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Remarks on Interventional Neuroradiology

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The reports by Duckwiler et al. [1] and Luessenhop [2] in this issue of *AJNR* provide preliminary information about the number and types of neurointerventive procedures being performed, including those being done by members of the American Society of Neuroradiology. Both reports relied on informal and voluntary information and are, therefore, incomplete surveys of the procedures used and of those who perform them. Still, they provide new and potentially useful information. Furthermore, they address a timely topic and stimulate further thought. They also reflect input from radiologists and neurosurgeons, the two main groups of physicians involved in these procedures. These articles [1, 2] and my commentary address the basic question, What is the nature and role of neurointerventive procedures in terms of the broad perspective of the clinical neurosciences?

I emphasize that these remarks are purely personal. I deliberately have neither consulted nor collaborated with colleagues, so these thoughts should indeed be considered "one man's opinion." I have perhaps even been deliberately inflammatory in certain statements in hopes of provoking response and discussion while, I hope, not inviting animosity.

In review, approximately 13,500 neurointerventive procedures reportedly were performed over the last 5 years, and one fourth of the respondents indicated a significant growth in the number of cases. Between 10 and 20% of responding institutions had some type of neurointerventive program. Approximately two thirds of the neuroradiologists who responded to the questionnaire indicated that they had performed such procedures, and one half of the responders considered themselves "endovascular therapists." However, despite the large percentage performing these procedures,

only 15–20% of the responding neuroradiologists had performed 80 or more cases over the last 5 years, and these physicians account for more than 80% of the total number of cases. In general, those who perform endovascular procedures reported using a similar and relatively broad range of procedures and materials, from gelatin sponges to glue to balloons.

Unfortunately, though not unexpectedly, and perhaps appropriately, hard data on morbidity and mortality are lacking. The authors [1, 2] admit that the figures reported might be considered "rough estimates," at best. In the long run, well-documented morbidity and mortality figures will be required to justify the performance of these procedures and, perhaps, to indicate the qualifications of those who perform them. Morbidity and mortality figures and statistics on clinical efficacy also will be needed to determine the type of training required to perform these procedures. Neurointerventive radiology is a young field, so many, if not most, of the physicians currently performing these procedures are self-taught. Formal fellowship training in these procedures probably has not been available for more than 5 years and at only a few sites. Most of the respondents thought that specific training should be required for the performance of these procedures and that an "additional" 1 year of training probably would be appropriate, though a significant percentage of respondents suggested 2 years. Importantly, they thought that the additional training should include time and experience in related disciplines, particularly neurosurgery.

Some of the most controversial parts of the reports deal with the relationships between these procedures and those physicians who perform them. Interestingly, most of the re-

This article is a commentary on the preceding articles by Duckwiler et al. and Luessenhop.

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spondents, who are neuroradiologists or neurosurgeons, thought that they had good working relationships with one another. However, it is implied that a question remains as to the role of the person performing these procedures. Is that person a "primary" physician or a "consultant"? This specific, and real, problem is addressed indirectly by the question about the "name" for physicians who perform these procedures.

I think that the persons who perform the procedures under discussion should be called Neuroradiologists! The implication that another or a new name for these physicians is required suggests the existence of a new discipline or field of study that is beyond or separate from neuroradiology, neurosurgery, or other existing specialties. The underlying disciplines related to the performance of these procedures might be considered first to see if some new, major field of thought is involved. The basic sciences related to neurointerventional procedures include both (1) the rapidly expanding and demanding basic imaging sciences, which involve a variety of sophisticated methods and advanced computer techniques and (2) the basic neurosciences, particularly neurovascular physiology. These basic sciences are essential to and part of the current fundamental training of neuroradiologists. In the clinical sciences, neurology and neurosurgery are of obvious importance, but head and neck surgery and anesthesia, particularly as they relate to neurologic critical care units, are also of importance. One must not underestimate the critical role of traditional clinical radiology, which includes training in catheter techniques. All of these clinical sciences are also a part of current neuroradiologic training (though I must admit that many training programs have abbreviated the time their fellows spend on the clinical neurosciences). It is true that those who perform neurointerventional procedures should be involved more intimately with acute neurovascular diseases of the nervous system and should have additional exposure to these conditions. However, all neuroradiologists should be familiar with the subject. Furthermore, I think it is unlikely that any abbreviated, non-board-qualifying, training in these clinical subjects would result in a physician who would be "independent" and not have to confer and rely on more traditionally trained clinical colleagues. Dr. Luessenhop's article is in agreement with this point. To state it bluntly, the clinical care of an acutely ill patient requires skills of all appropriate specialists, which, in many of the cases under discussion, would include a neurologist, a neurosurgeon, a critical care physician, and a neuroradiologist.

