CE Course Handout

“Un-break My Heart” An Overview of Cardiovascular Disease, Dental Considerations and Patient Care Planning

June 15th, 2017
Program Learning Objectives

Upon successful completion of this program, participants will be able to:

- List the different classes of antihypertensive agents including pharmacologic effects and adverse reactions.
- Define coronary artery disease and review the classes of medications used to treat it.
- List the categories of drugs used to treat high cholesterol including pharmacologic effects, adverse reactions and dental implications.
- Discuss the mechanism of action of anticoagulants and antiplatelet agents including their adverse reactions and patient care considerations.
- Describe the various antiarrhythmic agents.
- Discuss congestive heart failure and the pharmacologic effects and adverse reactions of cardiac glycosides.
- Describe the various dental treatment modifications necessary for patients with cardiovascular disease.

Cardiovascular Disease

The cardiovascular system is comprised of the heart and blood vessels.

- The function of the cardiovascular system is to supply oxygen via the blood to all areas of the body.
- This is accomplished through the contraction of the heart and actions of the blood vessels.
Cardiovascular Disease

As the demand for oxygen increases, the heart and blood vessels compensate.

- Cardiac force and rate of contraction increase to pump larger volumes under higher pressure.
- Blood vessels contract or dilate to direct blood flow to the areas requiring more oxygen.

Cardiovascular Disease

The cardiovascular system fails when the heart and/or blood vessels fail to provide sufficient oxygen to meet the demand.

- The heart may not contract sufficiently or pump efficiently.
- Blood vessels may become blocked.

Cardiovascular Disease

Cardiovascular disease refers to disease of the heart and blood vessels that result in this failure.

- Hypertension
- Coronary Artery Disease
- Cardiac Arrhythmia
- Congestive Heart Failure

Cardiovascular Disease

Cardiovascular disease is complicated by the presence of co-morbid diseases, such as diabetes and hyperlipidemia.

- Uncontrolled hyperglycemia and hyperlipidemia promote atherosclerosis which results in:
  - Cardiovascular disease
    - Interference with vessel blood flow
  - Thromboembolic disorders

Conundrum #1

With dental treatment, we must weigh the benefits of therapy against the risk of medical complications.

- Patients with cardiovascular disease are at higher risk for medical complications due to the nature of the disease and medications used in treatment.
- Patients with periodontal disease may be at higher risk for thromboembolic events.
Conundrum #2
With dental treatment, we must weigh the potential stress induced by the therapy against the patient’s ability to withstand it.

- Patients with cardiovascular disease have reduced functional reserve and are less able to respond to stressful situations, including dental treatment.

Conundrum #3
With local anesthesia, the benefits of using epinephrine must be weighed against the associated cardiovascular risk.

- In patients with cardiovascular disease, we must weigh the adverse effects of an absorbed dose of epinephrine against the adverse effects of elevated local anesthetic blood levels.

Conundrum #4
With anti-thromboembolic agents, the benefits of continuation of therapy must be weighed against the associated risk of bleeding.

- In patients with thromboembolic disorders, we must weigh the adverse effects of continuing therapy during surgical procedures against the adverse effects of temporarily discontinuing therapy.

Hypertension

- Hypertension
  - Most common cardiovascular disease in USA
  - Principle cause of death in 40,000 annually
  - Contributory cause of death in 200,000 others

- Types of hypertension
  - Essential hypertension (80-90% of all cases)
    - Unknown etiology (?)
  - Secondary hypertension
    - Known etiology (renal disease, drug induced)

- Hypertension
  - A failure in fluid volume homeostasis in the renin-angiotensin-aldosterone system in the kidneys
  - Causes the volume of blood being pumped to exceed the capacity of the cardiovascular system.
  - Results in high blood pressure (augmented by SANS stimulation)
Renin-Angiotensin-Aldosterone System

Reduced blood flow to kidneys → Renin release → Activation of angiotensinogen → Angiotensin I → ACE → Angiotensin II → Powerful vasoconstriction → Angiotensin III → Aldosterone release → Retention of salt and water → Increased blood pressure → Increased blood flow to the kidneys

Sympathetic Autonomic Nervous System

Receptor | Stimulation by (nor)epinephrine produces:
---|---
α₁ | Vasoconstriction (skin and mucosa)
β₁ | Increased cardiac activity
β₂ | Vasodilation (skeletal muscle) Bronchodilation

