

Echocardiography and Vascular Imaging Laboratory Overview for Cardiovascular Fellowship Trainees

Mission statement

The University of Rochester's Echocardiography Laboratory has 4 core missions:

1. Provide state-of-the-art cardiovascular ultrasound imaging services to our patients.
2. Provide our cardiovascular fellows with a training experience that is unsurpassed in competitive fellowship training programs.
3. Advance the field of echocardiography through teaching and research.
4. Provide a work environment for our staff that allows for maximal personal and professional growth.

Every one of our staff members, from physician to sonographer to secretary, is dedicated to achieving excellence in each of these missions. A process of continuous quality improvement is in place to constantly look for ways of better achieving the mission goals and our echo-physicians have dedicated a large proportion of their professional time to cardiovascular ultrasound imaging, research and training. The end result is our patients receive a more complete cardiovascular examination than is available in any other competitive lab in our area.

The educational directive of the Echocardiography and Noninvasive Imaging Lab is to provide an integrative experience in adult echocardiography and vascular imaging and to emphasize the relationship between cardiovascular anatomy as seen with ultrasound imaging, and the pathophysiology of clinical disease. We endorse the statement of mission implicit in the Guidelines for Training in Adult Clinical Cardiovascular Medicine (Core Cardiology Training Symposium, version 3 [COCATS3]; JACC 2008; 51(3):339-413, and Quinones, M. ACC/AHA Clinical Competence Statement on Echocardiography. A Report of the American College of Cardiology/American Heart Association/American College of Physicians–American Society of Internal Medicine Task Force on Clinical Competence. JACC 2003 41:687-708).

Statement of Educational Goals

The curriculum is designed to promote six broad goals based on the six ACGME core competencies:

1. **Medical Knowledge:** Exposure to a broad range of acute and chronic cardiovascular problems both through direct patient imaging and through many formal and informal didactic teaching sessions.
2. **Patient Care:** The training focuses on echocardiographic diagnoses that are based physiological principles and the pathophysiology of disease. To this end, most imaging is performed at the bedside so that the clinical findings may be integrated with the diagnostic imaging. The best treatment plan for each clinical scenario is discussed and implemented.
3. **Professionalism:** Echocardiographic imaging provides the most efficient means of gathering information compared to any other cardiovascular imaging test. In addition, the patient and their families often see the images during acquisition. This combination demands that the training include methods for communicating with patients, families, other physicians and allied health care personnel. Maintaining highest ethical standards and strict privacy when discussing patient case plans with other providers is also the goal of our training.
4. **Interpersonal and Communication skills:** As consultants, the ability to communicate our findings with the primary care givers and the patients is one of our most important tasks. The training emphasizes the most accurate and efficient means of communicating with both the spoken and written word.

5. **Practice Based Learning:** Using information technology, literature sources and other available resources to practice evidence based medicine based on sound medical principles, guidelines and best practices, while being still able to individualize this for a particular patient's circumstances.
6. **Systems Based Learning:** Training will emphasize the integration of echocardiographic imaging with other medical and surgical data. The bedside nature of echocardiography is a prime example of how this imaging modality is integrated into routine patient care. It is common for echocardiographic imaging to be performed throughout the hospital in all patient care areas, including but not limited to the medical floors, CCU, ICU and operating room. This exposure helps the trainee learn how care delivery systems work and how to use those systems to the maximal benefit of the patient.

General Statement of Expectations of Fellows

General. All fellows are required to achieve Level I training criteria by the end of their 3-year fellowship (see below for details). Level I training indicates exposure to echocardiography techniques, but is insufficient for the independent performance of echocardiography procedures. Most fellows meet Level II training criteria and are certified by the program director for the independent performance of echocardiography procedures. Level III certification requires at least an additional year of echocardiography education. Level III certification is only required for those fellows that desire to direct and echocardiography laboratory, or function as an echocardiography educator.

At a minimum, fellows are expected to be in the echo lab each day from 8:00AM to the end of the last examination. First year fellows are expected to obtain proficiency in echo imaging, so will usually spend most of the workday scanning patients. First year fellows also read echoes with attendings at the end of the day and between patients. Second and third year fellows are also expected spend a portion of their time scanning patients after which they will spend the majority of their time interpreting echoes with the attendings and assist with stress and transesophageal echoes. Fellows of all levels may be called upon to supervise stress echoes or help with transesophageal echoes or obtain patient consent for echocardiography procedures.

