Description: This module expands upon the concept of perfusion. Emphasis is placed on factors affecting cardiac output and how these factors affect the body’s ability to maintain an adequate supply of nutrients and oxygen to organs and tissues.

Applicable to the following Exemplars for NUR 213: Life Threatening Arrhythmias, Shock, Cardiomyopathy, MI, VSD, Trauma. Applies indirectly to Renal Failure, ARDS, Septic Shock, and Spinal Cord Injury.

Learning Outcomes:
Upon completion of this module the student will be able to:

1. Correlate the significance of cardiac output to perfusion.
2. Describe the four determinants of cardiac output.
3. Discuss collaborative interventions that optimize cardiac output and tissue perfusion.
4. Discuss the rationale for optimizing heart rate to enhance cardiac output.
5. Discuss the impact of age on a client’s cardiac output.
6. Discuss how an increased and/or decreased Preload could have a negative effect on cardiac output.
7. Describe the effect of an increased and/or decreased afterload on cardiac output.
8. Analyze assessment data to formulate nursing diagnoses/collaborative problems for clients with decreased cardiac output.
9. Using Evidence-based practice research, develop a comprehensive plan of care that is reflective of the nursing process for the client with decreased cardiac output.
10. Describe how each classification of common cardiac drugs affects the determinants of cardiac output.

Learning Resources:
Ch 31 pages 936-941 and 958-969 and Ch 32 pages 1022-1042
Simulation Lab: Use Sim Man to re-create the following scenarios.
Simulation Lab Scenario Example One:
64 yr old female patient admitted from Dr.’s office to telemetry with new onset atrial fibrillation with rapid ventricular response (150-160). BP stable at 130/80. Treated with IV Cardizem and PO Beta Blockers. No significant response. IV Amiodorone added. Atrial fibr continued though was rate controlled (60-100).

At 1600 on day 2 of admission, rhythm suddenly changed to junctional rhythm in the 30’s with drop in BP to 80/60. Rapid Response Team called. Pt given Atropine and Epinephrine. ABGs showed severe respiratory acidoses with pH of 6.32. Patient intubated and transferred to ICU.

Scenario Example Two:
73 female patient S/P Right BKA complicated by possible CVA with difficulty swallowing. BP increased (190/110) due to extreme pain and NPO status secondary dysphagia and thus being able to take PO BP meds. Pt awaiting insertion under fluoroscopy of Feeding Tube. Morphine 2 mg IV given per orders and according to agency injection guidelines. Adequate pain relief noted, but BP dropped to 80 palpable. Student assessed change in HR from 80 previously to 100 and from regular to irregular. Monitor showed sudden onset of atrial fibrillation. MD notified. Fluid Bolus ordered and administered. IV Cardizem ordered once BP stabilized.

Scenario Example Three:
72 yr old female patient admitted with shortness of breath, chest pain, elevated BP. Known ejection fraction of 25%. MI ruled out. Congestive Heart Failure diagnosed. Patient initially treated with Lasix IV and NTG paste. Condition improved until 0430 on second day of admission when patient again complained of SOB and had an O2 saturation of 82%. Was placed on 100% Non rebreather and IV Bumex ordered. NTG paste was changed to IV NTG to start at 50 mcgs per min. Nipride ordered and started at 10mcg/kg/min.

Learning Activities:
Perfusion/Cardiac Output Assignment (Attached)
Power Point Presentation (Attached)
Case Study (Attached)
Optimizing Cardiac Output Exercise (Attached)

Evaluation:
Unit exams
Lab competencies
Clinical Performance Evaluation
Assignment
Concept: Perfusion: Relationship to Cardiac Output

Reference:

Pages 1022 -1042
Describe how each of the following goals is achieved in optimizing cardiac output

