Medical Emergencies in the Dental Office

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Frequency of Emergencies

- Annually
  - Every 1.2 minutes someone dies of a sudden cardiac arrest
  - Every 20 seconds someone has a heart attack
  - Every 45 seconds someone has a stroke
  - Every 3.3 minutes someone dies from a stroke
  - Every 3 minutes someone has a seizure for the first time
  - Every 6.6 minutes someone has an anaphylactic reaction

Dental Economics, July 2007: Roberson DMD and Rothman DDS

Emergencies in Dental Office

<table>
<thead>
<tr>
<th>Type of Emergency</th>
<th>Total Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syncope</td>
<td>15,407</td>
<td>51.6%</td>
</tr>
<tr>
<td>Mild Allergic Reaction</td>
<td>2,583</td>
<td>8.7%</td>
</tr>
<tr>
<td>Angina Pectoris</td>
<td>2,552</td>
<td>8.6%</td>
</tr>
<tr>
<td>Postural Hypotension</td>
<td>2,475</td>
<td>8.3%</td>
</tr>
<tr>
<td>Seizures</td>
<td>1,595</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

JADA 112:499-501, 1986
JADA 124:40-53, 1993

Emergencies in Dental Office

<table>
<thead>
<tr>
<th>Type of Emergency</th>
<th>Total Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthmatic Attack</td>
<td>1,392</td>
<td>4.7%</td>
</tr>
<tr>
<td>Hyperventilation</td>
<td>1,326</td>
<td>4.4%</td>
</tr>
<tr>
<td>Epinephrine Reaction</td>
<td>913</td>
<td>3.1%</td>
</tr>
<tr>
<td>(Hypoglycemia)</td>
<td>890</td>
<td>3.0%</td>
</tr>
<tr>
<td>Cardiac Arrest</td>
<td>331</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

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Emergencies in Dental Office

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<tr>
<th>Type of Emergency</th>
<th>Total Number</th>
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</thead>
<tbody>
<tr>
<td>Anaphylactic Reaction</td>
<td>304</td>
<td>1.0%</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>289</td>
<td>1.0%</td>
</tr>
<tr>
<td>Local Anesthesia Overdose</td>
<td>204</td>
<td>0.7%</td>
</tr>
<tr>
<td>Acute Pulmonary Edema</td>
<td>141</td>
<td>0.5%</td>
</tr>
<tr>
<td>Diabetic Coma</td>
<td>109</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Type of Emergency</th>
<th>Total Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebrovascular Accident</td>
<td>68</td>
<td>0.2%</td>
</tr>
<tr>
<td>Adrenal Insufficiency</td>
<td>25</td>
<td>0.1%</td>
</tr>
<tr>
<td>Thyroid Storm</td>
<td>4</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>30,608</td>
<td></td>
</tr>
</tbody>
</table>

JADA 112:499-501, 1986
JADA 124:40-53, 1993
The Five Deadly Misconceptions

1. A medical emergency will not happen to me.
2. A medical emergency will not happen in the office.
3. Calling 911/EMS is the answer.
4. My staff and I won’t panic during a medical emergency.
5. CPR is all we need to know.

Prevention

• “Complete system of physical evaluation for all prospective dental patients would be capable of preventing approximately 90% of all life-threatening emergencies.”
• “When you prepare for an emergency, the emergency ceases to exist.”

5-Point Plan to Prevent Emergencies

• Use careful, routine patient assessment procedures.
• Document and update accurate, comprehensive patient records.
• Implement stress reduction protocols.
• Recognize early signs of emergency distress.
• Organize team management plan for emergency preparedness.

Information Gathering

• Ask open ended questions
• Medical History
• Medications including herbal medications
• Surgical History
• Social History
• Allergies
• Review organ systems (General, Neurological, Cardiovascular, Respiratory, Gastrointestinal, Renal, Musculoskeletal...)

Vital Signs

• Temperature
• Pulse
• Blood Pressure
• Respiratory Rate

Temperature

• Oral - 97.3 and 99.1 °F
• Fever – 98.9 °F in a.m. and 99.9 °F in p.m.
• Hyperthermia - > 104 °F
Pulse

- Normal – 60 to 100 bpm
- Tachycardia - > 100 bpm
- Bradycardia - < 60 bpm

Blood Pressure

<table>
<thead>
<tr>
<th>Blood Pressure Category</th>
<th>Systolic (mm Hg)</th>
<th>Diastolic (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>less than 120</td>
<td>less than 80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120 – 159</td>
<td>80 – 99</td>
</tr>
<tr>
<td>High Blood Pressure (Hypertension) Stage 1</td>
<td>160 – 159</td>
<td>100 – 110</td>
</tr>
<tr>
<td>High Blood Pressure (Hypertension) Stage 2</td>
<td>160 or higher</td>
<td>100 or higher</td>
</tr>
<tr>
<td>Hypertensive Crisis (Emergency care needed)</td>
<td>Higher than 180</td>
<td>Higher than 110</td>
</tr>
</tbody>
</table>

Respiratory Rate

- birth to 6 weeks: 30–60 breaths per minute
- 6 months: 25–40 breaths per minute
- 3 years: 20–30 breaths per minute
- 6 years: 18–25 breaths per minute
- 10 years: 15–20 breaths per minute
- adults: 12–24 breaths per minute

Team

- Know your team
- Know your roles
- Practice, Practice, Practice

Emergency Duties
Four-Member Dental Team

TEAM MEMBER 1: LEADER

- Directs team members
- Positions the patient and stays with him or her
- Performs “ABCs”* of cardiopulmonary resuscitation (CPR)
- Takes command and appears calm
- States instructions directly and clearly
- Requests acknowledgment from team members that instructions are understood
- Fosters open exchange among team members
- Concentrates on what is right for the patient, not who is right