In terms of technical skill, interventional neuroradiologists do need additional experience in the use of the appropriate devices, such as microcatheters and balloons. However, the basic skills required for these techniques are part and parcel of radiology, including neuroradiology. The additional experience can come as all or part of the second year of a neuroradiology fellowship plus a subsequent focused clinical practice. In summary, I do not think that the intellectual or technical breadth related to the performance of neurointerventional procedures is sufficient to warrant a separate discipline (or name).

This does not mean that I think the performance of neurointerventional procedures is trivial and should be practiced by everyone. To the contrary, these procedures are extremely

demanding, are associated with significant potential for morbidity and mortality, and should be performed only by those who have focused their individual attention and practice on this area. However, this is no different than the internist who becomes interested in and focuses his practice on asthma, the ophthalmologist who focuses on orbital masses, or the neurosurgeon who specializes in back surgery. All such physicians consider themselves part of their major discipline but have concentrated their interest and skills on a particular area of interest. As experts, they are recognized as individual authorities with special skills in these areas. However, the scope of their personal interest is not sufficient to justify the commitment and formal training required by the creation of a separate discipline.

Another concern with the concept of a subspecialty of interventional neuroradiology is the definition of the term. The preceding papers primarily address neurointerventional procedures as endovascular procedures. A variety of other neurointerventional procedures that use imaging techniques might be included under this broad category and are, in some cases, performed by radiologists (e.g., percutaneous discectomy, stereotactic biopsy, and stereotactically guided radiosurgery). Should these people be considered interventional neuroradiologists, or should neurointerventional radiologists be required to take special training in these nonvascular techniques?

I think that the heart of the current controversy is the concept of "my patient." This concept may reflect legitimate concern for the patient, but it also may involve ego and financial considerations. In principle, whatever is done to a patient, and whoever does it, should be for the benefit of the patient. In the case of relatively unusual and complicated disease processes, it is increasingly appropriate that a team become the patient's doctor rather than an individual. I think that many neurointerventional cases fall into this category. I believe that decisions about the appropriate forms of therapy for these patients are made best by a group that has members experienced in the surgical, X-ray therapy, and vascular approaches to these lesions as well as a "conservative" member who might advocate no treatment. I completely agree with the team concept suggested by Dr. Luessenhop (though I might prefer to describe the group as a "neurointerventional or neurovascular team").

Physicians who have a special, but narrow, skill may develop an inappropriate bias toward their particular method. In addition, a technology-based discipline or practice is always in danger of being superseded by another, new technology. If physicians are trained in a broad enough discipline, they will be able to retrain technologically in the new technique or redefine their practice in other aspects of their discipline. I am concerned that the training of neurointerventionalists might be too narrow. What would happen if endovascular therapy of aneurysms and arteriovenous malformations were superseded by another technique? Would the neurointerventionalists be trained adequately to return to diagnostic neuroradiology where they might be required to have significant knowledge of advanced MR imaging techniques that they might not have learned in their abbreviated neuroradiology training? Could they switch to a practice of clinical neurology?

No, not unless they were board certified. Could they become neurosurgeons? No, not unless they were board certified.

I think that the separation of interventional neuroradiology from traditional neuroradiology would be detrimental to our subspecialty. Part of the attraction and richness of our subspecialty is the intellectual stimulus related to its breadth. Neuroradiology requires extensive knowledge of the imaging sciences, the neurologic sciences and related technologies. The scope of knowledge in the field is challenging, and the use of and access to a wide variety of techniques continues to be a main attraction. That is not to say that all neuroradiologists are masters of all aspects of this field. We have persons who have focused their interest and become experts in head and neck imaging; functional imaging, including MR spectroscopy; computer digital imaging techniques; and interventional techniques. All these colleagues and their special interests are critical components of neuroradiology, which would be incomplete without them.

It is most important to acknowledge these "super" experts in neuroradiology. In general, they have been the leaders and innovators not only in neuroradiology but also in the imaging sciences in general. The neurointerventionalists, in particular, have been some of the most creative and courageous physicians in our specialty. They are probably the group of neuroradiologists who most legitimately can say that they actually invented and developed their field. I am deeply grateful to these pioneers, whom I consider among the most outstanding neuroradiologists—but I do consider them neuroradiologists.

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