Educational Purpose

This rotation is intended to supplement the noninvasive procedural education based at the UW Hospital and Clinics. As at the UW-based rotations, focus will be on understanding the indications, technical performance, and interpretation of studies. In addition, this rotation will include hands-on training in cardiac sonography, and supervision of both exercise and pharmacologic stress studies. This rotation will include education and experience in ECG interpretation and ambulatory ECG monitoring (i.e. Holter monitors) The purpose of these objectives is to outline the techniques and methods of achieving the goal of competent training in these areas.

Teaching Methods, Goals and Objectives

Echocardiography
This rotation is intended to supplement the UW Echocardiography rotation, and all goals and objectives described for that rotation will apply at the VA as well. Please refer to the UW Echocardiography Rotation Goals and Objectives document for a detailed description.

a. Technical performance: Fellows will receive hands-on training in performance of transthoracic and transesophageal studies from both VA sonographers and attendings. Fellows will be given opportunities to perform TTE’s on both outpatients and inpatients and receive guidance and feedback on their performance. All TEE’s will be performed under direct supervision of the echo attending. Fellows will work with procedural midlevels and attendings to supervise stress testing (dobutamine and exercise).
   a. Expectation: performance of at least 20 TTE’s, all available TEE’s during the month
   b. Expectation: supervision of at least 15 – 20 stress echocardiograms during the month
   c. Goal: technical ability to perform complete basic TTE, including 2D images, color and spectral Doppler recordings.
   d. Goal: technical ability to perform conscious sedation and complete basic TEE exam
   e. Goal: technical ability to supervise stress testing (both exercise and dobutamine), understanding indications for terminating a stress test
b. Interpretation: Fellows will receive individualized instruction on a daily basis appropriate to their current level of training. Fellows will read studies side-by-side with the assigned echo attending daily. Fellows may also preread studies for subsequent review with the attending. There is also a teaching file for less commonly seen abnormalities, that fellows may review.
   a. Expectation: Interpret at least 100 TTE’s, all TEE’s during the month
   b. Expectation: Interpret a minimum of 20 – 25 stress echos during the month
   c. Goal: ability to independently interpret TTE’s, TEE’s, and stress echos
ECG
This rotation is intended to supplement the UW-based training and educational lectures. Please refer to UW documentation for details. Fellows will read ECG’s in the VA MUSE system. Fellows are expected to review those ECG’s with the assigned attending before the end of each week (they will be notified which attending is responsible for each week).
   a. Expectation: Fellows are expected to interpret and review with attending 100 ECG’s per week, for a total of at least 400 ECG’s during the month.
   b. Goal: competency in ECG interpretation

Ambulatory ECG Monitoring
This rotation is intended to supplement the UW-based training and educational lectures. Please refer to UW documentation for details. There are several different types of ambulatory ECG monitors available. At the VA, Holter monitors, loop recorders, auto-triggered and manual event recorders, and ambulatory cardiac telemetry are utilized. Fellows will be assigned approximately 20 reports per week for interpretation. These should be prered and reviewed with the assigned outpatient consult attending on a daily basis. The reports must be entered into CPRS for cosignature by the attending. Fellows are also expected to ensure appropriate follow-up for significant abnormal findings.
   a. Expectation: Fellows are expected to interpret at least 75 monitors during the month.

Exercise Tolerance Tests (ETT)
Fellows will work with procedural midlevels and/or attendings to perform ETT’s. All ETT’s will be reviewed with the outpatient attending. Reports must be entered in CPRS for cosignature by the attending. Fellows are expected to ensure appropriate follow-up for significant abnormal findings. This training will overlap with exercise stress testing in the echo lab.
   a. Expectations: Fellows are expected to perform and interpret 10 – 15 ETT’s during the month.
   b. Goal: Competency in performance and interpretation of ETT’s

Evaluations:
Fellows are evaluated based on the core competencies defined by the ACCF, as applicable to this rotation.

The following scale is used:
   • Working toward competency
   • Competent
   • Working toward expertise
   • Expert
   • Mastery
   • Not applicable

Echocardiography:
The echo lab medical director or designee solicits feedback from each faculty member worked with the fellow during the month. This feedback is incorporated into the comments section of
the evaluation form. The director also talks individually to each fellow at the end of each rotation. Commentary is made not only on the fellow’s overall performance but also on the level of performance as compared to a typical fellow for the number of months of training that has been performed.

**ECG/Ambulatory ECG Monitoring:**
The ambulatory directors or designee solicits feedback from faculty members who have overread ECG’s and ECG monitors with the fellow during the month. Feedback is given as above for echo.

**ETT’s**
The ambulatory directors or designees solicit feedback from faculty members and midlevel providers who have performed or interpreted ETT’s with the fellow during the month. Feedback is given as above.

**360 Evaluations**
NPs, RNs and techs will be asked to complete a 360 evaluation for the fellow on the service at the end of the rotation.

### Sample Daily Schedule

8:30 – 9 am
- Check in with sonographers and echo attending regarding planned procedures for that day (stresses, TEE’s) and sonographer availability to supervise scanning
- Check in with outpatient consult attending to plan time to review ECG monitors

8:30 – noon:
- Time should be spent performing TTE’s (at least one patient per day, on average), supervising any available stress tests, performing TEE’s. Downtime can be used for reading ECG’s or ECG monitor reports.

Noon – 4 pm:
- TTE interpretation with echo attending.
- Continue to supervise stress tests, perform TEE’s.

