CARDIOVASCULAR SYSTEM

Heart rate

- Normal range is 60-100 beats per minute
- Tachycardia is greater than 100 bpm
- Bradycardia is less than 60 bpm
- Sympathetic system INCREASES HR
- Parasympathetic system (Vagus) DECREASES HR
- The vascular system consists of the arteries, veins and capillaries
- The arteries are vessels that carry blood away from the heart to the periphery
- The veins are the vessels that carry blood to the heart
- The capillaries are lined with squamous cells, they connect the veins and arteries

LABORATORY PROCEDURES

CARDIAC Proteins and enzymes

- CK- MB (creatine kinase)
- Elevates in MI within 4 hours, peaks in 18 hours and then declines

CARDIAC Proteins and enzymes

- CK- MB (creatine kinase)
- Normal value is 0-7 U/L
- Lactic Dehydrogenase (LDH)
- Elevates in MI in 24 hours, peaks in 48-72 hours
- Normally LDH1 is greater than LDH2
- Lactic Dehydrogenase (LDH)
- MI- LDH2 greater than LDH1 (flipped LDH pattern)
- Normal value is 70-200 IU/L

Myoglobin

- Rises within 1-3 hours
- Peaks in 4-12 hours
- Returns to normal in a day
- Not used alone
- Muscular and RENAL disease can have elevated myoglobin

Troponin I and T

- Troponin I is usually utilized for MI

- Elevates within 3-4 hours, peaks in 4-24 hours and persists for 7 days to 3 weeks!
- Normal value for Troponin I is less than 0.6 ng/mL

REMEMBER to AVOID IM injections before obtaining blood sample!

Early and late diagnosis can be made!

SERUM LIPIDS

Lipid profile measures the serum cholesterol, triglycerides and lipoprotein levels
Cholesterol= 200 mg/dL

- Triglycerides- 40- 150 mg/dL
- LDH- 130 mg/dL
- HDl- 30-70- mg/dL
- NPO post midnight (usually 12 hours)

ELECTROCARDIOGRAM (ECG)

- A non-invasive procedure that evaluates the electrical activity of the heart
- Electrodes and wires are attached to the patient

Holter Monitoring

- A non-invasive test in which the client wears a Holter monitor and an ECG tracing recorded continuously over a period of 24 hours
- Instruct the client to resume normal activities and maintain a diary of activities and any symptoms that may develop

ECHOCARDIOGRAM

- Non-invasive test that studies the structural and functional changes of the heart with the use of ultrasound
- No special preparation is needed
- Stress Test
- A non-invasive test that studies the heart during activity and detects and evaluates CAD
- Exercise test, pharmacologic test and emotional test

TREADMILL TESTING IS THE MOST COMMONLY USED STRESS TEST

Used to determine CAD, Chest pain causes, drug effects and dysrhythmias in exercise

Pre-test: consent may be required, adequate rest , eat a light meal or fast for 4 hours and avoid smoking, alcohol and caffeine

Post-test: instruct client to notify the physician if any chest pain, dizziness or shortness of breath . Instruct client to avoid taking a hot shower for 10-12 hours after the test

PHARMACOLOGICAL STRESS TEST

- Use of dipyridamole
- Maximally dilates coronary artery
- Side-effect: flushing of face

Pre-test: 4 hours fasting, avoid alcohol, caffeine

Post test: report symptoms of chest pain

CARDIAC CATHETERIZATION

- Insertion of a catheter into the heart and surrounding vessels
- Determines the structure and performance of the heart valves and surrounding vessels

Used to diagnose CAD, assess coronary atery patency and determine extent of atherosclerosis
Pretest: Ensure Consent, assess for allergy to seafood and iodine, NPO, document weight and height, baseline VS, blood tests and document the peripheral pulses

Pretest: Fast for 8-12 hours, teachings, medications to allay anxiety

Intra-test: inform patient of a fluttery feeling as the catheter passes through the heart; inform the patient that a feeling of warmth and metallic taste may occur when dye is administered

Post-test: Monitor VS and cardiac rhythm

- **Monitor peripheral pulses, color and warmth and sensation of the extremity distal to insertion site**
- **Maintain sandbag to the insertion site if required to maintain pressure**
- **Monitor for bleeding and hematoma formation**
- **Maintain strict bed rest for 6-12 hours**
- **Client may turn from side to side but bed should not be elevated more than 30 degrees and legs always straight**
- **Encourage fluid intake to flush out the dye**
- **Immobilize the arm if the antecubital vein is used**
- **Monitor for dye allergy**