Treatment of Hypertension

- Non-pharmacologic treatment of hypertension
  - Reduce weight
  - Limit alcohol consumption
  - Increase aerobic physical activity
  - Restrict sodium intake
  - Stop smoking

- Pharmacologic treatment of hypertension
  - Goal of Treatment: Reduce plasma volume
    - Drugs Employed: Diuretics
  - Dilate blood vessels: ACEI's, ARB's, CCB's, Alpha-1 Blockers
  - Reduce cardiac output (via SANS): Beta-1 Blockers, clonidine

Focus on Agents And Their Dental Considerations
### Diuretics

<table>
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<tr>
<th>Category</th>
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<th>Action</th>
<th>Diseases Treated</th>
<th>Adverse Effects</th>
<th>Patient Care Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiazide Diuretics</td>
<td>HCTZ</td>
<td>Reduce plasma volume, systemic blood pressure</td>
<td>Hypertension, Congestive Heart Failure</td>
<td>NSAIA’s decrease effectiveness</td>
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<tr>
<td></td>
<td>Lasix</td>
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<tr>
<td>Loop Diuretics</td>
<td>Hydrochlorothiazide</td>
<td>Reduce heart failure, orthostatic hypotension</td>
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<td>Aldactone</td>
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<tr>
<td>K-sparing Diuretics</td>
<td>Triamterene</td>
<td>Reduce heart failure</td>
<td>Hypertension, Congestive Heart Failure, hypokalemia (with or without K-sparing diuretics)</td>
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<tr>
<td>Combo Diuretics</td>
<td>HCTZ (Dyazide)</td>
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### RAAS Antihypertensive Agents

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<tr>
<th>Category</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ACE Inhibitors (ACEI’s)</td>
<td>Enalapril (Vasotec)</td>
<td>Reduce systemic vasodilation</td>
<td>Hypertension, Congestive Heart Failure</td>
<td>Orthostatic hypotension</td>
<td>NSAIA’s decrease effectiveness</td>
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<tr>
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<td>Ramipril (Altace)</td>
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<tr>
<td>Angiotensin II Receptor Blockers (ARB’s)</td>
<td>Losartan (Du��al)</td>
<td>Reduce systemic vasodilation</td>
<td>Hypertension, Congestive Heart Failure</td>
<td>Orthostatic hypotension, Headache</td>
<td>NSAIA’s decrease effectiveness, Not to be used in pregnancy</td>
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<tr>
<td></td>
<td>Irbesartan (Avapro)</td>
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### Calcium Channel Blockers

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<th>Category</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Calcium Channel Blockers (CCB’s)</td>
<td>Amlodipine (Norvasc)</td>
<td>Reduce vasodilation, reduce heart rate, cardiac activity</td>
<td>Hypertension, Angina, Mild to moderate CHF only, Cardiac Arrhythmia</td>
<td>Orthostatic hypotension, Constipation</td>
<td>No interaction with NSAIA’s, Possible gingival enlargement, Dysgeusia</td>
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<td>Diltiazem (Cardizem)</td>
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<td>Nifedipine (Procardia)</td>
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### Autonomic Antihypertensive Agents

#### Beta-1 Blockers

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<th>Category</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Cardioselective</td>
<td>Metoprolol ER (Toprol XL)</td>
<td>Reduce heart rate, force of contraction and cardiac activity</td>
<td>Hypertension, Angina, Mild to moderate CHF only, Cardiac Arrhythmia</td>
<td>Depression, Fatigue, Increased sensitivity to cold, Erectile dysfunction</td>
<td>Epinephrine may produce hypertensive effect with non-cardioselective beta blockers, Beta-blockers may mask symptoms of hypoglycemia in diabetic patients</td>
</tr>
<tr>
<td>Non-Cardioselective</td>
<td>Propranolol (Inderal)</td>
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#### Alpha-1 Blockers

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</thead>
<tbody>
<tr>
<td>Alpha-2 Agonists</td>
<td>Clonidine (Catapres)</td>
<td>Reduce SANS output</td>
<td>Hypertension</td>
<td>Xerostomia, Orthostatic hypotension, Broncho-constriction</td>
<td>Also used in managing withdrawal symptoms, Migraine prophylaxis, ADHD</td>
</tr>
</tbody>
</table>
Coronary Artery Disease