TEAM MEMBER 2

- Brings emergency kit
- Brings oxygen tank and attaches appropriate delivery system
- Brings automated external defibrillator
- Assists with ABCs of CPR, including monitoring vital signs
- Checks oxygen tank regularly
- Checks emergency kit regularly
- Prepares drugs for administration
Emergency Duties
Four-Member Dental Team

TEAM MEMBER 3
• Telephones emergency medical services (9-1-1)
• Meets paramedics at building entrance
• Keeps chronological log of events
• Assists with ABCs of CPR

TEAM MEMBER 4
• Assists with ABCs of CPR
• Assists with other duties as needed

JADA 2010;141(suppl 1):8S-13S

Basic Dental Office Emergencies

• Neurologic
  o Syncope
  o Postural Hypotension
  o Cerebrovascular Accident
  o Seizure Disorder
• Respiratory Distress
  o Dyspnea
  o Hyperventilation Syndrome
  o Asthmatic Attack / Bronchospasm
  o Airway Obstruction
• Cardiovascular
  o Angina Pectoris
  o Acute Myocardial Infarction

• Blood pressure abnormalities
  o Hypertension
  o Hypotension
• Diabetes
  o Hyperglycemia
  o Hypoglycemia
• Allergic Reactions
  o Urticaria / Pruritus
  o Anaphylactic shock
  o Epinephrine reaction
  o Drug Overdose
    o Local Anesthetics
    o Sedatives/Hypnotics
    o Narcotics

Neurologic Emergencies

• Syncope
• Cerebrovascular Accident
• Seizure Disorder

Syncope
What is syncope?

• Sudden, brief loss of consciousness
• Decreased blood flow to the brain
• Pre-syncope a person may feel lightheaded

What to do if someone is fainting

• Trendelenburg
• Establish airway
• 100% Oxygen
• Apply cold compress to pts forehead
• Assess consciousness
• Monitor vital signs

Causes of syncope

• Vasovagal reaction
• Panic or anxiety attacks
• Hyperventilation
• Low blood sugar
• Irregular heart beat
• Seizures

Vasovagal reaction

• A reflex of the involuntary nervous system that causes
  – Decreased heart rate (bradycardia)
  – Vasodilation (hypotension)
    • Decreased cardiac output
    • Less blood flow to head

Common Triggers

• Sight of blood
• Having blood drawn
• Straining (bowel movement)
• Standing for extended periods
• Heat exposure

Signs/symptoms/manifestations

• Pallor - loss of color
• Sensation of warmth
• Lightheadedness
• Diaphoresis (excessive sweating – cold and clammy)
• Loss of consciousness
• Dilation of pupils
Basic Treatment

- Place patient in Trendelenburg (head down, feet up)
- Assess consciousness
- Assess Airway, Breathing, Circulation (ABC’s)

Treatment

- 100% oxygen
- Monitor vitals
- Crushed ammonia under nose
- Cold compresses to forehead or neck
- Reassure and relax pt
- Full recovery 20 minutes

Advanced Syncope

Loss of consciousness more than 5 minutes

- Vital signs unstable
- Re-consider diagnosis
  - Seizure
  - Heart Attack
  - Stroke
  - Hypoglycemia
- Activate EMS
- Start ACLS

Prevention

- Thorough history
- Stress reduction
- Pre op sedation
- Patient monitoring
- 100% oxygen
- Early recognition

Definition

- Rapid fall in blood pressure when moving from supine to upright position
  - 20 mm Hg systolic BP
  - 10 mm Hg diastolic BP

Postural (Orthostatic) Hypotension
Causes

• Blood pools in lower extremity when standing causing decreased cardiac output and subsequent hypotension, decreased blood flow to brain
• Hypovolemia
  – Dehydration
  – Blood loss
  – Anemia

Risk Factors

• Prolonged periods of reclining, positioning
• Late stage pregnancy
• Advanced age
• Venous defects in legs-Varicose veins
• Exhaustion
• Starvation
• Nitrous oxide

Symptoms/signs/manifestations

• Dizziness
• Blurred or dimmed vision
• Lightheadedness
• Fainting (extreme cases)

Treatment

• Return patient to supine of trendelenburg
• Maintain airway
• Administer oxygen may assist recovery
• Monitor pulse
• Ammonia capsules
• Cold compresses
• Reposition patient slowly after become stable

Treatment

• Activate EMS if condition worsens
  o Complete loss of consciousness
  o Unstable vital signs
• Re-evaluate diagnosis
  o Hypoglycemia
  o Seizure
  o CVA
  o Cardiac Arrest

Cerebrovascular Accident (Stroke)
12/11/2013

Definition

• Onset of a focal neurologic deficit or abnormality
• Decrease in blood flow to a specific area of the brain
• Lasts from a few minutes to hours

Types

• Cerebral thrombosis
  – Blockage in arteries
• Cerebral hemorrhage
  – Aneurysm or other weakened area of an artery that burst

Causes/Risk factors

• Thrombosis
  – High cholesterol
  – DM
  – CAD, PAD
• Hemorrhagic
  – Hypertension
  – Aneurysm
  – Illegal drug use
  – Trauma

Knowing Signs of Stroke

• Will help you act faster in response
• Minimize damage to the brain, improve chances of recovery - and even save your patient’s life

Cincinnati Stroke Scale

1. FADAL DROP: Have patient show teeth or smile
   • Facial (half of the face moves equally)
2. ARM DROP: Patient closes eyes & holds both arms out for 10 sec
   • Arm (both arms move the same or both arms do not move at all)
3. ABNORMAL SPEECH: Have the patient say, “You can’t teach an old dog new tricks.”
   • ABNORM: patient cannot words with no slurring
   • ABNORM: patient can words, use the wrong words, or is unable to speak

INTERPRETATION: If any 1 of these 3 signs is abnormal, the probability of a stroke is 72%.