CVP

- The CVP is the pressure within the SVC
- Reflects the pressure under which blood is returned to the SVC and right atrium
- Normal CVP is 0 to 8 mmHg/ 4-10 cm H2O
- Elevated CVP indicates increase in blood volume, excessive IVF or heart/renal failure
- Low CVP may indicated hypovolemia, hemorrhage and severe vasodilatation

Measuring CVP

1. **Position the client supine with bed elevated at 45 degrees**
2. **Position the zero point of the CVP line at the level of the right atrium. Usually this is at the MAL, 4th ICS**
3. **Instruct the client to be relaxed and avoid coughing and straining.**

CAD

CAD results from the focal narrowing of the large and medium-sized coronary arteries due to deposition of atheromatous plaque in the vessel wall

RISK FACTORS

1. **Age above 45/55 and Sex- Males and post-menopausal females**
2. **Family History**
3. **Hypertension**
4. **DM**
5. **Smoking**
6. **Obesity**
7. **Sedentary lifestyle**
8. **Hyperlipedimia**

RISK FACTORS

Most important MODIFIABLE factors:

- **Smoking**
- **Hypertension**
- **Diabetes**
- **Cholesterol abnormalities**

PATHOPHYSIOLOGY

- **Fatty streak formation in the vascular intima → T-cells and monocytes ingest lipids in the area of deposition→ atheroma→ narrowing of the arterial lumen → reduced coronary blood flow → myocardial ischemia**

Pathophysiology

- **There is decreased perfusion of myocardial tissue and inadequate myocardial oxygen supply**

- **If 50% of the left coronary arterial lumen is reduced or 75% of the other coronary artery, this becomes significant**
- **Potential for Thrombosis and embolism**

ANGINA PECTORIS

Chest pain resulting from coronary atherosclerosis or myocardial ischemia
Angina Pectoris:
Clinical Syndromes
Three Common Types of ANGINA
1. STABLE ANGINA

- **The typical angina that occurs during exertion, relieved by rest and drugs and the severity does not change**

Three Common Types of ANGINA
2. Unstable angina

- **Occurs unpredictably during exertion and emotion, severity increases with time and pain may not be relieved by rest and drug**

Three Common Types of ANGINA
3. Variant angina

- **Prinzmetal angina, results from coronary artery VASOSPASMS, may occur at rest**

ASSESSMENT FINDINGS
1. Chest pain- ANGINA

- **Precipitated by *E*xercise, *E*ating heavy meals, *E*motions like excitement and anxiety and *E*xtremes of temperature**
- **Relieved by REST and Nitroglycerin**
- **2. Diaphoresis**
- **3. Nausea and vomiting**
- **4. Cold clammy skin**
- **5. Sense of apprehension and doom**
- **6. Dizziness and syncope**

Angina Pectoris

LABORATORY FINDINGS

1. ECG may show normal tracing if patient is pain-free. Ischemic changes may show ST depression and T wave inversion
2. Cardiac catheterization

- **Provides the MOST DEFINITIVE source of diagnosis by showing the presence of the atherosclerotic lesions**

Angina Pectoris

NURSING MANAGEMENT

1. Administer prescribed medications
- Nitrates- to dilate the coronary arteries
- Aspirin- to prevent thrombus formation
- Beta-blockers- to reduce BP and HR
- calcium-channel blockers- to dilate coronary artery and reduce vasospasm

2. Teach the patient management of anginal attacks

- Advise patient to stop all activities
- Put one nitroglycerin tablet under the tongue
- Wait for 5 minutes
- If not relieved, take another tablet and wait for 5 minutes
- Another tablet can be taken (third tablet)
- If unrelieved after THREE tablets→ seek medical attention

3. Obtain a 12-lead ECG
4. Promote myocardial perfusion
- Instruct patient to maintain bed rest
- Administer O2 @ 3 lpm
- Advise to avoid valsalva maneuvers
- Provide laxatives or high fiber diet to lessen constipation
- Encourage to avoid increased physical activities

5. Assist in possible treatment modalities
- PTCA- percutaneous transluminal coronary angioplasty
  To compress the plaque against the vessel wall, increasing the arterial lumen
- CABG- coronary artery bypass graft
  To improve the blood flow to the myocardial tissue

6. Provide information to family members to minimize anxiety and promote family cooperation
7. Assist client to identify risk factors that can be modified
8. Refer patient to proper agencies

