Editorial

MR in Evolution: Applications of New Technology

The rapid evolution of MR technology and its application to spine imaging are demonstrated in the paper by Enzmann and his coauthors in this issue of the journal [1]. Their use of standard spin-echo and flow-sensitive pulse sequences show that, in certain cases, the radiologist can no longer be satisfied with describing MR findings as if the pathologic processes were static in nature. Instead, he must try to demonstrate the dynamic state of these entities so that the information can be used in improving patient care.

The description of syringomyelia, both in that article and in an earlier paper by Sherman et al. [2], indicates how our understanding of a disease changes with technological advances. Older techniques used to diagnose and characterize syringomyelia included air myelography, in which a collapsing cord could be demonstrated, myelocystography, in which the characteristics of the cyst wall could be seen, and metrizamide CT, in which accumulation of contrast medium within an intramedullary cyst could be identified. Since all these studies are invasive, the CSF dynamics and hence the natural pathologic state of these cysts were altered in some degree simply by performing the examination. This is analagous to the uncertainty principle, which states that an observation requires an interaction between the observer and the object being observed and as a result the object itself is disturbed. The introduction of a needle into a thecal sac or into a spinal cord cyst is an obvious example of an observer altering the object under investigation. Many of the conclusions that were reached in the past concerning syringomyelia may have been erroneous because of this intervention. With MR, however, and particularly with the methods described by Enzmann et al., we can learn more about the CSF dynamics involved in the various forms of syringomyelia because we can look at the disease in a relatively undisturbed state.

There are, as a result, clear implications for diagnosis, treatment, and follow-up of this disease. Correlating levels of active pulsation with the clinical symptoms, differentiating myelomalacia from nonpulsatile cysts, recognizing those portions of a syrinx cavity under active expansion, and determining the efficacy of shunt placement are all important observations, regardless of the underlying cause of the syringomyelia.

As one practical example, this information can be significant in evaluating the chronically injured spinal cord. When there is progressive loss of neurologic function in these patients, the need to decompress an intramedullary cyst is obvious. But because most patients with spinal cord injuries show abnormalities on MR, whether or not they are neurologically stable, a problem in management exists if the classic signs of neurologic deterioration are absent and only dysreflexia and intractable spasticity exist. Because one of the primary objectives in the care of these patients is the avoidance of future functional loss, it is not enough to simply determine whether a cyst is present within the cord. It is also important to evaluate the fluid dynamics within the cyst. Even if an intramedullary cyst is not large and there are no progressive symptoms, a strong case for surgery can be made if the flow-void phenomena on standard T2-weighted images and/or flow-related enhancement on gradient refocused images can be demonstrated. This approach may thwart potential neurologic deterioration. Conversely, a cystic collection, regardless of size, which is static or nonpulsatile on MR, is one that probably is not undergoing active expansion and may be followed clinically with a greater degree of equanimity.

An increasing number of reports dealing with CSF flow-related enhancement and physiologic MR measurements can be anticipated. Bradley's preliminary observations [3] with cardiac-gated aqueductal flow measurements in normal and hydrocephalic patients suggest that in normal pressure hydrocephalus and in malfunctioning shunts there is increased flow velocity in the aqueduct. After more clinical experience is accumulated, the neurosurgeon may be able to use this information to decide whether shunt installation or revision is required. The work of DeLaPaz et al. [4] with flow-sensitive techniques used to identify normal intracranial CSF motion and to differentiate these areas from intracranial abnormalities also points to new applications in MR imaging. These types of investigations demonstrate the physiological information that can be extracted from current MR systems. The demand for such information will increase in the future. It is clear that as MR technology evolves, so must the radiologists' ability to apply it clinically.

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