

MESA Exam 5

Manual for

- 1. Digitizing Carotid Ultrasound Videotapes**
- 2. Creating Reference Images from Previous MESA Exams**
- 3. Reading Carotid Ultrasound Studies**

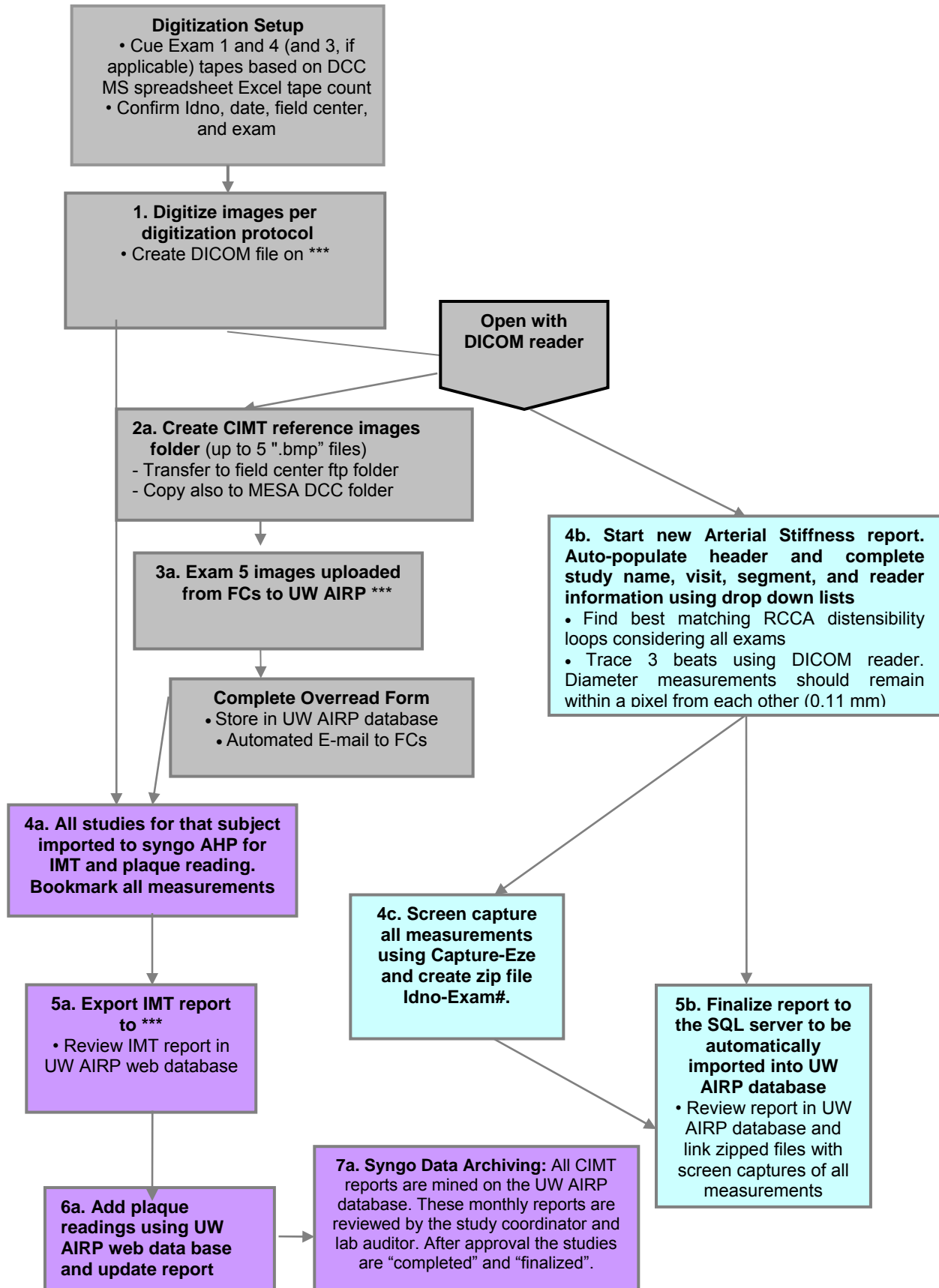
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*Overview of Ultrasound Image Management in UW AIRP



