**FMLH Echocardiography Lab Curriculum**

### Description of Rotation or Educational Experience

The echocardiography laboratory rotation is structured to permit an internist entering the cardiology fellowship program to progress over three years to the point where they can competently interpret a transthoracic echocardiogram independently (level II ACC/ASE training), as well perform and interpret a transesophageal echocardiogram. Training is available to those who express an interest in developing competency in conduction and interpretation of various forms of stress echocardiography.

There is limited exposure to patients and minimal direct patient care experience during an imaging rotation. The assessment of patients for appropriateness of the requested imaging modality and a brief history and physical examination on patients undergoing TEE are the primary forms of patient contact.

Given the wide age range of the referral base to the echocardiography lab, presence of valvular heart disease, congenital heart disease, and pulmonary hypertension specialty clinics at our institution, the trainee is exposed to a very wide array of pathology from simple to highly complex.

### Patient Care

**Goal**

Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Fellows are expected to:

**Competencies**

- Gain clinical experience in the echocardiographic evaluation of patients with, but not limited to, the following: chronic coronary heart disease, congestive heart failure, arrhythmias, acute myocardial infarction and other acute ischemic syndromes, lipid disorders, hypertension, cardiomyopathy, valvular heart disease, pulmonary heart disease and pulmonary embolism, peripheral vascular disease, infections and inflammatory heart disease, cardiovascular rehabilitation.
- Gain clinical experience in the echocardiographic evaluation of patients with the following: adult congenital heart disease, pericardial disease, cardiovascular trauma.
- Gain clinical experience in the performance of the following: transthoracic echocardiography, transesophageal echocardiography, stress echocardiography, 3D echocardiography, and intracardiac echocardiography.
- Gain clinical experience in the echocardiographic evaluation of: preoperative and postoperative patients; cardiac transplant patients; geriatric patients with cardiovascular disease.
- Understand the indications, contraindications, complications, and limitations of 2D and M-Mode echocardiograms as well as color, spectral, and tissue Doppler examinations.
• Understand the indications, contraindications, complications, and limitations of transesophageal echocardiography.
• Understand the indications, contraindications, complications, and limitations of 3D echocardiography.
• Understand the indications, contraindications, complications, and limitations of exercise, dobutamine, and supine bicycle Doppler echocardiography.

Objectives: First Year Fellows
• Demonstrate the ability to independently acquire basic cardiac ultrasound and Doppler images from the parasternal, apical, and subcostal locations.
• Become familiar with the most common ultrasound machine controls and their purpose.
• Appropriately assist and support laboratory sonographers and RN when a patient becomes hemodynamically unstable during an exam.
• Appropriately assist and support laboratory sonographers when potential life threatening imaging findings are identified.
• Become familiar with indications and contraindications for stress testing.

Objectives: Second Year Fellows
• Demonstrate the ability to appropriately triage requests for stress echocardiography based on understanding of indications and contraindications.
• Become familiar with advantages, pitfalls, and protocols for conducting stress echocardiograms.
• Become familiar with indications, risks, and benefits of transesophageal echocardiography.
• Demonstrate the ability to safely intubate patients during TEE.
• Become familiar with principles of performing safe administration of conscious sedation.

Objectives: Third Year Fellows
• Consistently review previous studies and make meaningful comparisons when preparing preliminary echo reports.
• Based on trainees expressed interest for additional training in stress echocardiography, demonstrate sufficient study volume and experience to competently supervise and interpret stress echocardiograms independently.
• Demonstrate the ability to apply echocardiographic findings to clinical management of patients.
• Demonstrate the ability to identify appropriate indications for TTE and TEE examinations, and provide effective consultation to referring physicians regarding an optimal imaging modality.
• Demonstrate the ability to safely administer conscious sedation, intubate, and acquire basic TEE images.