Vacation policy. All fellows receive 4 weeks of vacation per academic year. The rotations in echo make up less than 25% of any given academic year. Therefore, fellows may take no more than 1 week of vacation during their echo rotations. All vacation time must be pre-approved by Dr. Schwarz in advance and *before* booking non-refundable tickets, etc.

Night and weekend call. Fellows are responsible for performing all night and weekend transthoracic echoes on a rotating call basis. Echo sonographers are available to assist fellows in obtaining images on Saturdays and can be reached through the standard page system. Fellows are encouraged to make use of the on-call sonographer, especially for difficult cases. After performing the exam, the fellow will generate a preliminary report after discussing the case with the echocardiography attending by phone, if needed. The echo attending will have the option of coming in or reviewing the study on the next working day. If the attending does not review the study at the time of the exam, then the fellow is expected to review the study with the attending on the morning of the next regular work day. A final report will then be generated. Fellows take echo call only after completion of at least one month on the echocardiography service.

"Esprit de corps". Finally, it should be realized that the attitude of the trainee is an important factor in the success of their training and the reputation of the laboratory. It is important at all times to treat patients with the same courtesy, dignity and friendliness that one would desire for oneself or one's own family members. The echocardiogram is potentially the most "patient friendly" procedures in the cardiologist's armamentarium. The patient's experience and that of the referring physician should be positive and professional. To that end, fellows must act and dress in a manner reflecting their position as a professional. This means a clean pressed shirt and pants and professional work shoes (no sneakers, please). Surgical scrubs are not a substitute for regular professional clothing and should only be worn on

days when they are required for medical duty (like when performing transesophageal echoes in the operating room). A lab coat is optional.

Specific Procedures

Consults/Procedures during normal working hours

When fellows perform echocardiograms, they are responsible for all aspects of care related to that procedure. This means preparing the room before the study, escorting the patient to the room, performing the exam, generating the report, reviewing the study *with* the attending, discharging the patient and cleaning the room after the study. Fellows may also be called upon to prep patients for transesophageal echocardiograms and supervise exercise tests. Fellows must become familiar with the video tape storage system to function effectively in the lab. Most fellow exams are re-scanned by one of the sonographers before the study is reviewed by the attending. This quality control measure is required by the operator-dependent nature of ultrasound imaging.

After-hours consults/procedures

All fellows have keys to the echo exam rooms in the ACF. Tapes and preliminary reports should be left in the "night and weekend" tape box located in the echo reading room for review by the attending on the next working day.

Research Opportunities

Clinical Research

A wide range of clinical research opportunities are available to fellows in the Echo Lab. Fellows are encouraged to consult with the Echo faculty members about clinical projects that are on going or planned for the future. In addition, the Echo Lab has been using a computerized database for patient reporting since January 1991. The database includes codified variables and outcome data on hundreds of thousands of patient encounters.

Basic Research

Dr. Schwarz has a strong interest in basic ultrasound research. A wide array of resources are available to fellows in Dr. Schwarz's research lab in the medical center. Additional resources are available at the biomedical engineering schools on the U of R River Campus and Rochester Institute of Technology.

Echocardiography Fellowship Training Requirements

COCATS3 Echocardiography Requirements

Level 1 Training (3 months, 75 examinations performed, 150 examinations interpreted). Level 1 is defined as the minimal introductory training that must be achieved by all trainees in adult cardiovascular medicine. This includes a basic understanding of the physics of ultrasound, the fundamental technical aspects of the examination, cardiovascular anatomy and physiology as it relates to echo and Doppler imaging, and recognition of simple as well as complex cardiac pathology and pathophysiology. Level 1 trainees are required to train in echocardiography for a minimum of three months and perform and interpret a minimum of 75 two-dimensional and Doppler TTEs, and interpret an additional 75 two-dimensional and Doppler TTEs (total of 150 exams interpreted). This nominal hands-on training should enable a physician to expand on or clarify the data acquired by a sonographer, and to understand potential technical limitations and artifacts. *Level 1 training is not sufficient for a trainee to perform or interpret echocardiograms independently.*

Level 2 Training (6 months, 150 examinations performed [75 additional] and 300 interpreted [150 additional]). *Level 2 training is the minimum recommended training for a physician to perform and interpret echocardiograms independently.* These requirements are specifically for transthoracic two-dimensional and Doppler echocardiography. Level 2 is defined as a minimum of an additional 3 months of training in echocardiography (6 months cumulative) and the addition of 150 transthoracic two-dimensional and Doppler examinations interpreted (300 cumulative exams interpreted). Additional training in special procedures, such as TEE and stress echocardiography, is detailed subsequently in this document. Although some experience in special procedures may be attained as a part of Level 2 training, in most instances, full competence in these areas will require additional training beyond Level 2.

