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## Reflections from the backseat.

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### Reflections from the Backseat

Four years ago, I retired, moving from the driver's seat to the backseat. During this time, I have been fortunate enough to resume the former periodically, working in different neuroradiologic centers in Sweden and abroad. To old experiences, new ones have been added. Periods of stimulating intense work have alternated with intervals of relaxation—and reflection.

The development of neuroradiology has been exceptional. One may, indeed, talk about a continuous revolution or a series of separate revolutions, based upon the introduction of new contrast agents, new diagnostic methods, the use of old methods for new purposes, and the availability of entirely new technology. If one wishes to determine the borderline between old and new neuroradiology, I would suggest the 1960s, when radioactive isotopes were introduced into our diagnostic arsenal for routine work. In spite of both economic and medical advantages, the method was not immediately adopted. This was in contrast to what happened after the arrival of computed tomography (CT) and magnetic resonance (MR) imaging, both of which were rapidly accepted, even outside neuroradiologic centers, despite the exceptional costs involved. The reason was obvious. With these revolutionary techniques, it was for the first time possible to observe directly the central nervous system parenchyma and lesions within it.

Progress has been dramatic with regard to both diagnosis and therapy. However, many of the old problems remained unsolved, and new ones were created. It is evident that these revolutionary developments have deeply affected the basic conditions of neuroradiology and that many of the long-held tenets of neuroradiology must be reevaluated.

What are the existing problems? They seem to be universal and similar, irrespective of the health care systems in which they exist. Some are directly linked to the rapid development of neuroradiology, some are administrative in nature, and still others may be summarized under the title "imperfect communication."

Although the new techniques have dramatically increased our diagnostic capabilities, they have also produced new demands on the users. The basic technology is difficult to master, par-

ticularly with regard to MR imaging. Knowledge of quite a new kind is required. It is a tragic fact that much too often that kind of knowledge is not diffused as quickly or as widely as are the new machines. As a result, particularly in Europe, academic neuroradiology departments are flooded with CT and MR examinations from centers where neuroradiologic competence is missing. When an adequate evaluation of films is not possible locally, they are often forwarded to the specialist. This should be looked upon as a sign of good judgment. However, the work load on the specialized departments is greatly increased, and the ultimate responsibility is conveyed to the specialists. They must evaluate examinations that may be incomplete, that should have been performed in another fashion, or that perhaps should not have been performed at all. Clinical history is often totally absent. Time and money are wasted, and the medical and ethical dilemmas are obvious.

I am one of those who think that doctors should be held responsible for the economic consequences of their activities. This responsibility starts when buying equipment. Today, there are CT and MR apparatuses with a wide range of capabilities. One must choose between sophisticated ones, with the potential for scientific work, and simpler ones, more suitable for daily routine work. I have never understood the necessity of buying an apparatus with capabilities that cannot be adequately used, at a hospital where specialists are missing. The best possible apparatus is not necessarily the most expensive one!

However, the individual doctor may not find it easy to make the correct choice. Help is needed and should be given by academic centers. One of their responsibilities should be to test and to evaluate new apparatuses. On the basis of such evaluations, equipment should be recommended that best fits the conditions of the hospital for which the purchase has been planned. The formula "to everyone according to capacity, to everyone according to need" should be followed.

University hospitals have their own unique problems related to new equipment. In their effort to be in the front line, prototypes of the most modern equipment are often obtained. Because there may be a lack of money for rapid renewal,



they tend to be stuck with equipment rapidly becoming old fashioned. A more general use and acceptance of the leasing system might create new possibilities to overcome the problem and permit university clinics to work continuously with the most modern equipment.

Investments in new techniques have been made, not only by hospitals, but by serious private clinics. Investments have also been made by those in business, who anticipate a lucrative return on their invested money. Competition should naturally be welcomed. It may contribute to a lower cost per examination and, with luck, to increased quality. However, economic realities often lead to performance of the largest possible number of examinations on the largest possible number of patients in the shortest possible time. The risks are evident and further accentuated when true neuroradiologic competence is missing. It should become mandatory that each examination be founded on medically acceptable indications, be performed correctly, and be evaluated by a doctor with adequate training.

The simplest car may be driven only after skill in driving has been documented. This is in absurd contrast to a complicated CT or MR apparatus, the handling of which does not require any documented specific knowledge. I am against prohibitions but suggest that those who are paying, be it patients, insurance companies, or social security agencies, demand that the doctor responsible for the examination and the ultimate report on a CT or MR examination be able to prove his or her competence. Rules to such effect already exist in some European countries.

We neuroradiologists should not restrict our activities to our own departments. We must actively influence both our radiologic and our clinical colleagues. Generally, their expectations for the results of MR or CT exceed what is actually possible to achieve. It is our duty to explain and to educate. We must report facts and findings from scientific neuroradiologic studies. We must give the clinicians the knowledge of what results are realistically obtainable and which examinations should be performed and when. Only then will meaningful examinations be possible and acceptable medical and ethical standards be achieved. In addition, the economic advantages, both for the patient and for the payer, will be obvious.

There are reasons to scrutinize our own work critically. Adequate use of available resources and the flow and care of the patients should be under

constant debate. However, there is one area in which additional improvements can be made: requests for examinations. Today, we cannot passively accept work made on order. We must be willing to take responsibility, to question the need for examinations, and to suggest alternative or complementary examinations. We must be permitted to say "no," to refuse to perform a requested examination whenever we, on the basis of our knowledge, estimate such an examination to be inappropriate. The neuroradiologist must function, like other specialists, as a consultant.

I stated above that because of progress in neuroradiology, its basic concepts must be altered. In fact, profound changes have already taken place. Some colleagues have been particularly interested in neurologic diseases and malformations of the central nervous system in children. Other colleagues have developed interventional procedures. Subspecialization is already a fact and should not be considered a splitting of neuroradiology, but a sign of its vitality.

What other changes are possible or conceivable? In what direction will they take us? The neuroradiologic diagnosis was initially based upon anatomic changes, and later upon parenchymatous abnormalities. Functional studies played only a minor part—something that has been a matter of anxiety among many of us. Greitz has spoken about the "lack of interest demonstrated by the radiologist with regard to the functional aspects of diagnosis based on images." While discussing the position of positron emission tomography at a meeting of the American Society of Neuroradiology in 1986, Di Chiro made an even stronger statement: "We, the neuroradiologists, have to take an active part in this development. If not we will die out like the dinosaurs."

Taking a more active part in functional studies must become an immediate goal for us. Cerebral MR spectroscopy is one way to reach that goal, in collaboration with biochemists and neurophysiologists. For natural reasons, it is the latter who have developed functional studies (eg, cerebral blood flow, positron emission tomography) with results presented as images. Like neuroradiology, however, clinical physiology has passed through a continuous reevaluation of previously used examinations and methods. The electroencephalogram has lost its position as a screening examination in cases with varying and nonspecific neurologic symptoms. The method has instead gained increased importance in patients with epilepsy. Through digitalization of electroencepha-



lography, detailed mapping of the electric activity of the brain has become possible and can be registered as a kind of "image." Thus, there are two neurospecialties passing through decisive changes.

Neuroradiology and neurophysiology deal with imaging, often with methods that are complementary. In spite of this, daily routine work and scientific activities within these specialties are too often separated. Both disciplines should gain from a closer integration, possibly even a complete union. Perhaps, as Professor Hacker has suggested, we could call this new specialty *clinical neuropathology*. I used the word *revolution* early

in this article. A union such as the one I just suggested would truly be a positive step in the *evolution* of two specialties, both of which face the dinosaurs' dilemma.

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