

RESPONSIBILITIES OF FIRST YEAR CARDIOLOGY FELLOWS DURING ECHOCARDIOGRAPHY ROTATIONS (Academic Year 2015–2016)

The Echocardiography Rotation has been designed to provide an optimal environment for learning the discipline of cardiac ultrasound. The Echocardiography Faculty is committed to provide opportunities for the Fellows' learning and facilitate development of a broad based understanding about the role, performance and interpretation of transthoracic echocardiography. At the end of your rotation an evaluation form will be provided for constructive feedback regarding your experience in the Echocardiography Laboratory.

Suggested Reading:

Either one of these two introductory textbooks:

The Echo Manual - Jae K. Oh, James B. Seward, A. Jamil Tajik

Textbook of Clinical Echocardiography - Catherine Otto

The *Washington Manual of Echocardiography* (by Ravi Rasalingam et al) that has been provided to you is a quick, portable introduction to the field written by our former fellows and the Echocardiography Faculty. Please read this book as it contains many key teaching points that will be emphasized in lectures during the year. Also this is your book, so any changes and suggestions to improve this book are welcome!

Important review articles will also be provided in a PDF format in CDL. It is encouraged that Fellows add pertinent additional articles to this database during the academic year.

Responsibilities:

The following responsibilities and objectives are designed to outline the minimum requirements for successful completion of the Echocardiography rotation with the goal of attaining Level II COCATS 4 competence in echocardiography. A review of your performance will be undertaken by the Director and Associate Director of the Echocardiography Laboratory in combination with the Director of the Fellowship program. If deficiencies are identified a determination of suitable remedial work will be required prior to attaining certification.

- (1) The Fellows participating in the echocardiography rotation based upon their assignment as 'Echo I' or 'Echo II' fellow will be scheduled to read inpatients or stress-test/outpatients.
- (2) The Fellow should be in the Echocardiography Laboratory by **8:30 am for the morning session and 1 pm for the afternoon session every day.**
- (3) The daily goals for the Fellows include the following:
 - **Pre-read at least 10 patient studies** in the 2nd month by entering their preliminary interpretation in CardioReport. The Supervising Attending will then review these studies with the Fellow.
 - **Perform at least 5 transthoracic echocardiograms** under sonographer supervision. The name of the fellow performing the study should be listed under the 'second sonographer' tab on CardioReport.
 - **Participate in interpretation of inpatient or outpatient echocardiograms** with the Supervising Attending. It is the Fellow's responsibility to print a log of the studies interpreted and performed from CardioReport. A copy of this log should be provided to Debbie Taylor at the end of the Echocardiography Rotation. This will form the basis for meeting COCATS 4 requirements for all our Fellows. For COCATS 4 Level II competency in Echocardiography a total of 150 transthoracic echocardiograms need to be performed and a total of 300 transthoracic echocardiograms interpreted.

- **For those interested in COCATS 4 Level III Training** will need to spend a minimum of extra 6 months in the Echocardiography Lab dedicated to learning advanced echocardiographic techniques and to develop additional experience in performing and interpreting special procedures, such as advanced myocardial mechanics (strain echocardiography, dyssynchrony assessment, torsion), contrast echocardiography, 3D echocardiography and echocardiography during catheter-based interventional procedures.

This can be accomplished during the 36-month cardiovascular fellowship (which will require that you devote all your available electives to echocardiography) or during extra year of fellowship dedicated to echocardiography under direct supervision of one of the following full-time Echocardiography Faculty: Dr. Julio Perez, Dr. Majesh Makan or Dr. Nishath Quader.

- (4) **Fellow attendance to reading and practical sessions during the Echocardiography Rotation is mandatory.** Exceptions to this include post-call days, clinic days or vacation. Debbie Taylor should be advised of vacation time that has been planned. The Fellow is to coordinate with the Attending of the day, or with Dr. Pérez or Dr. Makan, of any other situations that may necessitate his/her absence from the service. A record of attendance will be taken for all Fellows participating in the echocardiography rotation with an expected attendance of > 75%.
- (5) When the Fellow reading Inpatients is absent, the “Stress test/Outpatient” Fellow will be assigned to read with the Inpatient attending.
- (6) **Attendance at the morning Echocardiography lectures are mandatory** (with exceptions discussed with the Director or Associate Director of the Echocardiography Laboratory). The conference on the last week of each month, called “Interesting Cases of the Month”, will be performed by the Fellows on the echocardiography rotation. It will consist of the most interesting cases seen with brief didactics or ‘echocardiographic pearls’ associated with the pathology seen. It is encouraged that at least one case be a fellow’s study at night. A mentoring attending should be sought for review of cases prior to presentation.
- (7) The Fellow is to be available for consultation with nurses, sonographers, and laboratory receptionists regarding communication with referring physicians, patient hospital floors, screening patients whose images require enhancement with contrast agents, assist the sonographers/nurses obtain antecubital vein access for the purpose of injecting agitated-saline, Definity® or Optison™ for contrast studies and he/she is to arrange for the interpretation sessions to proceed smoothly (making sure studies are loaded in the digital system, videotapes available, etc.).
- (8) The Fellow is in charge (in consultation with the AM or PM attending) of the care of any patient having a stress echocardiogram from the standpoint of medical management and clinical disposition in the case of prolonged myocardial ischemia, arrhythmia, need for hospitalization, transfer to intensive care unit, catheterization laboratory, need for cancellation of a study because of clinical instability, etc.
- (9) In the months where Echocardiography Quality Assurance meetings are held it will be expected that the Fellows on the Echocardiography Rotation will present at least two Fellow’s study done at night for review.

