N =
A =

51

How do you treat chest pain ? (Angina)

M = Morphine
O = Oxygen
N = Nitroglycerin
A =

52

How do you treat chest pain ? (Angina)

M = Morphine
O = Oxygen
N = Nitroglycerin
A = Aspirin

53

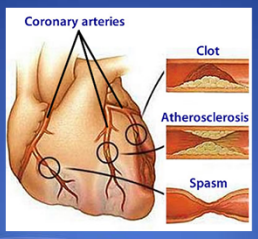
Myocardial Infarction

What is the difference between Angina vs Myocardial Infarction (MI)?

54

Angina vs Myocardial Infarction (MI)

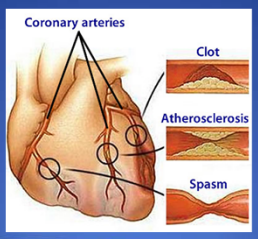
Angina - ischemia of heart muscle tissue due to lack of oxygen



55

Angina vs Myocardial Infarction (MI)

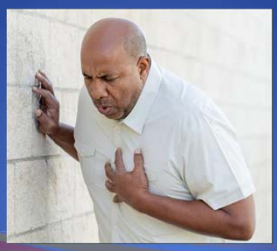
MI - death of heart muscle tissue due to lack of oxygen



56

Signs & Symptoms of MI

What are the signs and symptoms of a Myocardial Infarction (MI)?



57

Signs & Symptoms of MI

Chest pain
Left arm pain
Left jaw pain
Back pain
Nausea
Vomiting
Sweating

58

Coronary Artery Disease (CAD)

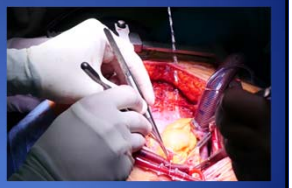
RISK FACTORS

Modifiable	Non Modifiable
High Blood Pressure	Age
Smoking	Race
High Cholesterol	Gender
Diabetes	Family History (MI, CHF, Valve, Rhythms)
Obesity	

59

How do you treat CAD ?

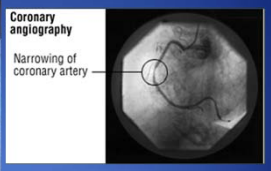
Cardiac Catheterization (Stent) or Coronary Artery Bypass Graft (CABG)



60

How do you treat CAD ?

Cardiac Catheterization : A catheter is introduced and a dye is Injected into the coronary arteries. This is called an angiogram.



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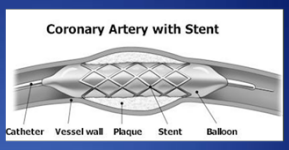
Catheterization with stent placement

Balloon angioplasty and placement of a stent:

Inflate the balloon to flatten the plaque against the arterial wall.

Leave the stent in place after the balloon is deflated.



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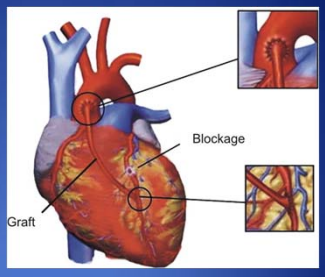
Coronary Artery Bypass Graft (CABG)

Take a graft (vessel) and attach one end to the aorta and the other end to a point in the artery beyond the blockage.
They "bypass" the blockage.



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Cardiovascular

Anatomy of the Heart
Function of the heart
Cardiac Disorders:
- Heart Valve Conditions
- Coronary Artery Disease (CAD)
- Hypotension / Hypertension (HTN)
- Cerebral Vascular Accident (CVA)
- Congestive Heart Failure (CHF)

64

Hypotension

What does hypotension mean ?

65

Hypotension

What does hypotension mean ?

Low Blood Pressure

66

Hypotension

How low
is too low ?

67

Hypotension

How low
is too low ?

90 / 60

68

Hypotension

What are the symptoms of low blood pressure ?

69

Hypotension

Signs & Symptoms:

Dizziness
Cold, clammy
Fatigue
Blurry vision

70

Hypotension - Causes

Excessive anesthesia
Allergic reactions
Myocardial Infarction
Cardiac dysrhythmias
Sepsis

71

Hypotension

How do you treat low blood pressure ?

When do you treat it ?

72

Hypotension Treatment

Place patient in supine

Fluid challenge

Drugs -

73

Hypotension Treatment

Place patient in supine

Fluid challenge

Drugs – Which ones ?

74

Hypotension Treatment

Place patient in supine

Fluid challenge

Drugs - Ephedrine or Phenylephrine

75

Hypertension

76

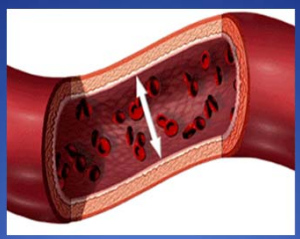
Hypertension

High Blood Pressure

77

Hypertension

What pressure are we measuring ?



78

Hypertension

What pressure are we measuring ?

Blood pressure measures the force of the blood inside an artery

79

Hypertension

BP = Systolic 120 / Diastolic 80

80

Hypertension

120 — ***Systole*** = Measures the pressure that blood exerts on the arteries while the **heart is beating**

80 — ***Diastole*** = Measures the pressure that blood exerts on the arteries while the **heart is at rest**

81

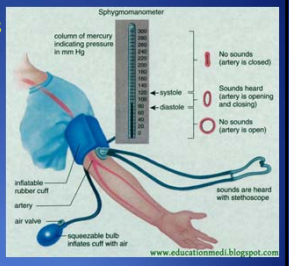
Hypertension

How do you take a blood pressure reading ?

82

Hypertension

1. Inflate the cuff to 180 or until you hear no sounds
2. Deflate the cuff and listen
3. The first sound you hear is the ____S_____
4. When sounds stop this is your ____D_____



83

Hypertension

How do you know that your BP is correct ?

84

Hypertension

How do you know that your BP is correct ?

What happens if the wrong cuff is put on ?

If its too small then.....?
BP is too _____.
and
If its too large then.....?
BP is too _____.

85

Hypertension

How do you know that your BP is correct ?

What happens if the wrong cuff is put on ?

If its too small then.....?
BP is too HIGH.
and
If its too large then.....?
BP is too LOW.

86

Hypertension

Stages of Hypertension

Blood Pressure Category	Systolic mm Hg (upper #)		Diastolic mm Hg (lower #)
Normal	less than **120**	and	less than **80**
Prehypertension	**120 – 139**	or	**80 – 89**
High Blood Pressure (Hypertension) **Stage 1**	**140 – 159**	or	**90 – 99**
High Blood Pressure (Hypertension) **Stage 2**	**160** or higher	or	**100** or higher
Hypertensive Crisis **(Emergency care needed)**	Higher than **180**	or	Higher than **110**

87

Hypertension

How high is too HIGH ?

88

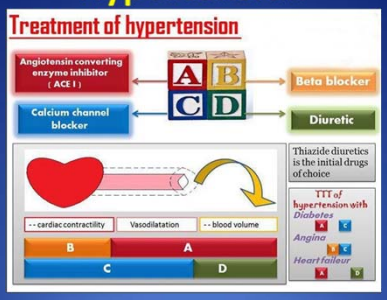
Hypertension

How do you treat it ?

1. Diuretics - "Water pill" - Lasix
2. Beta Blockers - Slows heart - Atenolol
3. Calcium Channel Blockers - Dilates - Norvasc
4. Ace Inhibitors - Inhibits Angiotensin – Lisinopril
5. Vasodilators – dilate blood vessels - Hydralazine

89

Hypertension



What do you think about a patient that is taking 1 medicine vs 3 medicines ?

90

Hypertensive Crisis

Blood Pressure > 240 / 140

Signs & Symptoms:

Headache
Dizziness
Chest pain, Shortness of breath
Nausea / Vomiting
Numbness/weakness
Nosebleeds
Loss of Vision

91

Hypertensive Crisis

Hypertensive Crisis - Pathophysiology

Precipitating factors: pain, anxiety, ↓ O_2, ↑ CO_2 or cardiopulmonary compromise (usually excessive adrenergic stimulation)

92

Hypertensive Crisis

- The anesthesia team should be vigilant in monitoring blood pressure throughout the surgical procedure.

93

Hypertensive Crisis Treatment

Hypertensive Crisis - Treatment

Try to determine cause and treat if possible e.g. pain

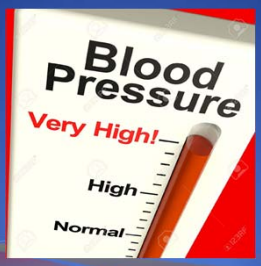
AN ADRERNERGIC BLOCKER (e.g. Labetalol) OR VASODILATOR (e.g. hydralazine)

94

Hypertension

What are we concerned about Hypertension ?

180 / 110



155 / 98

95

Hypertension

Can lead to :

Heart Attack (MI)
Stroke (CVA)
Congestive Heart Failure (CHF)

96

Cardiovascular

Anatomy of the Heart
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- Cerebral Vascular Accident (CVA)
- Congestive Heart Failure (CHF)

97

Cerebral Vascular Accident

Stroke (CVA) - Cerebral Vascular Accident

"Brain Attack"

What do you look for ?

98

Cerebral Vascular Accident (CVA)

Stroke - FAST

F = Face
A = Arm
S = Speech
T = Time

99

Cerebral Vascular Accident (CVA)

Stroke

F = Face

Facial Droop

100

Cerebral Vascular Accident (CVA)

Stroke

A = Arm

Weakness of one arm

101

Cerebral Vascular Accident (CVA)

Stroke

S = Speech

Trouble Speaking
Incomprehensible Speech

"You can't teach an old dog new tricks"

102

Cerebral Vascular Accident (CVA)

Stroke

T = Time

Call 911
ASAP

103

Cerebral Vascular Accident (CVA)

Stroke - FAST

F = Face

A = Arm

S = Speech

T = Time

104

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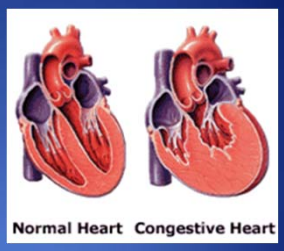
- Congestive Heart Failure (CHF)

105

Congestive Heart Failure (CHF)

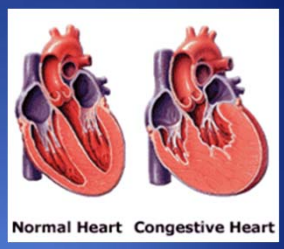
What is Congestive Heart Failure ? (CHF)



106

Congestive Heart Failure (CHF)

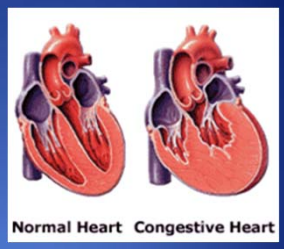
Definition = The Heart is unable to Pump sufficiently to Meet the body's needs.



107

Congestive Heart Failure (CHF)

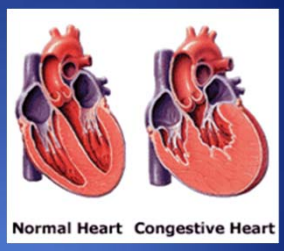
What causes CHF ?



108

Congestive Heart Failure (CHF)

Previous heart attack
High Blood pressure
Valve Problems
Dysrhythmias



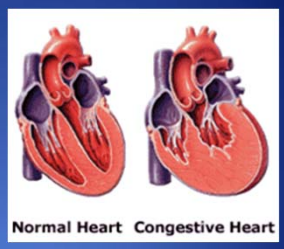
109

Congestive Heart Failure (CHF)

Two type of CHF

Right sided

Left sided



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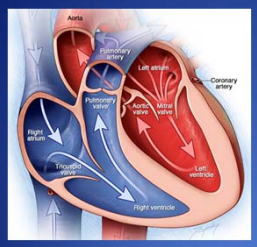
Congestive Heart Failure (CHF)

Superior Vena Cava



Inferior Vena Cava

Right sided Heart failure - Blood starts to back up…

Where does it come from ?

111

Congestive Heart Failure (CHF)

When the Right side of the heart fails.....

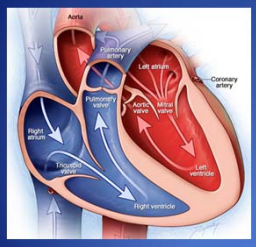
What are the signs of Right sided CHF ?

112

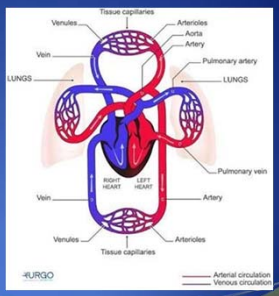
Congestive Heart Failure (CHF)

What happens when the Right side of the heart fails?

Neck



Feet



113

Congestive Heart Failure (CHF) RIGHT SIDE

Distended Neck Veins
Jugular Venous Distention
(JVD)

Pitting Edema to the Ankles
(Ankle Edema)

114

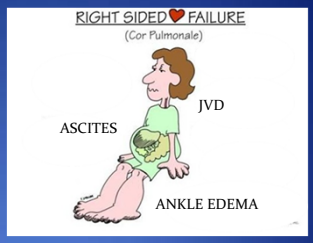
Congestive Heart Failure (CHF) RIGHT SIDE

Ascites = Fluid accumulation in the abdominal cavity

115

Congestive Heart Failure (CHF)

So when the Right side of the heart fails you will see.....



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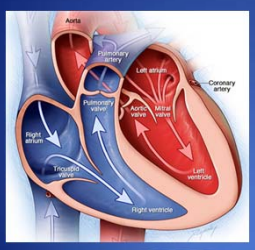
Congestive Heart Failure (CHF)

What happens when the Left side of the heart fails?



Left sided Heart failure -

Blood backs up....so

Where does it back up to?

117

Congestive Heart Failure (CHF)

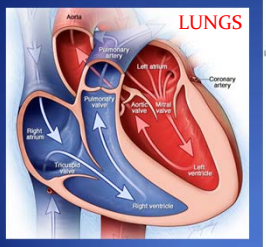
When the LEFT side of the heart fails.....

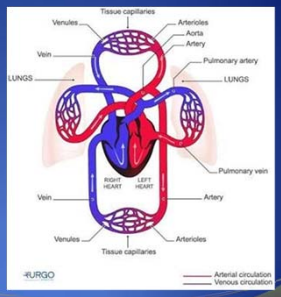
What are the signs of Left sided heart failure?

118

Congestive Heart Failure (CHF)

What happens when the LEFT side of the heart fails?





119

Congestive Heart Failure (CHF) - LEFT

Pulmonary edema = ?

120

Congestive Heart Failure (CHF) - LEFT

Pulmonary edema =

Fluid in the Lungs

Patients feel like they can not ....?

121

Congestive Heart Failure (CHF) - LEFT

Pulmonary edema =

Fluid in the Lungs

Patients feel like they can not ....**BREATH**

122

Congestive Heart Failure (CHF) - LEFT

Orthopnea = ?

123

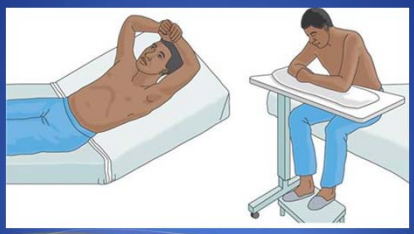
Congestive Heart Failure (CHF) - LEFT

Orthopnea = can't breathe lying down

124

Congestive Heart Failure (CHF) - LEFT

Paroxysmal Nocturnal Dyspnea = ?

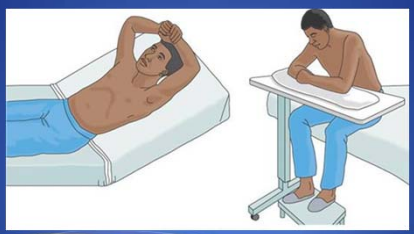


125

Congestive Heart Failure (CHF) - LEFT

Paroxysmal Nocturnal Dyspnea = ?

Waking up at night short of breath



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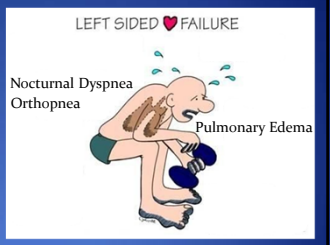
Congestive Heart Failure (CHF) - LEFT

When the LEFT Side of the Heart Fails…

What are the signs of left sided heart failure?



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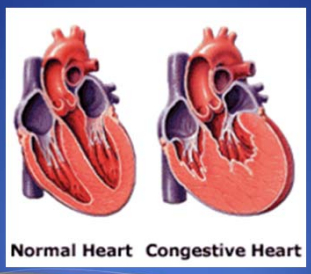
Congestive Heart Failure (CHF)

How do we treat CHF ?



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Congestive Heart Failure - Treatment

How do you fix the fluid problem ?

Too much fluid

How do you get rid of that fluid ?

129

Congestive Heart Failure - Treatment

How do you fix the fluid problem ?

Too much fluid

How do you get rid of that fluid ?

Diuretics

130

Congestive Heart Failure - Treatment

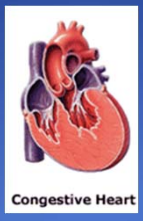
Digoxin – Increases contractility of the Heart without making the Heart work any harder

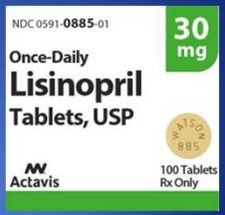
131

Congestive Heart Failure - Treatment

How do you make the heart more efficient when it pumps blood ?

Lisinopril – Vasodilator make it easier for the heart to pump.





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This concludes
Cardiovascular System Review
California Association of Oral & Maxillofacial Surgeons
Oral & Maxillofacial Surgery Assistant's Course

Conduction System Review

California Association of Oral & Maxillofacial Surgeons
Oral & Maxillofacial Surgery Assistant's Course

1

1

We will begin our discussion with an overview of how the conduction system of the heart regulates its function and how the activity of the conduction system can be monitored with the EKG.

2

2

The Conducting System

1. Its components and how it functions
2. Premature beats
3. Atrial dysrhythmias
4. Ventricular dysrhythmias
5. Clinical application

3

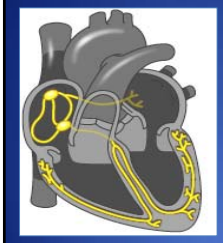
3

1. The components and function of the conducting system of the heart

4

4

Cardiac Conduction System – Definition



- The cardiac conduction system is a group of specialized cardiac muscle cells in the walls of the heart.
- These cells send signals to the heart muscle causing it to contract.

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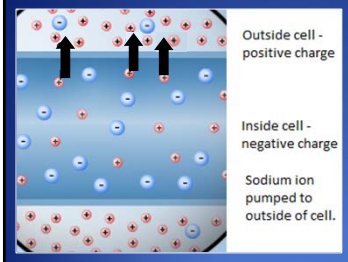
How do these cells work?



- At rest the cell membrane is polarized.
- Positively charged outside.
- Negative charged inside.
- There are gates in the cell membrane which are normally closed.

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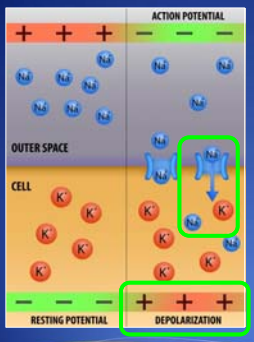
Initiation of Impulse



- The gates open, allowing the positively charged sodium ions to pass into the cell.
- These positive charges "neutralize" the negative charges inside the cell.
- Therefore, this is called "**depolarization**"

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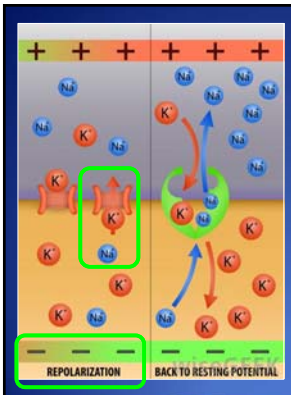

- **Once the cell is *depolarized*, the positive ions are "pushed" outside**
- **This *repolarizes* the membrane**

After **depolarization.... Repolarization**

8

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Conduction Pathway

This depolarization and repolarization process takes place along a pathway of the specialized cells of the conducting system.

- Much like a wave of arms or placards in a football stadium
- Or like a line of dominos

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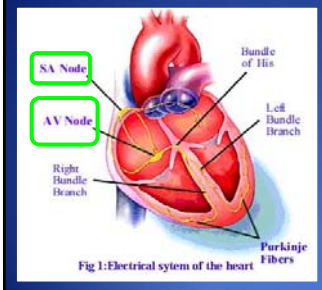
So here is the pathway in the heart



- The impulse originates in the **Sino-Atrial Node or SA Node** in the right atrium. This is the heart's **normal pacemaker**.
- It travels through the right atrium to another node near the junction of the atria and ventricles called **Atrio-Ventricular Node** or **AV Node**

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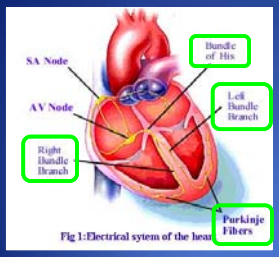
Cardiac Conduction Pathway continued



The path of the impulse from the AV node to the Purkinje fibers:

- From the AV node the impulse travels downward to the **Bundle of His** (pronounced HISS).
- It then travels down the interventricular septum (the septum in between the ventricles) and divides into the **right and left bundle branches.**
- At the bottom the bundle branches divide into the **Purkinje Fibers.**

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Do you have that pathway committed to memory?

SA Node to the AV Node to the Bundle of His to the right and left Bundle Branches to the Purkinje fibers.

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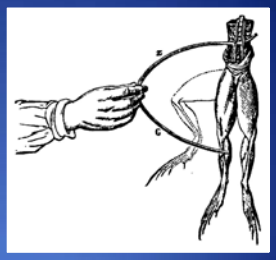
Impulse to Muscle Contraction

How does this impulse lead to the heart contracting?

- It was discovered that when an electrical current was applied across a muscle, the muscle contracted.
- So, as this conduction pathway progresses through the heart, the heart muscle contracts right after.