1. Decreasing Intravascular Volume

2. Decreasing Venous Return

3. Decreasing Afterload

4. Improving Gas Exchange and Oxygenation

5. Improving Cardiac Function

6. Reducing Anxiety
Describe how each of the following drugs helps to optimize cardiac output:

7. ACE Inhibitors

8. Diuretics

9. Inotropic drugs

10. Vasodilators

11. Beta Blockers
Decreased Cardiac Output Case Study

This 71 yo client was admitted for an acute MI and emergency placement of an RCA stent. During the procedure she went into ventricular fibrillation and had to be defibrillated twice before converting to NSR. She subsequently underwent an emergent CABG and mitral valve replacement with a pericardial tissue valve and required the Intra Aortic Balloon Pump for 48 hours post op. Her ejection fraction is estimated to be 25-30%. She is currently post op day 8. Her post operative course has been complicated by:

1. episodes of atrial fib treated with Beta blockers and IV/PO Amiodorone. She remains in a fib with a controlled heart rate in the 70’s
2. Fluid volume excess secondary to third spacing of fluid post op CABG with an 8kg post op weight gain (pre op wt = 94 kg, post op = 102 kg), and to decreased ejection fraction of 25-30% as well as acute renal insufficiency
3. renal insufficiency with a post op Creatinine of 2.2 and a BUN of 75
4. Left lower lung pleural effusion requiring thoracentesis (250 mls drained)
5. DOE with a drop in her O2 sat to the high 80’s with activity. At rest her O2 sat is 94% on room air.

Her assessment is normal except for decreased breath sounds in the bases and bi-basilar crackles with O2 sats as noted. CXR continues to show left pleural effusion. Her wounds are well approximated and without excess redness and with no drainage. She has 2+ pitting edema in both lower extremities. She is afebrile with a BP of 90/45, HR of 70’s atrial fib and respiratory rate of 20-24.

Questions

1. This client is exhibiting signs of decreased cardiac output. What factors are contributing to decreased cardiac output for her?
   A. She just had a CABG and MVR
   B. Atrial fib
   C. Known ejection fraction of 25-30%
   D. FVE secondary to third spacing of fluid post of CABG
   E. All of the above
   F. B, C, and D

2. Atrial fibrillation decreases cardiac output for this patient because
   A. It is not a normal rhythm
   B. Atrial contraction which contributes 25-30% of cardiac output is not happening
   C. The heart rate is too fast for her heart to fill adequately
   D. It increases her risk of CVA due to clot formation
3. Several factors are also contributing to altered gas exchange in this patient. These include:
   A. FVE s/p CABG with over 8 liters of fluid being retained
   B. Hx of CHF with known ejection fraction of 25-30% and current rhythm of atrial fib
   C. Left lower lung pleural effusion
   D. A and C
   E. All of the above

4. Describe how decreased cardiac output may alter “end organ” perfusion to the
   Brain
   Lungs
   Kidneys
   Skin (interstitial space)

5. This client is being treated with IV diuretics (Bumex and Diuril) primarily because:
   A. she has pitting lower extremity edema
   B. the excess fluid volume may enter her alveoli and cause further decrease in oxygenation
   C. she has a history of hypertension
   D. All of the above
   E. B

6. This patient is at risk for sudden cardiac death. You know this because:
   A. She has a history of ventricular fibrillation requiring cardioversion
   B. She has a known ejection fraction of 25-30%
   C. She is s/p CABG with MVR
   D. A and B
   E. All of the above

7. This patient is at risk for CVA due to embolic clots. Why?
   A. When the atria do not contract, blood may pool and form clots that may then be transferred to the brain
   B. With an ejection fraction of only 25-30%, blood may pool in the ventricle and form clots that are transferred to the brain
   C. With 2+ pitting edema she is at greater risk for peripheral vascular disease plaque formation
   D. All of the above
   E. A and B
8. Given what you know about this patient, which of the following may be true for her?
   A. Her pulmonary artery wedge pressure is probably higher than 18 indicating that her preload is too high
   B. Her cardiac index is probably less than 2.2
   C. Her LVEDP is probably higher than normal
   D. A and B
   E. All of the above