PERFORMANCE OF TRANSTHORACIC ECHOCARDIOGRAPHY AFTER 5:00 PM (WEEKDAYS), SATURDAYS AND SUNDAYS

The 1st year fellow that is on call is responsible, in consultation with the 2nd year fellow or an echocardiography attending, for performing a TTE on a patient only when the information obtained by an echo is urgently or emergently needed for decisions regarding patient treatment. The patient should first be evaluated by the fellow to determine if a formal consult would be most appropriate, and the echocardiogram performed only if deemed necessary. No routine echocardiograms by the Fellows are to be performed during these hours. Routine studies will be performed from 7:30 AM – 4:00 PM on Saturdays by the CDL staff only.

BRING WITH YOU

1. Echo machine (typically GE, **DO NOT TAKE THE RESEARCH ECHO MACHINE**)
2. Gel (make sure there is gel in the bottle!) and EKG tabs
3. Blue requisition forms
4. If necessary: Optison® and saline flush (hint: saline bottles work better than flush for bubble studies). Note if Definity® is used it can only be mixed in a Vialmix machine prior to use and not by hand agitation.

SET UP

1. Place sticker on blue requisition form (save a sticker for your records). Also write your name clearly, as well as the attending physician, diagnosis and reason for echo.
2. Plug in machine and turn power on (front switch on back and button in front).
3. Make the room as dark and comfortable as possible.
4. Put EKG leads on the patient. **A functioning EKG is important for proper image capture.**
5. Log on as USR, no password needed.
6. Press “archive” button on the left side and enter the patient’s information.
7. Last name, first name, date of birth and MRN # (on top right of stickers, add zeros before the number in order to obtain a total of nine digits).
*** If MRN # is unavailable then type in “123456789” and then contact system administrator (Katie Egan) in the AM to change this number.
8. Click “create patient” and “begin exam”.
9. Adjust gain and position of ECG using “physio” button and dials under the screen. If using contrast change to ‘Contrast preset’ in the menu options found by pressing the Application button. Administration and imaging with contrast should be learned from sonographers/senior fellows.
10. Place patient in the left lateral decubitus position if possible.

IMAGING AND UPLOADING IMAGES

1. A complete study should be performed when possible.
2. Record desired images (see below).
3. When study is finished push “archive” and click “end study”.
4. Turn off and wait to unplug the machine and proceed to nearest network drop (preferably CDL but there is a network outlet in 8200 next to Dr. Bach’s office). **Do not leave machine running all night to download studies.**
5. Connect network line (in 8200 left plug seems to work better), turn on machine.
6. Log on as USR and press “archive” and after ~5 minutes the machine should automatically send your stored loops to ProSolv (you should see a computer icon with an arrow underneath it on the bottom left of the screen indicating a good connection; the right of the screen will indicate the number of studies pending and should say “sending”; a crossed out computer on the bottom left indicates a problem with the network connection and changing the Ethernet cable to a different jack may help). ***If your study does not automatically transfer press F4 (spooler) and highlight your studies, select hold and then resend or send to ProSolv.

EXAMPLE SEQUENCE FOR IMAGING 2D IMAGES:

Push “Img Store” A digital loop is displayed

Push “Img Store” A digital loop is recorded onto hard drive

EXAMPLE SEQUENCE FOR IMAGING SPECTRAL DOPPLER AND M-MODE:

Push “Freeze” Image to be recorded will be displayed

Push “Img Store” Image is recorded onto hard drive

EXAMPLE SEQUENCE FOR WHEN YOU DO NOT WANT TO SAVE IMAGES (I.E. BAD IMAGE):

Push “Img Store” A digital loop is displayed

Push "2D" Returns to live imaging

THE VIEWS

Parasternal long axis	2 nd interspace	notch to RIGHT shoulder
Parasternal short axis	2 nd interspace	notch to LEFT shoulder
Apical 4 chamber	apex	notch to bed
Apical 2 chamber	apex	notch to LEFT shoulder
Apical 3 chamber	apex	notch to RIGHT shoulder
Subcostal 4 chamber	subcostal	notch to LEFT shoulder
Subcostal short axis	subcostal	notch to chin
Subcostal IVC	subcostal	notch to RIGHT shoulder

COLOR AND DOPPLER

Place color Doppler box over every valve any time seen in a new view.

