Tarrant County College District Massage Therapy Program
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1/31/2012 Cardiovascular Pathology
Circulatory System Function

**Delivery of nutrients and oxygen**
- Interruption = ischemia

**Removal of waste products**
- Interruption → toxicity, cell death

**Temperature**
- Interruption: hypothermia, hyperthermia

**Clotting**
- Interruption: hemophilia, thrombopenia

**Protection from pathogens**
- Interruption: infection, impaired immune system activity

**Chemical balance**
- Interruption: alkalosis, acidosis (small margin of tolerance)
Anatomic structures and physiologic processes related to the cardiovascular system.

1. Three fluids interact with stationary cells to help maintain homeostasis by delivering oxygen and nutrients and by removing wastes:
   ~ Blood
   ~ Interstitial fluid
   ~ Lymph

2. Three fluids bring nutrients to and remove waste from stationary cells:
   ~ Blood
   ~ Interstitial fluid
   ~ Lymph
Cardiovascular System cont’d

Main components:

~ Blood
~ Heart
~ Blood vessels

Blood: consist of a liquid portion called plasma and solids called blood cells

Functions of blood:

~ Transports oxygen from the lungs
~ Transports nutrients from the digestive tract
~ Removes waste
~ Regulates pH using buffers
**Cardiovascular System cont’d**

**Blood cells**

~ Erythrocytes: red blood cells; contains hemoglobin

~ Leukocytes: white blood cells

~ Thrombocytes: platelets

**Blood**

~ Helps adjust body temperature

~ Clots to protect against excessive loss due to injury

~ Protects the body from disease
Plasma proteins (jobs/tasks)

~ Transporters

~ Help with blood coagulation

~ Part of lymphatic/immune system

~ Enzymes

~ Hormones
The Heart

Septum divides left from right
- Right side pumps to pulmonary circuit
- Left side pumps to systemic circuit
- Atrioventricular (AV) valves divide top from bottom
- Atria, ventricles
- Lub-dupp is closing of AV and semilunar valves
- Ventricle work harder than atria
- Implications for seriousness of heart attacks
Cardiovascular System (cont’d.)

Heart: layers

~ Pericardium
~ Myocardium
~ Endocardium
~ Epicardium
Heart chambers

**Atria**: superior chambers; left and right

**Ventricles**: inferior chambers; left and right
Heart valves

Tricuspid (right atrioventricular valve)
Mitral (bicuspid) (left atrioventricular valve)
~ Major blood vessels connected to heart

~ Superior vena cava

~ Inferior vena cava

~ Pulmonary trunk

~ Aorta

~ Coronary sinus

~ Coronary arteries
Cardiovascular: Heart

Pulmonary and systemic circulation

- Deoxygenated blood enters right atrium
- Moves to right ventricle
- Moves to lungs
- Oxygenated blood enters left atrium
- Moves to left ventricle
- Moves throughout the body
Coronary circulation

- Heart's own blood supply
- Coronary arteries branch off aorta
- Coronary veins drain deoxygenated blood
- Coronary sinus drains into right atrium
Heart's conduction system

- Autorhythmicity
Ensures a regular, coordinated heartbeat
1. Heart's conduction system
   Sinoatrial node nerve impulse sets pace
   Atria contract at same time, ventricles relax
   Atrioventricular node contacted
   Ventricles contract at same time, atria relax

2. Heart rate increases
   Hormone epinephrine (adrenaline)
   Sympathetic nervous system

3. Heart rate decreases
   Parasympathetic nervous system
Blood vessels

- Arteries
- Arterioles
- Capillaries
- Veins
- Venules
Outbound: Systemic Circulation

Arteries

~ Distribute oxygenated blood
~ Branch off aorta
~ Have thick walls with smooth muscle and elastic tissues

Arterioles

~ Distribute oxygenated blood
~ Smallest branches of arteries
~ Single layer of tissue covered by some smooth muscle
Capillaries

~ Distribute nutrients and remove waste through interstitial fluid
~ Smallest branches of arterioles and venules
~ Single layer of epithelial tissue
Venules

- Remove deoxygenated blood
- Smallest branches of veins
- Single layer of tissue covered by some smooth muscle
Veins

- Remove deoxygenated blood
- Thin walls with smooth muscle and elastic tissues
- Skeletal muscles help move blood
- Valves prevent backflow
CLOTHING OF THE ARTERIAL/VENOUS SYSTEM

Tunics

- **Tunica intima**: innermost layer
- **Tunica media**: middle layer
- **Tunica adventitia**: outer layer

- **Vasa-vasorum**: blood supply for large vessels (vessels of the vessels)
MEDICAL ISSUES FOR CLIENTS INVOLVING THE CARDIOVASCULAR SYSTEM