Medical Knowledge
Goal
Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Fellows are expected to:
Competencies

- Enhance their knowledge of the following content areas: cardiovascular anatomy; cardiovascular physiology; cardiovascular metabolism; cardiovascular pharmacology, including drug metabolism, adverse effects, indications, the effects on aging, relative costs of therapy, and the effects of non-cardiovascular drugs upon cardiovascular function; cardiovascular pathology; genetic causes of cardiovascular disease.
- Demonstrate the ability to competently interpret 2D and M-Mode echocardiograms.
- Demonstrate the ability to competently interpret color, spectral, and tissue Doppler examinations.
- Demonstrate the ability to competently interpret basic TEE Images.
- Demonstrate the ability to competently interpret stress echocardiograms. Based on expression of interest and commitment to undergo at least 100 faculty supervised interpretations of stress echo images.

Objectives: First Year Fellows

- Obtain a solid foundation in normal cardiac anatomy.
- Obtain a basic understanding of ultrasound physics.
- Become familiar with the laboratory protocol for performance of a complete transthoracic echocardiogram.
- Gain a basic understanding cardiac hemodynamics and its assessment by Doppler techniques.
- Obtain a basic understanding of digital echocardiography, including acquiring, optimizing, storage and retrieval of digital dynamic and static images.

Objectives: Second Year Fellows

- Demonstrate advanced understanding of the following content areas: cardiovascular anatomy; cardiovascular physiology; cardiovascular metabolism; cardiovascular pharmacology, including drug metabolism, adverse effects, indications, the effects on aging, relative costs of therapy, and the effects of non-cardiovascular drugs upon cardiovascular function; cardiovascular pathology; genetic causes of cardiovascular disease.
- Recognize severe cardiac anatomic pathology.
- Recognize severe hemodynamic/Doppler abnormalities.
- Demonstrate the ability to independently interpret echocardiograms demonstrating severe abnormalities, and appropriately relate those results to referring physicians and echo laboratory faculty in a timely fashion.
- Begin using references available for grading severity of all varieties of cardiac pathology.
- Begin developing a working knowledge of basic TEE cardiac anatomy.
- Begin to independently review TTE studies and develop preliminary reports, followed by review of the study with a faculty member.
- Demonstrate the ability to make essential adjustments to optimize TTE image acquisition.

Objectives: Third Year Fellows

- Document independent acquisition of a minimum of 150 cardiac ultrasound...
• Document supervised interpretation of minimum 300 studies and at least 6 months total dedicated echocardiography training necessary for ACC/ASE level II echocardiography training. (most trainee’s have over 800 supervised studies interpreted).
• Based on trainees expressed interest for additional training in stress echocardiography, ability to supervise conduction of exercise and dobutamine protocols for stress testing, and supervision of image acquisition.
• Develop ability to recognize milder/earlier cardiac anatomic pathology.
• Develop ability to use Doppler techniques to recognize milder/earlier hemodynamic abnormalities.
• Competently interpret complete (2D/M-Mode and Doppler echocardiograms) with complex pathology independently.
• Become familiar with common forms of adult congenital heart disease and sequelae as identified by echocardiography.
• Demonstrate the ability to safely perform, and correctly interpret basic TEE images.
• Become familiar with principles of stress echo wall motion interpretation.

**Practice- Based Learning and Improvement**

**Goal**
Fellows must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life long learning. Fellows are expected to develop skills and habits to be able to:

**Competencies**
• Identify strengths, deficiencies and limits in one’s knowledge and expertise.
• Set learning and improvement goals.
• Incorporate formative evaluation feedback into daily practice.
• Locate, appraise and assimilate evidence from scientific studies related to their patients’ health problems.
• Use information technology to optimize learning.
• Participate in the education of patients, families, students, residents and other health professionals, as documented by evaluations of the fellow’s teaching abilities by faculty and/or learners.

**Objectives: First Year Fellows**
• Introduction to cardiac ultrasound imaging forms and techniques, as well as non-ultrasound modalities available in refining the nature of suspected pathology.
• Learn what references are available for appropriateness of imaging use.
• Learn what references are available for grading severity of all varieties of cardiac pathology.
• Learn what references are available for guiding use of echocardiography in the diagnosis and surveillance of chronic cardiac disease.
• Learn what suitable resources are available for preparing assigned topics in biweekly echo conference.
• ≥ 90% attendance required at biweekly echo/imaging conference.