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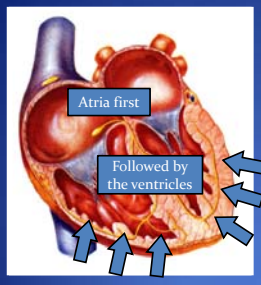
Heart Muscle Contraction



- Remember in our discussion about the cardiac cycle, we said that the atria contract first
- Followed by the ventricles
- Additionally, the ventricles contract from the bottom up, just like you would squeeze a toothpaste tube
- So you can see that the heart muscle contracts following the pathway of the electrical impulse

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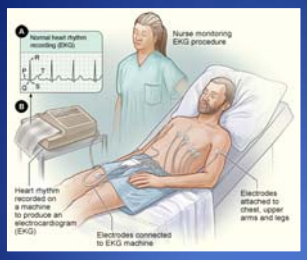
Electrocardiogram



The EKG machine places electrodes on either side of the heart:

- As the cells depolarize, this produces tiny rises and falls in the voltage between the two electrodes.
- This is displayed as a wave on the screen or paper.

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EKG Lead Placement

- Usually 3 leads
  - White lead designated as RA (right arm)
  - Black lead designated as LA (left arm)
  - Red lead designated as LL (left leg)
- "Salt and Pepper over Ketchup."
- "Smoke over Fire" (black over red); white on the right arm

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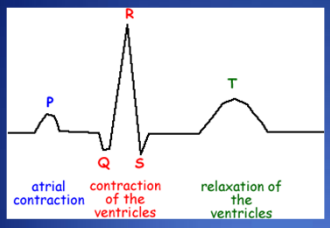
Normal EKG Wave



- **P wave = atrial depolarization**
- **QRS complex = ventricular depolarization**
- **T wave = ventricular repolarization**

Wait? What about the atrial repolarization?

It happens, but the wave gets lost in the QRS complex

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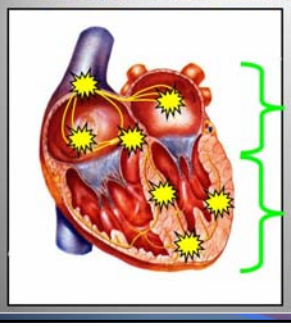
Other pacemakers

Cardiac rhythms can have a number of other pacemakers besides the SA node...



LEVEL	INHERENT RATE
Supraventricular foci	
SA Node	60 - 100/min.
Atria	60 - 80/min.
AV Junction	40 - 60/min.
Ventricles	20 - 40/min.

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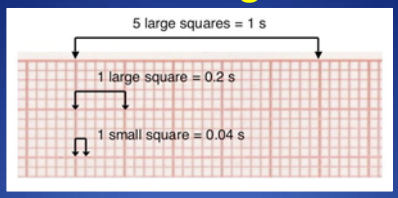
Determining Rate



- The graph paper is standardized to time
- For machines that have paper coming out, they all come out at the same speed
- 1 big square = .2 sec
- 1 little square = .04 sec
- 5 large squares = 1 second

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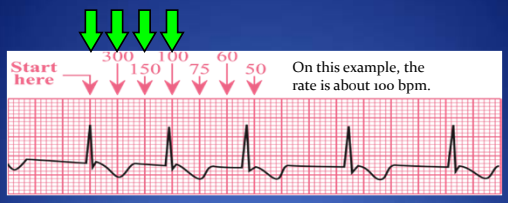
Determining the rate



- First: find an R wave that falls on a heavy line in the graph
- Second: Now. IGNORE the EKG tracing. Just concentrate on the graph paper
- Third: Count off and label each heavy dark line as follows: 300-150-100-75-60-50
- Fourth: Now look at the EKG tracing. Where does the next R wave fall? That's your rate.

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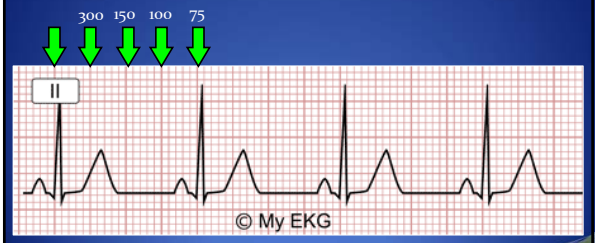
Okay. Now you try it:



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Terms

- Tachycardia = rate over 100 bpm
- Bradycardia = rate under 60 bpm
- Fibrillation = heart quivers
- Asystole = heart stops

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Arrhythmias and dysrhythmias…

- Arrhythmia means that there is no rhythm
- Dysrhythmia means that there is an abnormal rhythm
- However, it is common practice to use the two terms interchangeably

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Sinus Rhythms

- "Sinus" means the impulse originates in the SA node and travels in the normal route: SA node to AV node to Bundle of His to Bundle branches to Purkinje fibers.
- Normal sinus rhythm: rate is between **60-100** bpm
- Sinus tachycardia: the impulse travels the usual route, just fast
- Sinus bradycardia: the impulse travels the usual route, just slower

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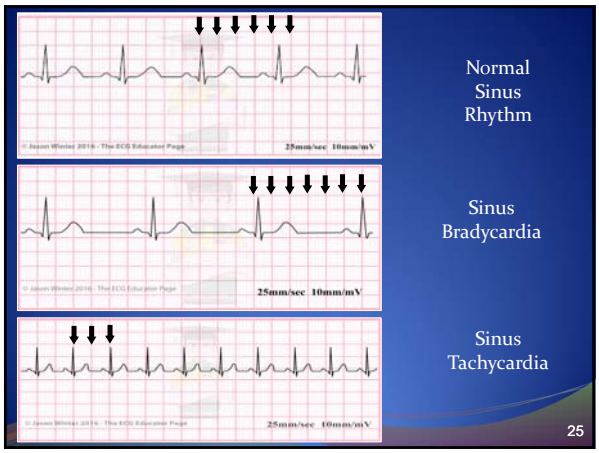

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2. Premature beats

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Premature beats

- Caused by **ectopic** foci.
- Ectopic = "not in the right place"
- Can occur in atria or ventricles
- Extra impulse that's not supposed to be there

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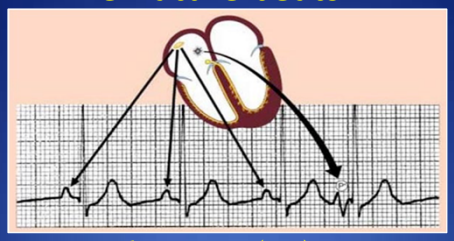
Premature beats



Premature Atrial Contraction (PAC) :

- Occurs when an ectopic focus in the atria fires early.
- This impulse gets conducted to the AV node which then fires.
- You see an abnormal P wave sooner than you expect with a normal QRS.

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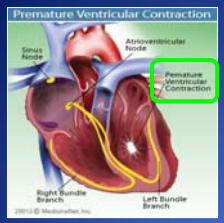
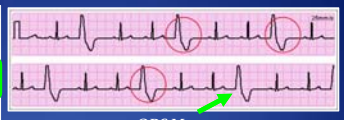
Premature beats in the ventricles





QRS Merges w/ T wave

Premature Ventricular Contraction (PVC):

- An ectopic impulse in the ventricles fires.
- Because it is not occurring down the usual pathway (down the interventricular septum and up the Purkinje fibers), the QRS loses its nice narrow appearance
- It looks wide and bizarre.

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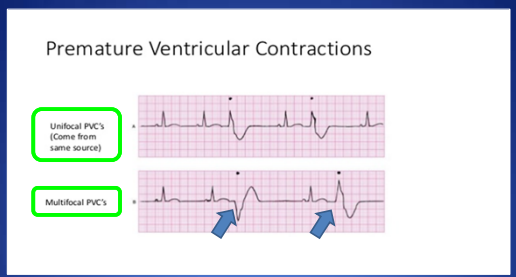
Premature Ventricular Contractions



- Unifocal: only 1 ectopic focus. All the PVC's look the same.
- Multifocal: more than 1 ectopic focus. PVC's look different.

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Multifocal PVC's

Multifocal PVC's

- Can be caused by cardiac hypoxia (lack of oxygen). Therefore they are very dangerous and require immediate attention.
- The multifocal PVC's mean that there are a number of extremely irritable foci discharging and trouble is imminent. The chance of developing ventricular fibrillation is HIGH.

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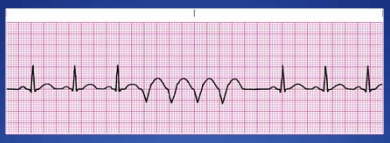
Runs of PVC's -------Ventricular Tachycardia



- Looks like PVC's all run together.
- This is a dangerous, potentially fatal rhythm.
- The heart is not pumping in a coordinated fashion, therefore the cardiac output will decrease.

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3. Atrial dysrhythmias

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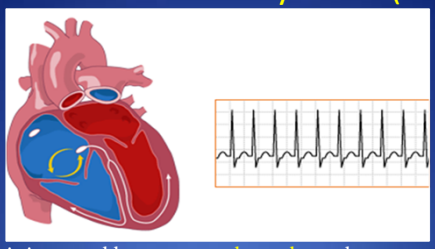
Supraventricular Tachycardia (SVT)



- This is caused by a re-entry loop above the ventricles.
- The impulses go around and around the AV node.
- You see very narrow complex going very rapidly (150-300 bpm).

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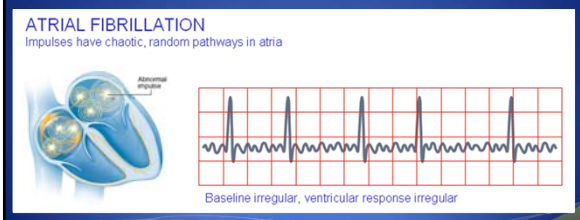
Atrial Fibrillation

- Multiple ectopic foci in atria fire, causing the atria to fibrillate, or "quiver".
- Intermittent ventricular response: the AV node fires normally when it receives a signal, but this is random.



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4. Ventricular dysrhythmias

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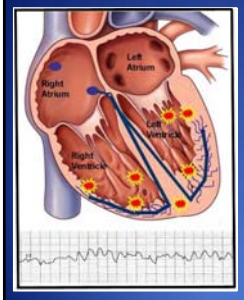
Ventricular fibrillation



- This is the most common rhythm in a patient in cardiac arrest.
- There is random, chaotic firing of multiple ectopic foci. There is no coordinated contraction and therefore no pulse.
- The heart is just quivering.
- The EKG is just a wavy line. No discernable P's or QRS or T waves.

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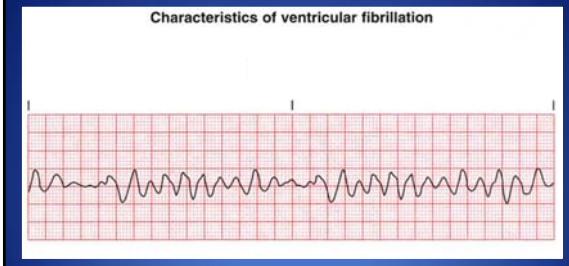
Ventricular fibrillation



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Asystole

- If you see a flat line, first check your leads
- No discernible electrical activity in the heart
- "Flatline"
- No pulse
- Confirm

39

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5. Clinical application

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Our Patient

The patient is a 61 year old stock broker who has "decided to fix his teeth" before his daughter's wedding. His dentist has recommended initially numerous extractions followed by the placement of a treatment partial denture.

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Health history

- He weighs 205 lbs. and is 5' 11" tall.
- His medical history is unremarkable.
- He works 60 hours per week and does not have time to exercise.
- There is no history of chest pain.

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Health history

- He does not take any medications routinely.
- He says he is allergic to penicillin.
- He has smoked 1 pack of cigarettes per day for the last 30 years.
- He drinks a martini when he gets home and has red wine with dinner.

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Vital Signs

- Vital Signs at consultation:
  - BP-139/89
  - HR-85
  - T-98.3
  - BMI-28.6

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On the day of surgery …

- He returns for surgery and appears a little nervous.
- The patient is taken to the surgery suite. The procedure is planned under local anesthesia.
- Pre-op vital Signs
  - BP-147/90
  - HR-92

45

45

Patient on day of surgery

- The mandibular extractions are to be performed first.
- The doctor administers two carpules of 0.5% Marcaine with 1:200,000 epinephrine and two carpules of 2% lidocaine with 1:100,000 epinephrine for bilateral inferior alveolar nerve blocks.
- The doctor tells the patient that he will wait for the local anesthetic to taken affect and return in about ten minutes.

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Patient on day of surgery

You leave to retrieve some instruments from the sterilization area. When you return, you see that the patient has lost consciousness and has an ashen color to his skin.

Shake and shout does not arouse patient, he has no palpable pulses and there are agonal respirations.

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Patient care

The first intervention is:

A. Precordial thump
B. Get ready to start an IV
C. Start CPR and call for help
D. Apply vital signs monitors
E. Place patient in reverse Trendelenburg position

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Patient care

Other staff members come to help. The next intervention would be:

A. Apply and analyze EKG rhythm
B. Get ready to start an IV
C. Apply and activate AED
D. Get ready to intubate patient
E. Synchronized cardioversion

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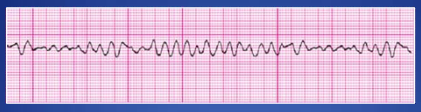
The following rhythm is seen on the EKG monitor.



This rhythm is:

A. Ventricular fibrillation
B. Atrial fibrillation
C. Asystole
D. Atrial flutter
E. Third degree heart block

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Immediately defibrillate!!

- BLS: start compressions
- Call 911
- Defibrillate as soon as AED is available
- Establish IV
- ACLS
- Advanced airway

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Let's talk about Pacemakers & Defibrillators

- Cardiac Pacemaker: battery operated implanted device which regulates heart rhythm. It takes the place of the normal impulse from the sinus node.
- Implantable Defibrillators: battery operated implantable device which can provide defibrillation in patients who are prone to develop ventricular fibrillation

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What about CPR & using an external defibrillator???

Q: Can CPR chest compressions be performed on patients implanted with pacemakers and/or defibrillators?

A: Yes, CPR compressions may be performed as usual.

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Q&A

Q: What if the implanted defibrillator delivers a shock while the responder is administering CPR?

A: If the implanted device delivers a shock during CPR, the responder may feel a tingling sensation on the patient's body surface. However, the shocks delivered by the implanted defibrillator will not pose a danger to the person administering CPR.

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Q&A

Q: What if the implanted defibrillator delivers a shock while the responder is in the process of operating a manual external defibrillator or an AED?

A: If the implanted device delivers a shock to the patient, the AHA recommends that the responder allow 30-60 seconds for the implanted device to complete the therapy cycle before administering external defibrillation

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Q&A

Q: Can the energy associated with external defibrillation damage the implanted device?

A: Yes. Although implantable pacemakers and defibrillators are designed to withstand external defibrillation, the implanted device can sustain damage if the external defibrillation electrode pads are placed too close to or directly over the device. Use the lowest energy output of external defibrillation equipment that is clinically acceptable.

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Q&A

Q: How should I position the external defibrillation pads to avoid damaging an implanted pacemaker or defibrillator?

A: Position the external defibrillation pads in a clinically acceptable position that is as far from the pulse generator as possible. Possibly utilize the anterior-posterior positioning.

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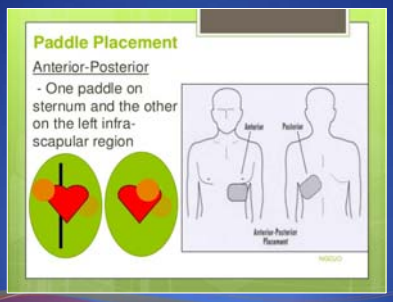
Anterior-Posterior AED pad placement



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The Conducting System

1. Its components and how it functions
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Conduction System Review

THE END

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Conduction System (ACLS) Review

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Basic Life Support

Review:

- "Are you okay?", check for breathing/pulse, activate 911, go get AED
- Start chest compressions
- 30:2
- Push hard, push fast ("Stayin' Alive")

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Automated External Defibrillator (AED)

- Turn on AED
- Attach pads to bare chest
- Plug in connector if necessary
- Stop CPR, push Analyze button
- If shock indicated, make sure everyone is clear.

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Categories of Cardiac Dysrhythmias

- Too Slow
  - Bradycardias
  - Heart blocks
- Too Fast
  - Supraventricular tachycardia
  - Ventricular tachycardia
- Too Dead
  - Ventricular fibrillation
  - Pulseless Electrical Activity
  - Asystole

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Bradycardias & Heart Blocks

Is patient symptomatic? Are the symptoms due to the bradycardia?

Symptoms:

- Hypotension
- Dizziness
- Shock
- Chest pain
- Shortness of breath
- Altered mental status?

Treatment:
Atropine .5 mg IV

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Tachycardias

Could be:

Sinus tachycardia?

Supraventricular tachycardia?

Ventricular Tachycardia?

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Tachycardias

- Does the patient have a **pulse**? If no, treat as ventricular fibrillation & defibrillate, start CPR
- Is the patient **stable or unstable**? Look for altered mental status, chest pain, hypotension
- If unstable, will need to do synchronized cardioversion (applying a shock on the R wave of the EKG). The AED cannot do this.

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Tachycardias (continued)

If stable, look at the QRS complex. Is it **wide or narrow**?

- Narrow? Possibly SVT.
  - Try vagal maneuvers
  - Adenosine 6 mg IV push. If no response, give 12 mg IV push
- Wide complex? Possibly Ventricular tachycardia
  - Consider Amiodarone 150 mg over 10 minutes

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Ventricular Fibrillation/Pulseless Ventricular Tachycardia

- **Confirm EKG leads are connected.**
- **Does patient have a pulse? No? Then probably V.Fib is real**
- **Start CPR, call 911**
- **Get defibrillator**

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V. Fib./Pulseless V. Tach.

TREATMENT: (Check pulse only after an organized rhythm is present)

- CPR (5 cycles), prepare to shock, apply pads. Check rhythm, – if shockable, charge, shock.
- CPR (5 cycles), check IV or start IV prn. Check rhythm, – if shockable, charge, shock.
- CPR (5 cycles), epinephrine 1:10,000 1.0 mg IV push, repeat q 3-5. Check rhythm, – if shockable, charge, shock.
- CPR (5 cycles) amiodarone 300 mg IV push, then 150mg q 3-5 min., or lidocaine 1 mg/kg IV push, then 0.5–0.75 mg/kg x3. Check rhythm, – if shockable, charge, shock.
- CPR (5 cycles), to paramedics and hospital.

1. CPR/pads
   Shock
2. CPR/IV
   Shock
3. CPR/epi
   Shock
4. CPR/amio
   Shock

CPR/Hosp.

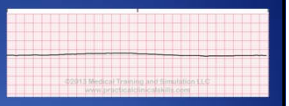
70

70

Asystole (Flatline) and PEA

If you see a flat line, check your leads – If leads are intact and no pulse:

- CPR
- O2
- Epinephrine 1 mg IV
- Cannot defibrillate this rhythm!



PEA (Pulseless Electrical Activity)

An organized rhythm on the monitor but no pulse. Treat as if asystole:

- CPR
- O2
- Epinephrine 1 mg IV
- Cannot defibrillate this rhythm!

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This Concludes

Conduction System (ACLS) Review

California Association of Oral & Maxillofacial Surgeons
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Respiratory System Review

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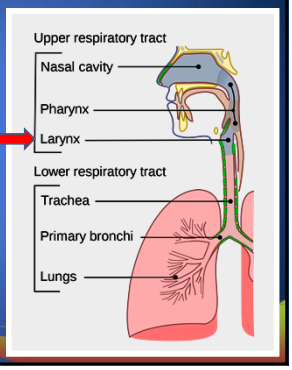
1

Respiratory System: Anatomy

- Structural classification:
  - **Upper Airway**

    Larynx – (demarcation)
  - **Lower Airway**



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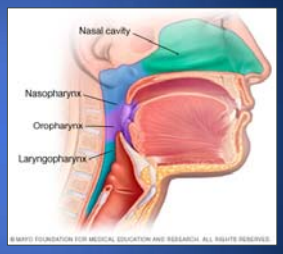
Anatomy: Upper Airway

- Nares = nostrils
- Nasopharynx = back of nose
- Oropharynx = back of mouth

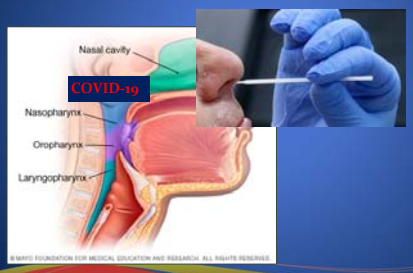


- Turbinates (Turbines): Increase surface area to warm & humidify air

3

Anatomy: Upper Airway

- Nasopharynx = Back of nose



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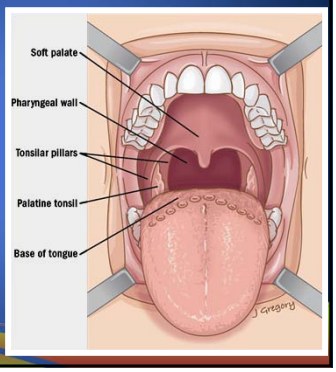
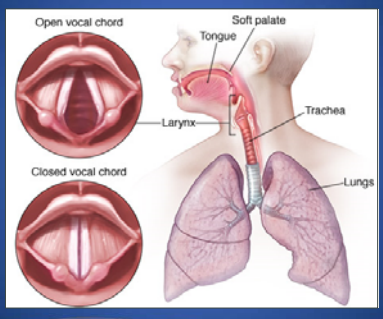
Anatomy: Oropharynx

- Oropharynx = Back of mouth



5

Anatomy: Upper Airway



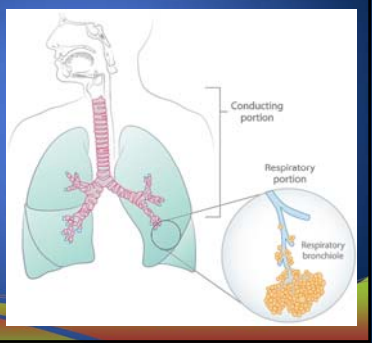
Larynx & Vocal Cords

6

Anatomy: Lower Airway

Conducting portion:
- Trachea
- Bronchi
- Bronchioles

Respiratory portion:
- Alveoli

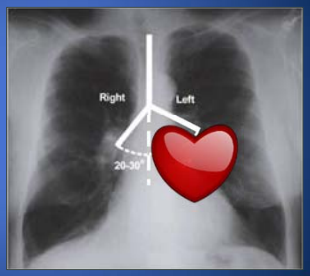


7

Right vs. Left Mainstem Bronchi

The left mainstem bronchus arises from the trachea at a more acute angle than the right mainstem bronchus.

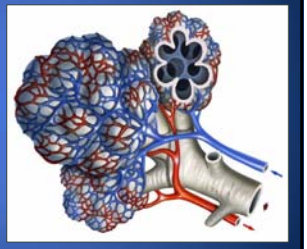
What's on the left?