Management

• Terminate procedure
• Oxygen by mask or nasal cannula
• Keep patient’s head slightly elevated
• Place patient on cardiac monitor
• Check vital signs frequently
• Activate EMS
Management - Advanced

- 250 ml bolus of normal saline (NS) or lactated Ringer’s (LR) if the patient’s blood pressure is low
- Do not treat blood pressure unless it is 220/120 if so aim is to bring it down slightly and slowly
- ACLS as appropriate
- Transport to hospital capable of fibrinolytic therapy
  — Ischemic CVA

Prevention

- Review patients history
- Take blood pressure before treatment

Seizure Disorder

Management

- Terminate procedure
- Supine position
- Ensure patient safety
- Establish airway
- Monitor vital signs
- 100% oxygen

Definition

- Abnormal electrical activity in the brain
- Change or loss of consciousness and involuntary muscle spasms called convulsions.
- Sudden onset with variation in duration and severity.

Causes

- Syncope
- Brain Tumor
- Head injuries
- Stroke
- Electrolyte imbalance
- Elevated body temperatures
- Brain infections (e.g., meningitis)
- Hypoglycemia (very low blood sugar)
- Medication or alcohol withdrawal
- Administration of local or general anesthesia
- Cocaine and heroin abuse
- Antipsychotics and some asthma drugs
Types

Generalized Seizures
(Produced by the entire brain)

<table>
<thead>
<tr>
<th>Types</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. &quot;Grand Mal&quot; or Generalized tonic-clonic</td>
<td>Unconsciousness, convulsions, muscle rigidity</td>
</tr>
<tr>
<td>2. Absence</td>
<td>Brief loss of consciousness</td>
</tr>
<tr>
<td>3. Myoclonic</td>
<td>Sporadic (isolated), jerking movements</td>
</tr>
<tr>
<td>4. Clonic</td>
<td>Repetitive, jerking movements</td>
</tr>
<tr>
<td>5. Tonic</td>
<td>Muscle stiffness, rigidity</td>
</tr>
<tr>
<td>6. Atonic</td>
<td>Loss of muscle tone</td>
</tr>
</tbody>
</table>

Types

Partial Seizures
(Produced by a small area of the brain)

<table>
<thead>
<tr>
<th>Types</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Simple (awareness is retained)</td>
<td>a. Jerking, muscle rigidity, spasms, head-turning</td>
</tr>
<tr>
<td>a. Simple Motor</td>
<td>b. Unusual sensations affecting either the vision, hearing, smell, taste, or touch</td>
</tr>
<tr>
<td>b. Simple Sensory</td>
<td>c. Memory or emotional disturbances</td>
</tr>
<tr>
<td>c. Simple Psychological</td>
<td></td>
</tr>
<tr>
<td>2. Complex (Impairment of awareness)</td>
<td>Automatisms such as lip smacking, chewing, fidgeting, walking and other repetitive, involuntary but coordinated movements</td>
</tr>
<tr>
<td>3. Partial seizure with secondary generalization</td>
<td>Symptoms that are initially associated with a preservation of consciousness that then evolves into a loss of consciousness and convulsions.</td>
</tr>
</tbody>
</table>

Management – Early

- Terminate procedure
- Protect patient
- Place patient in the supine position
- Loosen clothing
- Relocate instruments/supplies
- Establish airway
- Position head on side
- Suction mouth

Management – Advanced

- With continued seizures, consider IM benzodiazepine (Ativan)
- Establish IV if possible
  - Diazepam (Valium) - 5mg/minute I.V up to 10 mg
  - Midazolam (Versed) - 3mg/minute I.V. or I.M. up to 6mg
- Activate EMS
- Observe patient following a grand mal seizure for depressed respirations
- Support respiration during the recovery period (postictal state - period of time immediately following a seizure during which the patient will be confused and lethargic)
Prevention

- For known epileptics, check medication compliance
- Limit the amounts of precipitating drugs to the lowest effective dose to allow adequate results
- Avoid rapid injection of local anesthetic
- Calculate the maximum dose prior to initiating the procedure
- Aspirate prior to injection to avoid intravascular injection
- Consider diazepam instead of midazolam in I.V. sedation cases

Local Anesthetic Maximum Doses

<table>
<thead>
<tr>
<th>Anesthetic</th>
<th>Maximum Dosage</th>
<th>Maximum total</th>
<th>Carpules</th>
<th>mg/carpule</th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lidocaine 1:000,000 epi (Xylocaine)</td>
<td>7</td>
<td>3.2</td>
<td>500 mg</td>
<td>8</td>
</tr>
<tr>
<td>2% Mepivacaine plain (Carbocaine)</td>
<td>6.4</td>
<td>2.0</td>
<td>300 mg</td>
<td>6</td>
</tr>
<tr>
<td>4% Articaine 1:100,000 epi (Septocaine)</td>
<td>7.0</td>
<td>3.2</td>
<td>500 mg</td>
<td>6</td>
</tr>
<tr>
<td>4% Prilocaine plain (Citanest)</td>
<td>6.0</td>
<td>2.7</td>
<td>400 mg</td>
<td>5</td>
</tr>
<tr>
<td>0.5% Bupivacaine 1:200,000 epi (Marcaine)</td>
<td>1.3</td>
<td>0.6</td>
<td>90 mg</td>
<td>10</td>
</tr>
</tbody>
</table>

Adapted from Stanley Malamed, Handbook of Local Anesthesia, Fifth Edition

Respiratory Emergencies

- Dyspnea
- Airway Obstruction
- Hyperventilation Syndrome
- Asthmatic Attack / Bronchospasm

Dyspnea

- Establish airway
- 100% oxygen
- Monitor Vitals
- Treat underlying cause

Definition

- Sensation of labored, difficult, and uncomfortable breathing.
- Due to inadequate control of respiration, oxygenation, and ventilation
Causes