4 – 5 pm
- Review ECG’s with assigned attending (Thursday or Friday)
- Review ECG monitors with outpatient attending.
- (Read nuclear stress studies with nuclear attending)

It is expected that the fellow will be present at the VA except for scheduled lectures, post-call time off, and weekly continuity clinic. Other absences need approval by the assigned echo attending for that day.

### Monthly Procedure Log

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Expectation</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Echocardiography:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TTE (performed)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>TTE (interpreted)</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>TEE (performed and</td>
<td>All available</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>Stress (supervised)</td>
<td>15 - 20</td>
<td></td>
</tr>
<tr>
<td>Stress (interpreted)</td>
<td>20 - 25</td>
<td></td>
</tr>
<tr>
<td>ECG</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Ambulatory ECG Monitors</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>ETT (performed and interpreted)</td>
<td>10 - 15</td>
<td></td>
</tr>
</tbody>
</table>
Appendix A

VA Noninvasive Rotation Core Competencies

Medical Knowledge: Echocardiography

- Know the appropriate indications for: M-mode, two-dimensional, & three dimensional transthoracic echocardiography (TTE); Doppler echocardiography & color flow imaging; transesophageal echocardiography (TEE); tissue Doppler & strain imaging; contrast echocardiography.
- Know the limitations and potential artifacts of the echo examination.
- Know the standard views included in a comprehensive TTE.
- Know how to interpret results of cardiac chamber sizes, left and right ventricular systolic and diastolic function, and hemodynamics.
- Know the characteristic findings of cardiomyopathies.
- Know the use of echo and Doppler data to evaluate native and prosthetic valvular heart function & diseases.
- Know the echo & Doppler findings of cardiac ischemia and infarction, and the complications of myocardial infarction.
- Know the echo findings of pericardial disease, pericardial effusion, and pericardial constriction.
- Know how to utilize echo to evaluate cardiac masses, and suspected endocarditis.
- Know how and when to utilize echo in the evaluation of diseases of the aorta.
- Know how to assess pulmonary artery pressure and diseases of the right heart.
- Know how to evaluate patients with systemic diseases involving the heart.
- Know the indications for- and the echocardiographic findings in- patients with known or suspected cardio-embolic events.
- Know the physical principles of ultrasound, and the instrumentation used to obtain images.
- Know the standard views included in a comprehensive TEE.
- Know the indications, contraindications, and limitations of stress echocardiography for diagnosis of coronary artery disease, valvular disease, and other conditions for which stress echocardiography is utilized.
- Know the pharmacologic mechanism of dobutamine, protocol for use in stress echocardiography, indications for termination of dobutamine stress testing, and prognostic implication of abnormal findings.

Medical Knowledge: ECG/Ambulatory ECG Monitoring

- Know how to measure, and the normal values for, electrical axis and ECG intervals, durations, and voltage.
- Know the anatomy of the specialized conducting tissue, and the spread of excitation in the ventricles.
- Know the characteristic ECG patterns of key clinical diagnoses.
- Know the indications for, and limitations of, continuous (Holter) and intermittent (Event) ambulatory ECG recording.

Medical Knowledge: ETT
• Know the indications, contraindications, and limitations of non-invasive testing in the context of the pre-test likelihood and predictive value for diagnosis of coronary artery disease.
• Know the role of non-invasive testing in risk-assessment, including the clinical, functional capacity, ECG, and hemodynamic stress test findings indicative of advanced coronary disease or high-risk state.
• Know the indications for terminating exercise stress testing.
• Know the prognostic implications of abnormal findings on exercise stress testing.

Patient Care and Procedural Skills: Echocardiography

• Integrate echo findings with clinical and other testing results in the evaluation & management of patients.
• Perform & interpret comprehensive TTE exam.
• Perform & interpret comprehensive TEE exam. (Including administration of conscious sedation)
• Recognize pathophysiology, quantify severity of disease, identify associated findings, and recognize artifacts in echocardiography.
• Supervise & interpret stress echocardiography.

Patient Care and Procedure Skills: ECG/Ambulatory ECG Monitoring

• Identify normal ECG patterns, normal variants, and artifacts (including incorrect lead placement).
• Identify ECG signs of atrial abnormalities, and of right and left ventricular hypertrophy or enlargement.
• Identify types and significance of intraventricular conduction delay or block (including functional or aberrant conduction abnormalities).
• Identify the types of atrioventricular dissociation.
• Identify first, second (types I, II, 2:1, and high degree), and third degree atrioventricular blocks.
• Identify the ECG patterns and localization of cardiac ischemia and infarction.
• Identify the ECG changes of electrolyte and metabolic abnormalities, and of drug effects.
• Identify non-specific QRS and ST-T wave changes.
• Identify atrial, atrioventricular nodal, and ventricular arrhythmias.
• Identify common patterns and rhythms.
• Integrate ECG findings into clinical and risk assessments, and the management of patients.
• Select and interpret ambulatory ECG recording studies.
• Identify normal and abnormal pacemaker rhythms/functions.

Patient Care and Procedural Skills: ETT

• Interpret and apply results of non-invasive testing in the management of patients with suspected ischemic heart disease.
• Perform and interpret exercise ECG testing.
Systems-based Practice

- Identify systems errors and advocate for system improvement

Practice-based Learning and Improvement

- Identify competency gaps and engage in opportunities to achieve focused education and performance improvement.

Professionalism

- Promote adherence to guidelines and appropriate use criteria.

Interpersonal and Communication Skills

- Communicate with and educate patients and families across a broad range of cultural, ethnic, and socioeconomic backgrounds.
- Communicate testing results in a timely manner to primary and referring physicians.