8

Alveoli

- The bronchi divide again and again into smaller bronchioles
- Terminate in tiny thin-walled air sacs called **alveoli**.
- The alveoli are surrounded by a mesh of capillaries….the walls are thin, so O2 and CO2 just diffuse out.



9

Let's trace an oxygen molecule through the airway:

- Nose
- Nasopharynx
- Oropharynx
- Larynx
- Trachea
- Right & Left mainstem bronchi
- Bronchioles
- Alveolar sacs

10

Did you get that?

Let's try that one more time:

N_____, N_____, O_____, L_____

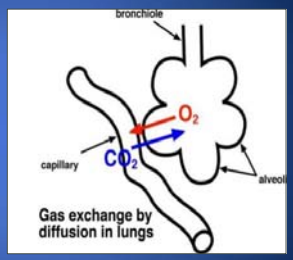
T_____, right and left B_____, B_____

A_____

11

Gas Exchange: Oxygen (O2)

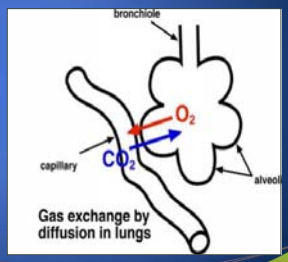
- When the patient inhales, the alveoli have a higher concentration of O2 than the capillary blood from the right ventricle. So O2 will just diffuse out of the alveoli into the capillaries.
- "Everything rolls downhill"



12

Gas Exchange: Carbon Dioxide (CO2)

- Similarly, the CO2 concentration will be higher in the capillaries than the alveoli, so the CO2 diffuses out of the capillaries into the alveoli to be exhaled.



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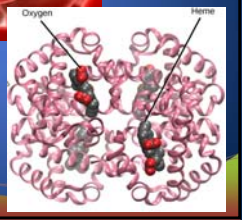
Oxygen & Hemoglobin

- Red Blood cells (RBC): Oxygen binds to the hemoglobin part of the red blood cell.
- Each molecule of hemoglobin can carry 4 molecules of oxygen.



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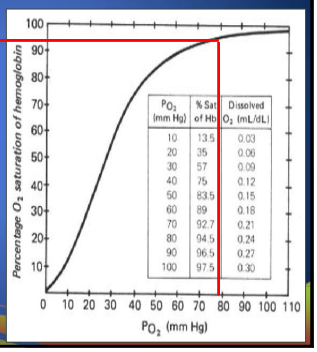
Oxyhemoglobin Dissociation curve

- Scary looking curve!
- The point of this curve is that at 95-96% O2 saturation (on the pulse oximeter), the oxygen is already falling off the hemoglobin at an alarming rate.
- PO2 at this point is only 80 mm Hg. That's low.
- That's why our alarms on the monitors are set at 90-92%



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Oxyhemoglobin Coaster

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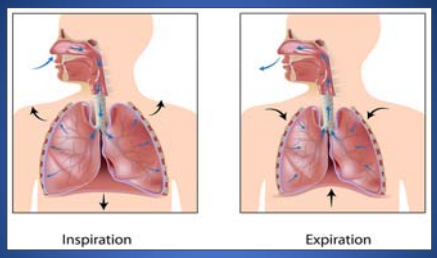
Breathing



- **Inspiration: (ACTIVE)** When you inhale, the thoracic cavity gets bigger: ribs expand, diaphragm moves downward. This causes **negative pressure** and air flows in.
- **Expiration: (PASSIVE)** When you exhale, the ribs contract, the diaphragm moves upward and the thoracic cavity gets smaller. Air then flows out..

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Control of Breathing

- Breathing is controlled in TWO ways:
  1. Autonomic
  2. Chemical (CO_2)

Small changes in CO_2, leads to large changes in rate and depth of respiration

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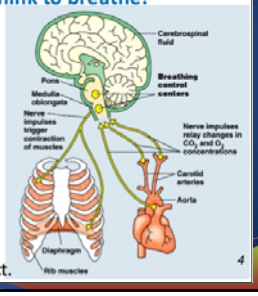
Control of Breathing: Autonomic

Automatic Brain Control

- **You don't have to think to breathe!**
  - medulla & pons
  - measure blood pH
    - ↑CO_2 = ↓pH (acid)
  - coordinate breathing, heart rate & body's need for energy
  - Medulla oblongata will stimulate diaphragm to contract.



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Control of Breathing: Chemical

Chemical Control of Ventilation

- Effect of carbon dioxide: small change in carbon dioxide in blood triggers a large increase in rate and depth of respiration
  - ex: an increase P_{CO_2} of 5 mm Hg causes an increase in ventilation of 100%.
  - **Hypercapnia**: greater-than-normal amount of carbon dioxide
  - **Hypocapnia**: lower-than-normal amount of carbon dioxide
- Chemosensitive area in medulla oblongata is more important for regulation of P_{CO_2} and pH than the carotid & aortic bodies (responsible for 15% - 20% of response)
- During **intense exercise**, carotid & aortic bodies respond more rapidly to changes in blood pH than does the chemosensitive area of medulla

23-50

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Now, hold your breath. Keep holding, keep holding….

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until you can no longer…you ***have*** to take a breath.

- What **made** you breathe? Is it controlled by:
  A. Lack of O2
  B. Accumulation of CO2?
- That's right! It is the **accumulation of CO_2** that produces the respiratory drive.

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Respiratory Depression

- Abnormally slow breathing, results in accumulation of CO2.
- Many of the drugs we use for sedation cause respiratory depression … normal control of respiration (CO2) is impaired.
  - Narcotics
  - Benzodiazepines
  - Sedative hypnotics
  - Barbiturates

23

Terminology

- Apnea = No breathing
- Dyspnea = Difficulty breathing
- Tachypnea a.k.a. Hyperpnoea = Fast breathing

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How do we monitor respiration?

1. **Visual**: chest rise
2. **Listen**: Precordial stethoscope
3. **Monitors**:
   1. **Capnography**: measures CO2 production (ventilation = are they breathing?)
   2. **Pulse oximeter**: measures oxygenation (oxygenation = is oxygen getting to the blood?)

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Pulse Oximetry

- How does it work?
- What are limitations of it?
- At which number is your lower limit set? Why?

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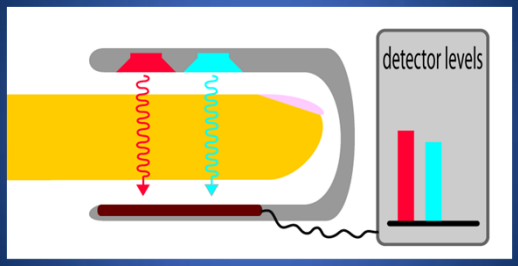
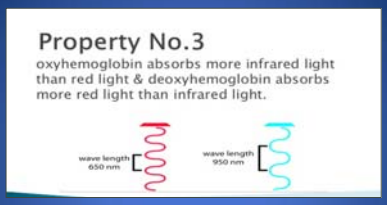
Pulse Oximetry



The sensor has **red** and **infrared** lights which gets transmitted through the nail bed. On the opposite end are diodes.

27

Pulse Oximetry



Oxyhemoglobin absorbs **Infrared**
Deoxyhemoglobin absorbs **Red**

The difference in absorption spectrums of **Infrared** & **Red** produces a percentage number that is displayed on the screen.

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Limitations of Pulse Oximetry

- Fingernail polish
- Cold fingers or venous congestion
- Movement
- Lag time
- Abnormal hemoglobin's (e.g. carboxyhemoglobin as seen in smokers)

29

Capnography

- Measures how much Carbon dioxide (CO2) is present in the patient's breath
- REQUIRED by AAOMS as "standard of care":

  Consequently, the use of capnography for patients under moderate sedation, deep sedation, and general anesthesia should be instituted in OMS practice and used on these patients - effective January 2014 unless precluded or invalidated by the nature of the patient, procedure, or equipment.

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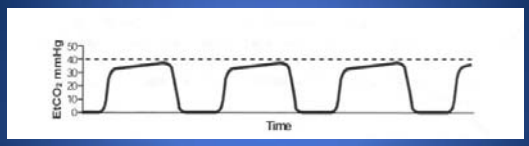
Capnography



NORMAL

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Capnography

- How does it work?
  - Infrared light (not visible to the human eye)
    - Absorbed by gases that have two or more different atoms.
      - For instance, O2 has 2 of the same type of atoms (oxygen), so it does NOT absorb infrared light.
      - CO2 has two different kinds of atoms, so it will absorb infrared light.

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Capnography

- The more CO2, the more infrared light is absorbed.
- The capnography machine takes a sample of the patient's exhaled breath and measures the amount of infrared light absorbed.
- The amount of exhaled CO2 is then transmitted to a graph.

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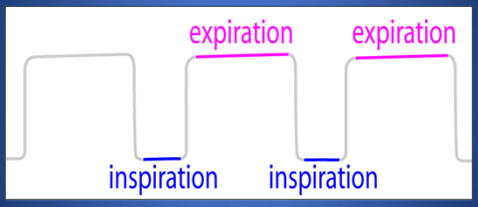
Normal Capnography Graph



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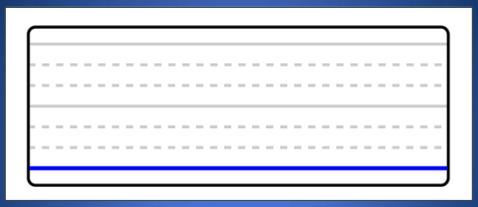
Sample Capnography Graphs



- Capnograph sensor not connected
- Complete obstruction of lungs
- Complete obstruction of the airway
- Respiratory arrest - apnea (secondary to opioids)
- Cardiac arrest

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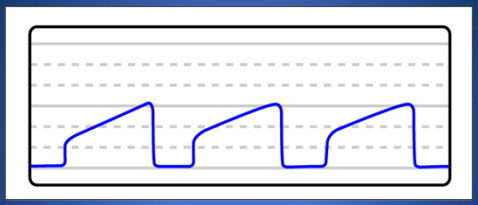
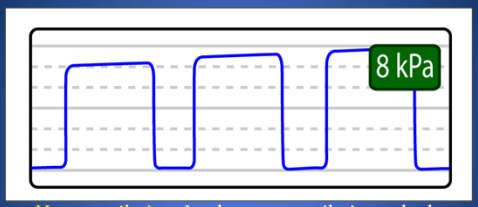
Sample Capnography Graphs



- Partial obstruction: (bronchospasm, COPD)
- Partial obstruction of airway (tracheal tube secretions, tube kinking)

36

Sample Capnography Graphs



- Hypoventilation: Inadequate ventilation - the lung has to pack more CO_2 in each breath
- Increased CO_2 production (for example, malignant hyperthermia)

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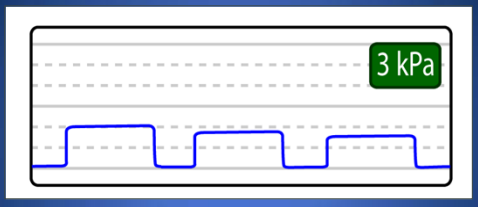
Sample Capnography Graphs



- Hyperventilation

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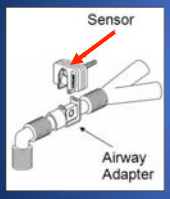
How is CO2 monitored in Oral Surgery?

- Intubated patient
- IV sedation patient



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How is CO2 monitored in Oral Surgery?

40

How do we provide oxygenation?

- Supplemental Oxygen via:

Nasal cannula

Nasal hood

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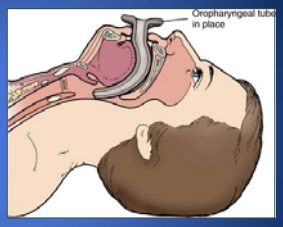
How do we control the airway and oxygenation?

- **Oral airways:** opens a path for oxygen and keeps the tongue away from the posterior pharyngeal wall



42

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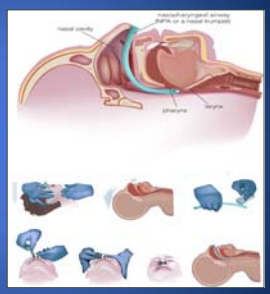

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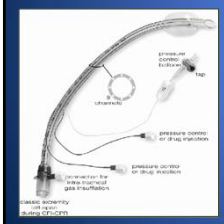
How do we control the airway and oxygenation?

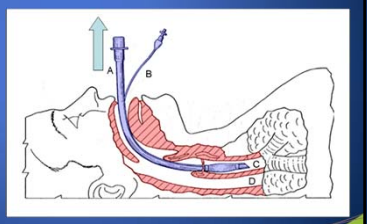
- **Laryngeal Mask Airway** (LMA)

44

How do we control the airway and oxygenation?

- **Endotracheal tube (ETT)**: considered the optimum method of airway maintenance. Allows administration of oxygen and prevents any possibility of aspiration.





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How do we ensure optimal airway exchange?

- We need to make sure the patients lungs are working properly PRIOR to surgery
- Always ask about Respiratory disorders…
  - Asthma?
  - COPD – smoking?

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Respiratory Disorders

- Upper respiratory infection (URI)
- Laryngospasm
- Respiratory depression/apnea
- Asthma/Bronchospasm
- Aspiration (foreign body or from emesis / regurgitation)
- Anaphylaxis
- Bronchitis/COPD/Emphysema
- Airway obstruction

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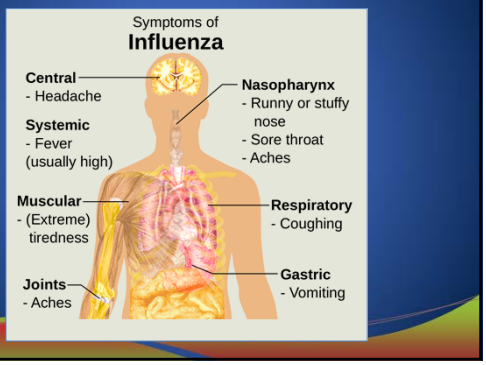
Upper Respiratory Infection (URI)



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Upper Respiratory Infection (URI)

Scenario:

A 12 year old male who needs primary teeth and bicuspids extracted. His mother calls the morning of his surgery and states he just came down with a cold.

What do you tell her?

Do you proceed with the surgery?

What are the risks?

49

Upper Respiratory Infection (URI)

- URI's increase the secretions in the airway.
- Increase the risk of anesthesia.

50

Upper Respiratory Infection (URI)

- URI's increase the secretions in the airway.
- Increase the risk of anesthesia.
- If the surgery is elective, it is best to RESCHEDULE!

Severe Symptoms

- Fever > 38 C
- Productive Cough
- Nasal Congestion with mucopurulent discharge
- Irritability
- Dyspnea
- Rales, Rhonchi and Wheezing on exam
- Toxic facies

CANCEL CASE

RESCHEDULE AFTER 3-4 WEEKS

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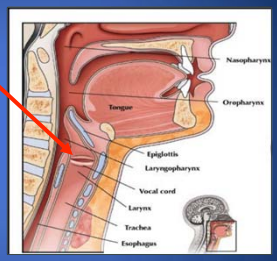
Laryngospasm

- An occlusion of the vocal cords:
- Defense mechanism of the upper airway and lungs
- Mediated by the vagus nerve.



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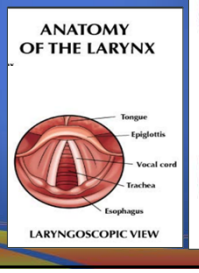
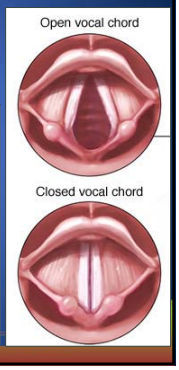
Laryngospasm

- Involuntary - protective reflex closure of the vocal cords that attempts to prevent passage of foreign matter such as blood or saliva into the larynx, trachea and lungs.





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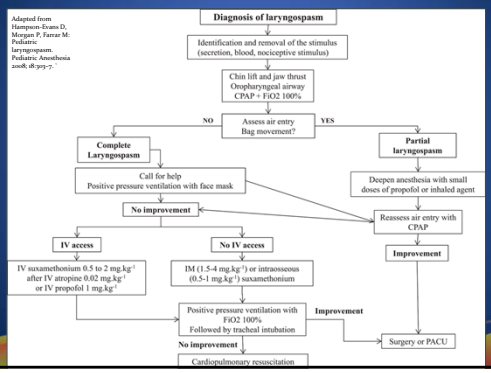
Treatment of Laryngospasm



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Laryngospasm

- Two types:
  - Partial:
  - Complete
- Signs and Symptoms
  - Whistling sound: "**Crowing**" or "**Stridor**"
  - Suprasternal retraction
  - Increased respiratory effort and decreased exchange
  - O2 saturation drops

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Laryngospasm Treatment

- Initial: Stop procedure, pack off site
- Suction oral cavity
- Tongue forward, suction oropharynx
- Reposition head, possible push on chest, listen for "huff"
- Attempt to ventilate with Ambu-bag – connected to 100% O2

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Laryngospasm Treatment

- If still present, administer succinylcholine
- Remember, succinylcholine is a paralyzing agent (muscle relaxant).
- It will also paralyze muscles of respiration.

HAVE TO BREATHE FOR THE PATIENT!

- Have to ventilate the patient!

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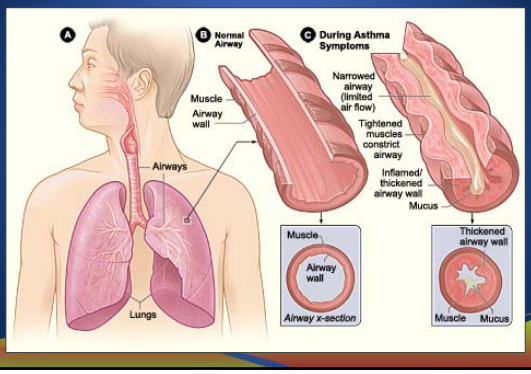
Physiology of Asthma



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Pathophysiology of Asthma

- Initiating factors:
  - Seasonal allergies
  - Anxiety - being nervous!
- Responsible cells: Mast cells – IgE mediated. Produce:
  - Histamines
  - SRS-A
  - Prostaglandins
- **Constriction** of bronchial smooth muscle
- Mucus plugging of the bronchi and smaller airways

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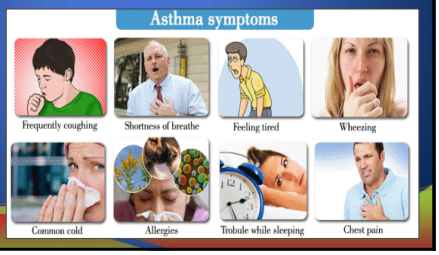
Asthma Symptoms

- Wheezing - during expiration
- Shortness of breath
- Coughing
- Fatigue



60

Treatment of Asthma

- Emergency: Epinephrine - Beta agonist properties to dilate bronchioles (Short-acting)
- Bronchodilator therapy: inhalers, usually Beta agonists (Short-acting)
  - **ALWAYS – ask the patient to bring their inhalers with them to surgery**
- Steroids: reduce inflammation in airways (Long-acting)
- Non-invasive ventilation / mechanical ventilation in severe cases

61

Vomiting/Emesis & Aspiration

- **Emesis** (vomiting) is regurgitation of acidic content of the stomach into the esophagus.
  - **Mortality rate = 50%**
- If the patient is under anesthesia, their protective reflexes (coughing) are depressed.
- This allows entry of stomach contents (liquid or solid) into the lungs (**aspiration**).
- Seen in patients that eat or drink prior to surgery despite instructions to be NPO!

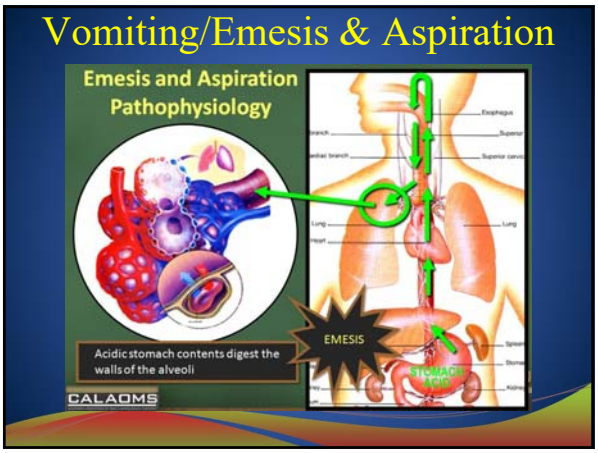
62

Signs and Symptoms of Vomiting

- Retching
- Large amounts of fluid in throat
- Gurgling
- Wheezing
- Signs of airway obstruction

63

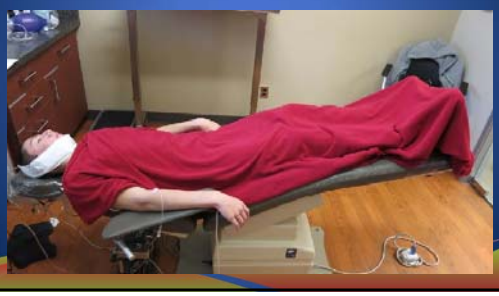
Vomiting/Emesis & Aspiration



64

Treatment of Emesis

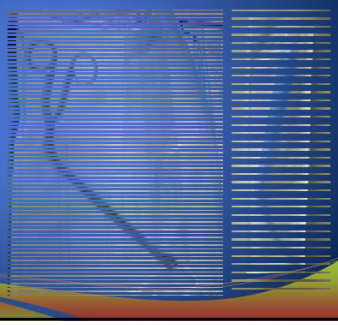
- Trendelenburg ("Head downing berg")
- Roll patient's head to right side



65

Treatment of Emesis

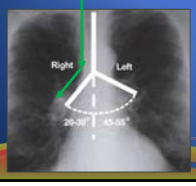
- Suction - Yankauer
- O2
- Check O2 saturation
- Visualize oropharynx
- Use Magill forceps to remove foreign body
- Intubate

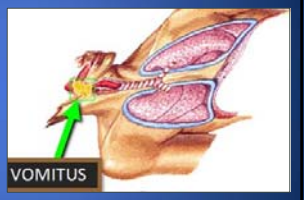


66

Why do we roll the patient on the right side?

- Idea is to ***save the left lung.***
- Vomit will travel down right mainstem bronchus anyway.
- Because of acute angle of left mainstem bronchus, vomit will not go there.