Aortic valve- CW and PW at LVOT in apical views.

Mitral valve- CW and PW at leaflet tips in apical views.

Tricuspid valve – CW on parasternal and apical four chamber views (assess PASP, the more views the more accurate you will be).

**PW at slow sweep speed 25 mm/s (set sweep speed with dials under the screen) with the respiratory indicator (under "physio"- button on left and then "more"- on the right of the knobs under the screen) necessary for tamponade studies.

Pulmonic valve- CW and PW at RVOT on parasternal views.

Pulmonary veins- PW on apical four view (may need to increase depth with dial on the right).

M-MODE

RV free wall helpful in tamponade (particularly parasternal short at AV level).

PAPER WORK AND FOLLOW-UP

1. Write PRELIMINARY findings in the chart before leaving the ward (emphasize prelim).
2. **You must return the machine by 8:00 AM the next business day! Do not leave on hospital floors unattended unless absolutely necessary.**
3. Put the paperwork at the front desk of CDL (tray is labeled and located on desk area next to the fax machine). It is most important that you write your name clearly, as well as the attending physician, diagnosis and reason for echo on the blue requisition forms so this information may be properly entered into CardioReport by the CDL staff.
4. ** The sonographers should teach you how to enter the studies into 4D Client echo reporting system. **It is important you ensure that your name is entered as the sonographer performing the study as this serves as a log of studies you performed.**
->Log in as BSMD1 and Password is BSMD1->Click on schedule patients icon->Click on quick schedule for new patient->Then fill in patient data->Click on echo tab and select patient name and enter your name as sonographer.
5. Communicate with the Inpatient reading attending the next day regarding studies performed to receive feedback. Preferably this should be done in person otherwise via e-mail or phone-call is acceptable.

****YOU MUST RECORD THE STUDY ON ANY PATIENT YOU IMAGE: IT IS A MEDICAL-LEGAL ISSUE****
****ECHOCARDIOGRAPHIC MACHINES & CABLES ARE EXPENSIVE- PLEASE TREAT WITH CARE****

TTE Protocol : After each view image store.

- 1) 2D PLAX (indicator to right shoulder) Depth 16cm. Focus: @10cm: LV function, pericardial effusion, pleural effusion, LA, aorta, RVOT (RV @ 12'O clock): Left lateral decub if possible with L Arm up. Move up and down Intercostals if needed
- 2) 2D PLAX with color: use trackball and enter to adjust size of box 1 inch past mitral into LV, 1 inch past aorta (eval for MR/AR) (Nyquist @ 0 .54)
- 3) M Mode thru Aortic valve (should look like a box when open)
- 4) Press "Measurements" Click Generic. "LA/Ao" Measure on R wave leading-leading aortic root (box open). Enter then measure LA@ max diameter: leading to leading
- 5) M Mode thru Mitral Valve. (should look like two triangles) E point septal separation >7mm = low Stroke Vol
- 6) M mode thru Mid Ventricle: look for systolic and diastolic thickness of LV walls. Good excursion = good function.
- 7) 2D RV inflow view (tilt probe tail up and toward left shoulder) color over TV: eval for TR.
- 8) RV inflow: CW over TV for TR Measure Vmax for RVSP: Measurements ->Tricuspid Valve -> TR max: place cursor on peak jet. ENTER
- 9) 2D RV outflow: (tip probe tail down and towards right shoulder). Color over pulmonic valve
- 10) 2D Zoom PLAX over aortic and MV. Adjust track ball so both fit. Image store live
- 11) 2D Zoom PLAX COLOR over aortic and MV: look for MR/.AR

