Invasive Cardiology III
Syllabus

Spring Term – Year 2

Course:
CVT-2421 C  Invasive Cardiology III  4 Credits / 3 Class / 3 Lab / 6 Contact

Prerequisites:
CVT-2420 C  Invasive Cardiology II

Corequisites:
CVT-2211C  Critical Care Applications
CVT-2842L  Cardiovascular Clinical Practicum III

Catalog Course Description:
This course is designed to tie together cardiac diseases as well as to continue teaching the student classifications and the use of equipment and techniques used in invasive cardiology. An in-depth presentation of various diseases including coronary artery disease, angina, myocardial infarction, heart failure, valve diseases, cardiomyopathies, pericardial disorders, dysrhythmias, congenital anomalies and repair procedures are also presented. Additionally, students will learn the various calculations performed in the cath lab including cardiac outputs, vascular resistance, valve areas, and shunts.

Instructor:
Name:
Office:
Office Hours:
Phone:
Email:

Texts:
• Instructor Handouts
• The Interventional Cardiac Catheterization Handbook by: Kern, Morton J.
• Grossman’s Cardiac Catheterization, Angiography, and Intervention 7th Edition by: Baim, Donald S.
• Textbook of Cardiovascular Medicine 2nd Edition by: Topol, Eric J.

VCC Core Competencies:
The Valencia Student Core Competencies (Think, Value, Act, and Communicate) are an established component of the College’s curriculum development and review process. A detailed overview can be found in the current Valencia Catalog or on the Valencia Website: //www.valenciacc.edu/competencies/default.asp. Developing these core competencies will be enhanced through critical thinking exercises, classroom discussions, and reasoned choices made by acquiring, analyzing, synthesizing, and evaluating knowledge. You will also need to read, listen, write, and speak effectively. The college’s goal is to provide the best education possible in exchange for the tuition it receives. Students should never expect a grade in exchange for tuition. Grades will be allocated on the basis of learned performance of core competencies.
Think: Analyzes data, ideas, patterns; draws well-supported conclusions; revises conclusions consistent with new observations, interpretations, or reasons.
   1. Analyzes diagnostic and laboratory data and correlates with cardiac pathologies.

Value: Distinguishes among personal, ethical, aesthetic, cultural, and scientific values.
   1. Distinguishes the difference between personal values and accepted scientific standards.
   2. Demonstrates knowledge and understanding of the concepts of Risk Management including legal and ethical concerns, patient rights / confidentiality, medical record documentation.

Communicate: Employs methods of communication (both oral and written) appropriate to audience and purpose.
   1. Demonstrates proper medical record charting.
   2. Demonstrates effective oral communication of patient information using appropriate medical terminology.

Act: Applies disciplinary knowledge, skills; implements effective problem-solving, decision making, and goal setting strategies; acts effectively and appropriately in various personal and professional settings.
   1. Applies understanding of data analysis to determine appropriate treatment for cardiac pathologies.
   2. Applies understanding of data analysis to determine appropriate catheterization procedures for cardiac pathologies.
   3. Performs appropriate calculations for cardiac pathologies.

Course Objectives / Outcomes:
- The student will be able to discuss the general description, etiology, pathogenesis, clinical manifestations including patient presentation, ECG, stress, and cardiac findings, detailed hemodynamic and angiographic findings, laboratory values, etc, and treatments of the following cardiac diseases:
  a) Coronary artery disease
     i) Atherosclerosis
     ii) Thrombus formation
     iii) Restenosis after angioplasty
  b) Stable angina
  c) Unstable angina
  d) Prinzmetal’s or variant angina
  e) Acute myocardial infarction
  f) Right side heart failure
  g) Left side heart failure
  h) Hypertension
  i) Dilated cardiomyopathy
  j) Hypertrophic cardiomyopathy with or without obstruction
  k) Restrictive cardiomyopathy
  l) Myocarditis
  m) Endocarditis
  n) Pericarditis
  o) Pericardial disorders and effusion
  p) Constrictive pericarditis
  q) Cardiac tamponade
  r) Aortic stenosis and insufficiency
  s) Mitral stenosis and insufficiency
  t) Pulmonary stenosis and insufficiency
  u) Tricuspid stenosis and insufficiency
  v) Various congenital anomalies
     i) Patient ductus arteriosis
     ii) Atrial septal defect
     iii) Ventricular septal defect
     iv) Truncus arteriosis
v) Bicuspid aortic valve
vi) Coarctation of the aorta
vii) Tetrology of Fallot
viii) Transposition of the great vessels
ix) Tricuspid atresia
x) Anomalous venous return
xi) Kawasaki's disease
xii) Ebstein's anomaly
w) Aortic dissection and aneurysm