9. This patient is taking Lopressor (Beta Blocker), Bumex (diuretic) and Amiodorone. What are some expected outcomes of these drugs?
   A. decreased preload, conversion to NSR and increased afterload
   B. decreased preload, decreased work of the heart, decreased O2 demand, conversion to NSR
   C. Decreased stroke volume, decreased HR and BP
   D. A and B

10. What is your highest priority problem for this patient? What is your goal for this problem?

11. The Intra Aortic Balloon Pump was used for this patient to:
   A. Decrease her preload and afterload
   B. Augment her contractility
   C. Decrease her afterload and enhance her coronary perfusion
   D. Decrease her HR and BP
Optimizing Cardiac Output Exercise

Directions:
Assign six to seven students placards with different determinants of Cardiac Output as follows:
1. Increased Preload
2. Increased Preload and Decreased Contractility
3. Decreased Preload
4. Increased Afterload
5. Increased Heart Rate
6. Decreased Heart Rate
7. Decreased Contractility

Divide class into 4-8 groups depending on size of class.
Give each group 4 - 8 cards with information about one or more of the following:
A. Scenarios reflective of different determinants of cardiac output (students must figure out which determinant is relative to the scenario)
B. Collaborative management interventions for scenarios (student to identify which determinant is being treated)
C. Specific drug actions (Students to determine which determinant would be affected by these drugs and how)

Have group discuss each card and determine which determinant of decreased cardiac output is correlated with the specific information as noted above.

Have students with placards round to each group and collect cards relative to their determinant.

Discuss Cards for Each Determinant as a class.

Scenario Examples:
82 year old female patient admitted with shortness of breath. VS: 97.6 -110 -28. BP 100/60. Crackles noted over lower half of lung fields. Neck veins evident with HOB at 45 degrees. SaO2 on room air 88%. 2+ pitting edema of lower extremities. History of CHF with a large anterior MI in the past, known ejection fraction of 25%.
(This scenario is indicative of fluid volume excess and increased Preload)
77yo male patient admitted with chest pain and SOB. Enzymes negative for Myocardial Infarction. VS 97.6 – 110 – 30 BP 80/60. SaO2 on 2L nasal cannula 88%. Crackles bilaterally in the bases. BNP 900 States weight has increased four pounds over the last two days. PMH: IDDM, Idiopathic Dilated Cardiomyopathy. Bi-Ventricular Pacemaker inserted one year ago. 
(This scenario is indicative of fluid volume excess with increased preload and decreased contractility)

68 yr old female patient 2 hours S/P CABG (Coronary Artery Bypass Surgery). VS: 97 – 90 – 14 BP 100/60 SaO2 99% on vent FiO2 of 40%. Normal Sinus Rhythm
Cardiac Output 3.8 (Normal is 4-8)
Cardiac Index 1.8 (Normal is greater than 2.2)
Pulmonary Artery Diastolic 6 (Normal is 6-12, for “sick” heart is 18)
CVP 2 (Normal is 4-6)
Systemic Vascular Resistance 1000 (Normal is 800-1200)
Blood Glucose 200 (Normal is 70-110)
PMH: CAD, Ejection Fraction 60%, NIDDM
(This scenario is indicative of decreased preload)

69 yr old female 1 hour S/P Mitral Valve Replacement with a Carpentier Edwards Pericardial Tissue valve. VS: 98 – 90 – 20 BP 106/60 SaO2 99% on vent FiO2 of 40%. Normal Sinus Rhythm
Cardiac Output 3.8 (Normal is 4-8)
Cardiac Index 1.8 (Normal is greater than 2.2)
Pulmonary Artery Diastolic 18 (Normal is 6-12, for “sick” heart is 18)
CVP 6 (Normal is 4-6)
Systemic Vascular Resistance 1400 (Normal is 800-1200)
Blood Glucose 200 (Normal is 70-110)
PMH: Rheumatic Fever as a Child, atrial fib, Ejection Fraction 55-60%
(This scenario is indicative of increased Afterload)