- Coronary Artery Disease
  - Atherosclerosis of the coronary arteries
    - Results from a combination of hypertension and hyperlipidemia
    - Oxygen demand of the myocardium is increased
    - Blood flow (and oxygen supply) to the myocardium via the coronary arteries is impeded and reduced

- Angina Pectoris
  - The metabolic demand for oxygen of the myocardium exceeds the ability of the coronary arteries to supply it
  - Symptoms include pain and discomfort in chest radiating to left arm, neck, back and lower jaw
  - Precipitated by
    - Physical exertion
    - Emotional stress
    - Nothing at all!

- Myocardial Infarction
  - The myocardium tissue is permanently deprived of oxygen and becomes necrotic
  - Results in death of myocardial tissue which is replaced by non-contractile, non-conductive scar tissue
  - Often leads to arrhythmias

Treatment of CAD

- Pharmacologic treatment of CAD
  - Goal of Treatment
    - Increase coronary artery flow
    - Reduce oxygen demand
    - Inhibit progression of disease
    - Prevent thromboembolism
  - Drugs Employed
    - Nitrates, CCB's
    - Beta-1 Blockers
    - Antihyperlipidemic Agents
    - Antithromboembolic Agents

Focus on Agents And Their Dental Considerations
Nitrates

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>NTG</td>
<td></td>
<td></td>
<td>Produce systemic and coronary vasodilation</td>
<td>Angina, Headache</td>
<td>Keep sublingual, translingual NTG readily available during appointment, check expiration date of patient NTG to ensure potency</td>
</tr>
<tr>
<td>Oral nitrates</td>
<td></td>
<td>Isosorbide dinitrate (Isordil)</td>
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<tr>
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<td></td>
<td>Isosorbide mononitrate (Imdur)</td>
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Antihyperlipidemic Agents

- Low-density lipoproteins (LDL’s)
  - Transport cholesterol to peripheral cells
  - Excess cholesterol is discarded into the blood
    - Leads to high cholesterol
    - Leads to atherosclerotic plaque formation
- High-density lipoproteins (HDL’s)
  - Transfer cholesterol from peripheral cells to liver
  - Cholesterol is metabolized in liver and excreted

Antihyperlipidemic Agents

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<tr>
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<tbody>
<tr>
<td>HMG-CoA Reductase Inhibitors (“statin”)</td>
<td>Atorvastatin (Lipitor), Simvastatin (Zocor), Pravastatin (Lipobay), Rosuvastatin (Crestor)</td>
<td>Inhibit enzyme necessary in the formation of cholesterol</td>
<td>Myopathy, Possible liver damage, Gastrointestinal upset, Anterograde amnesia</td>
<td>Liver enzyme inhibitors increase statin blood levels and increase adverse effects, Azole antifungals (Diflucan), Macrolide antibiotics (Biaxin), Grapefruit juice, Pomegranate juice, Constipation, Flatulence, Decrease LDL’s</td>
</tr>
<tr>
<td>Bile Acid Sequestrants</td>
<td>Cholestyramine (Questran)</td>
<td>Decrease production of LDL’s</td>
<td>Constipation, Flatulence, Decrease LDL’s, Abdominal pain, Diarrhea, Increase HDL’s, Increase levels of plasma protein bound drugs</td>
<td></td>
</tr>
<tr>
<td>Fibrates</td>
<td>Fenofibrate (Tricor, Antara)</td>
<td>Decrease triglycerides</td>
<td>Fatigue, Headache, Cough, Myopathy</td>
<td></td>
</tr>
<tr>
<td>Nicotinic Acid Derivatives</td>
<td>Niacin (Niaspan)</td>
<td>Decrease triglycerides, Increase HDL’s</td>
<td>Orthostatic hypotension, Flush, Gastrointestinal upset, Possible liver toxicity, Used illicitly to “flush” positive urine drug tests</td>
<td></td>
</tr>
<tr>
<td>Cholesterol absorption blockers</td>
<td>Ezetimibe (Zetia)</td>
<td>Decrease absorption of cholesterol from food</td>
<td>Fatigue, Headache, Cough, Possible myopathy</td>
<td></td>
</tr>
</tbody>
</table>