Objectives: Second Year Fellows
• Identify resources for supplementing understanding of performance and interpretation of TEE imaging.
• Continue to develop the ability to triage appropriateness of requested specific imaging type requested by referring physicians, and then effectively communicate recommendations for supplemental techniques or alternate imaging modality when appropriate.
• Continue developing expertise in cardiac ultrasound imaging techniques, as well as non-ultrasound modalities available in refining the nature of suspected pathology.
• Begin incorporating recommendations into preliminary reports based on references available for guiding use of echocardiography in the diagnosis and surveillance of chronic cardiac disease.
• Use suitable resources available for preparing high level discussion of assigned topics in fellowship level biweekly echo conference.
• ≥ 90% attendance at biweekly echo/imaging conference required.

Objectives: Third Year Fellows
• Use suitable resources available for preparing high level discussion of assigned topics in fellowship level biweekly echo conference.
• Learn to independently seek confirmation of TTE/TEE and stress echo findings by correlating individual patient findings with cardiac catheterization, MUGA, or surgery.
• ≥ 90% attendance at biweekly echo/imaging conference required.

Systems Based Practice
Goal
Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Fellows are expected to:

Competencies
• Work effectively in various health care delivery settings and systems relevant to cardiovascular medicine.
• Coordinate patient care within the health care system relevant to cardiovascular medicine.
• Incorporate considerations of cost awareness and risk-benefit analysis in patient care.
• Advocate for quality patient care and optimal patient care systems.
• Work in interprofessional teams to enhance patient safety and improve patient care quality.

Objectives: First Year Fellows
• Perform effective communication of study results to referring physicians, based on severity of pathology identified.
• Perform effective communication of study results to referring physicians, based on indication and circumstances of individual patients.
• Appreciate limitations in computer systems for appropriately relaying indication for imaging studies to interpreting physicians.
• Appreciate importance of sonographer skill, knowledge, and appropriate use of digital ultrasound technology in correctly identifying cardiac pathology.

**Objectives: Second Year Fellows**
• Begin developing ability to recognize situations in which inadequate or incomplete ultrasound information was obtained by a sonographer to appropriately answer the clinical question, and facilitating further evaluation as warranted.

**Objectives: Third Year Fellows**
• Demonstrate ability to identify studies in which inadequate or incomplete ultrasound information was obtained by a sonographer to appropriately answer the clinical question, and make recommendations to sonographer or faculty on required supplemental evaluation.

**Professionalism**

**Goal**
Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Fellows are expected to demonstrate:

**Competencies**
• Compassion, integrity, and respect for others.
• Responsiveness to patient needs that supersedes self-interest.
• Respect for patient privacy and autonomy.
• Accountability to patients, society, and the profession.
• Sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation.

**Objectives: First Year Fellows**
• Be readily available to review studies with requesting physicians.
• Learn to apply evidence based medicine to patient care.
• Show respect for patients and peers in daily interactions.

**Objectives: Second and Third Year Fellows**
• Independently studies prior to attending overread.
• Practice sound evidence based medicine.
• Continue to treat patients and peers with the utmost respect.

**Interpersonal and Communication Skills**

**Goal**
Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and teaming with patients, their families, and professional associates. Fellows are expected to:

**Competencies**
• Communicate effectively with patients and families across a broad range of socioeconomic and cultural backgrounds.
• Communicate effectively with physicians, other health professionals, and health
related agencies.
- Work effectively as a member or leader of a health care team or other professional group.
- Maintain comprehensive, timely, and legible medical records.

**Objectives: First Year Fellows**
- Work collaboratively with laboratory RN’s to screen inpatient and outpatient requests for appropriateness of stress test and TEE requests.
- Appropriately assist and support laboratory sonographers when unusual or unexpected findings occur, recommending additional images or techniques for further identifying nature of pathology.

**Objectives: Second Year Fellows**
- Work collaboratively with laboratory RN’s to screen inpatient and outpatient requests for appropriateness of stress test and TEE requests, and make recommendations to faculty when alternate tests or procedures are thought indicated.
- Appropriately assist and support laboratory sonographers when unusual or unexpected findings occur, recommending additional images or contrast techniques for further identifying nature of pathology.
- Appropriately contact referring physicians with daytime or on-call urgent echo findings requiring immediate attention.
- Continue developing appreciation for situations in which patient care is optimized by verbal notification of physicians of imaging findings.
- Continue developing appreciation for situations in which patient care is optimized by obtaining further information from the referring physician in regards to the study indication.