Level 3 Training (12 months, 300 transthoracic two dimensional and Doppler echocardiograms performed [150 additional] and 750 interpreted [450 additional]). *Level 3 represents a high level of expertise that would enable an individual to serve as a director of an echocardiography laboratory and be directly responsible for quality control and for the training of sonographers and physicians in echocardiography.* Although these guidelines reflect the minimum number of TTE and Doppler studies, most physicians who are Level 3-trained will also have additional training in TEE and stress echocardiography. It should be emphasized that these numbers reflect the minimum examinations considered for clinical competence; many training programs will offer a greater experience in interpretation of transthoracic echocardiograms over the time periods previously outlined.

Level	Objective	Time	TTE Performed	TTE Interpreted	TEE	Stress
I	Intro to Echo	3 mos	75	150	“Exposure”	
II	Independent Performance	6 mos	150	300	25 intubations 50 interpretations	100 Interpretations
III	Lab Director & Instructor	12 mos	450	750		

Level III training also assumes successfully completing a research project in echocardiography, teaching in local conferences, and experience with contrast echocardiography.

National Board of Echocardiography Requirements

- Dedicated echocardiography training: **6-months**
- Transthoracic echoes performed: **150**
- Transthoracic echoes interpreted: **300**
- Stress echoes interpreted: **100**
- Transesophageal echoes performed: **50**

URMC Echocardiography Requirements for Level II Certification

- Successful completion of COCATS3/NBE requirements
- Completion of following URMC practical examinations with a score of at least 80%
 - Complete transthoracic echocardiogram performance + report
 - Complete transesophageal echocardiogram + report
 - Stress echocardiogram report
 - Aortic stenosis or regurgitation or prosthesis echo/Doppler exam performance and report
 - Mitral stenosis or regurgitation or prosthesis echo/Doppler exam performance and report
 - LV volume, LVEF calculation, regional function testing package
 - LV diastolic function calculation testing package
 - Valve calculation testing package
 - Echo interpretation testing package

Evaluation process

Echo rotation evaluations

All fellows are scheduled for at least five 4-week rotation blocks in the echo lab. These are almost always scattered throughout the 3-year fellowship, with 2 of the blocks in the first year, 1 in the second year and 2 in the third year. The first year echo blocks are dedicated to transthoracic echocardiography training, and the second and third year blocks add transesophageal and stress echo training. Every fellow will be evaluated by the lab director at the end of each schedule block using the Fellow Echo-Rotation Evaluation Tool (see below). The Fellow Echo-Rotation Evaluation Tool includes *quantitative assessments* (cumulative and rotation-specific procedure volume figures, as well as an attendance record (accurate to the 1/2 day)), and a *qualitative assessments* of the fellow's performance (current skill level, and goals for the future). The Fellow Echo-Rotation Evaluation Tool is in addition to the other echo procedure evaluation tools (see below). The qualitative assessments will be scored on a 4-point grading system: 1 = No experience, 2= Novice, 3 = Independent Performance, and 4 = Expert. Copies of each fellow's echo rotation scores will be kept in the echo lab and with the fellowship director. Every fellow will also receive at least annual summaries of their echo volumes and evaluation scores.

Echo procedure evaluations

Specific Echo Procedure evaluation tools will be used to document fellow performance in transthoracic, transesophageal, stress echo imaging techniques, as well as in the assessment of ventricular size and function, and in the assessment of valvular heart disease (see below for the evaluation forms). A passing grade of at least 80% in each component is required to be considered for Level II echo certification.