- Heart disease
- Chronic obstructive pulmonary disease (asthma, COPD, emphysema, chronic bronchitis)
- Anxiety/hyperventilation
- Aspiration
- Lung infection
- Pulmonary embolism

Signs and Symptoms

- Sensation of not getting enough air
- Breathing is shallow and slightly labored
- Difficulty breathing at rest or after mild exertion
- Unable to speak in complete sentences
- Chest tightness
- Severe wheezing
- Anxiety, fear, agitation, restlessness
- Extreme drowsiness

Treatment

- Establish and maintain airway
- Assist ventilation as necessary
- 100% oxygen
- Monitor
  - Pulse oximeter
  - Blood pressure
  - Cardiac status
- Identify underlying cause and treat accordingly
- Transport unstable pt. to Emergency Room

Airway Obstruction

- Upright position
- Pack off surgical site
- Suction oropharynx
- Determine if airway obstructed
- Heimlich maneuver, if indicated.

Definition

- Bronchoconstriction, secretions, or solid material causing decreased or absence of ventilatory movement.
Causes

• Posterior displacement of the tongue due to loss of tone of pharyngeal muscle secondary to deep anesthesia and/or sedation.
• Foreign body on larynx and pharynx – secretions or solid material.

Causes

• Choking
• Gagging
• Violent expiratory effort
• Substernal notch retraction
• Cyanosis
• Rapid pulse initially then decreased pulse, respiratory arrest, cardiac arrest
• Airway obstruction causes HYPOXIA (deficiency of oxygen in body tissue) which leads to cardiovascular complications
• Respiratory arrest
• Cardiac arrest

Signs / Symptoms

Signs / Symptoms

• Position patient upright or comfortable position
• Pack off surgical site
• Suction oropharynx
• Digital traction of tongue with:
  - Gauze
  - Tongue Forceps
  - Hemostat
  - Suture

Heimlich Maneuver

• Stand behind patient
• Place fist of one hand slightly above patient’s navel
• Grasp fist with other hand
• Give quick upward thrusts into abdomen (chest thrust over sternum if pregnant or obese)
• Continue until object is expelled or patient becomes unconscious

Heimlich Maneuver

• Activate 911
• Positive pressure ventilation
• Endotracheal intubation
• Cricothyroidotomy

Treatment - Early

• Place patient supine
• Chin lift - jaw thrust
• Tilt head backwards and continue to attempt to open airway
• Check for respiratory sounds; ventilate of possible
• Perform abdominal thrust if no airflow with ventilations

Treatment - Advanced

IF NO SUCCESS AT CLEARING AIRWAY, AND IF PATIENT LOSES CONSCIOUSNESS:

• Place patient supine
• Chin lift - jaw thrust
• Tilt head backwards and continue to attempt to open airway
• Check for respiratory sounds; ventilate of possible
• Perform abdominal thrust if no airflow with ventilations

If patient is unconscious

• Stand behind patient
• Place fist of one hand slightly above patient’s navel
• Grasp fist with other hand
• Give quick upward thrusts into abdomen (chest thrust over sternum if pregnant or obese)
• Continue until object is expelled or patient becomes unconscious

If patient is unconscious
Prevention

• Proper placement of throat pack
• Preoperative removal of potential foreign bodies (dentures, partials, tongue piercings, secretions)
• Adequate suctioning
• Adequate visualization of operative field

Follow Up

• If the foreign body is not recovered or does not pass, refer patient as soon as possible for radiographic localization
  – PA / Lateral neck x-ray
  – Chest x-ray
  – Abdominal x-ray

Basic Treatment

• Upright / semi-reclined position
• Verbally calm / reassure patient
• Rebreathing bag to reduce carbon dioxide elimination
• Hold breath

Definition

• Patient breathes faster and deeper
• Patient exhales too much carbon dioxide, causing hypocapnea
• Respiratory alkalosis → cerebral vasoconstriction
  • Dizziness
  • Tingling of lips/extremities
  • Headache
  • Weakness
  • Fainting

Causes

• Stress
• Anxiety
Causes

- Ingestion or overdose of medications
  - Amphetamine
  - Aspirin
  - Beta-2 Agonist
  - Cocaine
  - Iron
  - LSD
  - Methamphetamine
  - Methanol

Causes

- Increased metabolism from
  - Exercise
  - Fever
  - Graves’ disease, hyperthyroidism, thyroid storm
  - Infection

SIGN/SYMPTOMS/MANIFESTATIONS

- Feeling of anxiety, nervousness, or tenseness
- Light headedness, vertigo
- Muscle twitching and spasm
- Numbness / tingling of hands, feet or around mouth
- Sweating
- Pounding and racing heartbeat
- Chest tightness, fullness, pressure, tenderness or pain

TREATMENT

- Terminate treatment and remove foreign bodies from the mouth
- Position patient in an upright/semireclining
- Maintain patent airway
- Calm patient

TREATMENT

- Breathe deliberately and slowly
  “7-11” breathing
  - Inhale 7 seconds
  - Exhale 11 seconds
- Breathing in bag no longer advised
  - Restricts inspired oxygen, worsening hypoxia

TREATMENT - ADVANCED

- If nonsedated patient fails to respond consider
  - Midazolam (Versed) 1-22mg slow IV
  - Diazepam (Valium) 5-10 mg slow IV
  - Methohexital (Brevital) 10 mg slow IV
  - Propofol (Diprivan) 10-20 mg slow IV
- Continue to monitor vital signs
- Discontinue rebreathing bag as patient’s breathing returns to normal
- Activate EMS call for assistance if patient’s condition deteriorates (patient loses consciousness, vital signs unstable)
Asthma Attack