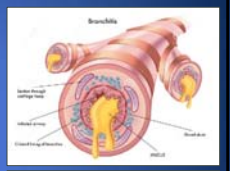


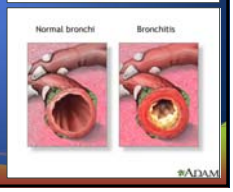


67

Bronchitis

- Definition: Daily cough and sputum production
- Excess secretions
- Patients are prone to laryngospasm and bronchospasm





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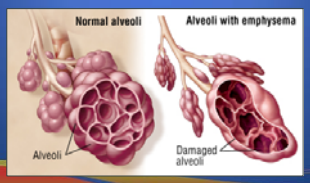
Chronic Obstructive Pulmonary Disease (COPD)

- COPD is an umbrella term that encompasses three different disease processes:
  - Chronic bronchitis
  - Emphysema
  - Asthma
- Characterized by progressive accumulation of inflammatory mucous exudates in the airways with thickening of their walls
- Defining feature: irreversible limitation of airflow during forced expiration

69

Emphysema

- Gradual destruction of alveoli
  - The alveolar septae (the walls in between the individual alveoli) and the capillary bed that surrounds them, leading to a decreased ability to oxygenate blood.



70

Foreign body aspiration

Symptoms of foreign body aspiration into the tracheobronchial tree:

(40% no symptoms!!!!!)

- 40% with classic triad:
  - Wheezing
  - Coughing
  - Dyspnea
- Respiratory arrest
- Stridor

- **Patient should be sent or transported to Emergency Room (ER) immediately for evaluation – (no Uber or Lyft)**

71

Case #1 (REAL CASE)

HPI: 29-year-old male currently experiencing extreme pain on the lower right side with difficulty opening mouth.

- Patient has had on and off pain on the lower right side for the last 6 to 8 weeks.
- Now pain and swelling is more severe within the last two days.
- Patient also states that he has had some moderate difficulty eating and swallowing.

72

Case #1

- Past Medical History (PMH):
  - Asthma: never hospitalized, but takes two inhalers daily and has a rescue inhaler in case of emergencies. He states it just manifests as "tightness" when he breathes.
  - GERD (gastro-esophageal reflux disease) – "Heart burn"
  - Surgeries: None
  - Hospitalizations: None

73

Case #1

- Medications:
  - Flonase and Seravent inhalers
  - Albuterol inhaler as needed
  - Omeprazole
- Allergies:
  - Latex (anaphylaxis)
- Habits:
  - Smoking: 1 pack per day (1PPD)
- Family History: Non-contributory

74

Case #1

- Physical Examination:
  - General:
    - Height 5'6", weight 155 pounds
  - Vital signs:
    - BP 102/63
    - Pulse 82 regular
    - Rate of Respiration (RR) 18
    - O_2 sat 96%
    - Temp - 99.8 F

75

Case #1: Clinical Exam

Extraoral

- Tenderness to palpation of right mandibular angle of mandible and masseter muscle region
- Erythema approximately 4 to 5 cm extending from the angle of the mandible to the submandibular region
- Maximal mouth opening = 15 to 20 mm (normal ~ 50 mm)
- Minimal tenderness to palpation of submental region

76

Case #1: Clinical Exam

Intraoral

- Full complement of teeth noted.
- Multiple large amalgam restorations and onlays.
- Obliteration of buccal vestibule on lower right side.
- Pericoronitis noted around erupted tooth #32.
- No sublingual or pharyngeal swelling noted.

77

Diagnosis & Treatment:

29-year-old male

- Infected tooth number 32
- Buccal space infection
- Progressing to submandibular infection.

Determination was made to IV sedate the patient in the office and extract tooth #32 in order to drain the buccal space infection.

78

Clinical Summary

Patient was placed in a supine position.

- EKG leads were placed
- Pulse oximeter placed
- blood pressure cuff
- nasal hood with 100% O2
- CO2/ capnography.
- A precordial stethoscope was also placed to monitor breathing during the procedure.
- A 20G IV was placed in the right AC fossa without difficulty
- General IV anesthesia was undertaken with versed, fentanyl and propofol.

79

Clinical Summary

On induction, it was noted that the patient saturation dropped to 89%.

The patient was coughing profusely and having difficulty controlling secretions.

80

What would you do at this point??

A - Adjust pulse oximeter
B - Protract mandible and suction out oropharynx
C - Give 1mg/kg Succinylcholine
D - Give epinephrine 0.5cc 1:1000 epi IM

81

Clinical summary

B - Protract mandible and suction out oropharynx

- The patients oropharynx was suctioned out and the anesthesia was deepened using Propofol.
- The patients saturation returned to 96%.
- The surgical portion of the case was then continued.

82

Clinical summary

- 2% lidocaine with epinephrine for a mandibular block and buccal infiltration.
- The mouth was opened to 35mm using a ratchet prop.
- A 4x4 gauze was placed as a throat screen along with a tongue retractor.
- Elevators and forceps were used to remove the tooth without difficulty.
- A 15 blade was used along with a mosquito to drain right buccal space infection (approx. 8-10cc pus drained from buccal space) a ¼ inch Penrose drain was sutured in place with 3-0 silk. Gauze was placed at #32 extraction site for direct pressure.

83

Clinical summary

At the end of the procedure as the patient is becoming more arousable you notice that the patient suddenly becomes unresponsive and the oxygen saturation abruptly drops to 72%.

Initial efforts to protract tongue and support airway do not work.

In supporting airway, you note there is copious amounts of bleeding and a restoration on #31 that is missing.

84

What would you do at this point??

A – place an AED and shock and call 911
B – give epinephrine IM for Bronchospasm
C – give 1mg/kg Succinylcholine and attempt to intubate
D – use a Macintosh intubation blade and a Magill forceps to retrieve a foreign body

85

Clinical summary

D – use a Macintosh intubation blade and a Magill forceps to retrieve a foreign body

- The patient is placed in lateral position
- The gauze is removed
- The oropharynx is suctioned out thoroughly.
- An intubation blade and a Magill forceps were used to remove a suspected foreign body.

86

Clinical summary

- Same scenario….
  - When the tongue is retracted you see open cords but no foreign body.
  - The patient saturation subsequently comes back up to 91% and the patient becomes slightly arousable.
  - Despite adjusting the pulse oximeter you still only get a saturation of 91%. (…was at 96%)

87

What would you do at this point??

A – check for bilateral breath sounds using stethoscope
B – stimulate patient with ammonium salts
C – get new pulse ox from another room to check O2 sat
D – call ride and have patient get ready to go home

88

Clinical summary

A – check for bilateral breath sounds using stethoscope

- You note decreased breath sounds in right middle and lower lobes of lung.
- Patient is now awake and complaining only of pain in his jaw and nausea.

89

What would you do at this point??

A – check for bilateral breath sounds using stethoscope again to verify pneumonia
B – call ride to go home and have patient follow up with PMD
C – call 911 and transport patient to ER
D – prescribe patient bronchodilator and steroids to treat bronchospasm/asthma related problem

90

Final summary

C – call 911 and transport patient to ER

- Patient is transported to ER after persistent low saturations (despite being alert).
- A chest x-ray was taken showing what appears to be a dental onlay in the middle lobe of the right lung.
- A bronchoscopy is attempted but the foreign body is not retrievable.
- The decision is made to perform a thoracotomy with partial lobectomy of the right lung to retrieve foreign body.

91

Case #2 (REAL CASE)

- 17 year old male high school athlete wrestler presents for removal of bony impacted third molars.
- PMH: non-contributory
- Meds: None,
- Allergies: None
- Exam: No visible maxillary or mandibular third molars. Mild pericoronitis noted associated with teeth #17 and 32. No purulent drainage noted.
- Remaining oral tissues, tongue and neck exam were unremarkable.

92

Case #2…continued

- TMJ: with no pain or clicking
- Airway: Mallampati Class I
- Cardiovascular exam: Coronary: RRR, Lungs clear bilaterally
- Weight: 90 kgs, height 5’8” BMI 29

93

Panoramic Image

94

Diagnosis & Treatment

- Diagnosis
  - 18 year old male athlete
  - ASA I
  - Asymptomatic complete bony impacted third molars #1, 16
  - Symptomatic complete bony impacted third molars #17, 32 due to pericoronitis.
- Proposed Treatment
  - Removal of four bony impacted third molars under deep sedation/non-intubated GA with open airway technique in an ambulatory surgery center.

95

Treatment (cont.)

- Patient was NPO and consent was signed
- Patient was placed in a semi-supine position
- Supplemental O2 at 2L/min was provided by nasal cannula
- Monitors including EKG, BP, and pulse oximetry were placed on the patient
- A 20 gauge IV was started in a left hand vein
- Baseline VS were recorded

96

Treatment (cont'd)

- The EKG revealed a normal sinus rhythm
- The patient's VS were stable: P -84, BP – 124/78, O2 sat – 99%
- Fentanyl 75 mcg and midazolam 4 mg were administered to the patient over 8 minutes
- Dexamethasone 10 mg was administered

97

Treatment (cont'd)

- Prior to local anesthesia administration a Propofol bolus of 40 mg was given
- Local anesthesia of 9 ml of 2% lidocaine with epi 1:100,000 was administered to the patient
- Following the administration of the local anesthesia the patient VS revealed P: 98, BP 100/58, O2 sat 97%

98

Treatment (cont.)

- Maxillary third molars #1 and 16 were removed and gauze packs were placed
- Mandibular third molars #17 and 32 were surgically removed
- During suturing of the third molar sites some blood entered the hypopharynx
- The VS revealed P 88, BP 108/82, SpO2 88%, EKG: sinus rhythm
- A slight "crowing" like noise was noted during inspiration

99

Diagnosis?

A. Bronchospasm
B. Upper airway obstruction
C. Partial laryngospasm
D. Allergic reaction

100

Answer

C. Partial laryngospasm produces a "crowing" noise with inspiration with some passage of air through the partially adducted vocal cords.

101

Treatment (cont'd)

- The patient's O2 saturation continued to fall and the patient was noted to have paradoxical chest movements upon attempted inspiration.
- VS revealed: P-90, BP-110/80, SpO2-76%, EKG – NSR
- Attempted upper airway repositioning and suctioning was unsuccessful
- Paradoxical chest movements and airway obstruction.
- No breath sounds or air movement was noted upon auscultation of the lungs.

102

Diagnosis

A. Foreign body airway obstruction
B. Complete laryngospasm
C. Bronchospasm
D. Pneumothorax

103

Answer

B. Complete laryngospasm with no air movement due to complete adduction of the vocal cords. No crowing!

- A foreign body airway obstruction is unlikely with the use of a throat barrier and no visible foreign body dislodgement.
- Bronchospasm would produce expiratory wheezing on lung auscultation.
- A spontaneous pneumothorax is possible although very unlikely.

104

Laryngospasm Treatment

- Initial treatment of laryngospasm
  - Thorough suctioning of the oropharynx and hypopharynx,
  - Positive pressure ventilation with 100% O2 through a bag valve mask.
- If the laryngospasm and continued desaturation persist, the use of muscle relaxants with 10-20 mg of succinylcholine should be used.
  - The succinylcholine will relax the vocal cord's musculature to permit ventilation and oxygenation.

105

Treatment (cont'd)

- Following administration of succinylcholine the patient was ventilated with a bag valve mask and 100% O2 for approximately 2 minutes.
- VS revealed P-110, BP 102/78, SpO2-78%, EKG-sinus tachycardia with few PVC's.
- The hypoxemia with low SpO2 persisted.

106

Recommended Treatment?

A. Continued ventilation with bag valve mask
B. Administration of additional succinylcholine
C. Administration of albuterol
D. Endotracheal intubation and ventilation

107

Answer

D. Endotracheal intubation to secure the airway and permit more effective ventilation and oxygenation via ambu-bag versus a bag valve mask alone.

- Endotracheal intubation also prevents air from entering the esophagus resulting in possible emesis and aspiration.
- Endotracheal intubation also facilitates alveolar recruitment to improve oxygenation and also facilitates possible pulmonary suctioning.

108

Chest X-ray obtained

"Fluffy"

109

The CXR reveals?

A. Foreign body airway obstruction
B. Pneumothorax
C. Aspiration pneumonitis
D. Bilateral diffuse interstitial and alveolar infiltrates

110

Answer

D. Bilateral diffuse alveolar and interstitial infiltrates appearing as soft fluffy white areas and surrounding dark butterfly pattern of the peripheral lung fields.

- No evidence of any foreign body airway obstruction is present.
- No evidence of pneumothorax with loss of lung markings.
- Aspiration pneumonitis would result in an inferior lung lobe consolidation.

111

Treatment (cont'd)

- The patient was intubated and endotracheal suctioning was performed
- Upon endotracheal suctioning copious pink frothy sputum was suctioned from the endotracheal tube
- Auscultation of the lungs revealed bilateral rales
- VS P-116 BP 104/84 SpO2 80% EKG: sinus tachycardia

112

Diagnosis?

A. Acute narcotic overdose
B. Negative pressure pulmonary edema
C. Mucous plugging of the trachea
D. Acute heart failure

113

Answer

B. Negative pressure pulmonary edema may be encountered upon breaking a laryngospasm, especially in young or muscular athletic patients.

- Acute Narcotic overdoes is unlikely since Fentanyl has not been given in some time.
- Ventilation with an Ambu-bag should be possible in a patient with a narcotic overdose or mucous within the trachea.
- Acute heart failure is unlikely in a healthy young patient with no prior cardiac history.

114

This Concludes

Respiratory System Review

California Association of Oral & Maxillofacial Surgeons
Oral & Maxillofacial Surgery Assistant's Course

Endocrine System Review

California Association of Oral & Maxillofacial Surgeons
Oral & Maxillofacial Surgery Assistant's Course

1

Endocrine System Definition

Collection of glands that secrete hormones directly into the circulation to be carried towards distant target organs.

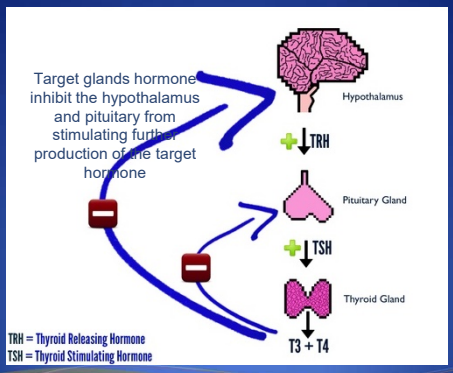
2

Glands

- Pituitary
- Pancreas
- Ovaries
- Testes
- Thyroid
- Parathyroid
- Adrenal

3

Control of the Glands



4

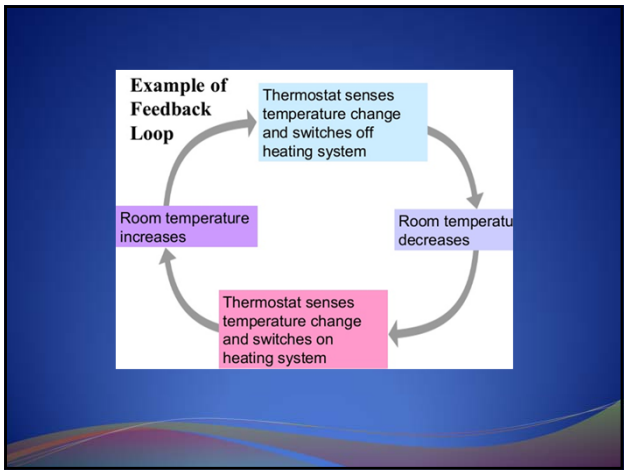
What??

5

Control of the Glands

- A lot of these glands are controlled by a feedback mechanism similar to the way the heater works in your house.

6



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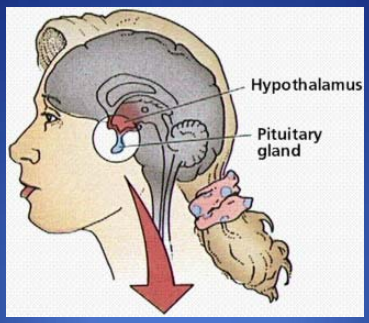
Hypothalamus & Pituitary



8

Hypothalamus

- Almond shaped part of the brain that sits above the brainstem
- It secretes ***releasing hormones***
- These releasing hormones travel to the pituitary and cause the pituitary to release ***stimulating hormones***

9

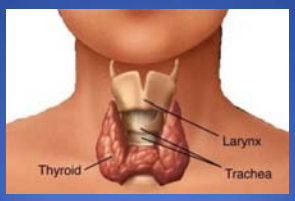
Pituitary

- About the size of a pea
- Sits under the hypothalamus
- Receives hormone signals from the hypothalamus that trigger the pituitary to release ***stimulating hormones*** that travel to distant glands

10

Example: Thyroid

- The thyroid gland is in the neck
- It secretes thyroid hormone which regulates metabolism

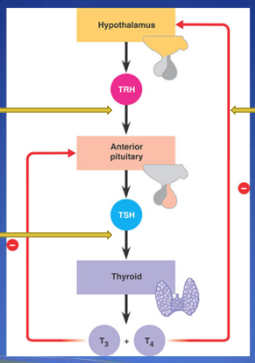


11

TRH ---TSH feedback loop

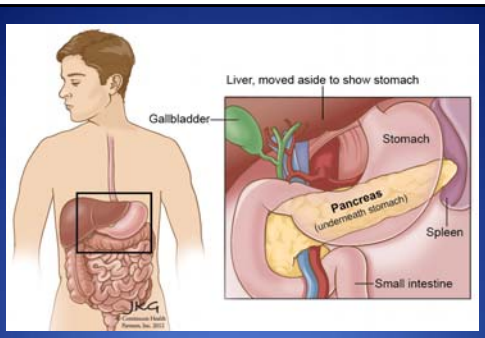
"Thyroid releasing hormone"

"Thyroid stimulating hormone"



"too much thyroid hormone? Shut off production!!"

12



Insulin and glucagon are hormones produced in the pancreas, along with digestive enzymes.

13

Insulin

Insulin pushes glucose into its storage form: **glycogen**

14

Insulin & Glucagon

When energy is needed, **glucagon** will convert the **glycogen** into its active form, glucose.

15

Insulin & Glucagon

16

Diabetes

Type 1

- Insulin dependent diabetes mellitus (IDDM)
- Pancreas do not produce enough insulin
- Possibly autoimmune
- Must take insulin
- Usually starts at young age

Type 2

- Non-insulin dependent diabetes mellitus(NIDDM)
- Insulin resistance- cells do not respond to insulin
- Usually adult onset

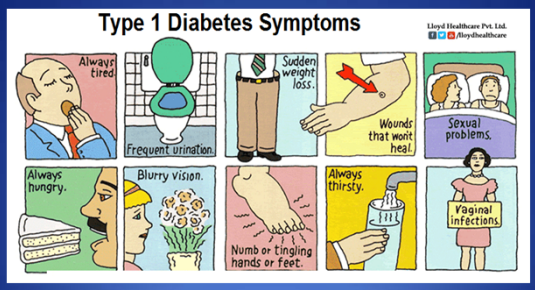
17

Diabetes symptoms

- The 3 P's:
- Polyuria: frequent urination
- Polyphagia: always hungry
- Polydipsia: always thirsty

18

Diabetes Symptoms



19

Diagnosis of Diabetes

- Blood glucose level
- **Normal = 80-130**
- Hemoglobin a1c = glycated hemoglobin
  - Glucose in your blood will attach to the hemoglobin which can be measured
  - The average lifespan of a red blood cell = 3 months
  - Therefore the hemoglobin a1c test will show the level of glucose in your blood for the past 3 months
  - Normal Hba1c should be less than 6%

20

Hemoglobin A1C

21

Complications of Chronic Diabetes

- Diabetic Nephropathy (chronic renal failure)
- Diabetic Retinopathy (blindness)
- Diabetic Neuropathy (numbness in extremities)
- Increased risk for coronary artery disease, cerebrovascular disease and peripheral vascular disease

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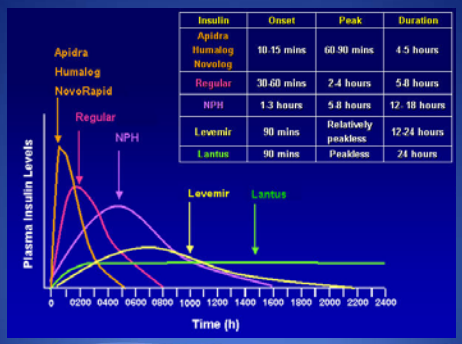
Insulin



Insulin	Onset	Peak	Duration
Apidra Humalog Novolog	10-15 mins	60-90 mins	4-5 hours
Regular	30-60 mins	2-4 hours	5-8 hours
NPH	1-3 hours	5-8 hours	12 - 18 hours
Levemir	90 mins	Relatively peakless	12-24 hours
Lantus	90 mins	Peakless	24 hours

23

Treatment Considerations of Diabetic Patients

- How well is their diabetes controlled?
  - Do they monitor their blood sugar?
- What medications are they on?
- Do they have any secondary diseases as a result of the diabetes?
- History of infections?

24

Intraoperatively

Hyperglycemia

- Stress causes increase in blood sugar
- If we totally discontinue all diabetic medications:
  - Increase risk of infections
  - Impaired wound healing

Hypoglycemia

- Weakness
- Fatigue
- Confusion
- Behavioral changes
- Seizures
- Brain damage
- Death
- Difficult to diagnose when patient is under anesthesia

25

Preoperative Instructions

- Insulin pump: maintain basal rate
- Intermediate-acting (NPH): hold morning dose until after case or give percentage of dose
- Fixed combination long & short acting: Hold morning dose or give percentage

26

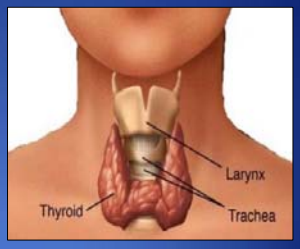
Preoperative Instructions

- Do finger stick blood test preoperatively and postoperatively
- Schedule early morning surgery time
- If hypoglycemic, can consider dextrose containing IV fluids

27

Thyroid Disease

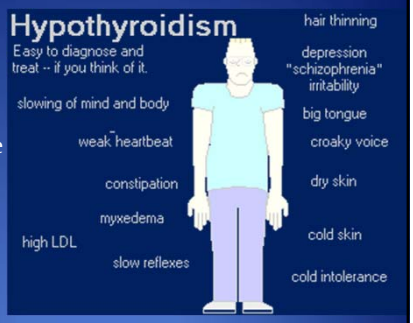
- Produces hormones which control metabolism and growth
- Hypothyroidism: not enough thyroid hormone produced
- Hyperthyroidism: too much thyroid hormone



28

Hypothyroidism

- Dry Skin
- Lethargic
- Weight gain
- Cold intolerance
- Depression
- Hair thinning
- "Myxedema madness"



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Hyperthyroidism

- Exophthalmos (bulging eyes)
- Facial flushing
- Tachycardia
- Hypertension
- Intolerance to heat
- Insomnia
- Tremors

30

Anesthetic Considerations

- Don't want patient to be hyperthyroid or hypothyroid
- Patients should be clinically ***euthyroid*** prior to surgery (normal functioning gland)

31

Anesthetic Considerations

Hypothyroid:

- Sensitivity to narcotics & barbiturates
- Hashimoto's thyroiditis: most common cause of hypothyroidism: autoimmune disorder, creating antibodies against the thyroid
- Patients cannot handle stress, may lapse into coma

32

Anesthetic Considerations

Hyperthyroid:

- Susceptible to **thyroid storm**: anesthetic risk
- Graves' Disease: also autoimmune: thyroid stimulating proteins bind to and activate TSH receptors, increasing hormone synthesis
- Treatment is radioactive iodine, destroy thyroid gland and then supplement with thyroid hormone

33

Thyroid Storm

A severe, life threatening condition, caused by excess thyroid hormone.