Thromboembolic Disease

- Coagulation
  - A normal clotting mechanism which prevents blood loss when the integrity of a blood vessel is disrupted
- Hypercoagulation
  - An abnormally overactive clotting mechanism which produces clots (thrombi) within undamaged vessels
    - Arterial thrombi produce stroke, MI, death
    - Venous thrombi produce deep vein thrombosis and pulmonary embolism
Oral Antiplatelet Agents

- Types
  - aspirin
  - clopidogrel (Plavix)
  - dipyridamole (Persantine)
  - prasugrel (Effient)
  - ticagrelor (Brilinta)

- Uses
  - Prevention of cardiovascular events in adults with
    - Acute coronary syndrome
    - Recent MI, TIA, stroke
    - Post-stenting

Dental considerations
- Drug interactions with liver enzyme inducers and inhibitors (Plavix and Brilinta)
- Increased risk of bleeding may be exacerbated by other drugs used in dentistry
  - NSAIA’s
  - Antibiotics
- No contraindication for dental treatment

Plavix (clopidogrel)

- Pharmacologic Classification
  - Platelet aggregation inhibitor

- Mechanism of Action
  - Inhibits binding of ADP to platelet receptors, inhibits formation of thrombi

- Therapeutic Indication
  - Treatment of MI, stroke, PVD
  - Treatment of acute coronary syndrome
  - Prevention of thrombosis post-stent placement

Adverse Effects
- Skin rash
- Epistaxis, bruising
- GI upset
- Stomatitis, dysgeusia

Dental Considerations
- Avoid discontinuation for dental procedures due to increased risk of thromboembolism
- Use NSAIA’s with caution
- Consider local hemostasis measures

Precautions
- Active liver disease
- Active bleeding

Oral Anticoagulant Agents

- Types
  - Coumadin (warfarin)
    - Inhibits the synthesis of Vitamin K-dependent clotting factors

- Uses
  - Prevention and treatment of venous thrombosis, pulmonary embolism, thromboembolism due to
    - Atrial fibrillation
    - Prosthesis
    - Recent MI
Oral Anticoagulant Agents

- Patient care considerations
  - Increased risk of bleeding
    - Assessed by INR
      - INR (international normalized ratio)
        - Value of 1 is "normal"
        - Value of <3.5 is needed for dental treatment
      - INR test should be done immediately before oral treatment

Oral Anticoagulant Agents

- Dental considerations
  - Anticoagulant effect may be reversed with administration of Vitamin K or whole blood
  - Increased risk of bleeding may be exacerbated by other drugs used in dentistry
    - NSAIA’s
    - Antibiotics
  - No contraindication for dental treatment!

Oral Anticoagulant Agents

- Types
  - Pradaxa (dabigatran)
    - Inhibits thrombin (factor IIa)

- Uses
  - Prevention and treatment of venous thrombosis, pulmonary embolism, thromboembolism due to atrial fibrillation

Oral Anticoagulant Agents

- Types
  - Xarelto (rivaroxaban)
  - Eliquis (apixaban)
  - Savaysa (edoxaban)
    - Inhibit factor Xa

- Uses
  - Prevention and treatment of venous thrombosis, pulmonary embolism, thromboembolism due to atrial fibrillation

Oral Anticoagulant Agents

- Patient care considerations
  - Antidote for reversal : Praxbind
    - No INR testing for monitoring
  - Increased risk of bleeding may be exacerbated by other drugs used in dentistry
    - NSAIA’s
    - Antibiotics
  - No contraindication for dental treatment!
Cardiac Dysrhythmia

- Malfunction of cardiac conduction system
- Disruption of normal cardiac sinus rhythm
- May cause too-fast or too-slow heart beat
- Results in poor oxygenation of blood and cardiac insufficiency and inefficiency
- May ultimately lead to death