Fellow Echo-Rotation Evaluation Tool

Fellow Name: _____ Date: _____

Rotation Block: _____ Examiner: _____

Quantitative Assessment

	This rotation	Cumulative Total
Days in Lab (use decimal days, eg: 12.5)		
Transthoracic Echoes (performed)		
Transthoracic Echoes (interpreted)		
Stress Echo (interpreted)		
Transesophageal Echo (performed and interpreted)		

Qualitative Assessment

	No Experience	Novice	Independent	Expert
Transthoracic Echo (performance):	-----	-----	-----	-----
Transthoracic Echo (interpretation):	-----	-----	-----	-----
Stress Echo (interpretation):	-----	-----	-----	-----
Transesophageal Echo (perf + interp):	-----	-----	-----	-----

Comments:

Transthoracic Echocardiogram Scoresheet

Fellow Name: _____

Date: _____

Exam Component Item	Points	Score
LV PSLAx images (2D and M-Mode)	2	
LV PSLAx measurements (LVd, Septum, Post Wall, LVOT)	1	
AV PSLAx images (2D, M-Mode, Color Doppler)	3	
MV PSLAx images (2D, M-Mode, Color Doppler)	3	
LA and Aortic measurements (PSLAx - 2D and M-Mode)	4	
LV SAX (MV, papillary muscle, apical level)	3	
AV SAX (2D, Color Doppler)	2	
PV (SAX or RV outflow view - 2D, CD, PWD, CWD)	4	
TV (SAX and RV inflow view - 2D, CD, PWD, CWD)	8	
LV (4C, 2C, 3C)	3	
LV TDV Mitral Annulus	2	
MV (4C, 2C, 3C) (2D & CD in each view, PWD, CWD in either 4C or 3C)	8	
Pulm Vein (CD & PWD)	2	
AV (3C, 5C) (2D & CD in each view and PWD & CWD in either 3C or 5C)	8	
RV/RA (4C)	1	
TV (4C 2D - PWD, CWD, CD)	4	
Atrial septum (4C - 2D, CD)	2	
LV/RV Subcostal (4C)	1	
Atrial septum Subcostal (4C - 2D, CD)	2	
IVC Subcostal (CD + 2D long loop for IVC collapse)	2	
LV/RV Subcostal (SAX)	1	
Ao Suprasternal (2D arch, 2D, CD, PWD, CWD descending thoracic)	5	
Exam Components Subtotal	71	

Transthoracic Echocardiogram Scoresheet

Fellow Name: _____

Date: _____

Imaging Performance Item	Points	Score
Image quality (on-axis)	5	
Image quality (gain)	5	
Image quality (dynamic range)	5	
Image quality (clips)	5	
Imaging Performance (esprit de corps)	5	
Imaging Performance (patient comfort)	5	
Imaging Performance (cleanliness)	5	
Imaging Performance Subtotal	35	

Reporting Item	Points	Score
Exam indication	1	
Clinical history synopsis	1	
Procedures performed listed	1	
Vital signs (HR, BP, Height, Weight, BMI, BSA)	6	
LV (diameter, wall thickness, LV mass, LV Vol _d , V Vol _s , LVEF, wall motion, LV thrombus, diastolic function)	9	
LA (diameter, LA Vol)	2	
RV/RA (RV size, RA function, RA size, IVC size, IVC respiratory size)	5	
AV (leaflet thickness, leaflet motion, stenosis, regurgitation)	4	
MV (leaflet thickness, leaflet motion, stenosis, regurgitation)	4	
PV (leaflet thickness, leaflet motion, stenosis, regurgitation)	4	
TV (leaflet thickness, leaflet motion, stenosis, regurgitation, TR gradient, PA press estimate)	6	
Pericardial effusion (Y/N)	1	
Aortic root size	1	
Compared to prior (if any)	1	
Reporting Subtotal	46	

Transthoracic Echocardiogram Scoresheet

Fellow Name: _____

Date: _____

Testing Results	Points	Score
Exam Components Subtotal	71	
Imaging Performance Subtotal	35	
Reporting Subtotal	46	
Total Score	152	
Exam Grade		

Comments:

Examiner: _____

Date: _____

Transesophageal Echocardiogram Scoresheet

Fellow Name: _____

Date: _____

Exam Component Item	Points	Score
LV (4C, 2C, 3C)	3	
MV (3C, 2C, 4C - 2D, Color Doppler)	6	
LAA (90°, 135°, 45°, 0°)	4	
LA Sweep & all 4 Pulmonary Veins w/ PWD in one vein	6	
AV (SAX, LAX - 2D, CD)	4	
Ascending thoracic aorta (135° (aortic root), 90° (tubular aorta)	2	
Pulmonary artery & PV (90° - 2D, CD,)	2	
RV (0° - 2D)	1	
TV (0°, 90°, 150° - 2D, CD and CWD in at least one view)	7	
RA (90°, 120° 2D imaging of RA, SVC, RAA)	2	
Atrial septum (90° - 2D, CD, contrast)	3	
LV (transgastric LAX, SAX)	2	
RV (transgastric LAX, SAX)	2	
LVOT/AV (transgastric 2D, CD, PWD, CWD)	4	
RVOT/PV (transgastric 2D, CD)	2	
Aortic sweep (SAX descending, SAX & LAX arch)	3	
Pulmonary artery & PV (90° through aortic arch - 2D, CD,)	2	
Exam Components Subtotal	55	