34

Thyroid Storm

- Tachycardia
- CHF
- Fever
- Altered mental state
- Nausea
- Vomiting

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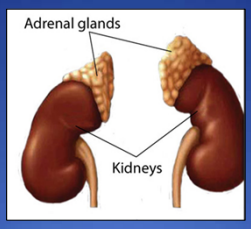
Adrenal Gland Diseases

Where are your adrenal glands?



They are small pyramid shaped glands that sit on top of each kidney

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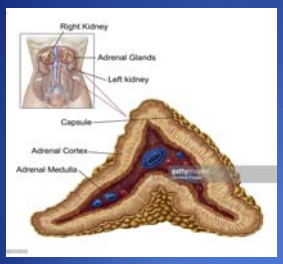
Adrenal Gland Hormones

Cortex (outside)

- Secretes corticosteroids



Medulla (inside)

- Secretes epinephrine and norepinephrine
- Stimulated by sympathetic stimulation: fight or flight

37

Cortisol

What does cortisol do?

- Mobilizes amino acids, glucose and fat to keep blood sugar from going too low
- Has anti-inflammatory and anti-allergic effects

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Cushing's Disease

- Adrenal gland hyperplasia
- Caused by a tumor of the pituitary gland
- Results in too much hormone production by the adrenal glands

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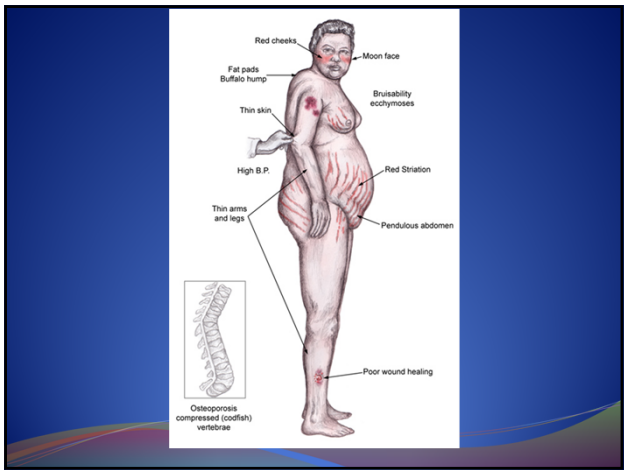

40

Addison's Disease

- Adrenal Insufficiency due to an autoimmune disease
- Symptoms include: dehydration, hypoglycemia, disorientation, nausea, vomiting, muscle aches, low blood pressure, cardiovascular collapse

41

Corticosteroids

- Cortisone
- Prednisone
- Methylprednisolone
- Dexamethasone

Indications:

- Allergy
- Asthma
- Autoimmune diseases
- Rheumatology
- Organ transplant

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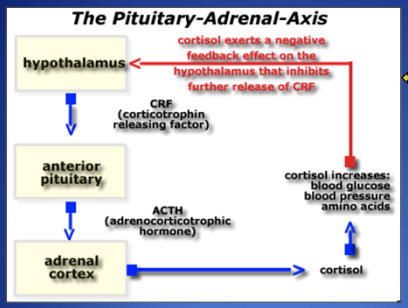
Long term effect on patients



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Long Term Effects on Patients

With chronic corticosteroid usage, the adrenal glands atrophy (shrink) and will not be able to produce adrenal hormones (adrenal suppression) when needed in times of stress.

44

Rule of 2's

- 20 mg or more of cortisone or its equivalent daily
- 2 weeks or long of therapy
- 2 years or less prior to dental therapy

*no longer used as a rigid guideline
**consultation with patient's MD is appropriate

45

Case Study

- This patient is an 18 year old male with a history of Type I diabetes mellitus who presents to the oral and maxillofacial surgeon with the complaint "my wisdom teeth hurt"
- The patient reports moderate pain (5/10) for the past week, centered over the posterior mandibular areas bilaterally

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Case Study: Medical History

- Diagnosed with Type I diabetes mellitus at age 10, and has been taking insulin for the pat 8 years
- Followed by his family physician
- Medications include:
  1. Lantus: Long acting synthetic insulin that provides a steady concentration of insulin once daily
  2. Humalog: (short acting insulin) three times daily

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Case Study: Medical History

- No prior surgeries
- Hospitalized twice during the previous years for hypoglycemia:
  - (previous episodes of hypoglycemia are a risk factor for future episodes: social, physiology, compliance reasons)
- Reports blood glucose between 80-160 mg/DL over the past week (normal or ideal blood glucose 80-130 mg/DL)
- No family history of diabetes mellitus (positive family history is often seen with Type 2 diabetes mellitus)

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Case Study: Examination

- Thin, calm, cooperative
  - Type I: thin and/or cachectic
  - Type II: rotund/overweight
- Vital signs stable
- Maxillofacial: No edema, erythema or induration MIO > 40 mm
- Intraoral: bilateral pericoronitis retromolar areas

49

Case Study: Imaging & Labs

- Panorex: Partial bony impaction #17 and 32, Supraerupted #1 and 16 with impingement on mandibular retromolar areas
- Labs: Blood glucose 125 mg/DL, HBA1C three months earlier = 6.5%

50

Case Study: Preparation

- Operation scheduled early in the morning
- Oral hypoglycemics are stopped the day before the surgery
- Short acting insulin medications should be avoided on the morning of the surgery to prevent dangerous hypoglycemia
- For short ambulatory procedures, long acting insulin preparations may be continued
- For major procedures in the hospital, stop long acting insulin 1-2 days before & start short acting insulin

51

Case Study: Patient Instructions

- NPO after midnight
- Continue Lantus (Long Acting)
- Withhold Humalog in the morning

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Case Study: Treatment

- Patient was jittery and nervous
- Skin clammy, palms sweaty (sympathetic response to hypoglycemia)
- Tachycardia: HR 120 bpm
- BP 120/80
- Checking pre-operative blood glucose: finger stick taken: patient becomes unresponsive [Syncope vs. hypoglycemia]

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Case Study: Treatment

- Finger stick was immediately processed
- Blood glucose 55 mg/DL [confirms hypoglycemia]
- Treatment: 1 ampule of 50% dextrose given IV/IM
- HR 80 bpm
- Patient regains consciousness and is now responsive
- Non-agitated

54

Case Study: Assessment

- It was determined that the patient misunderstood the pre-operative instructions - refrained from breakfast, but had taken his routine insulin injections before arriving at the office
- IMPERATIVE to confirm that patient has followed all the pre-operative instruction accurately BEFORE STARTING SURGERY!!

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This Concludes

Endocrine System Review

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Immune System Review

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1

Overview of the Immune System

- The immune system defends the body against foreign invaders such as:
  - Microorganisms (bacteria, virus, fungi)
  - Parasites (such as worms)
  - Cancer cells
  - Even transplanted tissues

2

Overview of Immune System

- In order to defend itself the immune system must be able to distinguish between
  - What belongs in the body (self)
  - What does not (non-self or foreign)
- Non-self substances are called **antigens**

3

Overview of the Immune System

- To get rid of the antigens (bad guys), this means WAR!
- Just like a country needs an army, navy and air force, your body needs an array of cells to fight the antigen. (soldiers!)

4

Types of Immune Cells

- B cell (B lymphocyte): a white blood cell that produces specific antibodies to specific antigens
- T cells: white blood cell that identifies antigens (surveillance system). Three types: helper, killer or regulatory
- Neutrophil, eosinophil, basophil: types of white blood cells that kill foreign cells (like bacteria), ingests them, attracts other white blood cells to the area, releases histamine

5

Where are these cells produced?

- Bone marrow: produces all the different kinds of white blood cells
- Thymus gland: T cells multiply, trained to recognize foreign antigens and ignore the body's own antigens

6

Lymph and Lymph Glands

- Lymph is a fluid that contains oxygen, proteins and other nutrients that nourish the tissues.
- Lymph also transports foreign substances, like bacteria to lymph nodes.
- A lymph node is where white blood cells can collect, interact with each other and with antigens to produce an immune response.

7

Patient #1

- 28 y/o male
- Multiple carious teeth
- Hx drug abuse (meth), NKDA
- HIV positive
- Frequent dental abscesses

8

Patient #1

- Problem list
  - HIV
  - Frequent infections (speaks to immune status)
  - Dental health: poor
  - Demands sedation
  - Physical exam: several skin abscesses
  - Need to remove source to assist immune statue

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Patient #1

- Management
  - Consult HIV status and meds
    - Normal T cell count: 500-1500
    - Below 200 = diagnosed with AIDS
  - Anesthesia management: difficult
    - Drug tolerance variable
    - Poor IV sites
    - Vital signs variable
  - Risk for infection is high: recommend antibiotics perioperatively

10

HIV: Human Immunodeficiency Virus

- The HIV virus attacks the T-helper cells (called CD-4 cells). These are the cells that help the B cells produce antigens against specific antigens, helps killer T cells to become active and stimulates macrophages (cells that digest foreign cells).
- With the T helper cells crippled, the body cannot fight infections.

11

HIV

Concerns:

- Decreased patient resistance
- Opportunistic infections
- Doctor and Staff exposure

Treatment Considerations:

- Optimal patient health
- Antibiotic coverage
- Universal precautions

12

Patient #2

- 21 y/o female
  - Removal of 3rds
  - Allergy to codeine and 'I think Demerol or morphine'
  - Wants sedation
  - Hospitalized in past for 'lung issues', OK now
  - VS P-77, BP 125/68

13

Patient #2

- Start the IV
- Titrate the benzodiazepine
- Add the narcotic
- Monitor starts ringing in<5 minutes
- Complains of
  - Difficulty breathing
  - Pale
  - BP drops to 75
  - ?????

14

Patient #2

- Vital signs deteriorating
- Peripheral color also pale
- Lungs wheezing
- Voice restricted

15

Allergic Reaction vs. Adverse Reaction

- Allergic Reaction:
  - True initiation of immune response
  - Urticaria/rash
  - Hives
  - Angioedema
  - Difficulty breathing: laryngeal edema
  - Hypotension (shock)
  - Repeated exposure could result in anaphylactic shock
- Adverse Reaction
  - An untoward reaction (bad) that is not directly related to triggering the immune system
  - Nausea/vomiting
  - Headache
  - Repeated exposure does not increase the immune response

16

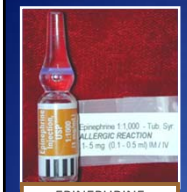
Rapid Allergy

Within 5-10 minutes of time of exposure…

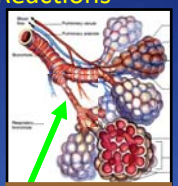
Life-threatening components of *anaphylaxis* are broncho-constriction, laryngeal edema and cardiovascular collapse

17

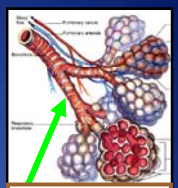
Severe Allergic Reactions



EPINEPHRINE



Bronchoconstriction



β2 Bronchodilation

- α - Vasoconstriction
- β Effects
  - β1 ↑'s HR, ↑'d BP
  - β2 Bronchodilation

β1 ↑'s HR, ↑'d BP

Vasoconstriction of edematous (swollen) membranes of throat - α

18

Treatment Of Allergic Reactions – Additional Medications

Dexamethasone (Decadron®):

- To stabilize membranes, which will reduce swelling
- To combat the other symptoms of inflammation

Benadryl (diphenhydramine)

- Stop or decrease release of histamine
- Reduce allergic reaction

19

Patient #2

- Management?
  - O_2
  - Epinephrine
  - Benadryl
  - Dexamethasone
  - Open IV
  - Intubate early!!
- Note vital signs

20

Patient #3

- 56 y/o male referred for rem of posterior teeth
- Undergoing chemotherapy
- About to start radiotherapy
- Lymphoma
- Has frequent oral infections: URI, bronchitis, gastric distress
- Labs: WBC 1,200, neutrophils <40%

21

Patient #3

- Problem list:
  - Chemotherapy patients can be immunosuppressed. The drugs wipe out good cells AND bad cells.
  - Susceptible to infections (low WBC)
  - Anemic (low RBC)
  - Tendency to bleed (low platelets)
- Solution(s):
  - Be as non invasive as possible
  - Consider pre op CBC
  - Use antibiotics
  - Close wounds as well as possible

22

Patient #3

- Problem list:
  - Immunosuppressed
  - Multiple surgical sites (molars)
  - Low WBCs
  - Susceptible to infection(s)
  - Must proceed before radiation
  - Wants sedation
- Management:
  - Medical consult to clarify condition
  - Atraumatic surgery
  - Antibiotic coverage
  - 'Light' sedation
  - Minimal flap reflection
  - Remove questionable bony prominences

23

Patient #4a, 4b

- 35 y/o female referred for placement of two implants in maxillary left region.
- Type I diabetic
  - Takes insulin
- Wants to go to sleep
- 23 y/o female referred for ext x 3
- Healthy
- Allergy to latex
- Precautions:
  - Non-latex gloves
  - Tape
  - Tubing

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Latex Allergy

List of Common Products which May contain Latex

Medical Products	Household Products
Urinary catheters	Rubber toys
Stethoscope tubing	Balloons
Endotracheal Tubes	Cleaning gloves
Piggyback IV ports	Electricians gloves
Tourniquet	Condoms - Diaphragms
EKG straps and electrode pads	Shower curtains - mats - & other rubber mats
Penrose Drains	Pacifiers
Ambu bags	Band-Aids
Ventilator bellows	Baby bottles
Masks (anesthesia, oxygen)	Elastic waist bands
Gloves (unless stated on label or box	Elasticized fabrics
Adhesive tapes	Adhesives
Multiple- use medication vials	Hot water bottles
Blood pressure cuffs	Sport racquet handles
Nasal airways	Carpet backing
Elastic on surgical bonnets or shoe covers	Rubber bands
Elastic bandages	Toy balls
Dental dams	Rubberized bed sheets
Push on crutches	Swim caps/ some goggle straps
Wheel chairs cushions (Roho) and tires	Some ties

25

Patient #5

- 22 y/o male s/p removal of 3rd molars 12 hrs previously
- Sedation / codeine meds
- Calls with complaints of
  - Swelling of face, lips, eyes
  - Pain moderate

26

Patient #5

- Probably diagnosis: angioedema
- Management:
  - Stop meds
  - Antihistamine
  - Review medical history
  - Follow up patient
    - Symptoms slow to resolve
    - Review history for other possible sources
- Allergy prone patient:
  - History
    - Rash, hives
    - Watery eyes
    - Rhinitis
  - Spring is allergy season

27

Monitoring – Observe for…


Rash


Watery eyes


Lip swelling


Hives


Swollen eyes


Itching

Also: Listen for wheezing and watch monitors.

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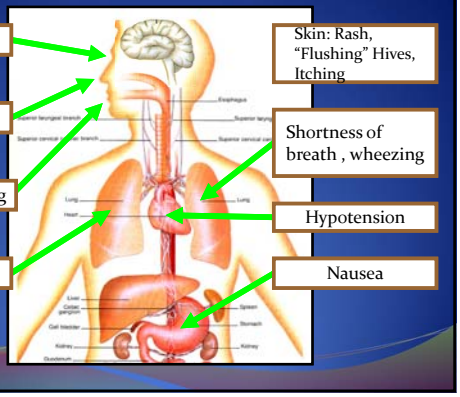
Allergy To Drugs - Diagnosis



29

Patient #6

- 44 y/o male
  - Presents for ext abscessed #12, 13
  - Swollen, painful
  - Couldn't eat
- Medical history
  - HBP
  - Diabetes
- Vital signs
  - 99.2, 102/75, HR 85

- Treatment:
  - Local given
  - Patient
    - Pale, diaphoretic
    - Disoriented
    - BP 95/65, HR 100

30

Patient #6

- Evaluation:
  - Patient reacting to what?
  - Did the patient take his medications and when
  - Glucometer: 325
- Problems list:
  - Infection
  - Diabetes, management
  - High blood pressure
- Management:
  - Continue with extractions?
  - Correct probable imbalance
  - Treat when vital signs and metabolism controlled
  - Glucometer
  - Give glucose
  - Monitor vital signs

31

Other Body Systems

Liver Disease

What does your liver do?

1. Filter blood (removes ammonia, bilirubin, which is a breakdown of hemoglobin and other toxins)
2. Produces clotting factors
3. Metabolizes and breaks down drugs

32

Liver Disease

Symptoms of Liver Disease:

- Fatigue
- Weight loss
- Abdominal pain
- Yellowing of skin or eyes due to elevation of bilirubin
- Swelling of legs

Types of Liver Diseases:

- Hepatitis A, B, C
- Cirrhosis
- Non alcoholic fatty liver disease
- Alcoholic hepatitis

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Considerations in Patients with Liver Disease

- Alter drug therapy
- Prolonged mental depression after anesthesia due to decreased metabolism of anesthetics and analgesics
- Post operative healing
- Universal precautions
- Assess ability to clot

34

Indications for Anticoagulant Therapy

- History of thrombophlebitis/pulmonary embolus
- Stroke patients
- Atrial fibrillation
- Prosthetic cardiac valves
- Cardiac stents (but usually not on Coumadin)

35

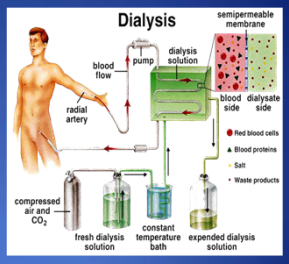
Kidney Disease

- Functions of kidney
- Filters blood
- Eliminates Waste
- Fluid & electrolyte balance

36

Considerations in Patients with Kidney Disease

- Drug doses may need to be reduced because they are not being eliminated as efficiently
- Hypertension
- Dialysis: blood is usually anticoagulated during dialysis. Therefore usually perform procedure on an OFF-dialysis day.
- Risk of infection



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This Concludes

Immune System Review

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Intravenous Therapy Review

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1

1

Important Disclaimer

Any lecture material covering the topics of I.V. placement, I.V. removal, I.V. drug draw and administration, is meant only as general information.

Attending the OMSA course and learning this material does not allow you to place I.V.'s, remove I.V.'s, or draw and administer I.V. drugs.

Only trained and licensed medical professionals may place an I.V.

2

2

Intravenous Therapy

1. Venipuncture sites for IV placement.
2. Intravenous fluids
3. Setting up an intravenous infusion
4. Inserting and removing IV catheters
5. Drawing up intravenous medications
6. Complications of venipuncture and intravenous fluid administration

3

3

1. Venipuncture sites for IV placement

4

4

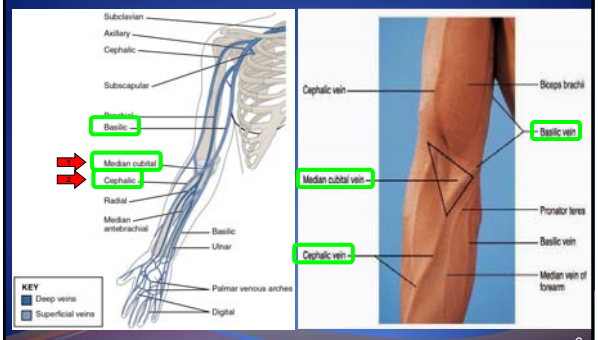
IV Sites

- Antecubital fossa: most common
- Radial branch of cephalic vein at the wrist: "intern's vein"
- Dorsal venous plexus of the hand
- Greater saphenous vein (foot): anterior to medial malleolus
- External jugular (neck)

5

5

Antecubital Fossa Anatomy



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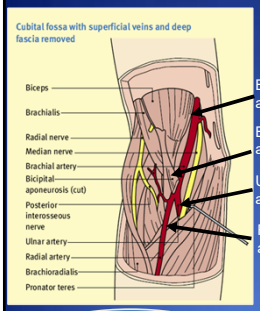
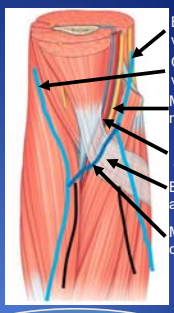
What to avoid? The Brachial Artery!!





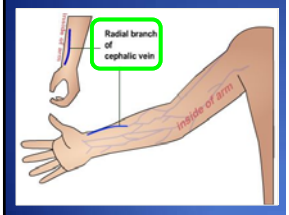
The brachial artery lies just below the bicipital aponeurosis.

In some cases branches of the brachial artery may lie on top of theaponeurosis.

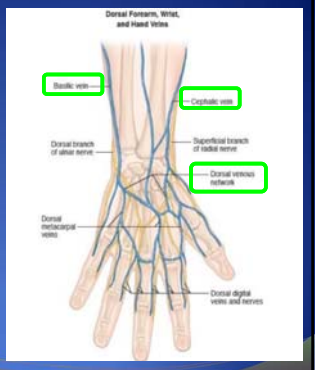
7

7

At or near the Hand



The "intern or resident's vein"



8

8

2. Intravenous fluids

9

9

IV Fluids

- Categorized by their "tonicity".
- What's that?

10

10

What's the difference?

VS

11

11

Electrolytes!

- Gatorade contains electrolytes, while water does not.
- What are electrolytes?
- Sodium, potassium, chloride, calcium
- These are also found in the body, and specifically in the body plasma (fluid surrounding the cells)

12

12

So what is tonicity?

- When the solution containing the electrolytes are at the same concentration as that found in plasma = isotonic
- When the solution containing the electrolytes has *more* electrolytes than the plasma = hypertonic
- When the solution containing the electrolytes have *less* electrolytes than plasma = hypotonic

13

13

Why is it important?