***** refers to confidential network directories**

**The primary comparisons are between Exam 1 and Exam 5, however Exam 4 (or 3, if applicable) images also will be digitized and measured if they were performed correctly, match, and are readable.*

Digitization Set up

1. Prior to digitization, confirm that the Idno, date, field center, and exam number match those in the Excel spreadsheet provided by the DCC.
2. Turn the power on to the Panasonic VHS video player, Sony TV monitor, and the Medical Digital Recorder (MDR).
3. Insert the VHS videotape into the tape deck.
4. Cue Exam 1 and 4 tapes (and Exam 3, if applicable) based on DCC Excel tape count
5. Preview the videotape and decide what segments will be most suitable for digitization and measurement.
6. For the bulb and ICA image selection, review the images from the 3 angles recorded and select the angle we will use to create reference images for Exam 5 studies. The criteria for this selection should include:
 - A. Far wall IMT image quality
 - B. Maximal IMT thickness
 - C. Presence of reproducible landmarks.
7. When you have chosen the best imaging plane, you will digitize only a still frame from that plane to serve as the reference image, then
8. Digitize 5 second loops to cover the 3 planes for plaque detection. See below
9. Repeat on left side

1. Tape digitization

1. After the MDR initializes, you will be at the Exam Manager screen. Press the “New Patient” soft key.
2. The next screen is the Patient Entry screen. This screen will default to the Pt Name field. Press “Enter” to edit the information in the Pt Name field. Use the MDR keyboard to type in the required information. Pt Name should include the exam number followed by a space and the subject acrostic number (i.e. E1 AAABBBF). After entering the information into the Pt Name field, press “Enter” followed by the ↓ (down arrow).
3. Press “Enter” again to move to the Pt ID field. Here you will fill in the subject’s 7 digit ID number followed by a “-1” or “-4” (i.e. 3334444-1), to identify the exam visit within the ID and press “Enter.”
4. Press the “Next” soft key.
5. To confirm the patient information is correct press the “OK” soft key. You now are ready to begin storing still frames/loops.
6. Record images (A) by using the dual-foot pedal or (B) by using the MDR user interface.
7. When the study is completed, press the “End Exam” soft key on the MDR. The exam will automatically be sent to the UW AIRP *** folder.
8. If you mistakenly forget to capture a cine loop or still image you can append images to an already completed exam in the MDR.

Images to be digitized for the Right Carotid Artery

1. 10 second loop covering the full transverse scan
2. Distensibility still frame for “*Idno+RCCA_e1_distens*” reference image
3. Distensibility loop – 10 seconds, avoid respiratory translation artifacts

4. Still frame of RICA Doppler with measurement.
5. RCCA still frame for "Idno_E1_RCCA" IMT reference image, in some cases this image will be the same than #2.
6. Anterior RBulb or RICA IMT loop - 5 seconds (or at least 3 good beats).
7. Lateral RBulb or RICA IMT loop - 5 seconds (or at least 3 good beats).
8. Posterior RBulb or RICA IMT loop - 5 seconds (or at least 3 good beats).
9. **Between steps 6 and 8 you must store a still frame of the best RBulb/ICA image to be used as the reference image for Exam 5 RBulb/ICA scanning. This will be labeled as "Idno_E1_RBulb or ICA_angle".**

Images to be digitized for the Left Carotid Artery

1. 10 second loop covering the full transverse scan
2. Still frame of LICA Doppler with measurement.
3. LCCA still frame for "Idno_E1_LCCA" IMT reference image.
4. LCCA IMT loop – 5 seconds (or at least 3 good beats).
5. Anterior LBulb or LICA IMT loop - 5 seconds (or at least 3 good beats).
6. Lateral LBulb or LICA IMT loop - 5 seconds (or at least 3 good beats).
7. Posterior LBulb or LICA IMT loop - 5 seconds (or at least 3 good beats).
8. **Between steps 6 and 8 you must store a still frame of the best LBulb/ICA image to be used as the reference image for Exam 5 LBulb/ICA scanning. This will be labeled as "Idno_E1_LBulb or ICA_angle".**

2a. Create IMT reference images folder using DICOM reader.