**Objectives: Third Year Fellows**
- Demonstrate the ability to competently review studies with referring physicians visiting laboratory, demonstrating findings. Providing consultation to referring physicians regarding clinical significance of abnormal findings, and advice on alternate testing which may be helpful.
- Effectively incorporate recommendations for imaging follow-up based on severity of findings and current clinical guidelines into preliminary echo report.

**Teaching Methods**
Teaching is facilitated by a combination of independent reading/learning combined with individual faculty instruction. Echocardiographic studies will serve as a basis for discussion of such points as interpretation of clinical data, pathophysiology, differential diagnosis, specific management of the patient, the appropriate use of technology, the incorporation of evidence and patient values in clinical decision making, and disease prevention.

Fellows are highly encouraged to perform daily textbook and article reading, with recommended progression from 2D and anatomy topics, to more complex cardiac function and Doppler topics. Questions based on individual reading are encouraged.
Daily interaction with interventionalists and electrophysiologists as well as consultants will also provide opportunity for further education.

The fellow will be expected to practice sound evidence based medicine and will be given access to resources to be utilized to enhance this practice. Resources include citations of important literature and use of hospital and MCW-based information technology.

**Assessment Method (Fellows)**

Fellows are given verbal feedback on their performance by the faculty throughout the rotation, in particular at the mid-point of the rotation. Final evaluations by each attending will be based on the general ACGME competencies of patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, systems-based practice, and professionalism. A formal written evaluation will be entered by the faculty into New Innovations. It will then be reviewed and signed by the fellow.

Fellows will also be evaluated in regards to their teaching skills by the housestaff and students when applicable.

Fellows are also evaluated through use of the 360 evaluation system, where feedback from nursing, social work, case management, patients, and others can be used to assess and refine performance. Specifically communication, systems-based practice, and professionalism can be further assessed.

**Assessment Method (Program Evaluation)**

Fellows will assess the rotation overall as well as their attending physicians. These will be written evaluations which will be shared with the Chair of the Division as well as the Fellowship Program Director. Feedback from the fellows will allow for correction of any perceived deficiencies in learning opportunities on this rotation.

**Level of Supervision**

**Coordinating Faculty:**
Timothy Woods, MD, Jason Jurva, MD

**Participating Faculty:**
Timothy Woods MD, Jason Jurva MD, James Macioch MD, Ashvin Patel MD, James Kleczka MD, Dalip Singh MD, Raymond Migrino MD, Michael Widlansky MD.

There are 2-3 faculty members assigned to the echocardiography lab daily. These faculty will be the attending of record on all procedures and will have primary supervisory responsibility for the cardiology fellow on rotation.

**Educational Resources**

The fellow will be expected to practice sound evidence based medicine and will be given access to resources to be utilized to enhance this practice. Resources include citations of important literature and use of hospital and MCW-based information technology.
The Echo Manual. 3rd Ed; Jae Oh. *(Preferred rotation textbook)*

Echocardiography, 6th Ed; H. Feigenbaum.

Principles and Practice of Echocardiography, 2nd Ed; A. Weyman

Textbook of Clinical Echocardiography; 3rd Ed; Otto.


Lang R, et al. Recommendations for Chamber Quantification: A Report from the American Society of Echocardiography’s Guidelines and Standards Committee and the Chamber Quantification Writing Group, Developed in Conjunction with the European Association of Echocardiography, and Branch of the European Society of Cardiology. JASE 2005;18:1440-1463.


ASE website holding all relevant recommendations for use of echocardiography: http://www.asecho.org/i4a/pages/index.cfm?pageid=3317

**Other Textbooks:**

Braunwald’s Heart Disease: A Textbook of Cardiovascular Medicine, 7th ed.

Clinical Recognition of Congenital Heart Disease; Perloff, 5th ed.

Diagnosis and Management of Adult Congenital Heart Disease; Gatzoulis, Webb, Daubney.
AGREEMENT

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Signature of Fellow                     Date

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Signature of Attending                  Date

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Printed Name of Fellow