AbstractID: 7952 Title: Quality Assurance of Image Registration in Clinical TrialsI

Imaging studies acquired at multiple times and using different modalities are important components to many clinical trials. Imaging is used for staging and protocol eligibility, for radiation therapy target definition, for adaptive radiation treatment delivery, for assessing response to therapy, and for outcome analysis. Currently co-registration of CT, MR and PET scans may be important for any of these purposes; in the future, molecular and biomarker imaging may be incorporated.

The challenges for the QA centers are to verify that institutions participating in protocols requiring image registration have the tools and expertise to perform the registrations, and to verify the appropriate registration for individual protocol patients. There are many software systems, many with multiple methods, available for image registration.

One method to credential institutions is by benchmarking. QARC's "fusion" benchmark has the institution download a DICOM MR and a DICOM CT scan set. The datasets are to be registered, the small lesion on the MR scan is to be outlined, and the geometrical center of the lesion on the CT scan is to be reported (lesion not visible on CT). Results from more than 40 institutions will be discussed.

An increasing number of protocols require PET imaging. Registration of PET imaging is problematic, except for PET/CT. Since the DICOM standard does not includes specifications for SUV calculations, currently only ACRIN, by using the manufacturers' workstations, is able to receive PET images and recalculate SUVs. Ideally these PET images would be registered with the planning CT in radiotherapy protocols.

More and more protocols propose requiring IGRT, particularly for few fraction treatments. For protocol participation, institutions need to demonstrate the reproducibility and accuracy of the imaging system used to adapt the daily treatment to the daily target position. Extensive questionnaires (QARC) and submission of representative patient data (RTOG) are required by the QA centers. The variety of systems - MV CT, kV CT, Tomotherapy, Cyberknife, ultrasound - provide a challenge for the QA center.

An even greater challenge is how to provide QA for individual patient treatments. If CT/CT or CT/MR registration is used for target delineation, how can the QA center assess the registration? Do they need to redo it themselves? What tools can be developed to register and verify CT/PET registration? For adaptive radiotherapy, what is the benefit of reviewing the daily assessment of required repositioning? And at what cost?

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Educational objectives:

1) Understand the issues faced by the QA centers in reviewing image registrations
2) Understand the difference between credentialing and providing individual patient QA for image registration
3) Become familiar with the current strategies of QA for image registration by the QA centers