Definition

- Generalized smooth muscle contraction of the bronchi and bronchioles
- Restriction of inhalation and exhalation air flow
- Bronchospasm – more difficult with exhalation

Causes

- Genetic
- Environmental
- Immune system
  - Allergens
  - Triggers
- Sinusitis
- GERD
- Medication reactions (Aspirin and NSAIDS)
  - Samter’s triad: asthma, nasal polyposis, ASA sensitivity

Signs / Symptoms / Manifestations

- Labored breathing
- Expiration difficulty
- Diminishing respiratory status
- Cyanosis
- Decreased oxygen saturation
- Decreased ventilations
- Wheezing
- Chest tightness
- Shortness of breath
- Tiring quickly during exercise
- Anxiety
- Spastic cough

Treatment - Early

- Patient in upright position
- Monitor vital signs
- Administer 100% oxygen

Treatment - Advanced

- Activate EMS
- Bronchodilating medications
  - Albuterol (Ventolin)
    - 4-8 puffs every 20 minutes for up to 4 hours than q1-4 hours
  - Ipratropium bromide (Atrovent)
    - 2 puffs stat than every 4 hours
    - 0.5mL of 0.02% nebulized solution every 4 hours
  - Epinephrine 0.3-0.5mg 1:1000 subcutaneous every 20 minutes to max of 1gm
- Prednisone 40-60mg orally
Prevention

• Thorough medical history
  – Assess severity of asthma
  • Last attack?
  • How often do you use inhaler?
  • Prior hospitalizations? Intubation required?
  • Other medications?

Cardiovascular Emergencies

• Angina Pectoris
• Myocardial Infarction

Angina Pectoris

Definition

• Chest pain or discomfort due to insufficient oxygen to the heart

Causes

• Narrowing or constriction or coronary arteries
• Decreased blood supply/oxygen
• Increased cardiac demand for oxygen (caused by cold, stress, increased heart rate)

Signs / Symptoms

• Early symptoms mistaken for indigestion
• Pain in chest
• Wide differential diagnosis
• Heaviness or squeezing sensation
• Exhibits a crescendo-decrescendo pattern
• Key to differentiate from MI
  – Duration of symptom
  – History of similar symptoms
  – Relieved by rest, nitroglycerin, or reduction of stress
  – Angina pain usually relieved within 5-15 minutes
MANAGEMENT - EARLY

- Terminate surgery
- Activate EMS if new onset or signs of hemodynamic instability
- Monitor vital signs
- Immediate administration of oxygen
- Nitroglycerine sublingually (0.2-0.6mg) every 5 minutes to max 3 doses over 15 minutes if BP>90
  - Vasodilatation to improve cardiac flow
- Place patient in comfortable position
- Loosen all clothing

MANAGEMENT - ADVANCED

- Aspirin, nonenteric coated-325mg orally (chewable)
- MONA (Morphine, Oxygen, Nitroglycerin and Aspirin)
- Transport patient to medical facility

MANAGEMENT - ADVANCED

- Continuous EKG and pulse oximeter monitoring
- Set up and activate automatic external defibrillator
- Continue dialogue with patient to reassure
- Quickly review medical history
- Second/third nitroglycerine at 5 minute intervals over 15 minutes with max of 3 doses
- After 3rd dose, if no relief, assume MI
- Activate EMS with signs of hemodynamic instability
  - Unrelieved chest pain
  - New onset of chest pain
  - Pain does not subside with nitro
  - Pain not typical of angina pain

PREVENTION

- Consult with patient’s physician prior to tx
- Use premedication for stress reduction
- Consider preoperative medications – discuss with physician
- Administer supplemental oxygen
- Monitor vital signs
- Limit amount of epinephrine used
- Discuss with pt how they are feeling

DEFINITION

- Inadequate blood flow and oxygen (ischemia) to the heart muscle (myocardium) resulting in irreversible injury to the myocardium
Causes

• Decreased oxygen flow to the heart muscle
• Complete or partial blockage of the coronary arteries

Signs/Symptoms/Manifestations

• New onset of chest pain
• Chest pain which lasts for at least 20 minutes
• Evidence of ischemia on EKG
• Increased levels of cardiac enzymes
• Chest pain-crushing / squeezing
• Pain continues at rest

Signs/Symptoms/Manifestations

• Elevated or reduced blood pressure
• Pain not immediately relieved by nitroglycerin
• Pain may originate under sternum—may radiate to arm, neck, and mandible
• Nausea / vomiting
• Diaphoresis
• Anxiety
• Sense of impending doom
• Dyspnea

Management - Early

• Place patient in upright/semi-reclined position
• Activate EMS
• Establish and maintain airway
• Administer 100% oxygen

Management - Advanced

• Monitor vital signs / EKG
• Reassure patient
• Start ACLS if patient loses consciousness
• Transport patient to hospital

Management - Advanced

• Set up automated external defibrillation
• Administer non-enteric coated aspirin 325mg (chewable)
• Establish I.V. access
• Nitroglycerin 0.2-0.6 mg sublingually
  — repeat every 5 minutes up to 3 doses over 15 minutes
Prevention

- Identify patient at risk for myocardial infarction
  - Thorough medical history
  - Family history
  - Exercise tolerance
- Physician consult
- Consider anxiolytic night before and morning of surgery
  - 5-10 mg diazepam (Valium) POHS
  - Continue anti-hypertensive
- Consider preoperative nitroglycerin if blood pressure allows or is desirable
- Avoid low PaCO2

Blood Pressure Abnormalities

- Hypertension
- Hypotension

Hypertension

- An elevation in blood pressure that increases the risk for end-target organ damage.
  - Systolic blood pressure >140 mm Hg
  - And/or a diastolic pressure >90 mm Hg

Causes

- Anxiety
- Inadequate anesthesia or light anesthesia
- Hypoxia
- Excessive or intravascular injection of vasoconstrictor
- Anesthetic overdose
- Exacerbation of essential hypertension
- Noncompliance with medications