Save reference images, and upload to site specific ftp folder and MESA DCC subfolder, approximately 2 weeks prior to scheduled Exam 5 visit. In cases of a change of schedule or a last minute "walk-in," the field center should contact the UW AIRP lab and request reference images which they will provide as soon as possible.

3a. Exam 5 images uploaded from field centers to UW AIRP * DICOM directory.**

- Overread form will be completed. See MESA Exam 5 Carotid US MOP.
- Store in UW AIRP database
- E-mail to field centers
- If incidental findings are discovered, the exam will be forwarded to Dr. Stein (or his backup designee) and a preliminary IF form will be created
- Dr. Stein will review, sign, and date if he agrees that the findings should be reported.
- Reviewer creates a .pdf file of the signed and dated IF form and e-mails it to the site and DCC. The e-mail should include:
 - The site sonographer/s, coordinator/s, and study PI/s
 - The DCC for MESA and MESA air personnel
 - UW AIRP MESA readers

4a. Exam 5 images together with Exam 1 and 4 (and 3, if applicable) images digitized from tapes will be imported into syngo Arterial Health Package (AHP) for IMT measurement and plaque reading

The major focus of IMT reading is matching images from Exam 1 and Exam 5. Exam 4 (or 3, if applicable) CCA IMT images will be measured as well. The goal of IMT reading is to match Exam 1. For each segment, compare images side by side. Focus on the far wall, assuring that the image shows high quality double lines in the matching region. Editing of tracings should be minimized and only performed if the incorrect interface is identified by the AHP or if a part of the

segment is clearly measured incorrectly. Each traced segment is graded by its matching quality compared to Exam 1 as: “high quality match.” “poor quality match, but measurable”, or “no match, per-protocol.”

Bookmark every tracing/measurement saved by clicking on the “Create Bookmark” icon at top left of screen. The saved images with the tracings comprise our “Lab Notebook” and serves as documentation of the measurements we made. After completing the segmental readings, review the exam worksheet by clicking on the “Report” icon.

5a. Export AHP worksheet values to ***

6a. Add plaque readings in UW AIRP web data base

7a. Complete, Finalize and Archiving Studies on the Syngo Workstation

In order to have an active database that is manageable in size, and easy to sort, a monthly archive process is followed. All subjects read (Exam 1, 4 and 5, and Exam 3 if applicable) on syngo and already exported to the UW AIRP web database are finalized and completed.

Completing a Study

Completing a study on the SYNGO workstation identifies the study images are read and the report is ready for review and to be finalized.

Finalizing a Study

Finalizing a study on the SYNGO workstation locks the study and identifies it as an archived study on the study list. Always complete a study before finalizing it.

Archived studies

Once a study is archived it will be stored on the UW AIRP syngo server along with its report. The study will remain available on the syngo studies list until the system has reached the maximum number to display (in our case we allowed to show the last 999 GB). This works as a cache which will delete the oldest study in from the list to free up space for the new studies to be uploaded.

How to retrieve an offline archived study

To import back old finalized studies we use the “import “ tab and locate the old studies in the network-server folder *** depending on the workstation used for the reading. Only syngo users with administrative rights will be able to access this folder on the server.

Server configuration and backup plan

The server has 5 hard drives, 4 in a RAID5 configuration and one as a hot spare. The server can have 2 hard drives fail and still be operational. We back up the syngo SQL database weekly to a backup file located on the server. We perform full backups of the entire server weekly and differential backups on weekdays, including the syngo software install and all data in the archive. All backup data including the SQL database backup are stored in a disk-to-disk backup system, where we keep a total of 4 weeks worth of backups.