➢ The student will be able to perform calculations, know the normal values, implications, and treatments for abnormal values for the following:
  a) Mean arterial pressure
  b) Cardiac output:
     i) Fick
     ii) Thermodilution
     iii) Angiography
     iv) Green dye
c) Cardiac index
d) Ejection fraction
e) Regurgitated fractions
f) Systemic and pulmonary vascular resistance
g) Systolic ejection period, diastolic filling period
h) Valve area calculations (Gorlin formula)
i) Shunts R → L → R
j) Systemic blood flow, SBF
k) Pulmonary blood flow, PBF
l) Shunt ratio, Qp:Qs
m) Percent shunt
n) Absolute shunt

➢ The student will demonstrate an advanced knowledge of the common cardiac medications and I.V. therapy including indications, contraindications, actions, risks, benefits, dosages, and drug calculations.

Performance Competency Objectives / Outcomes

These performance objectives are designed to measure individual student competency in the concepts and skills associated with lecture, laboratory, and clinical components of Cardiac Catheterization. All competencies must be successfully completed prior to graduation. All competencies will be evaluated by written examination and/or demonstration in a laboratory / clinical environment.

❖ Coronary artery disease
  ➢ Describe the determinants of myocardial oxygen supply and demand
  ➢ Describe the sequela of myocardial oxygen supply and demand mismatch
  ➢ Describe the process of atherosclerosis
  ➢ Describe the process of restenosis after coronary interventional procedures
  ➢ Describe the sequela of thrombus formation and coronary artery obstruction by a thrombus
  ➢ Describe the sequela of coronary artery spasm
  ➢ Differentiate between stable, unstable, and variant (prinzmetal's) angina
  ➢ Describe the etiology, pathogenesis, clinical manifestations, and treatment of the three types of angina listed above
  ➢ Describe the etiology, pathogenesis, clinical manifestations, and treatment of myocardial infarction
  ➢ Describe the physical examination findings including chest pains, ECG, enzyme, laboratory results, etc; of stable, unstable, and variant angina and acute myocardial infarction
Describe the effects of aspirin, thrombolytics, beta blockers, calcium channel blockers, nitrates, morphine, platelet inhibitors, lifestyle modifications, and interventional procedures on the three types of angina and acute myocardial infarction

Congestive heart failure
- Define the syndrome of CHF
- Describe how the human body compensates for decreases in cardiac output and blood pressure common in congestive heart failure
- Describe the negative consequences of the normal body’s compensation on CHF
- Differentiate between left side and right side heart failure with respect to its etiologies, pathogenesis, clinical findings, including hemodynamic and physical exam findings and treatments
- Describe the role of oxygen, digitalis, diuretics, and ACE inhibitors in CHF

Cardiomyopathy
- Define cardiomyopathy
- Differentiate between dilated cardiomyopathy, restrictive cardiomyopathy, hypertrophic cardiomyopathy with or without obstruction with respect to their etiologies, pathogenesis, clinical manifestations, including hemodynamic findings and treatments
- Explain the significance of a sub-valvular gradient
- Explain the significance of a positive Brockenbrough Braunwald sign
- Explain the significance of an M or W pattern on an atrial or pulmonary capillary wedge pressure wave form
- Explain the significance of a square root or dip and plateau sign in a ventricular wave form

Pericardial disorders
- Explain the structure and function of the pericardium and pericardial fluid
- Differentiate between acute pericarditis, constrictive pericarditis, pericardial effusion, and cardiac tamponade with respect to their etiologies, pathogenesis, clinical manifestations, including hemodynamic findings and treatments
- Differentiate between restrictive cardiomyopathy and constrictive pericarditis
- Explain the significance of an M or W pattern on an atrial or pulmonary capillary wedge pressure wave form
- Explain the significance of a square root or dip and plateau sign in a ventricular wave form
- Describe the hemodynamic findings of cardiac tamponade and constrictive pericarditis
- Describe the procedures for pericardiocentesis

Valvular disorders
- Describe the structure, size, and function of the tricuspid, pulmonic, mitral, and aortic valves
- Differentiate between stenotic and insufficient valves with respect to their effects on the heart and vessels
- Describe the etiologies, pathogenesis, clinical manifestations, including hemodynamic findings and treatments of aortic stenosis, pulmonic insufficiency, tricuspid stenosis, and tricuspid insufficiency
- Describe the specific hemodynamic pressure gradients and wave form abnormalities associated with the above listed valvular disorders
- Define critical stenosis of the mitral and aortic valves
- Identify and differentiate between various artificial valves