Hypertensive Urgency

- SBP > 180 or DBO > 110
- No end organ damage
- Possible Symptoms
  - severe headache
  - shortness of breath
  - nosebleed
  - severe anxiety

Hypertensive Emergency

- SBP > 180 or DBO > 110
- With symptoms of end organ damage
  - Stroke
  - Loss of consciousness
  - Memory loss
  - Heart attack
  - Damage to eyes
  - Loss of kidney function
  - Pulmonary Edema

Hypertensive Crises

Hypertensive Urgency

- SBP > 180 or DBO > 110
- No end organ damage
- Possible Symptoms
  - severe headache
  - shortness of breath
  - nosebleed
  - severe anxiety

Hypertensive Emergency

- SBP > 180 or DBO > 110
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  - Memory loss
  - Heart attack
  - Damage to eyes
  - Loss of kidney function
  - Pulmonary Edema

Hypertensive Crises
Treatment - Early

- Cessation of TX
- Confirm patient airway, adequacy of ventilation and give 100% O2
- Benzodiazepines for hypertension secondary to anxiety or emergence delirium
- Review medications and dose given
- Reassess patient
- Record vital signs every 5 minutes
- Check for monitor malfunctions
- If using electronic monitors confirm with manual determination

Treatment - Advanced

- Consider activating EMS
- Oral therapy

<table>
<thead>
<tr>
<th>Table 1. Agents for the Management of Hypertensive Urgency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent, Class</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Labetalol, β-adrenergic blocker</td>
</tr>
<tr>
<td>Metoprolol, β-blocker</td>
</tr>
<tr>
<td>Glycopyrrolate, anticholinergic</td>
</tr>
<tr>
<td>Atropine, anticholinergic</td>
</tr>
<tr>
<td>Epinephrine, sympathomimetic</td>
</tr>
</tbody>
</table>

Preventive

- Continue anti-hypertensive drug therapy
- Check compliance to medications
- Consider oral antianxiety night before surgery and day of surgery
- Adequate local anesthesia and pain control

Hypotension

Definition

- Systolic BP < 90 mm Hg
- Diastolic BP < 60 mm Hg
- Good cardiovascular health
- Pathologic - inadequate blood flow to the heart, brain and other vital organs.

Causes

Preoperative:
- Dehydration
- Poor diet
- Heart problems
- Blood loss
- Excessive premedication or drug allergies
- Orthostatic: rapid fall in blood pressure when moving from supine to upright position)
Causes

Intraoperative:
- Hypoxia
- Anesthetic overdose (especially narcotics and barbiturates)
- Drug allergies

Signs/symptoms/manifestations
- Weakness
- Nausea
- Impending loss of consciousness
- Dizziness
- Thirst
- Cold, clammy, pale skin
- Fatigue

Early Treatment
- Terminate surgery
- Support airway, give 100% oxygen
- Monitor vital signs
- Stimulate the patient
- Trendelenburg position or raise legs above head
- Activate EMS if condition deteriorates
- Ammonia inhalant

Advanced Treatment
- Initial fluid bolus of normal saline solution
- Ephedrine-2.5-5 mg I.V then titrate until blood pressure is stabilized
  - increases heart rate
  - causes vasoconstriction
- Phenylephrine
- Hypotension from narcotics
  - Naloxone(Narcan) 0.4 - 2 mg I.V. every 2-3 hours as needed start with lower dosage for narcotic dependent patients.

Diabetic issues
- Hypoglycemia
- Hyperglycemia

Diabetes
- Type I – body cannot produce insulin
  - Formerly known as insulin dependent DM or juvenile onset
  - Requires insulin replacement
  - Causes: genetic, autoimmune
  - Diabetic ketoacidosis (emergency, LOC)
- Type II – body cannot use insulin properly (insulin resistance)
  - Formerly known as non-insulin dependent DM or adult onset
  - Can be combined with reduced insulin secretion
  - Treated with oral hypoglycemics and/or insulin
  - Causes: lifestyle, genetics
  - Hyperosmolar hyperglycemic state
Symptoms
• Polyuria, polydipsia, polyphagia, weight loss, loss of strength
• Bed wetting, skin infections, irritability, headache, drowsiness, malaise, xerostomia

Diagnosis
• Fasting Blood Sugar (FBS) < 125 mg/dl
  – Current more stringent guidelines <100 mg/dl
• Post Prandial (PP) < 140 mg/dl
• HbA1C (4-6%) > 8% uncontrolled in the past 2-3 months

Managing the Diabetic Patient
• Maximum of 2 carpules in poorly controlled patient
  – Epi causes glycogen breakdown which increases hyperglycemia
• Use full dose of antibiotics after major procedure for management of infections.
• Treat only acute dental issues and delay treatment for routine procedures for poorly controlled diabetic
• Control blood glucose first
• A normal type 2 diabetic can undergo all dental procedures unless diabetic complication exists
• Avoid chronic use of NSAIDS and Steroids

Hypoglycemia

Definition
• Reduction in blood glucose level
• Blood levels of glucose drop too low to properly fuel the body

Causes
• Excessive insulin therapy/oral hypoglycemics
• Missed/delayed meals
• Illness/infection
• Excessive exercise
• Alcohol ingestion
Signs/symptoms/manifestations

Mild (<60-65mg/dl)
- Cold, clammy wet skin
- Extreme hunger
- Nausea
- Tachycardia
- Numbness/tingling lips and fingers tips
- Trembling

Moderate (50mg/dl)
- Lack of energy
- Irritability
- Restlessness
- Headache
- Dizziness
- Slurred speech
- Blurred vision