~ Refer client to health care provider:

- Bradycardia or tachycardia
- Palpitations
- Difficulty with or rapid breathing
- Skin discolorations (pallor, redness, jaundice, cyanosis)
- Unexplained bruising or skin irritation
- Presence of rashes, hives, or scaliness
~ Refer client to health care provider if they experience:

- Unexplained chest or calf pain

- Edema (pitting edema, molten skin, or limbs of unequal circumference)

- Limbs unequal in temperature

- Chronic fatigue or dizziness

- Exercise intolerance
DISORDERS OF BLOOD AND CIRCULATION

Anemia
Sickle Cell Disease
Hemophilia
Thrombosis
Embolism
Shock
Anemia

~ Reduction in RBC quantity or their hemoglobin, which impairs the blood’s ability to carry O2

**MASSAGE CONSIDERATIONS:**
~ Obtain medical clearance for severe forms;
~ Reduce treatment time and pressure if client is overly fatigued

From Damjanov I, Linder J: Pathology: a color atlas, St. Louis, 2000, Mosby; Copyright Dennis Kunzel Microscopy, Inc.; and Miale JB: Laboratory medicine: hematology, ed 6, St. Louis, 1982, Mosby.
### A Selection of Types of Anemia:

**Table 8-1 Comparison of Select Anemias**

<table>
<thead>
<tr>
<th>Type of Anemia</th>
<th>Red Blood Cell Characteristic</th>
<th>Etiology</th>
<th>Additional Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron deficiency</td>
<td>Smaller than normal (microcytic)</td>
<td>Decreased dietary intake, slow blood loss, malabsorption</td>
<td>Generalized symptoms of anemia only</td>
</tr>
<tr>
<td>Pernicious anemia</td>
<td>Larger than normal (macrocytic)</td>
<td>Malabsorption of Vitamin $B_{12}$; lack of intrinsic factor</td>
<td>Numbness and tingling in fingers and toes</td>
</tr>
<tr>
<td>Sickle cell anemia</td>
<td>Sickled shaped</td>
<td>Inherited</td>
<td>Generalized pain, jaundice, skin ulcers, splenomegaly, and congestive heart failure</td>
</tr>
<tr>
<td>Aplastic anemia</td>
<td>Normal</td>
<td>Bone marrow failure</td>
<td>Excessive bleeding and petechiae</td>
</tr>
</tbody>
</table>
A SELECTION OF TYPES OF ANEMIAS

Iron-deficiency - Associated with iron depletion; most common type
Pernicious - Larger than normal RBC
Folic Acid - Associated with folic acid deficiency
Sickle Cell - Associated with RBC destruction, changing to sickle shape
Aplastic - Associated with bone marrow failure; a rare, life-threatening form
Sickle Cell Disease

**Definition**

~ Autosomal recessive genetic condition

~ Production of abnormal hemoglobin

**Demographics**

~ SC gene most common in blacks, Hispanics, Mediterraneans, from Middle East

~ 2 million people with SC trait in the United States

~ 72,000 have SC disease
Sickle Cell Disease

Complications

~ Sickle cell crises: infarctions
   ~ Hand-foot syndrome
   ~ Organ damage
   ~ Infections (lost spleen function)
   ~ Gallstones
   ~ Vision loss
   ~ Acute chest syndrome (looks like pneumonia)
   ~ Others
      ~ Delayed growth, chronic skin ulcers at lower legs, priapism

Massage

~ Rigorous exercise not recommended
~ Circulatory, mechanical massage contraindicated
~ Reflexive, energetic may be helpful
~ Warm packs, gentle stroking for pain
Hemophilia

~ Genetic disorder that impairs the blood’s clotting mechanisms

~ **Massage is contraindicated in moderate or severe forms;** otherwise, obtain clearance and use lighter pressure; joint mobilizations are omitted or cautiously applied
Thrombosis

Transformation of fluid blood into a gelatinous mass; also called blood clot formation

**MASSAGE CONSIDERATIONS:**
Avoid deep or vigorous techniques on lower extremities for up to 10 days after the client is ambulatory if client is at risk for thrombosis (e.g., recent surgery)

**Definition**
- Embolism: traveling clot
- Thrombus: lodged clot
Thrombosis (cont’d.)

A

- Endothelium
- Prothrombin
- Thrombin
- Platelets
- Defect
- Fibrin meshwork

C
Embolism

Occlusion of a blood vessel by an embolus

Embolus: floating matter in the intravascular space carried by blood

Massage is contraindicated
Embolism (cont’d.)