- 12) Freeze. 2D Zoom PLAX over aorta and MV. Using trackball, scroll to aortic valve open (end of QRS) to measure LVOT Diameter (Measurements -> Dimension -> LVOT -> annulus to annulus, image store)
- 13) Unzoom. Freeze PLAX 2D. Scroll QRS to R wave. (largest cavity size) Measurements -> Dimension -> LVD. Place first cursor on leading edge of septum. Enter. 2nd cursor on septal width. Enter. 3rd cursor leading edge PW. Enter. 4th cursor thickness of PW. Image store
- 14) Scroll cursor to systole (smallest cavity size) Measurements -> Dimensions -> LVs. Septal base to leading edge PW. Image store.
- 15) D PSAX (indicator to Left shoulder): aortic valve level (inverted Mercedes Benz Sign) image store. Tail down. Look for bicuspid AV.
- 16) 2D PSAX with color over RVOT (eval for pulm regurg)
- 17) 2D PSAX PW (place cursor in RVOT immediately above PV) Pulm Valve: (looking for subpulmonic stenosis)
- 18) 2D PSAX CW RVOT: eval for PS and PR and PVET: Measurements -> Pulmonic Valve -> PVET. Cursor on opening click. ENTER Cursor on closing click. Used for TEI index (measure of RV function)
- 19) Measure PA Acceleration Time: Measurements -> Generic-> Time -> Place cursor on opening to peak. Correlates w TR VMax & Estimated Peak Systolic PAP (<90ms correlates with PVR >3 Woods units)
- 20) 2D PSAX CW Pulm Valve: Eval for Pulm Regurg: Measure Peak Regurg Velocity
- 21) 2D PSAX Zoom Aortic Valve
- 22) 2D PSAX Zoom Color Aortic Valve
- 23) 2D PSAX Color Tricuspid Valve
- 24) 2D PSAX CW Tricuspid Valve: Measure Peak TR velocity to get RV systolic pressure
- 25) 2D PSAX Mitral Valve (looks like a fish mouth) Tail slightly up
- 26) 2D PSAX Color Mitral Valve
- 27) 2D PSAX Papillary Muscles (all LV walls seen: good visual estimate of LV systolic function.
- 28) 2D PSAX Apex: (clot and LVAD inflow cannula) Tail more up.
- 29) 2D A4C: Index pointing to left flank. RV looks like acorn. LV looks like bullet.
- 30) 2D 4C Color MV. If significant MR: want to see jet hit posterior LA
- 31) A4C: CW MV: adjust baseline so that peak MR jet can be seen (should be 5-6 m/s)
- 32) A4C: PW MV inflow: measure E and A: Measurements -> Mitral Valve; 1st cursor peak of E, 2nd cursor at end of slope of E wave, 3rd cursor at peak of A: measures E velocity, A velocity, E:A ratio (diastolic function)
- 33) A4C: PW pulmonary veins (use color to help find PV): assesses diastolic function. Normally S >D. Look for diastolic flow reversal in severe MR
- 34) A4C Tissue Doppler (TDI) + PW septal mitral annulus: assesses diastolic function. Normal E' 10cm/s
- 35) A4C Tissue Doppler (TDI) + PW lateral mitral annulus: assesses diastolic function. Normal E' 12 cm/s
- 36) A4C Color TV
- 37) A4C CW TV Measure Peak Velocity again for RVSP. Measure-> Tricuspid -> TCO -> opening enter -closing. (RV function measurement)
- 38) A4C TDI RV free wall. Image store.
- 39) A4C TDI +PW Lateral Tricuspid Annulus for strain imaging (RV function) Image store
- 40) M mode thru Lateral Tricuspid Annulus. Freeze. Measurements -> Generic -> Caliper -> 1st cursor lowest dip of RV. Enter. To peak hump and image store (want to see horizontal line. Don't hit enter a second time.)
- 41) A5C: tilt tail downward to open aorta. 2D
- 42) A5C Color over LVOT
- 43) A5C PW LVOT: Measure -> Aortic -> LVOT VTI: Trace. Only seen closing click.
- 44) A5C CW Aortic Valve (eval for AS). If Vmax over 2m/s measure Aortic VTI to measure for AS
- 45) A2C: rotate indicator to 12 o'clock. Image store: TIP: may need to move up or down a rib space.
- 46) A2C. color MV.
- 47) A3C (long axis): rotate indicator counter clockwise from 12 to 10 o'clock
- 48) A3C color over LVOT
- 49) Subcostal: 2D: patient supine, knees up. indicator to left flank. Probe under xyphoid tip. Tail down. Angle up.
- 50) Subcostal: Color over intraatrial septum (eval for ASD)
- 51) Subcostal: 2D IVC view: rotate indicator to 10-11 o'clock
- 52) Subcostal: PW hepatic vein. (diastolic function)
- 53) Subcostal: Aortic view: Tip tail toward left hip.
- 54) Subcostal Aortic view: color (should be red)
- 55) Subcostal: PW Aorta (Normal Vmax <1m/s, above baseline)
- 56) SSN: Indicator toward chin (1 o'clock).
- 57) SSN: Color over desc aorta
- 58) SSN: PW as far down desc as possible (Normal Vmax <1m/s). Eval for coarct, supravalvular AS, flow reversal in severe AI.