Valvular calculations
- Describe the hemodynamic gradients found with stenotic valves
- Describe the process of “retracing” valve gradients to compensate for the delay in some pressure wave forms
- Define, identify, and measure the systolic ejection period (SEP)
- Define, identify, and measure the diastolic filling period (DFP)
- Calculate mitral and aortic valvular areas utilizing the Gorlin formula
- Calculate mitral and aortic valve areas using the Hakki (shortcut) formula

PHARMACOLOGY
- Demonstrate retention of previously instructed pharmacology concepts
- Describe, discuss, and demonstrate IV access and IV equipment:
  - uses of IV equipment
- aseptically drawing up medications
- aseptically drawing up medication onto sterile field
- IV cannulation techniques
- basic principles of IV therapy
- veins commonly used for IV cannulation
- advantages and disadvantages of various IV cannulation sites
- troubleshoot IV Equipment
- assess an IV site

➢ Demonstrate calculating medication dosages:
  - abbreviations used in medication orders
  - conversion between unit systems
  - calculate dosages
  - calculate IV concentrations
  - mixture of IV medications
  - calculate IV drip rates
  - standard types of IV equipment

➢ Describe and demonstrate Advanced Cardiac Life Support (ACLS) procedures:
  - personal responsibilities in a cardiac arrest
  - when and how to call a code (site specific)
  - the code team and their responsibilities
  - management of a cardiac arrest
  - intubation and oxygenation
  - IV lines
  - precordial thump
  - defibrillation
  - cough CPR
  - correction of acidosis

➢ Demonstrate the following ACLS algorithms:
  - ventricular fibrillation-monitored
  - ventricular fibrillation-unmonitored
  - ventricular tachycardia-conscious with pulse
  - ventricular tachycardia-unconscious with pulse
  - ventricular tachycardia-unconscious-without a pulse
  - bradycardia

❖ INTERVENTIONAL CARDIAC CATHETERIZATION TECHNOLOGIES Following the unit of instruction, the student will:
  ➢ Describe and discuss Percutaneous Transluminal Coronary Angioplasty (PTCA):
    - history of PTCA and technological improvements
    - current techniques in PTCA
    - indications and contraindications for PTCA
    - risks and complications of PTCA
    - explain the purpose, sizing, structure, and techniques of equipment used in PTCA including:
      - guiding catheters
      - balloon catheters and balloon materials
      - guide wires
      - steering devices
      - indeflators
    - techniques of PTCA
    - newer techniques of treatment
    - peripheral angioplasty
    - rotational atherectomy (rotablator)
    - directional coronary atherectomy (DCA)
    - transluminal extraction catheter (TEC)
    - filter wire
    - intra coronary stenting
Indications for stenting
Complications of stenting
Stent designs
Late loss / in restenosis

Describe Valvuloplasty:
- Techniques
- Indications
- Expected results
- Balloon septostomy

CONGENITAL HEART DISEASE
- Describe the growth of the fetal heart starting with the heart tubes to the fully developed heart
- Describe the formation of the intra-atrial septum and the intraventricular septum
- Describe fetal circulation
- Describe the circulatory changes that occur at birth
- Identify normal vital signs and hemodynamic values for the newborn
- Describe the pathogenesis, clinical manifestations, hemodynamic findings, and treatments of the following congenital anomalies:
  - Patent ductus arteriosus
  - Ventricular septal defect
  - Truncus arteriosus
  - Sub-aortic stenosis
  - Coarctation of the aorta
  - Tetralogy of fallot
  - Complete transposition of the great vessels
  - Atrial septal defect
  - Tricuspid atresia
  - Anomalous venous return
  - Ebstein’s anomaly
  - Kawasaki’s syndrome

Describe the following palliative and corrective surgical procedures:
- Blalock Taussig shunt
- Glenn anastomosis - unidirectional and bidirectional
- Watterson - Cooley shunt
- Potts shunt
- Rashkind procedure
- Mustard procedure
- Atrial switch or Janteen procedure
- Fontan procedure
- Rastelli repair
- Pulmonary artery banding

SHUNT CALCULATIONS
- Describe the process of a saturation run in the cardiac cath lab
- Describe methods of determining mixed venous saturation and content in patients with shunts
- Differentiate between right to left, left to right, and bidirectional shunts
- Using saturations, calculate the percent shunt and shunt ratio
- Using oxygen content, calculate systemic blood flow (SBF), pulmonary blood flow (PBF), absolute shunt, percent shunt, and shunt ratio
- Differentiate mild, moderate, and severe shunts

Course Format:
Course objectives will be met by using both lecture and lab demonstrations. Students are expected to come to class prepared, ready, and willing to participate in both task assignments as well as critical thinking sessions. Students will complete these objectives by both individual and team assignments.