Treatment of Cardiac Dysrhythmias

- Pharmacologic treatment of cardiac dysrhythmia

**Goal of Treatment**
- Restore sinus cardiac rhythm
- Prevent thromboembolism

**Drugs Employed**
- Antiarrhythmic Agents
- Antithromboembolic Agents

Antidysrhythmic Agents

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Potassium Channel Blockers</td>
<td>amiodarone (Cordarone)</td>
<td>Reduce cardiac arrhythmias</td>
<td>Cardiac Arrhythmia</td>
<td>Abnormal salivation, Altered taste</td>
<td>Local anesthetics with epinephrine may have additive cardiac effects</td>
</tr>
<tr>
<td></td>
<td>dromedarine (Mullag)*</td>
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<tr>
<td></td>
<td>quinidine</td>
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<tr>
<td>Sodium Channel Blockers</td>
<td>Type IA quinidine</td>
<td>Reduce cardiac arrhythmias</td>
<td>Cardiac Arrhythmia</td>
<td>Type IA Xerostomia, Oral candidiasis</td>
<td>Local anesthetics with epinephrine may have additive cardiac effects</td>
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<tr>
<td></td>
<td>Type IB lidocaine</td>
<td></td>
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<td>Type IB Altered taste</td>
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<td>Type IC bepridil (Tambocor)</td>
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<td>Type IC Nausea</td>
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Focus on Agents And Their Dental Considerations

Congestive Heart Failure
Congestive Heart Failure (CHF)

- Congestive Heart Failure
  - The systemic demand for blood (and oxygen) exceeds the pumping capacity of the heart
  - Inadequate cardiac output to supply oxygen to the body (including the heart itself)
  - Leads to decreased perfusion of other organs and decreased function
    - Decreased liver function
    - Decreased renal function

Treatment of CHF

- Pharmacologic treatment of CHF

<table>
<thead>
<tr>
<th>Goal of Treatment</th>
<th>Drugs Employed</th>
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<tbody>
<tr>
<td>Reduce plasma volume</td>
<td>Diuretics</td>
</tr>
<tr>
<td>Dilate blood vessels</td>
<td>ACEI's, ARB's, CCB's</td>
</tr>
<tr>
<td>Reduce contraction rate</td>
<td>Beta-1 Blockers</td>
</tr>
<tr>
<td>Increase cardiac contractility</td>
<td>Digoxin</td>
</tr>
<tr>
<td>Prevent thromboembolism</td>
<td>Antithromboembolic Agents</td>
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Agents Used to Treat CHF

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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Glycosides</td>
<td>Digoxin (Lanoxin)</td>
<td>Increase force of, decreases rate of, cardiac contraction</td>
<td>Congestive Heart Failure</td>
<td>Anorexia</td>
<td>Use epinephrine with caution (increased risk of cardiac arrhythmia)</td>
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<td></td>
<td>Cardiac Arrhythmia</td>
<td>Hyper-salivation</td>
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<td>Increased gag reflex</td>
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<td>Visual disturbances</td>
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Focus on Agents And Their Dental Considerations

Breaking Through The Cardiovascular Disease-Induced Dental Clinical Conundrums

Solving Conundrum #1…

(Is Today a Bad Day?)
Patient Assessment

Obtain and update a complete medical history at each appointment.

- Assess the status of any cardiovascular system disease as well as the patient's overall health.
- Identify serious cardiovascular conditions and any recent changes in signs and symptoms
- Determine need for cardiac consultation

Physical Evaluation

Perform a physical evaluation of the patient, including determination of vital signs, at each appointment.

- The four "vital" signs
  - Blood pressure
  - Pulse
  - Height
  - Weight

Physical Evaluation

Physical evaluation of the patient should be based on the American Society of Anesthesiologists (ASA) classification

- ASA classification organizes patients into categories of health
- We can associate appropriate patient management considerations with each category

Physical Evaluation

- ASA Classification
  - Class 1
    - Healthy patient with no current medical problems
    - Patient management considerations
      - Can receive routine dental treatment and local anesthesia usually without issue
      - No treatment modifications necessary

Physical Evaluation

- ASA Classification
  - Class 2
    - Patient with mild to moderate systemic illness
    - Patient management considerations
      - Consider stress reduction techniques
      - Consider limiting duration of treatment per appointment

Physical Evaluation

- ASA Classification
  - Class 3
    - Patient with severe systemic disease that is incapacitating but not life-threatening
    - Patient management considerations
      - Stress reduction techniques necessary
      - Medical consultations necessary
Physical Evaluation

- **ASA Classification**
  - Class 4
    - Patient with severe systemic disease that limits activity and threatens life
  - Patient management considerations
    - Elective care contraindicated
    - Emergency care in acute care setting

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Physical Evaluation

- **ASA Classification**
  - Class 5
    - Patient not expected to survive the next 24 hours
  - Patient management considerations
    - Usually hospitalized
  - Class 6
    - Clinically dead but life support maintained for organ donation
  - Patient management considerations
    - None

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Solving Conundrum #2…

Is Any Day a Good Day?