76 year old male admitted with dizziness, SOB. VS: 97.8 – 150 – 28 90/60 SaO2 88% on room air Rhythm on admission identified as rapid atrial fibrillation.
PMH: NIDDM, HTN,
(This scenario is indicative of increased Heart Rate)
82 year old female patient visited by Home Health RN and found to have HR of 40. Is awake, alert and oriented with BP of 100/60. Skin warm and dry. Respiratory Rate 20 with SaO2 of 93% on room air. Home Health RN called 911 and had patient admitted to hospital. 
PMH: PPM four years ago for Third Degree Heart Block, HTN, CAD treated medically. (This scenario is indicative of decreased Heart Rate)

75 year old male with history of CHF with know ejection fraction of 15% admitted for permanent pacemaker for battery check and upgrade. 
VS: 98 – 80 – 16  88/60 Lungs clear SaO2 93% on room air. Monitor shows AV pacing. 
(This scenario is indicative of decreased contractility)

67 yo female with admitted for SOB and Hypertension. VS: 97.6  110 – 28  210/94 Known EF of 60%. Sinus Tachycardia. 
PMH: IDDM, Renal Insufficiency with Creatinine of 2. 
(This scenario is indicative of increased afterload.)

Collaborative Intervention Cards

CXR
Titrate O2 to maintain saturation of 93%. 
Lasix 40 mg IV now and then BID 
Activity: OOB to chair with assistance 
Diet: 2GM Na Heart Healthy 
(Orders for Increased Preload)

CK with MB Bands and Troponin now and every 8 hours times 2 
CXR
Titrate O2 to maintain saturation of 93% 
Dopamine start at 10mcg/kg/min. Titrate to maintain BP of 110 systolic 
Lasix 20 mg IV now and BID if BP greater than 100 systolic. 
(Orders for Increased Preload and Decreased Contractility)
VS q 1 hour and PRN
Normal Saline fluid bolus, 500 ml now
(Orders for Decreased Preload)

VS q 1 hour and PRN
Begin Nipride. Titrate to maintain BP > 100 systolic.
(Orders for increased Afterload)

CXR
Titrate O2 to maintain saturation of > 93%
Cardizem 5 mg IV bolus, then start Cardizem drip at 5 mg/hour. Titrate for HR of 60-100 and BP of 90 systolic. Not to exceed 15mg/hour.
(Orders for increased Heart Rate)

CXR
Titrate O2 to maintain saturation of > 93%
Implement Zoll External Pacing with Rate set at 70. MA set at 10 above capture threshold.
Versed 1 mg IV every 2 hours prn
Atropine 1 mg IV prn for loss of capture, not to exceed 3mg total.
(Orders for decreased HR)

Hibiclens prep to entire chest.
Digoxin 0.25 mg PO daily
NPO after Midnight except for meds.
Permit for Permanent Pacemaker Upgrade to Atrial BiVentricular Pacemaker
Consult Cardiovascular Teaching Nurse for Pacemaker Education.
(orders for decreased contractility)

Nipride drip titrate for BP less than 150 systolic
NTG 50 mcg/min Titrate for BP 100-150 systolic
Bumex 2 mg now and BID
CXR
Titrate O2 to maintain saturation of > 93%
(orders for increased Preload and Increased Afterload)
Drug Card Information

Beta Blockers
Digoxin
Calcium Channel Blockers
(Drugs that decrease HR)

Diuretics
Venous Vasodilators like NTG
(Drugs that decrease Preload)

ACE Inhibitors
ARBs
Nipride
Calcium Channel Blockers
(Drugs that decrease afterload – arterial vasodilators)

Digoxin
Dopamine
Dobutamine
(Drugs that Increase Contractility)