MYOCARDIAL INFARCTION

Death of myocardial tissue in regions of the heart with abrupt interruption of coronary blood supply

ETIOLOGY and Risk factors
1. CAD
2. Coronary vasospasm
3. Coronary artery occlusion by embolus and thrombus
4. Conditions that decrease perfusion- hemorrhage, shock

Risk factors
1. Hypercholesterolemia
2. Smoking
3. Hypertension
4. Obesity
5. Stress
6. Sedentary lifestyle

PATHOPHYSIOLOGY
- Interrupted coronary blood flow→ myocardial ischemia →anaerobic myocardial metabolism for several hours→ myocardial death → depressed cardiac function → triggers autonomic nervous system response → further imbalance of myocardial O2 demand and supply

ASSESSMENT FINDINGS

1. CHEST PAIN
- Chest pain is described as severe, persistent, crushing substernal discomfort
- Radiates to the neck, arm, jaw and back
- Occurs without cause, primarily early morning
- *NOT* relieved by rest or nitroglycerin
- Lasts 30 minutes or longer

2. Dyspnea
3. Diaphoresis

4. cold clammy skin
5. N/V
6. restlessness, sense of doom
7. tachycardia or bradycardia
8. hypotension
9. S3 and dysrhythmias

Laboratory findings

1. ECG- the ST segment is ELEVATED. T wave inversion, presence of Q wave
2. Myocardial enzymes- elevated CK-MB, LDH and Troponin levels
3. CBC- may show elevated WBC count
4. Test after the acute stage- Exercise tolerance test, thallium scans, cardiac catheterization

Nursing Interventions

1. Provide Oxygen at 2 lpm, Semi-fowler's
2. Administer medications

- Morphine to relieve pain
- nitrates, thrombolytics, aspirin and anticoagulants
- Stool softener and hypolipidemics

3. Minimize patient anxiety

- Provide information as to procedures and drug therapy

4. Provide adequate rest periods
5. Minimize metabolic demands

- Provide soft diet
- Provide a low-sodium, low cholesterol and low fat diet

6. Minimize anxiety

- **Reassure client and provide information as needed**

7. Assist in treatment modalities such as PTCA and CABG
8. Monitor for complications of MI- especially dysrhythmias, since ventricular tachycardia can happen in the first few hours after MI
9. Provide client teaching

MEDICAL MANAGEMENT

1. ANALGESIC

- The choice is MORPHINE
- It reduces pain and anxiety
- Relaxes bronchioles to enhance oxygenation

2. ACE

- Prevents formation of angiotensin II

3. Thrombolytics

- Streptokinase, Alteplase
- Dissolve clots in the coronary artery allowing blood to flow

NURSING INTERVENTIONS AFTER ACUTE EPISODE

1. Maintain bed rest for the first 3 days
2. Provide passive ROM exercises
3. Progress with dangling of the feet at side of bed

NURSING INTERVENTIONS AFTER ACUTE EPISODE

4. Proceed with sitting out of bed, on the chair for 30 minutes TID
5. Proceed with ambulation in the room→ toilet→ hallway TID

NURSING INTERVENTIONS AFTER ACUTE EPISODE

Cardiac rehabilitation

- To extend and improve quality of life
- Physical conditioning
- Patients who are able to walk 3-4 mph are usually ready to resume sexual activities

CHF

- A syndrome of congestion of both pulmonary and systemic circulation caused by inadequate cardiac function and inadequate cardiac output to meet the metabolic demands of tissues
- Inability of the heart to pump sufficiently
- The heart is unable to maintain adequate circulation to meet the metabolic needs of the body
- Classified according to the major ventricular dysfunction- Left or Right

Etiology of CHF

1. CAD
2. Valvular heart diseases
3. Hypertension
4. MI
5. Cardiomyopathy
6. Lung diseases
7. Post-partum
8. Pericarditis and cardiac tamponade

NEW YORK HEART ASSOCIATION

Class 1

- Ordinary physical activity does NOT cause chest pain and fatigue
- No pulmonary congestion
- Asymptomatic
- NO limitation of ADLs

Class 2

- SLIGHT limitation of ADLs
- NO symptom at rest
- Symptom with INCREASED activity
- Basilar crackles and S3

Class 3

- Markedly limitation on ADLs
- Comfortable at rest BUT symptoms present in LESS than ordinary activity

Class 4

- SYMPTOMS are present at rest

LEFT SIDED SIGNS:

1. Dyspnea on exertion
2. PND
3. Orthopnea

4. Pulmonary crackles/rales
5. cough with Pinkish, frothy sputum
6. Tachycardia
7. Cool extremities
8. Cyanosis
9. decreased peripheral pulses
10. Fatigue
11. Oliguria
12. signs of cerebral anoxia

RIGHT SIDED CHF

ASSESSMENT FINDINGS

1. Peripheral dependent, pitting edema
2. Weight gain
3. Distended neck vein
4. hepatomegaly
5. Ascites
6. Body weakness
7. Anorexia, nausea
8. Pulsus alternans

NURSING INTERVENTIONS

1. Assess patient's cardio-pulmonary status
2. Assess VS, CVP and PCWP. Weigh patient daily to monitor fluid retention

CHF

3. Administer medications- usually cardiac glycosides are given- DIGOXIN or DIGITOXIN, Diuretics, vasodilators and hypolipidemics are prescribed
4. Provide a LOW sodium diet. Limit fluid intake as necessary
5. Provide adequate rest periods to prevent fatigue
6. Position on semi-fowler’s to fowler’s for adequate chest expansion
7. Prevent complications of immobility

HYPERTENSION

A systolic BP greater than 140 mmHg and a diastolic pressure greater than 90 mmHg over a sustained period, based on two or more BP measurements.

TYPES OF HYPERTENSION

1. Primary or ESSENTIAL

- Most common type

2. Secondary

- Due to other conditions like Pheochromocytoma, renovascular hypertension, Cushing’s, Conn’s , SIADH

PATHOPHYSIOLOGY

Multi-factorial etiology

BP= CO (SV X HR) x TPR

Any increase in the above parameters will increase BP

1. Increased sympathetic activity
2. Increased absorption of Sodium, and water in the kidney
3. Increased activity of the RAAS
4. Increased vasoconstriction of the peripheral vessels
5. insulin resistance

ASSESSMENT FINDINGS

1. Headache

2. Visual changes
3. chest pain
4. dizziness
5. N/V

Risk factors for Cardiovascular Problems in Hypertensive patients
Major Risk factors

1. Smoking
2. Hyperlipidemia
3. DM
4. Age older than 60
5. Gender- Male and post menopausal W
6. Family History

DIAGNOSTIC STUDIES

1. Health history and PE
2. Routine laboratory- urinalysis, ECG, lipid profile, BUN, serum creatinine , FBS
3. Other lab- CXR, creatinine clearance, 24-huour urine protein

MEDICAL MANAGEMENT

1. Lifestyle modification
2. Drug therapy
3. Diet therapy

DRUG THERAPY

1. Diuretics
2. Beta blockers
3. Calcium channel blockers
4. ACE inhibitors
5. A2 Receptor blockers
6. Vasodilators

NURSING INTERVENTIONS

- Provide health teaching to the patient
- Provide list of LOW fat , LOW sodium diet of less than 3 grams of Na/day
- Limit alcohol intake to 30 ml/day
- Regular aerobic exercise
- Advise to completely Stop smoking
- Promote Home care management
- Instruct regular monitoring of BP
- Involve family members in care
- Instruct regular follow-up
- Manage hypertensive emergency and urgency properly

PERIPHERAL ARTERIAL OCCLUSIVE DISEASE

- Refers to arterial insufficiency of the extremities usually secondary to peripheral atherosclerosis.
- Usually found in males age 50 and above
- The legs are most often affected

Risk factors for Peripheral Arterial occlusive disease
Non-Modifiable

1. Age
2. gender
3. family predisposition

Modifiable

1. Smoking
2. HPN
3. Obesity
4. Sedentary lifestyle
5. DM
6. Stress

ASSESSMENT FINDINGS

1. INTERMITTENT CLAUDICATION- the hallmark of PAOD

This is PAIN described as aching, cramping or fatiguing discomfort consistently reproduced with the same degree of exercise or activity

ASSESSMENT FINDINGS

1. INTERMITTENT CLAUDICATION- the hallmark of PAOD. This pain is RELIEVED by REST and commonly affects the muscle group below the arterial occlusion
2. Progressive pain on the extremity as the disease advances
3. Sensation of cold and numbness of the extremities
4. Skin is pale when elevated and cyanotic/ruddy when placed on a dependent position
5. Muscle atrophy, leg ulceration and gangrene

Diagnostic Findings

1. Unequal pulses between the extremities
2. Duplex ultrasonography
3. Doppler flow studies

MEDICAL MANAGEMENT

1. Drug therapy

- Pentoxyfylline (Trental) reduces blood viscosity and improves supply of O2 blood to muscles
- Cilostazol (Pletaal) inhibits platelet aggregation and increases vasodilatation

2. Surgery- Bypass graft and anastomoses

<u>BUERGER'S DISEASE</u>

Thromboangiitis obliterans
A disease characterized by recurring inflammation of the medium and small arteries and veins of the lower extremities
Occurs in MEN ages 20-35
RISK FACTOR: SMOKING!