- In the body water is divided into:
  - Intracellular (inside the cells)
  - Extracellular (outside the cells)
    - Intravascular (in the blood vessels)
    - Interstitial (between the cells, but outside the blood vessels)
- Water can move freely between compartments

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14

Why is it important (Con't) ?

- Movement of the water depends on the concentration of electrolytes.
- Water will naturally move toward an area that has more electrolytes to try to dilute them.
- In general, we want the solution to stay intravascularly.

15

15

Effect of IV Fluids of Different Tonicity

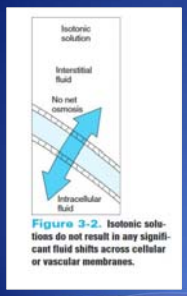

Figure 3-2. Isotonic solutions do not result in any significant fluid shifts across cellular or vascular membranes.

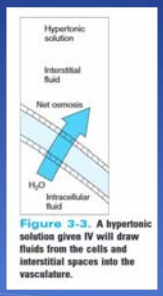

Figure 3-3. A hypertonic solution given IV will draw fluids from the cells and interstitial spaces into the vasculature.

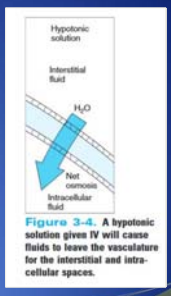

Figure 3-4. A hypotonic solution given IV will cause fluids to leave the vasculature for the interstitial and intracellular spaces.

16

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Different IV Fluids

- NS: (or NSS) Normal Saline: isotonic solution containing .9% sodium chloride
- LR: Lactated Ringers: isotonic solution containing sodium chloride, potassium chloride, calcium chloride and sodium lactate in sterile water
- D5W: 5% dextrose in water
- D5NS: 5% dextrose in normal saline
- D51/2NS: 5% dextrose in a half normal saline
- D51/4 NS: 5% dextrose in a quarter normal saline

17

17

The most ideal fluids

It is now recommended that maintenance fluids in outpatient surgery consist of a solution such as normal saline (NS) or Lactated Ringer's solution (LR)

18

18

3. Setting up an intravenous infusion

19

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Setting up an IV

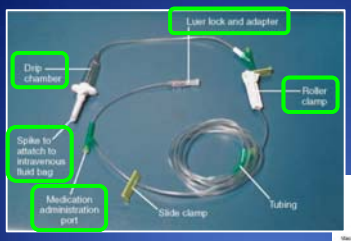
Chose IV type (NS, LR) and size (1 liter, 500 cc, 250 cc)

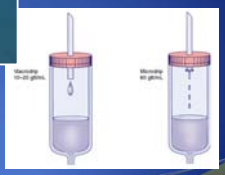
Remove this cover

20

20

IV Administration Sets





"Adult" "Pediatric"

21

21

Tear the perforated corner of the outer packaging; check color, clarity, and expiration date

1. Remove IV solution from outer packaging and gently squeeze.

Remove IV solution from packaging.

2. Remove primary IV tubing from outer packaging.

IV tubing.

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22

3. Move the roller clamp about 3 cm below the drip chamber and close the clamp.

Move roller clamp

Be Careful and do not contaminate the spike.

4. Remove the protective cover on the IV solution port and keep sterile. Remove the protective cover on the IV tubing spike.

Remove protective cover from spike on IV tubing.

23

23

5. Without contaminating the solution port, carefully insert the IV tubing spike into the port, gently pushing and twisting.

Insert IV spike into sterile solution using sterile technique.

6. Hang bag on IV pole.

The IV bag should be approximately one meter above the IV insertion site.

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24

7. Fill the drip chamber one-third to one-half full by gently squeezing the chamber. Remove protective cover on the end of the tubing and keep sterile.

Filling the drip chamber prevents air from entering the IV tubing.

Fill drip chamber

8. With distal end of tubing over a basin or sink slowly open roller clamp to prime the IV tubing. Invert backcheck valve and ports as the fluid passes through the tubing. Tap gently to remove air and to fill with fluid.

Inverting and tapping the access ports and backcheck valve helps displace and remove air when priming the IV tubing.

Invert IV tubing when priming with solution

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9. Once IV tubing is primed, check the entire length of tubing to ensure no air bubbles are present.

This step confirms that air is out of the IV tubing.

10. Close roller clamp. Cover end with sterile dead-ender or sterile protective cover. Hang tubing on IV pole to prevent from touching the ground.

Keep the distal end sterile prior to connection IV to patient.

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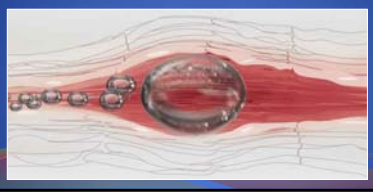
Why is it important to prime the line (flush with IV fluid)?

- Prevents air from entering the IV fluid and ultimately, into the vasculature.
- What if that were to happen?
- Then it is called an Air Embolus



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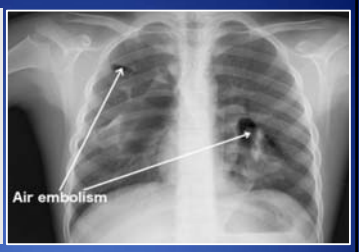
What happens to an Air Embolus?



- It will travel through the vasculature to the heart…
- And to the lungs
- Where it may obstruct blood flow

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4. Inserting and removing IV catheters

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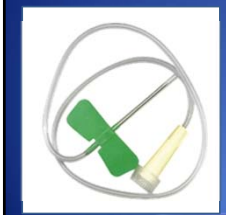
Types of Catheters

Butterfly catheters. Don't use these!!



Angiocaths: use these!

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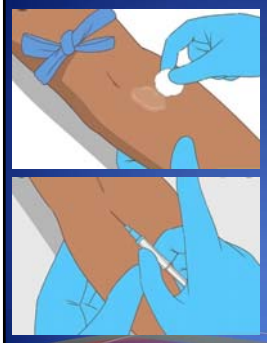
Inserting the IV Catheter



- Place tourniquet above IV site
- Disinfect skin surface with alcohol wipe or betadine wipe
- Stabilize the overlying skin with the non-dominant hand
- Gently pierce the skin and then advance into the vein
- When flashback appears, advance the entire needle/catheter another 1/16 – 1/8" to insure the catheter is in the vein

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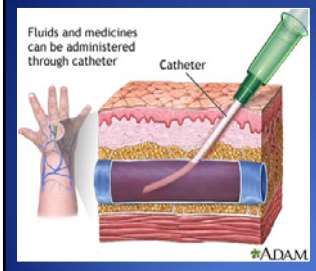
Inserting the IV Catheter



- Thread catheter off the needle and into the vein.
- Withdraw the needle.
- Activate the rollerball safety mechanism slowly.

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Removing the IV Catheter

- Stop the IV fluid infusion by rolling the rollerball down,
- Remove the tape and adhesive dressing around the IV site,
- Have a gauze (usually a 2x2) ready
- Slowly withdraw the cannula (compare length to original catheter length to be sure entire catheter was removed).
- Then press the gauze over the site for 1-3 minutes until no further bleeding is seen.

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Removing the IV catheter

- Maintain pressure to assure that there is no more bleeding
- Either secure the 2x2 with tape or apply a Band-Aid.

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5. Drawing up intravenous medications

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Understanding Concentrations of Medications

- Medication strengths are usually expressed in milligrams per milliliter (mg/mL).
- It is important to understand the metric system of measures which is based on multiples of 10.

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Grams vs. Liters

The basic units of the metric system are grams for weight and liters for volume.

A **gram** is a unit of dry weight.

A **liter** is a unit of liquid volume.

One liter is approximately equal to 1 quart

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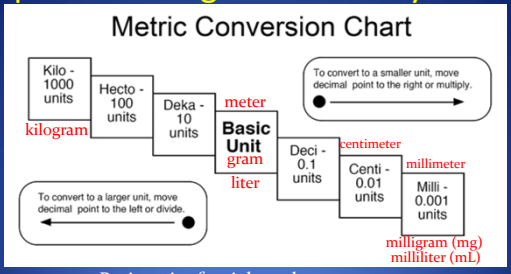
Both concentration and weight are expressed using the Metric System

Metric Conversion Chart



- Basic unit of weight = the gram
- Basic unit of volume = the liter
- Basic unit of length = the meter

38

38

Now mix grams into a liter

If I mix the 1 gram of powder into 1 liter of liquid, I get a concentration ratio of:

$$\frac{1 \text{ gram}}{1 \text{ liter}} \; \frac{\text{– There are 1000 mg in 1 g}}{\text{– There are 1000 mL in 1 L}} = \frac{1000 \text{ mg}}{1000 \text{ mL}}$$

$$\frac{\cancel{1000}\text{ mg}}{\cancel{1000}\text{ mL}} = \frac{1 \text{ mg}}{1 \text{ mL}}$$

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In the Metric System…

- 1 liter = 1000 milliliters
- And did you know?
- 1 mL = 1 cc
- So when you see "cc", you can replace it with "mL"

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40

Concentration of Drugs

1% solution means **1 gram in 100 cc (or ml)**

$$\frac{1 \text{ gram}}{100 \text{ cc}}$$

Since there are 1000 mg in 1 g

$$\frac{1000 \text{ mg}}{100 \text{ cc}}$$

Now strike through the same number of zeros on top and bottom…

41

41

Higher Math

With the zeros crossed out from the numerator and denominator we got:

$$\frac{10 \text{ mg}}{1 \text{ cc}}$$

- 1% solution = 10 mg/cc or 10 mg/mL
- 2% solution = 20 mg/cc or 20 mg/mL

42

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Let's look at Vasoconstrictors

- 1:100,000 means 1 gram in 100,000 cc
- 1:200,000 means 1 gram in 200,000 cc
- Which one is more dilute?
- The 1:200,000 concentration!

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Withdrawing Medication from a Vial

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Withdrawing Medication from a Vial

- Chose the smallest gauge needle appropriate for the task and avoid coring the rubber top of the vial and introducing particulate into the liquid inside.
- Attach needle onto the syringe
- Wipe rubber top of vial with alcohol wipe to disinfect it.

45

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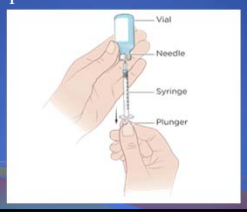
Withdrawing Medication from a Vial

- Draw into the syringe an amount of air equal to the amount of medication you wish to withdraw from the vial.
- Puncture the rubber stopper with the syringe, bring both the syringe and bottle to a vertical position with the bottle on top.



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Withdrawing Medication from a Vial

Now that you've injected the appropriate volume of air into the vial:

- Withdraw the plunger and double check to make sure the correct volume of medication has been withdrawn.
- Remove the syringe from the bottle.
- Confirm with the doctor, the medication and dose before injecting (Closed loop communication), and...
- Show the vial to the doctor.

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6. Complications of venipuncture and intravenous fluid administration

48

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Complications of IV Therapy

There is a wide range of things that can go wrong…

- Infiltration and extravasation
- Thrombophlebitis
- Intra-arterial injection
- Compression syndrome

49

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Infiltration and extravasation

Inadvertent administration of IV fluid into surrounding tissues:

- The difference is the type of medicine or fluid that is leaked.
- Infiltration – the fluid does not irritate tissue.
- Extravasation – the fluid irritates tissue.

Usual treatment – elevation of the arm and warm compresses

50

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Thrombophlebitis

Inflammation (phlebitis) and thrombus (clot) formation in the vein itself :

- Pain, tenderness
- Redness of the vein
- Ropey, hard feeling to the vein
- Treatment – For superficial thrombophlebitis apply moist heat to the painful area, elevate the affected arm, nonsteroidal anti-inflammatory drugs (NSAIDs). May require steroids and antibiotics.
- Treatment (severe) – for thrombosis medical consultation will be necessary and anticoagulants may be required.

51

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Intra-arterial injection

We thought the catheter was in the ***vein***, but it was accidently in the ***artery*** instead!!

52

52

Intra-arterial Injection

Mechanism of injury:

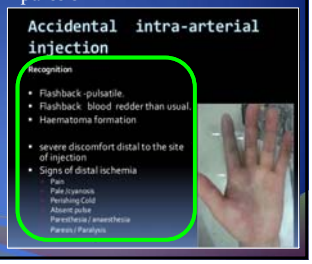
- Arterial spasm caused by drug prevents oxygen from getting to the tissues.
- Direct tissue destruction.
- Subsequent chemical arteritis, destroying the endothelium and muscular layers of the vessel.

Prevention is the key:

- Watch for bright red flashback
- And pulsation

Watch for signs and symptoms:

- Pain, pale appearance or cyanosis
- Absent pulse, paresthesia and paresis



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Intra-arterial Injection

- The result? The blood supply to the tissues distal to the injection site is severely compromised.
- Vascular emergency!! Patient needs immediate surgical attention by a vascular surgeon.
- Can lead to necrosis of the limb.

54

54

Intra-arterial Injection

Treatment:

- Leave needle in place.
- Draw up 10 cc of 1% lidocaine without epi – dilutes anesthetic, reduces pain and vasospasm.
- Ice pack to area.
- Transport to hospital.
- Vascular surgery consult.

Figure 1. Woman Develops Gangrene after Receiving Phenergan IV. Image provided courtesy of ISMP.

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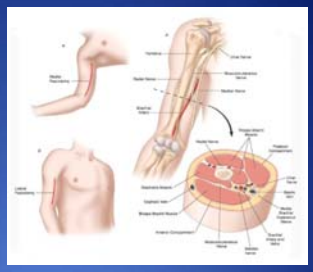
Compartment Syndrome



- Dense, thick fascia surrounds the muscles of the arms and legs.
- Muscle injury (which can sometimes accompany multiple venipuncture attempts) can lead to massive muscle swelling.
- However, the overlying fascia will not stretch to accommodate the swelling and the blood vessels become compressed by the swollen muscles.

Treatment – fasciotomy, a cut through the skin and subcutaneous tissues down to the muscle to release the pressure.

56

56

Compartment Syndrome

Signs and Symptoms

- Pain
- Paresthesia (pins and needles)
- Paralysis of the limb
- Lack of pulse
- Tense, shiny skin
- Congestion of digits

Treatment:

- Immediate transfer to the hospital.
- The patient must be evaluated by a vascular surgeon ASAP.
- A fasciotomy must be performed in a timely fashion to relieve the pressure.
- If the pressure is not rapidly relieved, it can impair the circulation enough to cause tissue necrosis and require amputation.

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57

Intravenous Therapy

1. Venipuncture sites for IV placement.
2. Intravenous fluids
3. Setting up an intravenous infusion
4. Inserting and removing IV catheters
5. Drawing up intravenous medications
6. Complications of venipuncture and intravenous fluid administration

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This Concludes

Intravenous Therapy Review

California Association of Oral & Maxillofacial Surgeons
Oral & Maxillofacial Surgery Assistant's Course

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Pharmacology Review

California Association of Oral & Maxillofacial Surgeons
Oral & Maxillofacial Surgery Assistant's Course

1

2

Pharmacology Review

- Methods of administration
  - Topical: on the skin
  - Subcutaneous: just under the skin
  - Intramuscular: injected into the muscle
  - Intravenous: injected into a vein

3

Pharmacology Review

- Methods of administration (cont.)
  - Intravenous administration:
    - Preferred route
    - Rapid onset of action
    - Greater bioavailability of drugs
    - Ability to titrate
  - Most oral surgery offices use total intravenous anesthesia

4

Pharmacology Review

- Fate of drugs in the body: (what happens to these drugs?)
  - Drugs are distributed to the brain, muscle mass & fat stores
  - They are metabolized in the liver
  - They are excreted by the kidneys
- How do you adjust the dosage of anesthetic agents for a patient who has renal or liver disease?

5

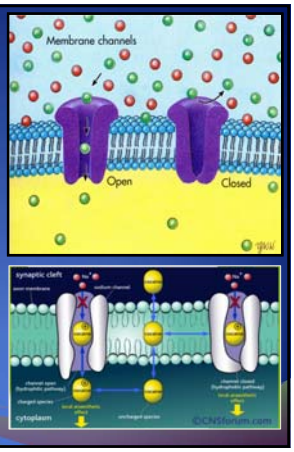
How do anesthetics work?

- Nerve cells conduct electrical impulses to the brain.
- The cell is polarized: positive ions on the outside and negative ions on the inside, with "gates" in the cell wall.
- Usually, the gates open up and allow the positive ions to flow in, resulting in depolarization of the membrane.

6

Local anesthetic

- Local anesthetics BLOCK THE GATES and do not allow the positive ions to flow into the cell, thus preventing depolarization and conduction of the impulse.



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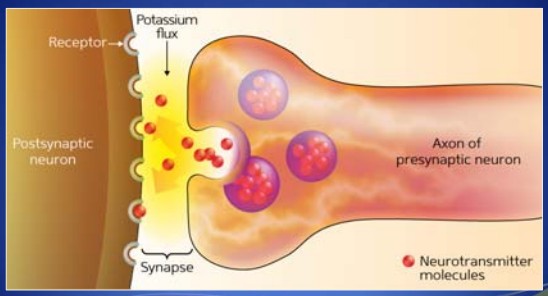
General Anesthetics

- General anesthetics work a little bit differently. They prevent synaptic transmission of impulses between neurons.
  - Neurons (nerve cells) are separated by a tiny space called a synapse.
  - One end of the neuron has chemicals in it.
  - When the impulse comes along, chemicals are released from the end of one neuron and travel across the synapse to the next neuron.

8

Synaptic cleft



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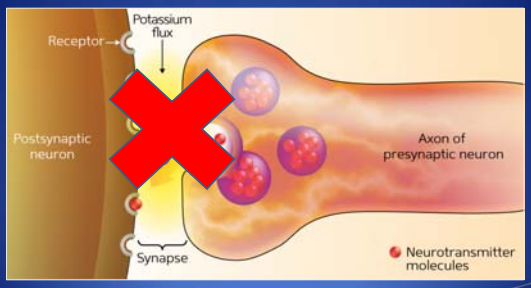
General anesthesia



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Local vs. General

Local: "locked out"

General: "botched relay"

11

What parts of the brain are affected?

- Center for Emotion

- The Wakefulness System

- The Central Relay Center

12

Inhalational Anesthetics

- Oxygen
  - Green tanks (universal)
  - Use with every sedation and general anesthetic in the office!
  - 21% O_2 in room air
  - Use 30% or greater when using other agents
  - Caution in patients with COPD

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Inhalational Anesthetics

- Nitrous Oxide
  - Blue tanks
  - Non-flammable
  - Gives a sense of euphoria and relaxation
  - Analgesic properties
  - Diffusion hypoxia

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Diffusion Hypoxia

- At the end of a procedure, if a patient who was on N_2O + O_2 is allowed to breathe only room air, the N_2O will diffuse from the blood stream to the lungs and fill up the alveoli.
- This displaces oxygen in the alveoli and also dilutes the CO_2, resulting in decreased respiratory drive & ventilations.
- It causes a hangover-type effect.
- Avoid this complication by breathing 100% O_2 for 3-5 minutes after turning off the N_2O.

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Intravenous Agents

- Benzodiazepines
- Opioids
- Sedative Hypnotics
- Dissociative Anesthetics
- Reversal agents
- Corticosteroids
- Anti-emetics
- Anticholinergics

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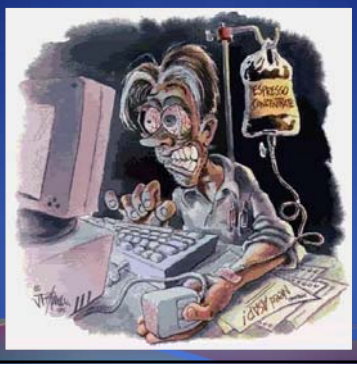
Benzodiazepines



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Benzodiazepines

- Diazepam----------Valium
- Midazolam----------Versed
- Lorazepam----------Ativan
- Alprazolam----------Xanax
- Triazolam----------Halcion

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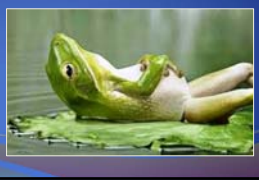
Benzodiazepines: Action

- Reduces anxiety, relaxes the patient
- Works on the Center of Emotion
- Amnesia
- Reversal agent = Flumazenil (Romazicon)



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Benzodiazepines: Considerations

- Anticonvulsant
- Contraindication: narrow angle glaucoma
- Minimal change in respiration, but it IS a respiratory depressant
- Mild decrease in blood pressure
- Relaxes muscles

20

Valium vs. Versed

- Valium can be irritating to the veins due to the carrier, propylene glycol
- Versed is stronger (greater sedation) than Valium
- Versed has more profound anterograde amnesia than Valium
- Versed is water-soluble (no propylene glycol) so it doesn't irritate veins

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Narcotics

- Also known as Opioids as parent compound is Opium, derived from the poppy.
- Mainly used for Pain Control

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Narcotics

- Morphine
- Demerol
- Fentanyl
- Sufentanyl
- Alfentanyl
- Codeine
- Hydrocodone
- Oxycodone

23

Narcotics: Action

- Used for pain relief (analgesics)
- Respiratory depressant (activate specific receptors in the central nervous system)
- Cardiovascular system remains stable, but can see bradycardia
- Reversal agent = Naloxone (Narcan)

24

Narcotics: Considerations

- Can trigger nausea and vomiting (stimulates vomiting center in the brain)
- Produces drowsiness, mental clouding, euphoria
- Can cause constipation
- Use with caution in asthmatics: (histamine release, especially morphine and Demerol)
- Pinpoint pupils

25

Morphine

- Parent compound
- Derived from the opium poppy

26

Meperidine (Demerol)

- Synthetic
- 1/10 as potent as morphine
- Mild histamine release
- May produce hypotension

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Fentanyl

- 100x more potent than Morphine
- Dosage is in *micrograms (mcg)*
- Rapid onset
- Ultra short duration (30-60 min)
- Cardiovascular system remains stable

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Pain medications after surgery

- Hydrocodone (Vicodin, Norco)
- Oxycodone (Percocet)
- Codeine
- Tramadol (Ultram)

29

Sedative-Hypnotic: Propofol

- Propofol (Diprivan): used to put patient to *sleep*
- Targets the Wakefulness Center
- Associated with emergence euphoria (patients feel good when they wake up)
- Anti-emetic effect

30

Propofol: Considerations

- Cardiovascular system: slight decrease in blood pressure
- Little or no change in heart rate
- Respiratory depressant
- Very rapid recovery
  (distribution half life = 2 – 8 min)
- Anti-emetic properties
- Less apnea than Brevital, but apneic episodes can last longer

31

Propofol: Considerations

- Carried in a lipid emulsion containing soybean oil, glycerin, and egg lecithin
- Contraindications to use:
  - Allergy to egg YOLK
    (most people allergic to egg white)
  - Allergy to soybeans
- Can burn on injection
- Elderly: decreased dose
- Women & children: increased dose

32

Sedative-Hypnotic: Barbiturates

- Brevital is an ultra-short acting barbiturate
- Used to put patients to *sleep* (affects the Wakefulness Center)

33

Brevital: Considerations

- 1% solution (10 mg/cc)
- Drop in blood pressure (hypotension)
- Increase in heart rate (reflex tachycardia)
- Respiratory depressant - see apnea after induction
- See more laryngospasms with Brevital than propofol

34

Dissociative Anesthetic: Ketamine

- Synthesized in 1962 from PCP
- Some classify it as a hallucinogen
- Value as a street drug – make sure it is stored securely

35

Dissociative Anesthetic: Ketamine

- Action in cerebral cortex in the "Relay Center"
- Potent analgesic
- Produces amnesia
- Sympathetic stimulation: increase HR & BP
- Increased cerebral blood flow & intracranial pressure
- Can be associated with emergence delirium (prevent with benzodiazepines)
- Half life: 10-15 minutes

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Respiratory Depression

- What is it?
  - A decrease in respiratory RATE and/or VOLUME
- Which anesthetic agents can cause it?
  - Narcotics
  - Benzodiazepines
  - Sedative-Hypnotics
    - Propofol
    - Barbiturates

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Reversal Agents

- Reversal for Narcotics
  - Naloxone (Narcan)
  - Danger: short duration of action means Narcan could wear off and patient could get resedated if the narcotics haven't worn off yet.