Severe (<30mg/dl)
- Loss of consciousness
- Seizures / convulsions
- Hypothermia

Treatment - Early
- Stop dental treatment
- Placed patient in supine patient
- Monitor vital signs
- Check blood glucose <50 mg/dl, even with no symptoms

Treatment - Early
- Oral Glucose:
  - Regular soft drink, fruit juice
  - Candy, cake frosting
- Eating quick sugar foods puts glucose into the blood stream in about 5 minutes
- Any quick-sugar food on this list will raise blood sugar about 30mg/dl in about 15-20 min

Food and amount
- Fruit juice and regular soda - ½ cup
- Glucose tablets - 3 tablets
- Glucose Gel - ½ tube
- Hard Candy - 3 pieces
Treatment - Advanced

- Patient becomes unconscious: Basic life support
- Patient not responding - Activate EMS

Establish I.V access
- 1 ampule I.V glucose (50 ml or 50% glucose solution)
- Recheck blood glucose in 15 minutes
- Start I.V infusion of 5% to 20% dextrose solution

Without I.V access:
- 1 mg of glucagon I.M
- Recheck blood glucose in 15 min
- Repeat glucagon, as needed, based on blood glucose

Prevention

- Thorough medical history and physical examination
- Focus on glycemic/insulin control
- Maintain normal glycemic control
- Avoid hypoglycemia
  - A little high is better than a little low
- Early identification and management

Preoperative

Insulin dependent diabetes:
- Consider half dose of long acting insulin if fasting for surgery
- Check blood glucose
- Start I.V with D5W

Noninsulin-dependent diabetes:
- Discontinue oral hypoglycemic in the morning
- Check blood glucose

Hyperglycemia

Definition

- Increase in blood sugar level
  - 100 – 126 mg/dl: hyperglycemia
  - > 126 mg/dl: diabetic
Hyperglycemic crises

- Diabetic ketoacidosis
  - Type 1 diabetic
  - 5% mortality
- Hyperosmolar hyperglycemic state
  - Type 2 diabetic
  - 15% mortality

Causes
- non-compliance/under-treatment of insulin (DKA)
- Infection
- Alcohol abuse
- Trauma
- PE
- MI

Signs/symptoms/manifestations

- Dry mouth
- Increased thirst
- Frequent urination
- Drowsiness
- Stomach pain
- Bed wetting

Treatment - Early

- Fluids/hydration
- Administer insulin
- Send to ED for management

Prevention

- Check compliance with medications
- Check blood glucose
- Treat infections aggressively

Allergic Reactions

- Urticaria / Pruritus
- Anaphylactic Shock
- Epinephrine Reaction
Definition

- Inappropriate or excess immune reaction to antigen / allergen
- Slow (delayed) or fast (immediate) onset
- Intense itchy and erythematous plaque that occurs on the skin

Causes

- Allergic response to:
  - Medications
  - Latex
  - Environment
  - Food

Signs / Symptoms / Manifestations

- Urticaria (wheal / flare)
  - Face, trunk, extremities
  - Blanching
  - Hives
- Pruritus
  - Mild to severe itching

Signs / Symptoms / Manifestations

- Angioedema
  - Face, lips, perioral tissues
  - Edema
  - Lesions (painful or burning)
- Erythema
  - Generalized or localized
  - Hives
  - Redness

Treatment - Early

- Upright / semi-reclining position
- Administer oxygen
- Monitor pulse, blood pressure and PaO2
Treatment - Advanced

- Unsure – activate EMS
- Monitor vital signs
- Withdraw drug in question
- Benadryl (diphenhydramine)
  - 25-50mg PO every 4-6 hours (max 300 mg/day)
  - 25-50mg IV/IM every 2-4 hours (max 400 mg/day)
    - More severe reactions

- Epinephrine
  - Severe reactions
  - See anaphylactic reactions
  - 0.3-0.5mg (1:1,000) IM
- Oral Benadryl 25-50mg PO every 6-8 hours for 3 days

Prevention

- Thorough history
- Avoid known allergens

Anaphylactic Shock

Definition

- Immediate hypersensitivity
- Sudden and severe allergic reaction
- Characterized by
  - Cardiovascular collapse (severe hypotension)
  - Respiratory compromise (bronchospasm)

Causes

- Allergic response to:
  - Medications
  - Latex
  - Environment
  - Food
**Signs / Symptoms / Manifestations**

- **Onset**
  - Injectable drugs: 5-30 minutes
  - Oral ingestion: up to 2 hours

**Signs / Symptoms / Manifestations**

- **Skin**
  - Flushed face (early symptoms)
  - Rash
  - Urticaria (nose / hands)
  - Tingling (lips, axilla, groin, hands, feet)
  - Angioedema (tongue / oropharynx)

**Signs / Symptoms / Manifestations**

- **Respiratory**
  - Apnea (without breathing)
  - Dyspnea (shortness of breath)
  - Dysphagia (difficulty swallowing)
  - Labored breathing
  - Coughing
  - Dysphonia (change in voice)
  - Inspiratory stridor
  - Wheezing

**Signs / Symptoms / Manifestations**

- **CNS**
  - Diaphoresis
  - Impending doom
  - Altered level of consciousness
  - Seizure – unconsciousness
  - Incontinence

**Signs / Symptoms / Manifestations**

- **CVS**
  - Cyanosis / pallor
  - Dizziness
  - Hypotension
  - Tachycardia to bradycardia
  - Vascular collapse
  - Cardiac arrest

**Treatment - Early**

- If suspect, ACTIVATE EMS IMMEDIATELY
- Supine – BLS
- Administer oxygen and/or ventilate
- Monitor pulse, blood pressure, PaO2, patient color, and verbal response
  - Document and record
- Check patient’s history and medication record
Epinephrine Reaction