PATHOPHYSIOLOGY

- Cause is UNKNOWN
- Probably an Autoimmune disease
- Inflammation of the arteries→ thrombus formation→ occlusion of the vessels

ASSESSMENT FINDINGS

- Leg PAIN
- Foot cramps in the arch (instep claudication) after exercise
- Relieved by rest
- Aggravated by smoking, emotional disturbance and cold chilling
- Digital rest pain not changed by activity or rest
- Intense RUBOR (reddish-blue discoloration), progresses to CYANOSIS as disease advances
- Paresthesia

DIAGNOSTIC STUDIES

1. **Duplex ultrasonography**
2. **Contrast angiography**

Nursing Interventions

Post-operative care: after amputation

- **Elevate stump for the FIRST 24 HOURS to minimize edema and promote venous return**
- **Place patient on PRONE position after 24 hours**
- **Assess skin for bleeding and hematoma**
- **Wrap the extremity with elastic bandage**

RAYNAUD'S DISEASE

- A form of intermittent arteriolar VASOCONSTRICTION that results in coldness, pain and pallor of the fingertips or toes
- Cause : UNKNOWN
- Most commonly affects WOMEN, 16- 40 years old
- **ASSESSMENT FINDINGS**
  - Raynaud's phenomenon
  - A localized episode of vasoconstriction of the small arteries of the hands and feet that causes color and temperature changes
  - Pallor- due to vasoconstriction, then
  - Blue- due to pooling of Deoxygenated blood
  - Red- due to exaggerated reflow/hyperemia
  - tingling sensation
  - Burning pain on the hands and feet

MEDICAL MANAGEMENT

- **Drug therapy with the use of CALCIUM channel blockers**
- **To prevent vasospasms**
  - **Nursing Interventions**
  - **1. instruct patient to avoid situations that may be stressful**
  - **2. instruct to avoid exposure to cold and remain indoors when the climate is cold**
  - **3. instruct to avoid all kinds of nicotine**
  - **4. instruct about safety. Careful handling of sharp objects**

VARICOSE VEINS

TheseE are dilated veins usually in the lower extremities

- Predisposing Factors
- Pregnancy
- Prolonged standing or sitting
- Constipation (for hemorrhoids)
- Incompetent venous valves

Pathophysiology

- Factors → venous stasis→ increased hydrostatic pressure → edema
- Assessment findings
- Tortuous superficial veins on the legs
- Leg pain and Heaviness
- Dependent edema

Laboratory findings

- Venography

- Duplex scan pletysmography

Medical management

- Pharmacological therapy
- Leg vein stripping
- Anti-embolic stockings

Nursing management

1. Advise patient to elevate the legs
2. Caution patient to avoid prolonged standing or sitting

Nursing management

3. Provide high-fiber foods to prevent constipation
4. Teach simple exercise to promote venous return

Nursing management

5. Caution patient to avoid knee-length stockings and constrictive clothings

Nursing management

6. Apply anti-embolic stockings as directed
7. Avoid massage on the affected area

DVT- Deep Vein Thrombosis

- Inflammation of the deep veins of the lower extremities and the pelvic veins
- The inflammation results to formation of blood clots in the area

Predisposing factors

- Prolonged immobility
- Varicosities
- Traumatic procedures

Complication

- PULMONARY thromboembolism

Assessment findings

- Leg tenderness
- Leg pain and edema
- Positive HOMAN’s SIGN

Laboratory findings

- Venography
- Duplex scan
- Medical management
- Antiplatelets
- Anticoagulants
- Vein stripping and grafting
- Anti-embolic stockings

Nursing management

- Provide measures to avoid prolonged immobility
- Repositioning Q2
- Provide passive ROM
- Early ambulation
- Provide skin care to prevent the complication of leg ulcers
- Provide anti-embolic stockings
- Administer anticoagulants as prescribed
- Monitor for signs of pulmonary embolism