4b. Read RCCA distensibility studies with DICOM reader Arterial Stiffness Report

The major focus of distensibility reading is matching images from Exam 1 and Exam 5. If the Exam 5 images do not match Exam 1 or Exam 1 images are not measurable, check to see if the Exam 5 images match Exam 4 (or 3, if applicable). Each traced right CCA segment is graded on its matching quality against Exam 1 (if measured) or Exam 4 (or 3, if applicable) as: “not measurable”, “high quality match”, “poor quality match, but measurable”, or “no match, per-protocol.” Exam 4 (or 3, if applicable) RCCA distensibility images will be measured if they match Exam 1, OR if Exam 1 RCCA distensibility images are so poor that they can’t be measured, the Exam 4 (or 3, if applicable) RCCA distensibility images will be measured and serve as a reference image for comparison with Exam 5.

5b. Import Distensibility reports into the UW AIRP database

1. The report is automatically imported into the UW AIRP database every 20 minutes. You also can force the import by opening the UW AIRP database and selecting the “Execute the import script immediately”
2. Review the report in UW AIRP web database for consistency
3. Upload a .zip file containing all the screen captures of measurements that correspond to that report.

Quality Assurance

1. Reading QA Studies for Reader Reproducibility
 - a. 20 cases from Exam 1 and Exam 5 will be selected to represent all 6 sites.
 - b. Each of the 3 readers will read all 20 cases every 8 months.
 - i. The 20 cases have been burned to individual CDs and renamed with the subject’s idno and the QA information
 - ii. Studies are imported into the syngo environment for measurement. The first reproducibility reading session will include paired readings of all 20 subjects by all MESA readers, 8 months later a single reading of the 20 subjects will be repeated.
 - iii. Inter- and intra- reader variability will be assessed.
2. Reading QA Studies for Scanning Reproducibility
 - a. Selected subjects at each Field Center will be scanned a second time on the same day of their Exam 5 visit or they may be rescheduled to come back within 28 days of their Exam 5 visit. If the scan is performed the same day, the subject will be asked to get up from the exam table and return at least 30 minutes later.
 - b. The scans will be labeled in the Logiq 700 as instructed.
 - c. Once the scan is sent to the UW AIRP lab via ***, it will be overread.
 - d. Each sonographer is supposed to re-scan 15 subjects. The DCC will select the subjects for scanning reproducibility. Most sites will complete 30 reproducibility scans, but that will vary according to the number of sonographers certified and actively scanning for MESA Exam 5 at a given Field Center.

Handling of Exam 4 (or 3, if applicable) images

The major focus of IMT and distensibility readings is matching images from Exam 1 and Exam 5. Exam 4 (or 3, if applicable) images will be digitized and measured at the time the Exam 5 images are measured.

1. Exam 4 (or 3, if applicable) IMT images will be measured with a goal of matching them with Exam 1. The same matching quality scale used for Exam 5 tracings is used for Exam 4 (or 3, if applicable).
 - a. When setting up to read an Exam 5 study, check for the presence of an Exam 4 (or 3, if applicable) videotape for the subject.

- b. If a videotape is present, follow steps above, however match the Exam 4 (or 3, if applicable) images to the references images from Exam 1.
- 2. Exam 4 (or 3, if applicable) RCCA distensibility images will be measured if they match Exam 1, OR if Exam 1 RCCA distensibility images are so poor that they can't be measured, the Exam 4 (or 3, if applicable) RCCA distensibility images will be measured and serve as a reference image for comparison with Exam 5.
 - a. When setting up to read an Exam 5 study, check for the presence of an Exam 4 (or 3, if applicable) videotape for the subject.
 - b. If a videotape is present, follow step 1, however match the Exam 4 (or 3, if applicable) images to the references images from Exam 1.
 - c. If Exam 1 images are poor, then do not read Exam 1 and read Exam 4 (or 3, if applicable) instead, but try to read both if possible.
 - d. Follow steps 4a/b-5a/b and 6a for reading, remembering that matching to Exam 1 is the main priority.