In recent years, image guidance systems have revolutionized the way clinicians localize and treat patients. Image guidance systems (IGS), along with advanced imaging techniques, are now used to plan and successfully execute therapies with speed, precision, and accuracy that had previously been unachievable. Moreover, the advancement of novel MRI imaging techniques, cone-beam CT, and various real-time tracking devices allow for intra-procedural adjustments to be made to account for patient/tissue motion. All of these aspects of imaging and image guidance systems make them an important part of a modern clinical practice.

While these systems may improve patient therapies, the process required for an expert to employ an IGS clinically has become increasingly more complicated. The steps and additional quality assurance components are numerous. Typically, an image set (ie. CT, MRI, ultrasound, PET) is acquired and a therapeutic plan (ie. surgery, biopsy, radiation therapy) is created based off this image set. A reference within the scan (ie. tracking spheres, anatomic surfaces) can be used to relate the patient's coordinate system to that of the image set. Finally, a therapy is delivered with either patient positional confirmation throughout the process (ie. real-time tracking) or before/after in the case of imaging techniques that require longer acquisition times.

This lecture is an overview of the procedure required to employ an IGS in clinical practice for patient therapies with an emphasis on the increased demands on imaging.

Educational Objectives:

1. Understand the steps required to employ an image guidance system
2. Understand the additional necessary requirements on image modalities
3. Understand the core concepts behind image guidance quality assurance