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Reversal Agents

- Reversal for Benzodiazepines
  - Flumazenil (Romazicon)
  - Half life = 4-11 min
- Danger: short duration of action means flumazenil could wear off and patient could get re-sedated if the benzodiazepine hasn't worn off yet.

39

Corticosteroids

- Function: suppress immune system
- Use to decrease inflammation and swelling
- Will increase blood glucose
- Commonly used:
  - Decadron
  - Medrol Dose Pack
  - Solu-Medrol/Solu-Cortef
  - Prednisone
  - Cortisone

40

Antiemetics (Anti-nausea)

- What causes nausea?
  - Medications
  - Viral or bacterial infection (gastroenteritis)
  - Migraines
  - Pregnancy
  - Anxiety
  - Ear problems
  - Motion sickness

41

Medications that cause nausea

- Narcotics
- Antibiotics
- Some antidepressants
- Chemotherapy drugs

42

Medications for Nausea

- Ondansetron (Zofran): blocks serotonin (5HT) in the gut and brain which causes nausea.
- Promethazine (Phenergan): antihistamine, thought to block the histamine receptor in the brain that causes nausea. Works well for motion sickness & ear problems.
- Prochlorperazine (Compazine): blocks dopamine
- Decadron

43

Case Study

- Your patient is a 22-year old male who presents to your office for extraction of his third molars. He complains #32 is painful and the gum is swollen.

44

Past Medical History

- Childhood asthma: hasn't used an inhaler or had an attack in over 7 years
- Fractured wrist, age 13
- No medications
- Allergic to soy & eggs

45

Clinical examination

- Patient is afebrile
- Some extraoral swelling is noted
- Mild trismus: opening = 30 mm
- + edema and erythema of pericoronal tissue over #32

46

Anesthetic Plan

- What medications would you use?
- Versed? Valium?
- Fentanyl? Demerol? Morphine?
- Decadron? SoluMedrol?
- Ketamine?
- Propofol?
- Brevital?

47

Anesthetic Course

- You plan to sedate this patient using:
  - Versed
  - Fentanyl
  - Decadron
  - Brevital

48

Anesthetic Course

- Patient is 6'1", weighs 165 lbs.
- Treatment plan and NPO is confirmed.
- Just before starting, the patient asks you when he can smoke again after the surgery because he smokes marijuana daily.
- Monitors are attached.
- O2 is administered via nasal hood at 6L/min.
- A 20 gauge angiocath is used to start an IV in the right antecubital fossa w/ normal saline.

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Anesthetic Course

- Versed 5 mg, Fentanyl 50 mcg & Decadron 4 mg is administered through the IV.
- Local anesthetic 2% lidocaine with 1:100,000 epi and .5 % Marcaine with 1:200,000 epi is administered as bilateral mandibular blocks and infiltrations around the teeth.
- 6 cc's of 1% solution of Brevital (10mg/cc) is administered.

50

Anesthetic Course

- #17 is extracted uneventfully.
- An additional 3 cc's of Brevital was administered and #16 is then extracted.
- Before #32 could be extracted, "crowing" or stridor is heard.
- O2 saturation drops to 92%.

51

What do you think is happening?

- What should be the next course of action?

52

Anesthetic Course

- The surgery is terminated temporarily, and the sites are packed off.
- The airway is repositioned by using a head-tilt maneuver.
- The throat pack is removed and the oropharynx is suctioned.
- Within a few minutes, the saturation returns to 99% and patient's ventilations return to normal.

53

Anesthetic Course

- However, when the surgery is resumed, the patient becomes very agitated and combative.
- An additional 25 mcg of Fentanyl is administered as well as a bolus of 50 mg (5cc's) of Brevital.
- Additional local anesthetic 0.5% Marcaine with 1:200,000 is administered as a mandibular block.

54

Anesthetic Course

- However, the patient continues to be very combative.
- He repeatedly removes the pulse oximeter from his finger, so a reading is difficult to obtain.
- Additional Versed 4 mg, Fentanyl 25 mcg and a bolus of Brevital 40 mg is given.

55

Anesthetic Course

- The decision is made to administer 30 mg Ketamine to the patient.
- Finally, the patient calms down and #32 and #1 are finally extracted.

56

Post operative Course

- Post operatively, the patient remains drowsy and semi-responsive to verbal stimuli.
- You notice that you repeatedly have to remind him to breathe, occasionally even doing a head-tilt procedure to get him to breathe.
- You inform the doctor of these findings.

57

What do you think is happening?

- What should be the next course of action?

58

Post operative course

- Flumazenil and Narcan were administered.
- The patient now responds to verbal commands.
- After additional recovery time, the patient is finally able to be discharged.
- But now he says he is nauseated:
  - What prescriptions might be sent home with this patient?
  - Are there any specific instructions you would give to his home care provider?

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Local Anesthetics

- Two types:
  - Esters (chemical structure: C=O)
  - Amides (chemical structure: CO-NH)

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Local Anesthetics

- Esters
  - Not used very much today due to high incidence of allergy
  - Procaine (Novocain) is most commonly known
  - Benzocaine, Cocaine, Tetracaine

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Local Anesthetics - Amides

- Lidocaine
- Mepivacaine
- Bupivacaine
- Prilocaine
- Etidocaine
- Ropivacaine
- Articaine

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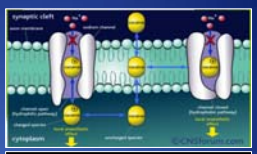
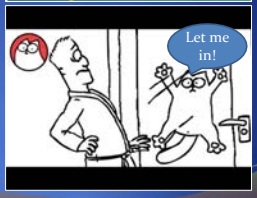
Mechanism of Local anesthetics

- Local anesthetics block the gates and do not allow the positive ions to flow into the cell, thus preventing depolarization and conduction of the impulse.





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Local Anesthetic Toxicity (overdose)

- Early signs – Patient may become anxious, talkative and disoriented
- At higher doses the patient may develop seizures which can require emergency treatment

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Vasoconstrictors

- Epinephrine or Neo-cobefrin are commonly added to local anesthetics to:
  - Increase duration of action.
  - Limit absorption of local anesthetic into the system. Therefore the maximum number of carpules that can be safely delivered is increased.
  - Limit surgical site bleeding with vasoconstriction.

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Maximum Doses of Local Anesthetics

Agent	Mg/ cartridge	Max mg/kg	Max mg/lb	Max dose
2% lidocaine	36	4.5	2	300
2% lido w/ 1:100,000 epi	36	7	3.3	500
3% mepivacaine (Carbocaine)	54	5.5	2.6	400
2% mepivacaine w/ 1:20,000 levonordefrin	36	5.5	2.6	400
4% prilocaine (Citanest)	72	8	4	600
4% prilocaine w/ 1:200,000 epi	72	8	4	600
.5% bupivacaine wi/ 1:20,000 epi (Marcaine)	9	1.3	0.6	90
1.5% etidocaine w/ 1:200,000 epi (Duranest)	27	5.5	2.6	400
4% articaine w/ 1:100,000 epi	68	7	3.2	500

66

Anesthesia for Pregnancy

- Ideally: defer elective procedures until after delivery
- Next best time: second trimester
- Let the OB know treatment plan
- ALL medications cross the placental barrier
- Usually treat using local anesthetic only
- Confirm pain medication with the patient's physician: Tylenol considered safe

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This Concludes

Pharmacology Review

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Outpatient Anesthesia Review

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1

CASE BASED LEARNING MODULE

- a. Chief complaint/history of present illness
- b. Past medical history
- c. List of Medications
- d. Known Allergies
- e. ASA Classification
- f. Clinical Exam
- g. Clinical Dental Diagnosis
- h. Reflexes and Depth of Anesthesia Correlations
- i. Clinical synopsis and surgical care summary
- j. Anesthetic complication and "hidden" emergency
- k. Treatment considerations in delayed emergence

2

OUR PATIENT AND HIS CHIEF COMPLAINT

- 54 y.o. "retired" male referred from GD for extractions of all remaining teeth due to non-restorability(in pain)
- He currently has mild jaw pain and had several weeks of dental pain and head aches.
- GD has placed patent on Penicillin VK 500mg QID two days ago.
- Patient recently "moved" in with his mother
- Dentist took impression last week for Full Upper/Lower Dentures

3

PAST MEDICAL HISTORY

- High Blood Pressure
- Prostate hypertrophy
- Bleeding Ulcers/Colitis
- Gout
- Sinus Problems
- Recently switched to a new doctor locally
- Appendectomy 30 year ago, T/A and 3rd molars as a teen

4

Medications

- Atenelol
- Allopurinol
- Tamsulosin
- Trazadone
- Pen VK
- Tylenol ES

5

ALLERGIES/Adverse reactions & Social History

- ASA – Stomach Problems
- Ativan – Gets angry violent
- Sulfa-Utricaria, Pruritus
- DENTISTS – severe phobia
- TOB 1-2 PPD trying to quit last two weeks
- MJ occasional non last 48hrs
- History of polysubstance abuse >1 year ago
- ETOH quit 3 mos. ago

6

Additional Questions BASED on Med Hx

MET status

CP/SOB incidence

Current use of Medications

Most recent Use of ETOH/Illicit "recreational" Drug

Last visit with MD and any pending follow up care

7

The ASA Classification is?

- ASA I
- ASA II
- ASA III
- ASA IV

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ASA PS Classification	Definition	Examples, including, but not limited to:
ASA I	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use
ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity (30 < BMI < 40), well-controlled DM/HTN, mild lung disease
ASA III	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Examples include (but not limited to): poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, premature infant PCA < 60 weeks, history (>3 months) of MI, CVA, TIA, or CAD/stents.
ASA IV	A patient with severe systemic disease that is a constant threat to life	Examples include (but not limited to): recent (< 3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis

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ASA Classification I

Class I: Few patients will truly be in this category. The patient has no physiological, or psychiatric disturbances whatsoever, is less than 50 years old, a non-smoker, and takes no medication.

Exceptions: Birth Control Pills, Estrogen Replacement Therapy, Prophylactic Salicilates (aspirin), but without any cardiac history i.e. atrial fib or stent.

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ASA Classification II

Class II: Most patients will be in this classification therefore, requiring lab work.
The patient has mild to moderate systemic disturbances caused either by the condition to be treated surgically or by other pathophysiologic processes. These disturbances **do not limit activity.**
Examples:

- Current smoker
- Age over 65 years or less than 3 months old will automatically require a medical consult
- Asthma, well controlled on as needed basis for medication.
- Hypertension well controlled with medication and/or diet; HTN requires an EKG at any age

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ASA Classification II (continued)

- Heart dysrhythmia (abnormal rhythm) controlled with meds
- Obstructive Sleep Apnea (OSA)
- Stable Angina, well controlled, not limiting activity
- Mild Diabetes, well controlled on medication
- Mild to moderate obesity
- History of seizure disorder, controlled with medication
- History of Congestive Heart Failure, controlled with meds
- COPD, stable
- Chronic Bronchitis
- History of Hepatitis C or Cirrhosis stable, not limiting activity
- Renal Insufficiency, stable

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ASA Classification III

Class III: Many patients are actually in this classification and require a medical consult.

The patient has serious systemic disturbances or diseases, even though it may be impossible to define the degree of disability. The disease process **limits activity in some way but is not incapacitating.**

Appropriate MD consultation, where deemed necessary is also required.
i.e., patients with: insulin pumps, pacemakers and on pain management,

Other Examples:
- Any combination of 3 or more of the disease processes listed for a Class II patient.
- Any single disease process listed for a Class II patient with one or more of these enhancing criteria:
- Intense severity
- Poorly controlled on current medication
- Limits activity in some way

(continued on next slide →)

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ASA Classification III (continued)

- "Heart attack", a healed myocardial infarction (MI) of more than 6 months ago, or patients who have undergone coronary artery bypass surgery (CABG), valve replacement or angioplasty.
- Pacemaker, Internal Cardiac Defibrillator (ICD), sometimes CABG patients also have these.
- Diabetes with complications to vascular or other organs, i.e., retinopathy, neuropathy, etc.
- Chronic Pain Management patients taking daily pain medication must have a consultation with a pain management physician prior to the day of surgery for the purpose of pain management during the immediate post-op period while in the post anesthesia care unit.
- Pulmonary insufficiency, including asthma, requiring the use of chronic medications and which limit activity or have uncontrolled symptoms, i.e., shortness of breath, cannot lay flat.
- Any implantable electronic device (IED) i.e., for pain, insulin, deafness, etc.
- Renal failure requiring Dialysis

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ASA Classification IV

Class IV: These patients are not candidates for elective surgery.

These patients have severe systemic disease that is life threatening.
Examples:
- Organic heart disease with marked signs of cardiac insufficiency (i.e., NYHA class 4).
- Recent myocardial infarction of less than 6 months duration.
- Unstable angina.
- Advanced degrees of pulmonary, renal or endocrine insufficiency.

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CLINICAL Exam

- 5' 9" 220 lbs.
- BMI 32.4
- NARD Alert/Oriented/Disheveled/ Minimally Verbal
- Presents with 84 y.o. mother
- Moderate apprehension/discomfort
- NIBP 158/99 HR 84 RR 18
- No JVD, Neck Supple, No peripheral edema
- Extremities I x 4, but palpable joint pain and slow to ambulate
- Chest CTA no wheezing, rales, rhonchi, crackles

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Body MASS INDEX and Health Risk

- Normal weight
- Overweight
- Obese Mild
- Obese Severe (Morbid)

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Body Mass Index (BMI) Kg/m²

Classification	BMI Caucasian	BMI Asian	Health Risk
Underweight	18.5 >	18.5 >	Low
Normal Weight	18.5-24.9	18.5-22.9	Average
Overweight	25.0 <	23.0 <	
Pre-Obese	25.0-29.9	23.0-24.9	Mildly increased
Obese	30.0 <	25.0 <	
Class I	30.0-34.9	25.0-29.9	Moderate
Class II	35.0-39.0	30.0 <	High
Class III	40.0 <		Very High

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Patient's Clinical Oral Exam

- Generalized coronal caries
- Gingival swelling and discharge on multiple site
- MIO 37mm TMJ Normal
- MP III Airway
- Short TM space
- Macroglossia
- 18 ½ inch neck

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Mallampati airway classification

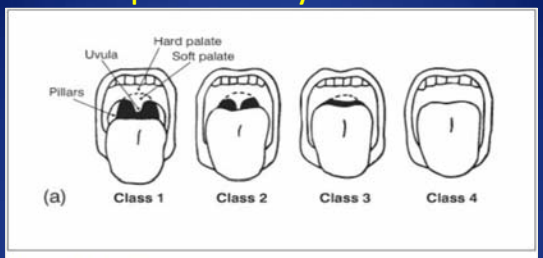

Figure 1. The Mallampati score:
Class I: Soft palate, uvula, fauces, pillars visible.....
Class II: Soft palate, major part of uvula, fauces visible.....
Class III: Soft palate, base of uvula visible.....
Class IV: Only hard palate visible.....

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DIAGNOSIS

Medical

- ASA III male
- Medically controlled hypertension
- Type II Diabetes
- Benign prostatic hyperplasia
- Subacute Gout poorly controlled
- TOB Smoker
- Hx of Substance abuse/alcoholism

Dental

- Generalized caries
- Moderate to severe periodontitis with gingival abscesses
- Multisite chronic periapical inflammatory disease

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Medical Clearance/Optimization ?

- Patient stable as of last visit 6 months ago
- No contraindication to dental work

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ASA NPO Guidelines

ASA Fasting guidelines

Ingested material	Minimum fast
• Clear liquids	2 h
• Breast milk	4 h
• Infant formula milk	4-6 h
• Non human milk	6 h
• Light meal	6 h
• Heavy meal (contain fat &meat)	8 h

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Treatment Plan FOR OFFICE SURGERY

- Local Anesthesia
- Oral Conscious sedation
- IV conscious sedation
- IV Moderate Sedation GA

Two Key Questions:

1. How difficult will the surgical procedure be? How stimulating?
2. What is this patient's anesthetic risk?

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Depth Based Stages of Anesthesia

Stage	Description
I	Amnesia, induction of anesthesia to loss of consciousness
II	Delirium, excitation, potential for vomiting, laryngeal spasm, hypertension, tachycardia, uncontrolled movements, dilated pupils
III	Surgical anesthesia, constricted pupils, regular respiration, adequate anesthetic depth, prevention of hypotension and tachycardia, absence of movement
IV	Overdosage; shallow or no respiration; dilated, nonreactive pupils; hypotension

Note: The stages of anesthesia are not always obvious when modern anesthetic agents are used. The stages are used only as a guide for recognition of wakefulness from the anesthetized state.

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Depth of Anesthesia Assessment

Reflexes and Other Indicators of Anesthetic Depth

Reflex =

1. Reflex activity --diminishes w/ deeper anesthesia
2. Palpebral reflex -- blink
3. Swallowing reflex – indicator to pull e-tube
4. Pedal reflex – squeeze digit>>pulls leg back
5. Ear flick reflex – tickle inside of ear
6. Corneal reflex – corneal contact >> blink/retract
7. Laryngeal reflex – closes epiglottis
8. Muscle tone – jaw tone
9. Eye position and pupil size – I central II ventral III central
10. Salivary and lacrimal secretions – why we need lube
11. Heart and respiratory rates – reflexes discussed prev.
12. Response to surgical stimulation – pain response
    - Increase HR and increase RR

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SURGICAL ANESTHESIA-Stage 3

- Plane 1: Light: still has blink and swallowing reflexes and regular respiration
- Plane 2: Surgical Anesthesia: Loss of blink reflexes, pupils become fixed and respiration is regular.
- Plane 3: starts to lose ability to use the respiratory muscles and breathing becomes shallow, may require assisted ventilation
- Plane 4: Loss of all respiratory effort, breathing may stop entirely.

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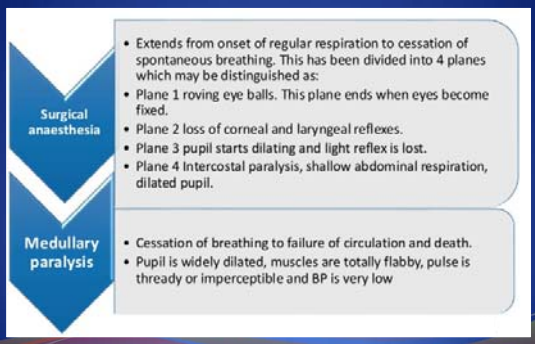
Depth of Surgical Anesthesia (Guedel's Signs)



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Surgery/Anesthesia Details

- Monitors NIBP,EKG,Co2, O2 Sat
- IV 22 gauge LR at 100cc/hr.
- O2 via Nasal cannula 2l/min
- IV Meds Versed 10mg, Fentanyl 50mg, Propofol 30mg, Toradol 30mg
- Local
  - 15.3 cc 2% Lidocaine + 1:100K Epi
  - 3.4 cc 4%Marcaine + 1:100K Epi

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Immediate Denture Delivery

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Course of Operative Care

- Patient still responded to minimal surgical stimulus after 3 minutes of sedative and narcotic administration with movements
- Local anesthesia and initial sedation doses deemed not effective
- Additional medications given to control patient movements
- Patient becomes hypertensive and some hypopnea ensues
- Attempt to deepen plane of anesthesia results in worsening of hypopnea, tachycardia and hypertension worsening
- PPV improves SAT and maintains ventilation but voluntary breathing is slow and shallow
- Procedure is quickly completed with mild persistent hypoxia and moderate hypertension
- Patient's vitals stabilize BUT he does not fully return to baseline LOC within 1hr of the last sedative dose.....?

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Summary of Events (continued)

- Reversal agent given with minimal improvement of cognitive function
- After one additional hour patient is still groggy, but finally emerges and ambulates with assistance to the recovery/discharge area
- Initially when walking, slight left sided weakness and foot drag is present, but patient is able to stand up and walk 20 feet with slight assistance. He normally walks with slight limp due to gout.
- Patient able to nod and speak, but gauze is present in the mouth, so not very articulately. However, he appears to respond appropriately and follows commands. He is discharged on his own power, ambulating with assistance to his vehicle, 3hrs after start of the procedure.

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CASE VITALS FLOW CHART

Time	0	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100
BP SYS DIA	185 99	169 93	200 100	220 110	201 107	215 113	197 99	188 99	180 100	130 93	138 997	126 96	113 93	129 89	125 91	122 85
HR	99	89	105	110	115	100	99	97	88	96	99	93	99	89	98	99
SAT O2	97	97	92	88	83	88	93	89	92	91	92	93	93	94	92	97
RESP	18	15	8	5	3	5	8	7	7	8	9	9	8	9	7	12
Local Toradol	4 L 2M 30			2L			1L	2L								
Versed Romazicon Naloxone	5	2.5	2.5				2.5			0.2 0.4	0.2					
Fentanyl Propofol	50	10	10			10										
LOC Surgery Airway	A	NR S	C	C P PPV	NR P PPV	C P PPV	NR RS	C PPV	NR	NR E	NR	NR	NR	NR	P	V

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EMERGENCY ISSUES

- HTN
- RESPIRATORY DEPRESSION
- HYPOXIA
- DELAYED EMERGENCE FROM IV SEDATION

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Patient's Post Op Course

Recovered for additional 60 minutes. Discharged home ambulatory with assistance to his mom with full instructions.