SYMPTOMS OF PULMONARY EMBOLISM
- Shortness of breath
- Hemoptysis
- Pain
- Sudden death

A. Venous embolism
- Venous thrombus
- Saddle embolus
- Lung infarct

B. Arterial embolism
- Brain infarct
- Ventricular thrombus
- Splenic infarct
- Kidney infarct
- Intestinal infarct
- Infarct of the extremity
Shock

~ Failure of the cardiovascular system to deliver enough oxygen and nutrients to meet the body's needs

Massage is contraindicated
### TABLE 8-2 Types of Shock

<table>
<thead>
<tr>
<th>Type</th>
<th>Mechanism</th>
<th>Specific Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiogenic shock</td>
<td>Heart failure</td>
<td>Myocardial infarction, heart valve disorders, heart infections (myocarditis,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>endocarditis), other problems with the heart</td>
</tr>
<tr>
<td>Hypovolemic shock</td>
<td>Hypovolemia</td>
<td>Massive hemorrhage, excessive urination (seen in untreated diabetes), severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vomiting and diarrhea, severe burns</td>
</tr>
<tr>
<td>Anaphylactic shock</td>
<td>Generalized vasodilation</td>
<td>Allergic reaction to insect stings, drugs, nuts, shellfish</td>
</tr>
<tr>
<td>Septic shock</td>
<td>Generalized vasodilation</td>
<td>Severe or multiple infections</td>
</tr>
<tr>
<td>Neurogenic shock</td>
<td>Generalized vasodilation</td>
<td>Pain, fear, spinal cord injury, hypoglycemia (insulin shock)</td>
</tr>
</tbody>
</table>
Shock (cont’d.)

Modified from Damjanov I: Pathology for the health-related professions, ed. 2, Philadelphia, 2000, WB Saunders.
Disorders of the Heart

~ Angina pectoris
~ Arrhythmias
~ Congestive heart failure
~ Rheumatic fever
~ Rheumatic heart disease
~ Cardiomyopathy
~ Endocarditis
~ Myocarditis
~ Pericarditis
~ Myocardial infarction
~ Cardiac arrest
Angina Pectoris (Angina)

~ Chest pain caused by reduced blood supply to heart
~ Be sure to keep client warm (cold may trigger an attack);
ensure client has necessary medications
Arrhythmias

Any deviation from a normal heartbeat or rhythm; term encompasses abnormally fast or slow rhythms as well as irregular rhythms

Reduce treatment time and pressure if client is overly fatigued

**TYPES OF ARRHYTHMIAS:**

- **Bradycardia** - <50 or 60 BPM
- **Tachycardia** - >100 BPM
- **Atrial fibrillation** - atria quiver rather than contract
- **Ventricular fibrillation** - ventricles quiver rather than contract
CONGESTIVE HEART FAILURE

Heart’s inability to meet body demands; associated with disease (longstanding HBP, CAD) or from heart problems (past MI, valvular)

Types are:

Left-sided CHF - Most common

Right-sided CHF - usually from left-sided CHF
Congestive Heart Failure (cont'd.)

- Pulmonary congestion
- Hepatic congestion
- Enlarged heart
- Distended neck veins
- Abdominal edema
- Edema of legs and feet
~ For acute cases, massage is contraindicated

~ For chronic cases, determine massage appropriateness or treatment modifications by presenting symptoms

   Example: in cases of severe pitting edema, avoid the area
### TABLE 8-5 New York Heart Association’s Heart Failure Symptom Classification System

<table>
<thead>
<tr>
<th>Class</th>
<th>Level of Impairment</th>
<th>Massage Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>No symptom limitation with ordinary physical activity</td>
<td>Massage is appropriate with consideration for other conditions and medications.</td>
</tr>
<tr>
<td>II</td>
<td>Ordinary physical activity somewhat limited by shortness of breath (e.g., long distance walking, climbing two flights of stairs)</td>
<td>Massage is appropriate with consideration for other conditions and medications.</td>
</tr>
<tr>
<td>III</td>
<td>Exercise limited by shortness of breath at mild work loads (e.g., short distance walking, climbing one flight of stairs)</td>
<td>While supine, elevate the client’s upper body. If the client is overly fatigued, reduce treatment time to 30 mins, and use lighter-than-normal pressure to prevent further fatiguing the client.</td>
</tr>
<tr>
<td>IV</td>
<td>Shortness of breath at rest or with very little exertion</td>
<td>Avoid the prone position. The client’s back can be massaged while he or she is sitting or while in the side-lying position; the latter requires the client’s upper body to be slightly elevated. While the client is supine, elevate his or her upper body. Reduce treatment time to 30 mins, and use lighter-than-normal pressure to prevent fatiguing the client.</td>
</tr>
</tbody>
</table>

