

# **PET/MR Technologists Challenges from a Nuclear Medicine Technologists point of view**

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**PURPOSE:** The purpose of this lecture is to provide an overview of the challenges within PET/MR technology for Nuclear Medicine technologists and to review quality control, clinical workflow and imaging protocols as implemented at a large university research center.

## **CONTENT ORGANIZATION:**

- A. Overview of what is PET/MR and what is involved
- B. The three main PET/MR scanner designs
- C. PET/MR scanner quality control (daily, weekly, quarterly)
  - a. Detectors
- D. Radiation Safety and MR safety
  - a. Training
  - b. Implants
- E. Technologist workflow in the PET/MR suite
- F. Responsibilities of a Nuclear Medicine Technologists
  - a. Patient Care
- G. Acquisition and Reconstruction of images
  - a. Artifacts
- H. Challenges
  - a. Knowledge of MRI
  - b. PET/CT versus PET/MR
- I. Conclusion
  - a. PET/MR outlook
    - i. Research
    - ii. Job opportunities

Nuclear Medicine is a budding field that offers a variety of opportunities. One of the emerging new fields is the powerful hybrid modality of PET/MR which offers simultaneous acquisitions of two very influential and complementing fields, PET and MRI. The fusion of these two disciplines provide nuclear medicine with an instrument that produces high quality molecular imaging datasets and detailed, high-contrast structural images. As a Nuclear Medicine Technologists, there is an opportunity to cross-train in MRI.

There are three companies that declare availability of PET and MRI scanners, Siemens, GE and Phillips. Siemens and newly announced GE offer simultaneous acquisitions. The designs of the scanners remain consistent with its true form, allowing the PET detectors to fit along the inner edge of the MRI bore. The inner diameter of the bore is 60 cm; this allows for high PET system sensitivity and excellent MR image quality. While the slightly smaller bore size compared to modern PET and MR systems has some impact on patient comfort, the vast majority of patients are able to tolerate the exam.

In addition to consistency of the design, quality control of the scanner shares many similarities with what is currently practiced with conventional PET/CT scanners. Maintaining daily quality control is one of the responsibilities of the nuclear medicine technologist, along with performance of routine tasks and accurate record-keeping. Some of these activities include execution of weekly and quarterly PET quality assurance tests, acquiring patient information, recording and storing all patient data, maintaining reports on progress, reviewing patient images, reconstructing patient data, performing risk management assessments and networking with radiologists, referring physicians, engineers and management. At the beginning of each day, a daily quality assurance test is acquired on the scanner. The daily quality assurance is performed to ensure that the PET scanner provides high quality and quantitative images of patients while maintaining consistent diagnostic performance. The PET technologist also performs the MRI daily QC including MR phantom measurements, checking the helium level (used for cooling the magnet), and surveying the room and scanner for temperature level, coil function, table position, and more. All of these help to ensure patient safety as well as the technologist's safety.

This new technology has provided PET technologists with an incredible opportunity to interact with researchers, nuclear medicine physicians, radiologists, engineers, referring physicians, administrators, and most importantly patients in new ways that is advancing our field and providing and a fantastic opportunity for personal development. As part of this interaction, PET technologists have the chance to participate in a large number of research projects, many of which require the preparation of special phantoms and development of custom imaging protocols.

While there are numerous advantages for PET technologists, there are also many challenges. Some of these challenges include having knowledge of MRI and the safety that is involved in regards to the technologist, their patients and co-workers. Patient safety is very important and there are certain restrictions that prevent a patient from being scanned such as rods, metals and replacements. PET technologists need to be aware of what is safe within the scanner and scan room. MRI can be a very challenging field in which there are several parameters and concepts that need to be grasped. The magnet is always on and this may present a challenge for PET technologists who may not be used to constantly being surrounded by a magnet. A technologist must be able to understand how the data is acquired, reconstructed and stored, while also having knowledge of anatomy in all three planes.

One major advance in the medical and research field is simultaneous PET/MR acquisition. Offering an essential outlook on what the future has to offer, PET/MR involves exposing patients to less ionizing radiation, advancing diagnosis, helping to monitor treatment, particularly related to cancer and bone disease, enhancing the value of certain tracers, and providing more anatomic and physiological detail than CT scans, especially when imaging soft tissue. PET technologists are at the forefront of a growing field in which there are advantages and challenges. With knowledge and training, this newly fused modality offers another step forward for PET technologists.