MRI in Multicenter Trials: Challenges and Limitations

M. D. Schnall[1]

[1]University of Pennsylvania, Philadelphia, Pennysylvania, United States

Results from multicenter clinical trials are generally considered the strongest evidence for supporting clinical decision making. This is based on the fact that by using multiple sites, multicenter trials better predict the outcome of an intervention in the general clinical setting. Growing interest in imaging as an in vivo assay to serve as a biomarker or study endpoint for treatment trials; and more emphasis on the need to justify the clinical applications of imaging with evidence of positive effect on patient outcome have lead to a need for a more prominent role for multicenter trials in the imaging science communities. This is particularly true for newer imaging technologies such as MRI. There are significant challenges in nearly every stage of developing and implementing multicenter trials in imaging. Trial designs are often diverse and complex due to the many ways imaging can be applied to a specific disease. Furthermore, there is no standard template for the sequence of imaging trial designs needed to validate imaging in a clinical or biomarker role.

Another major challenge in multicenter imaging trials is standardization across sites. This is particularly true with MRI. Reconciling differences between equipment and pulse sequences from different manufacturers represents a major challenge. This can even be a significant issues between platforms of the same manufacturer. There is a need to balance rigorous technical protocol specifications against flexibility in order to arrive at a scan protocol that allows collection of consistent data over a wide range of sites. Ensuring forward compatibility with equipment upgrades can also present a problem. Expecting sites to lock in their platform for the benefit of a multicenter trial is not reasonable. Extracting quantitative data from MRI is also complex. Differences in the implementation of what appears to be the same imaging sequence on different platforms can lead to systematic difference in quantitative data. Difference in reconstruction filtering can also lead difference in extraction of some quantitative data. There is a need to validate quantitative approaches across platforms prior to study implementation.

By design, multicenter studies involve centers with different experience/ capabilities. Although some sites are quite sophisticated with MRI technology, typically there are sites that need a great deal of help implementing even the most basic experimental imaging protocol. Thus confirmation of protocol compliance and QC of imaging technique are required. The standard approach utilizes a central image archive that collects all of the images obtained on a trial. In order to allow meaningful image QC the image collection and review must be near real time to provide feedback to sites so that any errors can be detected and rectified. Tracking and managing this process is a significant technical and administrative burden. In addition, firewalls, and local policy to ensure compliance with HIPPA often conspire to make this process very difficult.

Although there are many challenges to multicenter imaging trials, they will continue to play a more important role in the development and validation of imaging applications. The development of standard approaches and better training will be necessary to better prepare the MRI research community for this challenge.