*Note: The last column was added to assist the therapist in treatment protocol for these clients.*
Artificial Pacemaker

Delivers small electrical currents to stimulate heart contraction

Postpone massage until physician removes restriction of strenuous activity; then avoid overhead movement of the pacemaker-side arm for additional 6 wks
Implantable Cardioverter Defibrillator (ICD)

Delivers electrical shock to restore normal heart rate and rhythm

If ICD delivers a shock during massage, discontinue massage; otherwise massage modifications same as artificial pacemaker
Massage considerations:

~ Massage is postponed until client is completely recovered from surgery and cleared by his or her physician.

~ Surgery incision should be fully healed.

~ Scar mobilization is permissible.

~ Avoid moving the arm near the pacemaker over the head.
 Massage considerations (cont'd.):

~ Offer a soft pillow to place under the chest while the client is prone.

~ The therapist might feel the shock if the therapist is touching the client when the device discharges.

~ **Massage should be discontinued if the device discharges, and the client should seek immediate medical attention.**
Rheumatic Fever

Condition that develops as a rare complication after an untreated strep throat infection

Massage is contraindicated
Rheumatic Heart Disease

Heart disease following rheumatic fever; affects all heart layers
Massage is contraindicated
Cardiomyopathy

Any weakening or change in the heart’s myocardium; associated with inadequate heart pumping

Obtain medical clearance
Endocarditis

Inflammation of heart’s internal lining (endocardium)

Massage is contraindicated
Inflammation of the heart muscle (myocardium)

Massage is contraindicated

- What are some of the possible causes of myocarditis?
  
  *Viruses and parasites are the two most common causes. Myocarditis may also be a complication of other diseases, or be caused by exposure to toxic agents.*
Pericarditis

- Inflammation of the sac surrounding the heart (pericardium)
- Massage is contraindicated

1. Fluid around heart compresses heart wall
2. Heart cannot expand to fill
3. Backup into systemic circulation
4. Decreased blood flow to lungs
5. Decreased output to body
Definition

- Damage to cardiac muscle from ischemia
- Muscle tissue doesn’t repair; replaced by scar tissue
- Damaged area = infarct
- Heart attack = myocardial infarction
Myocardial Infarction: (Heart Attack)

Demographics

- Number 1 cause of death in the United State
- 1 million heart attacks/year (1:5 deaths)
- 500,000+ deaths/year
- 13 million survivors alive today
- Risk profile
  - Sedentary, hypertension, high cholesterol, smoking, overweight
  - Male 45+, Female 55+
  - Family history
Myocardial Infarction (Heart Attack)

- Death of myocardial tissue from interrupted blood supply and prolonged ischemia

- Medical clearance needed for recent MIs; once obtained, use reduced treatment time and pressure and maintain this protocol until client has regained most of his/her strength, then regular massage can resume
Myocardial Infarction (cont'd.)
Myocardial Infarction (cont’d.)

Warning signs of heart attack:

- Chest pain that may be described as crushing, burning, viselike, heaviness, or fullness
- Discomfort in other areas of the upper body such as the arm, shoulder, neck, or jaw
- Shortness of breath, profuse sweating, fatigue, dizziness
- Nausea and indigestion
- Anxiety or fear

Warning signs of heart attack (cont’d.):

- Unusual chest pain, stomach or abdominal pain
- Continuous midthoracic or interscapular pain
- Continuous neck or shoulder pain
- Isolated right biceps pain
Warning signs of heart attack (cont’d.):
- Pain unrelieved by antiacids, rest or nitroglycerin
- Nausea and vomiting; flu-like manifestation without chest pain/discomfort
- Unexplained intense anxiety, weakness, or fatigue
- Breathlessness or dizziness
Cardiac Arrest

- Sudden and unexpected complete cessation of heartbeat

- Massage is contraindicated
Diseases of Arteries

- Arteriosclerosis
- Atherosclerosis
- Coronary artery Disease
- Peripheral arterial disease
- Hypertension
- Aneurysm
- Orthostatic hypotension
- Raynaud disease and Raynaud syndrome
- Thromboangiitis obliterans

Arteriosclerosis

- Group of diseases characterized by thickening and loss of elasticity in arterial walls; hardening of the arteries

- See slide on atherosclerosis for massage recommendations

Arteriosclerosis

- Presence of lesions called plaque within middle-large size arteries; four main forms:
  - CAD
  - Cerebrovascular disease
  - Atherosclerosis of the aorta
  - PAD

- Since atherosclerosis leads to other diseases, follow massage recommendations for those specific diseases
Atherosclerosis (cont'd.)