Transesophageal Echocardiogram Scoresheet

Fellow Name: _____

Date: _____

Imaging Performance Item	Points	Score
Patient evaluation	5	
Conscious sedation	5	
Patient recovery	5	
Image quality (on-axis, clips, etc)	5	
Imaging Performance (esprit de corps)	5	
Imaging Performance (patient comfort)	5	
Imaging Performance (cleanliness)	5	
Imaging Performance Subtotal	35	

Reporting Item	Points	Score
Exam indication	1	
Clinical history synopsis	1	
Procedures performed listed	1	
Vital signs (HR, BP, Height, Weight, BMI, BSA)	6	
LV (LV Vol _d , V Vol _s , LVEF, wall motion, LV thrombus)	5	
LA (diameter, LA Vol)	2	
RV/RA (RV size, RA function, RA size, IVC size, IVC respiratory size)	5	
AV (leaflet thickness, leaflet motion, stenosis, regurgitation)	4	
MV (leaflet thickness, leaflet motion, stenosis, regurgitation)	4	
PV (leaflet thickness, leaflet motion, stenosis, regurgitation)	4	
TV (leaflet thickness, leaflet motion, stenosis, regurgitation, TR gradient, PA press estimate)	6	
Pericardial effusion (Y/N)	1	
Aortic root size	1	
Compared to prior (if any)	1	
Reporting Subtotal	42	

Transesophageal Echocardiogram Scoresheet

Fellow Name: _____

Date: _____

Testing Results	Points	Score
Exam Components Subtotal	55	
Imaging Performance Subtotal	35	
Reporting Subtotal	46	
Total Score	136	
Exam Grade		

Comments:

Examiner: _____

Date: _____

Stress Echocardiogram Scoresheet

Fellow Name: _____

Date: _____

Reporting Item	Points	Score
Exam indication	1	
Clinical history synopsis	1	
Procedures performed listed	1	
Vital signs (HR, BP, Height, Weight, BMI, BSA)	6	
Resting ECG	1	
LV (LV Vol _d , V Vol _s , LVEF, wall motion, LV thrombus)	5	
Stress vital signs (HR, RPP, % MPHR)	3	
Stress ECG	1	
Stress LV (LV Vol _d , V Vol _s , LVEF, wall motion, Ischemia by echo Y/N)	5	
Test positivity for ischemia Y/N	1	
Reporting Subtotal	25	
Exam Grade		

Comments:

Examiner: _____

Date: _____

Aortic Stenosis/Regurgitation/Prosthesis Scoresheet

Fellow Name: _____

Date: _____

Imaging Item	Points	Score
LVOTd, LVOT PWD	2	
AV 2D (SAX, LAX, 5C, 3C)	4	
AV CWD (A5C, A3C, R paraternal, suprasternal)	4	
AV CD (SAX, LAX, A5C, A3C)	4	
LV Vol _d , V Vol _s (A3C, A2C, A4C)	3	
Desc thoracic aorta (CD, PWD)	2	
Imaging Subtotal	19	
Exam Grade		

Reporting Item	Points	Score
LVOTd	1	
LVOT PWD - V _p , VTI	2	
AV CWD - V _p , VTI, mean ΔP , peak ΔP	3	
LV SV (LVOT Doppler, Simpson's)	2	
AVA (V _p , VTI, Simpson's, planimetry)	4	
AI regurgitation grade	1	
Reporting Subtotal	13	
Exam Grade		

Comments:

Examiner: _____

Date: _____

Mitral Stenosis/Regurgitation/Prosthesis Scoresheet

Fellow Name: _____

Date: _____

Imaging Item	Points	Score
LVOTd, LVOT PWD	2	
MV 2D (SAX, LAX, 4C, 2C, 3C)	5	
MV PWD (A4C, A3C)	2	
MV CWD (A4C, A3C)	2	
MV CD (SAX, LAX, A4C, A2C, A3C)	5	
MV CD (MS PISA, MR PISA)	1	
LV Vol _d , V Vol _s (A3C, A2C, A4C)	3	
Pulm Vein PWD	1	
Imaging Subtotal	21	
Exam Grade		