Post op call: Sleeping with no complaints.

Next day: Call from DDS, patient is at the office but appears disoriented, potential hemi-facial weakness, balance issues, and slightly slurring his speech.

Recommended to be seen by ER for STAT eval. Patient driven to local ER.

Seen in hospital ED: impression TIA vs stroke, apparently we learned then that he fell at home twice last night and seemed "Out of it".

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Continued Sequelae of Surgery

- Patient spent three days in hospital under close observation.
- Diagnosis: Mild Cerebral infarction R side with slight left sided paralysis due to an unspecific artery occlusion.
- Patient discharged home at 72hrs
- Had another mild stroke in three days after being discharged.
- He was readmitted for another 24hrs.
- Seen for PT and Speech therapy for subsequent three months.
- At six months recovered almost entirely to baseline.
- Small sequestrum removed at 3 months post extractions with local.

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KEY DELAYED EMERGENCE CAUSE DIFFERENTIAL CONSIDERATIONS

- Pharmacological Effects
- Metabolic Disturbances
- Neurological Deficits

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Basic WORK UP FOR DE

- Vital signs (including temperature) – hypothermia, Malignant Hyperthermia
- Neurologic Exam (pupils, cranial nerves, reflexes, response to pain)
  - Over sedation, Stroke, aneurism
- Finger stick- glucose level hypoglycemia
- Make arrangements for naloxone, flumazenil, physostigmine, imaging (ex. CT scan-Hospital admission)
- ABG with electrolytes (Hospital/Surgery Center) – Rule out metabolic unbalance
- Twitch monitor (Hospital/Surgery Center) - Ensure recovery from Paralytic/Inhalation agents

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Pharmacologic Differential

- Residual anesthetic (volatile, Propofol, barbiturates, ketamine)
- Excess narcotics – can be reversed by **naloxone** (0.4 mg bolus) – remember it's short-acting CAREFULLY MONITOR FOR ADDITIONAL TIME – **RESEDATION POSSIBLE**
- Preoperative sedatives – too much midazolam? – reversed by **flumazenil** 0.2 mg q1min up to 1 mg CAREFULLY MONITOR FOR ADDITIONAL TIME - **RESEDATION POSSIBLE**
- Acute alcohol intoxication or other illicit drugs rendering unconsciousness may significantly extend the length of the anesthetic
- Physostigmine 1.25 mg IV can reverse cholinergic effects (ex. scopolamine) and possibly the effects of anesthetic agents (Stanford Delayed Emergence Protocol)
- Inadequate reversal or no reversal of muscle relaxation or rarely pseudo cholinesterase deficiency – edrophonium/atropine work faster (1-2 mins) than neostigmine/glycopyrrolate (peak effect around 10 mins) and may be indicated in this setting

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Metabolic Differential

- Hypoxemia – may require mechanical ventilation or supplemental oxygen
- Hypercarbia – check gas, may need to ventilate postoperatively until the patient resumes adequate spontaneous ventilation
- Acidosis – correct the underlying disorder (metabolic/respiratory)
- **Hypoglycemia**/Hyperglycemia – FS or check Met Panels, correct as indicated
- Hyponatremia – correct slowly such as not to create central pontine myelinolysis
- Hypothermia/Hyperthermia – correct as indicated with warming/cooling
- Malignant Hyperthermia – Dantrolene ICU care
- Underlying metabolic disorder – e.g. liver disease

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Neurologic Differential

- New ischemic event – Evaluate for reperfusion with thrombolytics STAT
- Cerebral Hemorrhage – Need Head CT STAT
- Seizures or post-ictal state – Check history and use of meds
- Increased ICP or pre-existing obtundation – Mostly Trauma cases

THINK FAST!

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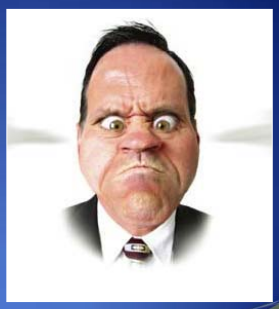
Acute ischemic stroke

- Destruction of brain due to:
  - Intra-cranial hemorrhage
  - thrombosis
  - embolism
- Risks factors:
  - **HTN**
  - **Stress**
  - **Atherosclerosis**
  - **Age**
  - **arrhythmias**



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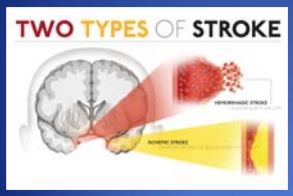
Focal "Brain" ATTACK



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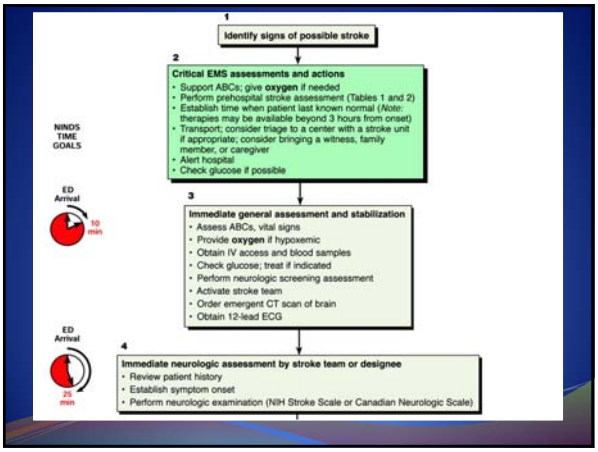

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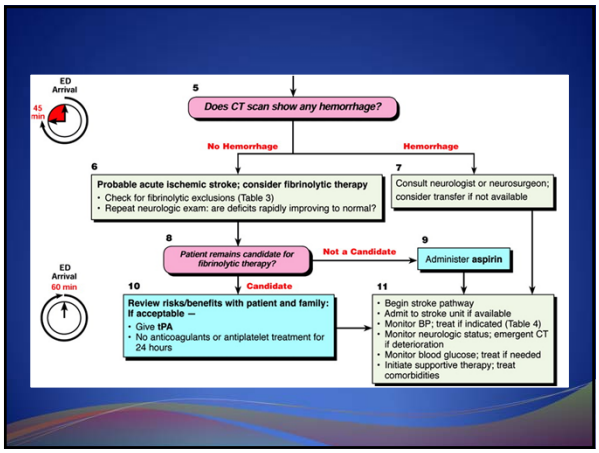

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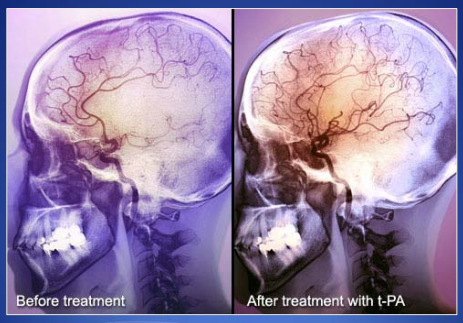
Reperfusion therapy with Thrombolytics



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This Concludes

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Office Anesthetic Emergencies Review

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1

Emergency Scenarios

- Be Prepared!
- Know Signs & Symptoms
- Know what is happening: the pathophysiology of the emergency
- Know the treatment: drugs, dose, sequence of actions
- And…

2

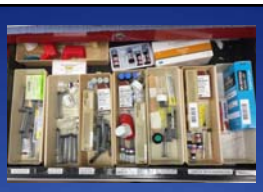
Practice, rehearse, drill!!!

3

The Emergency Cart:

- Organize by condition with written treatment, not A to Z


4



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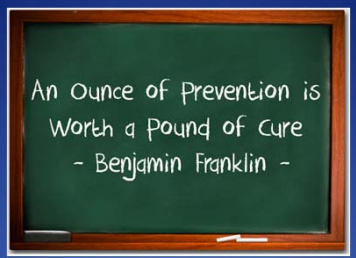


6

Never Treat a Stranger!

- Always take and record a thorough medical history
- Fax the patient's primary physician for concerns, using form
- "Time Out"

7

Emergencies to know:

- Laryngospasm
- Bronchospasm
- Airway obstruction
- Emesis/aspiration
- Respiratory Depression/Arrest
- Angina Pectoris
- Myocardial Infarction

(continued on next slide →)

8

Emergencies to know: (continued)

- Hypertension
- Hypotension
- Cardiac Dysrhythmias: non arrest & arrest
- Syncope
- Seizures
- Hypoglycemia
- Mild allergic reactions
- Severe allergic reactions: anaphylaxis

9

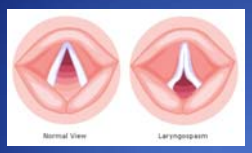
Symptoms:

- Little or no air movement
- Decreased O_2 Saturation
- "Crowing" or stridor
- Labored Respiratory effort
- Suprasternal notch retraction

What is the diagnosis?

10

Laryngospasm



- Pathophysiology
- Protective reflex closure of vocal cords that attempts to prevent passage of foreign matter, such as blood or saliva, into the larynx, trachea & lungs

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Laryngospasm

- Treatment
- 100% oxygen
- Pack off surgical site
- Suction oropharynx
- Positive pressure O_2
- Succinylcholine (10-20 mg) IV
- Support respiration

- Prevention
- Throat packs
- Effective suctioning
- Head position
- Careful titration

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Symptoms:

- Labored breathing, difficulty with expiration
- Decreased O_2, increased CO_2
- Wheezing
- Increasing resistance to ventilation
- Cyanosis of skin & mucous membranes

What is the diagnosis?

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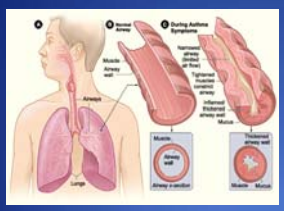
Bronchospasm



- Pathophysiology
- Generalized contraction of smooth muscles of the bronchioles due to asthma, an allergic reaction or chemical irritation (emesis with aspiration)

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Bronchospasm

- Treatment
- Beta 2 agonist drugs: Albuterol (inhaler)
- Epinephrine 1:1000 (little ampule) .3mg SQ or IM
- Consider steroid

- Prevention
- Keep a dry field
- Pre-operative inhaler puffs
- Avoid histamine releasing drugs (Demerol)
- Careful with Brevital

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Albuterol Nebulizer:

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Airway Obstruction

- Signs & Symptoms
- Stridor, wheezing
- Use of accessory breathing muscles
- Decreased O_2 saturation
- Cyanosis
- Pathophysiology
- Complete or partial blockage of the airway resulting in insufficient gas exchange

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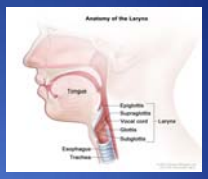
Airway Obstruction

- Treatment
- Conventional methods first
- Intubation
- Cricothyrotomy
- Tracheostomy
- Prevention
- Appropriate head position
- Count throat packs
- Adequate suction
- Good visualization

18

Did he swallow it?



ALWAYS GET A CHEST X-RAY!

19

Symptoms:

- Retching
- Large amounts of fluid in throat
- Gurgling sounds
- Signs of airway obstruction
- Wheezing

What is the diagnosis?

20

Emesis/Aspiration

- Pathophysiology
- Vomiting when the patient has depressed or absent laryngeal reflexes which may allow stomach contents to enter the lungs
- Acidic stomach contents digest and irritate the walls of the alveoli resulting in bronchospasm

21

Emesis/Aspiration

- Treatment
- Tonsil suction (rubber tip)
- Trendelenburg position on the right side
- 100% O_2
- Visualize with laryngoscope and remove large particles with Magill forceps
- If wheezing, treat as bronchospasm
- Possible intubation

- Prevention
- ASA - NPO standards: Solid food 6 hrs. before anesthesia. Most surgeons prefer 8 hrs.
- Clear liquids 2 hrs. before.

22

Symptoms:

- Decreased respiration: rate and depth (dyspnea) or absence of breathing (apnea)
- Mental clouding, drowsiness
- Low O_2 saturation
- Skin: pallor and ultimately cyanosis
- Loss of consciousness

What is the diagnosis ?

23

*

Respiratory Depression

- Pathophysiology
- Decreased normal breathing rate and/or volume
- In anesthesia, secondary to narcotics (Fentanyl) and/or benzodiazepines, (Versed, Valium)

24

Respiratory Depression

- Treatment
- Supine position
- Airway and Oxygen
- Reposition head: head tilt/chin-lift
- Naso/oropharyngeal airway
- Narcan (naloxone 0.4-2 mg IV, repeat 2-3 min
- Flumazenil (Romazicon) 0.2 mg IV over 15 sec. initially, then .1 mg/min up to 1 mg.

- Prevention
- Titrate sedative and narcotic medications
- If respiratory depression occurs after a seizure or local anesthetic overdose, support airway and provide positive pressure O_2 prn

25

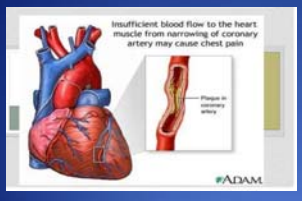
Symptoms:

- Pressure-like chest pain
- Pain radiates to arm, shoulder, neck, mandible or teeth
- Relieved by nitroglycerin

What is the diagnosis?

26

Angina Pectoris



- Pathophysiology
- Narrowing of coronary artery from plaques, depriving cardiac musculature of oxygen
- Commonly occurs in times when heart needs more oxygen as with emotional distress or exercise

27

Angina Pectoris

- Treatment
- Terminate surgery
- Suction, pack surgical site
- 100% O_2 by mask
- Semi-sitting position-Loosen clothing
- Nitroglycerin sublingually (tablet or spray) – may repeat every 5 minutes X 3, if no improvement, assume MI
- Monitors
- Call 911
- MONA
- Prevention
- Patient's History
- Oral premedication or sedation
- 100% O_2 during surgery
- Profound local anesthesia
- Pre-operative nitroglycerin

28

Myocardial Infarction

- Signs & Symptoms
- Chest pain not relieved by nitroglycerin
- Sweating, pallor
- Nausea
- Arm, shoulder or jaw pain
- Hypotension
- Cardiac dysrhythmias
- Pathophysiology
- Necrosis or death of heart muscle precipitated by decreased oxygenation from partial or complete blockage of blood flow in the coronary arteries

29

Myocardial Infarction

- Treatment
- Terminate surgery
- 100% Oxygen
- Place patient in comfortable position, loosen clothing
- Call 911
- Monitor vital signs
- Establish IV
- MONA
- Prevention
- Thorough medical history
- 100% O_2 throughout procedure
- Oral premedication or sedation
- Profound local anesthesia

30

Hypertension

- Treatment
- Terminate procedure
- Place patient in comfortable position and loosen tight clothing
- Pain control-reinject if under anesthesia
- 100% O_2
- Beta blocker (Labetalol) or vasodilator (Hydralazine)
- Prevention
- Thorough medical history
- MD consultation and medication adjustment when necessary
- Maintain anti-hypertensive medications
- Profound local anesthesia
- Consider sedation

31

Hypotension

- Signs & Symptoms
- Pallor
- Dizziness
- Weakness
- Nausea
- Tachycardia
- BP drop > 20%
- Pathophysiology
- Abnormally low arterial blood pressure (<90/60)
- Pooling of blood in extremities and abdomen

32

Hypotension

- Treatment
- Terminate procedure
- Attempt to determine cause
- 100% O_2
- Supine or Trendelenburg position
- Fluid challenge
- Vasoconstriction and increase rate and force of cardiac contraction: ephedrine or phenylephrine
- Prevention
- Titrate doses of anesthetic and sedative medications and avoid excessive doses, especially in the elderly
- Avoid stress
- Avoid rapid positional changes
- Recognize dehydration

33

- Signs & Symptoms
- Dizziness
- Weakness
- Fatigue
- Shortness of breath
- Chest pains
- Confusion

- Pathophysiology
- Abnormally slow heart rate such that inadequate perfusion results

What is the diagnosis?

34

Bradycardia

- Treatment
- Terminate procedure
- 100% O_2
- Monitor vital signs
- Atropine .5 mg every 3-5 minutes

- Prevention
- Consider medical history
- Appropriate consultation
- Appropriate anesthetic

35

- Signs & Symptoms
- Palpitations (racing feeling in heart)
- Chest pain
- Dizziness or lightheadedness
- Sweating
- Pounding pulse

- Pathophysiology
- Abnormally fast heart rate with EKG showing regular narrow complex tachycardia (150-250 bpm) which decreases ventricular filling time. Ultimately, cardiac output falls.

What is the diagnosis?

36

Supraventricular Tachycardia

- Treatment
- Terminate procedure
- 100% O_2
- Monitor Vital Signs
- Try Vagal Maneuvers
- Adenosine 6 mg IV
- Prevention
- Consider medical history
- Appropriate consultation
- Appropriate anesthetic

37

- Signs & Symptoms
- Dizziness
- Fatigue
- Chest pain
- Shortness of breath
- Pallor
- Hypotension
- Tachypnea
- Pathophysiology
- Results from a single ectopic focus in the ventricles that sometimes creates a re-entry circuit in the ventricles
- May also be caused by problems with ventricular repolarization (possibly from scar tissue from previous MI)
- Wide complex tachycardia

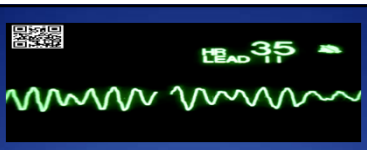
What is the diagnosis?

38

Ventricular Tachycardia

- Treatment
- Terminate procedure
- 100% O_2
- Monitor Vital Signs
- Call 911
- If stable: consider medications: Procainamide, Amiodarone or Sotalol
- If unstable, treat as ventricular fibrillation: defibrillate
- Prevention
- Consider medical history
- Appropriate consultation
- Appropriate anesthetic

39



- Signs & Symptoms
- Loss of consciousness
- No pulse
- Possibly earlier symptoms of chest pain, dizziness, nausea

What is the diagnosis?

- Pathophysiology
- Chaotic electrical signals/multiple ectopic foci arising from heart
- The heart is no longer beating. It is only quivering.
- No cardiac output

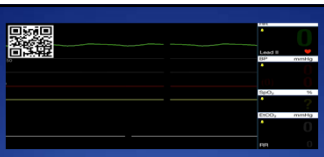
40

Ventricular Fibrillation

- Treatment
- Call 911
- Start chest compressions while obtaining AED (CPR)
- Apply shock from AED to defibrillate
- Epinephrine 1 mg
- Continue CPR
- ACLS

- Prevention
- Consider medical history
- Appropriate consultation
- Appropriate anesthetic

41



- Signs & Symptoms
- Loss of consciousness
- No pulse
- Possibly earlier symptoms of chest pain, dizziness, nausea

What is the diagnosis?

- Pathophysiology
- No electrical activity in the heart
- Cannot be treated with defibrillation

42

Asystole

- Treatment
- CPR
- Call 911
- Place monitors
- ACLS
- Establish IV
- Epinephrine 1 mg
- Intubate
- Prevention
- Consider medical history
- Appropriate consultation
- Appropriate anesthetic

43

What is the diagnosis?

44

Syncope

- Signs & Symptoms
- Disorientation, Dizziness
- Pallor
- Nausea
- Sweating
- Very slow pulse
- Low BP
- Pathophysiology
- Slow heart rate results in low cardiac output, causing these symptoms
- Vasovagal

45

Syncope

- Treatment
  - Terminate Procedure
  - Pack off surgical site
  - Trendelenburg
  - Monitor BP and pulse
  - 100% Oxygen
  - Cool cloth on head
  - Possible ammonia inhalant
  - Consider Atropine .4 mg IV
- Prevention
  - Patient positioning
  - Stress reduction
  - Oral premedication

46

Seizures

- Signs & Symptoms
  - Change in sense of smell, sight, sound ("aura")
  - Loss of consciousness
  - Muscle spasm and flailing
  - Tonic/clonic jerking
- Pathophysiology
  - Aberrant electrical discharge in the brain which stimulates various motor nerves

47

Seizures

- Treatment
  - Most require no medication
  - Protect patient from injury
  - Protect tongue if you can
  - If prolonged: Valium or Versed IV or Versed IM
  - Support airway prn
  - 100% O_2 if possible
- Prevention
  - Check drug levels (Dilantin)
  - Valium premedication
  - Avoid hypoxia
  - Monitor dose of local anesthetic

48

This diabetic patient is NPO and took his dose of insulin.

If not treated, symptoms of tachycardia, loss of consciousness & seizures.

What is the diagnosis?

49

Hypoglycemia

- Pathophysiology
- Possible etiology: patient takes a normal insulin dose but has no oral intake, such as fasting prior to surgery
- When glucose drops below the critical level for brain function, the patient looses consciousness

50

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Hypoglycemia

- Treatment
- Conscious patient
  - High sugar beverages/food
- Unconscious patient
  - 50% dextrose solution IV
  - Glucagon IM
- Prevention
- Careful patient history
- Watch time of day for surgery
- Check patient's blood sugar
- Intravenous dextrose infusion

51

This patient was administered penicillin 1 hour ago.

What is the diagnosis?

52

Anaphylaxis (severe allergic reaction)

- Signs & Symptoms
- Skin rash, flushing, hives, itching
- Shortness of breath, wheezing,
- Hypotension
- Nausea
- Coughing
- Labial swelling

- Pathophysiology
- Systemic release of chemical mediators of allergic response: particularly histamine

53

Anaphylaxis (severe allergic reaction)

- Treatment
- Stop administration of all drugs
- Epinephrine
  - 1:1000 dilution .3-.5 cc SQ or IM
- Benadryl: 25-50 mg IV or IM
- Corticosteroids
- Early intubation
- 911

- Prevention
- Thorough medical history with details of previous reaction

54

Mild Allergic Reaction

- Signs and Symptoms
- Rash, itching
- Mild swelling of eyes or mouth

- Pathophysiology
- Systemic release of chemical mediators of allergic response: particularly histamine

55

Mild Allergic Reaction

- Treatment
- Benadryl 25-50 mg. P.O or I.M
- Corticosteroids

- Prevention
- Accurate history
- Careful administration of medications

56

This Concludes

Office Anesthetic Emergencies Review

California Association of Oral & Maxillofacial Surgeons
Oral & Maxillofacial Surgery Assistant's Course

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