**Symptoms**
- Rapid elevation in blood pressure
- Increased pulse rate
- Anxiety
- Tremor
- Treatment
- Position patient comfortably
- Administer Oxygen
- Reassure patient
- Monitor vitals (could be 20 minutes for return to normal bp)
- Activate EMS if further symptoms develop or if elevated BP remains

**Treatment**
- Position patient comfortably
- Administer Oxygen
- Reassure patient
- Monitor vitals (could be 20 minutes for return to normal bp)
- Activate EMS if further symptoms develop or if elevated BP remains

---

**Epinephrine Reaction**

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- Rapid elevation in blood pressure
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- Anxiety
- Tremor
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- Activate EMS if further symptoms develop or if elevated BP remains

**Treatment**
- Position patient comfortably
- Administer Oxygen
- Reassure patient
- Monitor vitals (could be 20 minutes for return to normal bp)
- Activate EMS if further symptoms develop or if elevated BP remains

---

**Treatment - Advanced**

- **Administer epinephrine**
  - 0.3-0.5mg (1:1,000) IM
  - 0.2-0.5mg (1:10,000) IV
  - Repeat every 10-20 minutes

- **Bronchospasm / laryngospasm**
  - Albuterol (Ventolin)
    - 4-8 puffs every 20 minutes for up to 4 hours than q1-4 hours

---

**Treatment - Advanced**

- **Moderate to severe anaphylaxis**
  - Prevent late-phase recurrence symptoms
  - Dexamethasone (Decadron): 4mg IV
  - Hydrocortisone: 100mg IV

- **Pruritus / Urticaria**
  - Benadryl (diphenhydramine hydrochloride)
    - 25-50mg IV/IM every 2-4 hours (max 400 mg/day)

---

**Treatment - Advanced**

- **IV fluids**: 500 – 1000 mL normal saline or Ringer’s lactate
- **Intubate or cricothyrotomy**
- **Transfer to hospital STAT**
Epinephrine Interactions

- Hypertensive episodes associated with:
  - Tricyclic antidepressants (e.g., amitriptyline)
  - Non-selective beta blockers

Drug Overdose

- Local anesthetics
- Sedatives/hypnotics
- Narcotics

Local Anesthetics

Local Anesthetic Maximum Doses

<table>
<thead>
<tr>
<th>Anesthetic</th>
<th>Maximum Dose</th>
<th>Maximum Total Dose</th>
<th>Carpules</th>
<th>mg/carpule</th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lidocaine 1:000,000 epi (Xylocaine)</td>
<td>7.3</td>
<td>500 mg</td>
<td>8</td>
<td>30 - 60 mg</td>
</tr>
<tr>
<td>2% Mepivacaine plain (Carbocaine)</td>
<td>4.4</td>
<td>300 mg</td>
<td>5</td>
<td>51 - 54 mg</td>
</tr>
<tr>
<td>4% Articaine 1:200,000 epi (Septocaine)</td>
<td>7.0</td>
<td>500 mg</td>
<td>6</td>
<td>68 - 72 mg</td>
</tr>
<tr>
<td>4% Prilocaine plain (Citanest)</td>
<td>6.0</td>
<td>400 mg</td>
<td>5</td>
<td>68 - 72 mg</td>
</tr>
<tr>
<td>0.5% Bupivacaine 1:200,000 epi (Marcaine)</td>
<td>1.3</td>
<td>90 mg</td>
<td>10</td>
<td>8.5 - 9 mg</td>
</tr>
</tbody>
</table>

Adapted from Stanley Malamed, Handbook of Local Anesthesia, Fifth Edition

Signs / Symptoms / Manifestations

- Low to Moderate Overdose Levels
- Confusion
- Talkativeness
- Apprehension
- Excitement
- Slurred speech

Signs / Symptoms / Manifestations

- Low to Moderate Overdose Levels
- Elevated BP
- Elevated HR
- Elevated RR
- Generalized stutter
- Twitching
Signs / Symptoms / Manifestations

Low to Moderate Overdose Levels

- Restless
- Visual disturbances
- Auditory disturbances
- Numbness
- Metallic taste

Signs / Symptoms / Manifestations

Low to Moderate Overdose Levels

- Light-headed and dizzy
- Drowsy and disoriented
- Losing consciousness
- Sensation of twitching (before actual twitching is observed)

Signs / Symptoms / Manifestations

Moderate to High Overdose Levels

- Generalized tonic-clonic seizure activity followed by
  - Generalized CNS depression
  - Depressed BP, heart rate
  - Depressed respiratory rate

Treatment - Early

- Administer oxygen
- Monitor vitals

Treatment - Advanced

- Activate EMS
- Place patient in supine position
- Maintain airway
- Manage seizures
  - Diazepam (Valium) 5-10mg IV
- Manage postictal state
- Transfer

Sedatives / Hypnotics
Signs / Symptoms / Manifestations

• Decreased respiratory rate
• Cyanosis
• Unresponsiveness

Treatment

• Place patient in supine position
• Maintain open airway
• Administer oxygen and ventilation assistance if needed
• Monitor vital signs
• Activate EMS
• Flumazenil (Romazicon)
  – 0.2mg IV than 0.1mg/minute up to 1 mg

Narcotic Overdose

Signs / Symptoms / Manifestations

• Decreased respiratory rate
• Cyanosis
• Unresponsiveness

Treatment

• Place patient in supine position
• Maintain open airway
• Administer oxygen and ventilation assistance if needed
• Monitor vital signs
• Activate EMS
• Naloxone (Narcan)
  – 0.4-2mg mg IV every 2-3 minutes

References

• Advanced Protocols for Medical Emergencies- Lewis, McMulln; Lexi-Comp, Inc.
• Dental Office Medical Emergencies- Meiller, Wynn; Lexi-Comp, Inc.
• Medical Emergencies- 5th edition, Malamed- 2000
• Oral and Maxillofacial Surgery Secrets – Abubaker, 2007