**Atherosclerosis**

Narrowing of large arteries by cholesterol plaque and thrombus

- **Clear artery**
  - Coronary arteries
  - Partial occlusion → **ANGINA PECTORIS** (Ischemic heart disease)
  - Total occlusion → **MYOCARDIAL INFARCTION (MI)**

- **Brain**
  - Carotid or cerebral arteries
  - Partial occlusion → **TRANSIENT ISCHEMIC ATTACK**
  - Total occlusion → **CEREBROVASCULAR ACCIDENT (CVA)**

- **Peripheral arteries**
  - **Aorta**
  - **Legs**
    - Iliac arteries → **ANEURYSM** – Occlusion → Rupture and hemorrhage

  - **Peripheral vascular disease** – Gangrene and amputation
Atherosclerosis (cont'd.)

- Nonmodifiable factors
  - Age
  - Gender
  - Genetics
Atherosclerosis (cont’d.)

- **Modifiable factors:**
  - Obesity
  - Elevated LDL-cholesterol and triglycerides and low HDL-cholesterol
  - Cigarette smoking
  - Sedentary lifestyle
  - Diabetes
  - Hypertension
Atherosclerosis (cont'd.)

**A**
- Damaged endothelium: Chronic and/or Chemical Injury
  - Hypertension
  - Smoking
  - Hyperlipidemia
  - Hyperhomocysteinemia
  - Hemodynamic factors
  - Toxins
  - Viruses
  - Immune reactions

**B**
- Fatty streak
  - Monocytes/macrophages
  - Lipid accumulation
  - Fibroblast

**C**
- Fibrous plaque
  - Collagen cap (fibrous tissue)
  - Fibroblast
  - Fissure in plaque
  - Lipid pool

**D**
- Complicated lesion
  - Thrombus
  - Thinning collagen cap
  - Lipid pool

**Response to injury**
- Platelets attach to endothelium
- Foam cells/macrophages ingesting lipids
- Migration of smooth muscle into the intima
- Lipid accumulation
- Fibroblast
Coronary Artery Disease

Narrowed coronary arteries from atherosclerotic plaque

- Since CAD leads to other diseases, follow massage recommendations for those specific diseases (angina pectoris, CHF, MI)

Coronary Artery Disease (cont’d.)

Atherosclerotic lesions

- Plaque
  - Percent occlusion: 10-25
  - Clinical presentation: Asymptomatic

- Nonocclusive thrombus
  - Percent occlusion: 50-70
  - Clinical presentation: Angina pectoris

- Occlusive thrombus
  - Percent occlusion: 100
  - Clinical presentation: Congestive heart failure, Myocardial infarct

Coronary artery
Peripheral Arterial Disease

- Disease of narrowed arteries outside the heart
- Local contraindication (usually lower extremities)

Hypertension

High blood pressure; often asymptomatic

In cases of untreated HBP, treat as an absolute contraindication; otherwise, massage is indicated

Aneurysm

- Localized weakness in a blood vessel wall that bulges outward
- Obtain physician consent; once obtained, **avoid** affected area (usually the abdomen)

Orthostatic Hypotension

- **Sudden drop in blood pressure** when moving from recumbent to upright position causing loss of balance; dizzy spell

- Assist client getting off table if needed; remind him or her to move slowly rather than quickly

Raynaud Disease and Raynaud Syndrome

- Cycle of periodic temporary, but severe, vasospasms; usually in fingers and toes
- Avoid affected area during attacks;
- Otherwise, massage indicated while avoiding cryotherapy

Thromboangiitis Obliterans

- Inflammatory condition of small-medium size arteries of upper and lower extremities
- Local contraindication; avoid all forms of thermo- and cryotherapy
Diseases of Veins

- Phlebitis
- Thrombophlebitis
- Varicose veins
Phlebitis

- Inflammation of the veins

- **Local contraindication:** while massaging other areas, place the affected limb on cushions to raise it above the level of the heart


Inflammation of a vein with thrombus formation; **Homan’s sign** may be present

Local contraindication

**Treatment:**
- Prophylactic anticoagulants

**Massage**
- Rigorous circulatory massage is contraindicated for clients who tend to form clots
- Cautions with anticoagulant medications
Varicose Veins

- Dilated veins from incompetent valves

- Local contraindication if pressure causes pain or if client has a history of blood clots

Varicose Veins (cont'd.)

Blood flows upward through open valve as muscle contraction compresses vein

Competent closed valve prevents backflow of blood

Incompetent or "leaky" valve permits blood to flow backward in vein, causing varicosities
Good-bye