RELEASE OF STUDENT INFORMATION
Throughout the Cardiovascular Technology Program and at the completion of the Cardiovascular Technology Program, information necessary for clinical affiliation and licensure will be sent to the appropriate agency.

**Student Responsibility:**
If you have any questions, concerns, or are having difficulty completing any of the course requirements contact, or make an appointment with the instructor ASAP. Valid communication must be either oral or written and must come directly from the student. No student information will be given out to unauthorized persons.

Assignments -- Reading assignments for next class, discussion topics, formal laboratory observations and participation, formal clinical observation and participation. Students are expected to be prepared for lecture and laboratory activities and will be expected to participate in these activities.

This course utilizes many varying formulas therefore, the student will be expected to provide the instructor with any formulas used at the time of testing in order to receive credit. The student’s written work is expected to be neat and legible to receive credit.

It is recommended that the student bring a metric ruler and calculator to each class. Note: Only non-programmable calculators will be permitted.

**Attendance/Accountability/Professionalism:**
See Rubric: Attendance is mandatory. All clinical / laboratory excused absences must be made up to the satisfaction of the instructor. Two absences are considered excessive by VCC policy. A student with ≥ two absences may be dropped from the course. The student is expected to arrive on time. Two tardy arrivals or early departures will be equal to one absence. Tardy is defined as ≥ 10 minutes. The student is expected to notify the instructor and the affiliate coordinator, in advance, of any anticipated tardy arrivals, early departures, or absences (this is considered to be an “excused” absence). Only “excused” absences can be made up. Unexcused absences will result in a drop in letter grade for each offense. It is the responsibility of the student, not the instructor, to initiate and serve any and all make up time.

Attendance and participation in class are essential to your success in this course. If the student doesn’t attend class or do the readings the student will have difficulty mastering this material. The student is expected to participate in class discussions covering homework or chapter assignments. In order to contribute, the student must put your best effort toward preparing for the class material. This does not necessarily mean that the student understand all concepts perfectly, but it does mean that the student can offer and discuss relevant data and issues. I will often call upon students at random to discuss their views and to respond to explanations proposed by others.

**Academic Honesty:**
Students are expected to be in complete compliance with the VCC policy on academic honesty. This policy is written in the Valencia Community College Catalog and Student Handbook.

**Students with Disabilities:**
If the student has a documented disability, which requires accommodations in this course, please see the instructor ASAP. We are happy to make appropriate accommodations, provided timely notice is received. Students with disabilities who qualify for academic accommodations must provide a letter from the Office for Students with Disabilities (OSD) and discuss specific needs with the professor, preferably during the first two weeks of class. The Office for Students with Disabilities determines accommodations based on appropriate documentation of disabilities (West Campus  SSB ).
WebCT:
This course is Web-Enhanced. You will need to check daily. The instructors will post email, helpful hints, and updated information to keep you current.

Cell Phones:
Refrain from bringing beepers and cell phones to class, lab, or affiliate locations. All beepers and cell phones MUST be on silent / vibrate mode. The student will need to wait until a break is given by your instructor to answer any pages / calls. The first time the student’s beeper or cell phone rings the student will be given a written warning, the second time you will be asked to leave and it will be counted as an unexcused absence.

Non-programmable Calculator:
The student will need to purchase a non-programmable calculator. The student is expected to bring the calculator to all class sessions. In the event that the student forgets to bring a calculator to class, the student may use a blank sheet of paper to perform calculations. All scratch paper used for calculations will be turned into the instructor with the assignment.

Metric Ruler:
The student will need to purchase a clear metric ruler. The student is expected to bring the ruler to all class sessions. In the event that the student forgets to bring a ruler to class, the student is still required to complete all class assignments.

Course Disclaimer:
These course requirements may be changed with notification, as deemed necessary by the instructor due to unforeseen circumstances.

Grade Breakdown:
<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance &amp; Collaborative Work Skills</td>
<td>5%</td>
</tr>
<tr>
<td>Tests (Note Team Poster Project = one test grade)</td>
<td>60%</td>
</tr>
<tr>
<td>Other</td>
<td>10%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
</tbody>
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Note:
- **No make-up** will be offered for lab exercises.
- Any missed assignments / tests / quizzes must be made up within one week of absent date. Any exam not made up within one week will result in a grade of “0” for the exam. No make up exams will be provided without prior permission of the instructor.
- Missed pop quizzes have no make-up option, therefore any missed pop quiz will receive a “0” grade.
- All make-up exams or make-up scheduled quizzes will receive an automatic 7% grade deduction.

Grading Scale:
- A = 92 – 100
- B = 85 – 91
- *C = 75 – 84
- D = 70 – 74
- F = < 70

* Note: A minimum grade of “C” is required to continue with the program.