What the Defense Should Know About Magnetic Resonance Imaging (MRI)

Peter G. Bernad, M.D.

Magnetic Resonance Imaging (MRI), previously referred to as MR, is a completely noninvasive, safe way of imaging the human body and particularly the human brain. MRI is unencumbered by the usual assortment of caveats; it involves

1. no side effect;
2. no untoward effect;
3. no allergic reaction;
4. no radiation exposure;
5. no painful intravenous injections.

The MRI requires no special patient preparation. This new technique evaluates the human body and brain as no other technique in the past. Although this imaging approach is used to look at the entire body, for the purpose of this article I will concentrate on the human brain. A neurologist can examine a patient using conventional techniques, but he or she is limited by the thick bony covering of the brain called the skull. To identify brain abnormalities called "lesions" the neurologist seeks to look within the "black box" or skull. In the past the neurologist was hampered by the hard calcified cranium which blocked good imaging.

How MRI Works

The new technique, MRI, is entirely blind to bone or calcified structures and can only see soft tissue which contains hydrogen atoms or water (H_20). Brain is a tissue which is mostly made up of water, as are many of the organs, and therefore is an ideal structure to be imaged with MRI. This new technology uses no radiation, does not need intravenous contrast agents, and cannot be allergic to patients. It can very early on detect brain tumor, multiple sclerosis, blood clots, or evidence of trauma and many subtle neurologic abnormalities and causes of brain dysfunction and disturbance which in the past could not be identified by other means. Rather than using x-rays or ultrasound or other mechanisms to probe into the brain structures, MRI obtains its information from the inside looking to the outside through the use of a large magnet. Not only is a large magnet needed, but also certain radio frequencies and sophisticated computer technology. It is with the development of advanced computer technology that this form of imaging has come about. Although Magnetic Resonance Imaging was known in the past as Nuclear Magnetic Resonance (NMR) and was used in the laboratory, it was only with the advent of computerized technology that it could be used in the clinic. This is accomplished by the use of a highly energized magnetic field. The patient is situated into the center of the magnet (so that the brain or other body organ is placed into the most advantageous position). Then the magnetic field aligns internal molecular structures within the brain's natural molecular-chemical makeup.

"All too often [MRI] studies are misinterpreted, frequently over-read, or misread."

Adjustments are made by pulsing radio frequencies which create changes in feedback patterns that are measured and plotted with the sophisticated computer technology. The image of the brain which is under scrutiny is detailed allowing the neurologist to identify abnormalities which would have been missed in the past when only other types of studies were available.

What MRI Can Do

This technology in many ways is superior to computerized axial tomography (CAT Scan). MRI is truly unique in its abilities to identify abnormalities whether in the anterior, middle, or posterior part of the brain and specifically the posterior fossa. Furthermore, this technology also identifies beautifully, areas of the upper brain stem, cervical cord, and areas all the way down in the spinal cord. Frequently, this technique will pick up herniated disks, tumors, and even syringomyelia. New applications are being developed all the time.

The entire procedure takes approximately 50 minutes, varying with the area that is studied or imaged. The cost on the average is $700, and the patient need not be admitted to a hospital for this study because it is done primarily as an outpatient procedure.

Problems With MRI

However, there are problems with Magnetic Resonance Imaging. All too often, studies are misinterpreted, frequently over-read, or misread. The author has had to ask for reinterpretation of these studies in the past after personally reviewing the Magnetic Resonance Imaging scans and comparing those with the "official report" which just did not fit with the clinical information. For example, unidentified bright objects or UBO's are frequently reported after head injury, but these may have no relevance to the clinical picture or the presentation of the actual patient.

Not enough time has elapsed since the development of clinical Magnetic Resonance Imaging (MRI) and there has not been clinical-pathologic correlation to be definite about some of the lesions currently being described by non-clinicians (frequently radiologists without any training in neurology, neurosurgery, or even MRI). As with any new modality in noninvasive assessment of the brain, further research is necessary and a prudent, conservative approach is required when making interpretations (blindly) so that major errors in diagnosis may be avoided. MRI is just like all other tests, invasive or noninvasive. It can be a great asset to the clinician but should always be of secondary importance to a good medical evaluation, consisting of the time honored and eminently-proven, detailed history and physical examination of all patients.