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Physical Evaluation

Determine if medical history and physical evaluation findings represent contraindications to dental treatment.

- Severe hypertension (blood pressure ≥ 180/110)
- Recent history of MI
- Uncontrolled CHF and low functional reserve
- Unstable angina pectoris

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Physical Evaluation

Determine patient’s “functional reserve” to estimate risk of exacerbation of cardiovascular disease resulting from oral healthcare procedures.

- Metabolic equivalents (METs)
  - Used to estimate a patient’s functional reserve, the physical and emotional ability to withstand stress induced by dental procedures

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Physical Evaluation

- Metabolic equivalents (METs)
  - 1 MET
    - Complete light housework
    - Walk a block on level ground at 2-3mph
  - 4 METs
    - Climb a flight of stairs, walk up a hill
    - Walk on level ground at 4mph
    - Run a short distance
  - 10 METs
    - Strenuous sport activities

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Physical Evaluation

Patients who cannot perform one or more 4-MET activities should be referred for medical consultation.

- Risk of exacerbation of pre-existing cardiovascular disease is increased in patients with decreased functional reserve.
  - ASA Class 3 or 4

Solving Conundrum #3…

Ask The Epinephrine Question

Considerations with Epinephrine

The side effects of epinephrine absorption must be weighed against the side effects of absorbed local anesthetic.

- Epinephrine may cause adverse effects in patients with pre-existing cardiovascular disease.
- However, rapid absorption of local anesthetic may result in adverse effects as well

Considerations with Epinephrine

The benefit of using epinephrine to achieve profound anesthesia may outweigh the risk in patients with controlled cardiovascular disease.

- Pain-induced stress leads to the release of endogenous epinephrine.
- This may exacerbate cardiovascular disease.

Considerations with Epinephrine

If the patient is cleared for treatment, then epinephrine should be used in the lowest possible effective concentration.

- Use of epinephrine is contraindicated in situations of severe uncontrolled cardiovascular disease.
- However, these situations in themselves are contraindications to elective dental treatment!

Considerations with Epinephrine

The dose of epinephrine in a dental cartridge is far less than that used in treating anaphylaxis.

- However, epinephrine should be avoided in:
  - Patients with uncontrolled hypertension
  - Patients with uncontrolled hyperthyroidism
  - Patients with severe uncontrolled cardiac disease
  - Patients receiving non-specific beta blockers, tricyclic antidepressants and MAO inhibitors
Considerations with Epinephrine

In normal healthy patients, the maximum recommended dose of epinephrine is 0.2 mg per appointment, or 11 cartridges of 1:100,000 dilution.

In patients with clinically significant cardiovascular impairment, the maximum recommended dose of epinephrine is 0.04 mg per appointment, or 2 cartridges of 1:100,000 dilution.

1:50,000 dilution = 1 cartridge
1:100,000 dilution = 2 cartridges
1:200,000 dilution = 4 cartridges

Solving Conundrum #4…

Ask The Antithromboembolic Question

There is a widespread belief that oral anti-thromboembolic therapy must be discontinued before dental treatment to prevent serious hemorrhagic complications.

- However, dental treatment rarely involves trauma to major blood vessels
- Local hemostatic measures exist in dentistry (aminocaproic acid or tranexamic acid oral rinse)

The potential for excessive bleeding with continuation of therapy must be weighed against the adverse effects of discontinuation of therapy.

- Patients receiving oral antithromboembolic therapy may bleed more than what is normally encountered.
- Patients who discontinue such therapy are at greater risk for resulting hypercoagulation.

Clinical literature does not support routine discontinuation of oral antithromboembolic therapy for dental patients.

- Discontinuation of oral antithromboembolic therapy prior to dental treatment puts the patient at unnecessary risk for severe morbidity and mortality.