Reporting Item	Points	Score
LVOTd	1	
LVOT PWD - VTI	1	
MV CWD - MS - Vp, VTI, mean ΔP , PHT; MR - Vp, VTI	3	
LV SV (LVOT Doppler, Simpson's)	2	
MVA (PHT, VTI, Simpson's, PISA, planimetry)	4	
MR regurgitation grade (qualitative, ROA, RF, Regurg Vol)	4	
Reporting Subtotal	15	
Exam Grade		

Comments:

Examiner: _____

Date: _____

LV Volume/LVEF/Regional function Scoresheet

Fellow Name: _____

Date: _____

Case 1

LV Volume: _____ / _____

LVEF: _____

Comments:

Case 2

LV Volume: _____ / _____

LVEF: _____

Comments:

Case 3

LV Volume: _____ / _____

LVEF: _____

Comments:

Case 4

LV Volume: _____ / _____

LVEF: _____

Comments:

Case 5

LV Volume: _____ / _____

LVEF: _____

Comments:

Examiner: _____

Date: _____

LV Diastolic Function Scoresheet

Fellow Name: _____

Date: _____

Case 1

E: _____ A: _____ IVRT: _____ Ea: _____ Vp: _____

E/A: _____ E/Ea: _____

PVs: _____ PVd: _____ Ar: _____ PV S/D: _____

Diastolic Function (Circle): NL, Type I, Type II, Type III, Type IV, Constriction

Comments:

Case 2

E: _____ A: _____ IVRT: _____ Ea: _____ Vp: _____

E/A: _____ E/Ea: _____

PVs: _____ PVd: _____ Ar: _____ PV S/D: _____

Diastolic Function (Circle): NL, Type I, Type II, Type III, Type IV, Constriction

Comments:

Case 3

E: _____ A: _____ IVRT: _____ Ea: _____ Vp: _____

E/A: _____ E/Ea: _____

PVs: _____ PVd: _____ Ar: _____ PV S/D: _____

Diastolic Function (Circle): NL, Type I, Type II, Type III, Type IV, Constriction

Comments:

Case 4

E: _____ A: _____ IVRT: _____ Ea: _____ Vp: _____

E/A: _____ E/Ea: _____

PVs: _____ PVd: _____ Ar: _____ PV S/D: _____

Diastolic Function (Circle): NL, Type I, Type II, Type III, Type IV, Constriction

Comments:

Examiner: _____

Date: _____

Valve Calculation Scoresheet

Fellow Name: _____

Date: _____

Case 1 (Aortic Stenosis)

LVOT d: _____ Vp: _____ VTI: _____

AV Vp: _____ VTI: _____ ΔP (peak): _____ ΔP (mean): _____

AVA Vp: _____ VTI: _____ Planimetry: _____

Aortic Stenosis Severity (Circle): None, Mild, Moderate, Severe, Indeterminate

Comments:

Case 2 (Aortic Regurgitation)

LVOT d: _____ VTI: _____ AI Vena Contracta d: _____

AI Slope: _____ PHT: _____ Vp: _____ VTI: _____

MV Pre-closure: Y / N Ao Flow Reversal: Y / N

Aortic Regurgitation Severity (Circle): None, Mild, Moderate, Severe, Indeterminate

Comments:

Valve Calculation Scoresheet

Fellow Name: _____

Date: _____

Case 3 (Mitral Stenosis)

LVOT d: _____ LVOT VTI: _____

MS VTI: _____ MS Pmean: _____

LVOT MTD - MV Area: _____

LV Vol (Dias/Sys): _____ / _____

Simpson's MTD - MV Area: _____

PISA r: _____ PISA Vn: _____ PISA Angle: _____ MR Vp: _____

PISA MTD - MV Area: _____

PHT: _____

PHT MTD - MV Area: _____

Stenosis Grade (Circle): None, Mild, Moderate, Severe

Comments:

Case 4 (Mitral Regurgitation)

LVOT d: _____ LVOT VTI: _____

LV Vol (Dias/Sys): _____ / _____

MR VTI: _____

LVOT MTD - MR ROA: _____ MR Volume: _____ MR Fraction: _____

PISA r: _____ PISA Vn: _____ PISA Angle: _____ MR Vp: _____

PISA MTD - MR ROA: _____ MR Volume: _____

Pulm Vein Flow Reversal: Y / N

Regurgitation Grade (Circle): None, Mild, Moderate, Severe

Comments:

Examiner: _____

Date: _____