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**On low back pain.**

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## Special Report

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### On Low Back Pain

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Low back pain, a human frailty that dates back to antiquity, has generated prodigious revenues and is about to teach a lesson about the changing medical market. I was invited to make a presentation at the ASNR Meeting entitled "Overview of Imaging of Low Back Pain." My initial plans were to extol the virtues of magnetic resonance (MR) and to review the optimal pulse sequences for scanning the lumbar spine. Current events, however, changed my focus because I felt that radiology was facing a "forest and the trees" issue. Radiology has thrived in the trees. It has excelled in a logical, deductive-reasoning milieu which allowed it to concentrate not only on the trees in the forest but, with increasing subspecialization, also on individual leaves. This approach has been successful. It is a productive and a reasonable course of development as long as our basic assumptions about radiology and medicine, that is, the forest, are stable. But is the forest stable?

That will never be, for how can a forest move its earthbound roots!

*Macbeth (Act 4, Scene 1)*

Medical care is facing a fundamental shift in its structure and market. Medicine as a whole, and radiology as part of it, have been living and prospering in a technology-driven market. It is a market where professionals are in charge. The market, however, is changing and moving toward a customer-driven market, which has markedly different characteristics, most of which are unwelcomed by professionals.

This market transition has many far-reaching ramifications, but the bottom line is that in a technology-driven market, technology-oriented professionals (physicians, nurses, etc) determine which medical services are produced, how they are delivered, and how much they will cost. In the receding fee-for-service environment, physicians essentially determined which medical services were delivered to patients, how (and where)

they were delivered, and at what price. These halcyon days are over; the forest is moving. In a customer-driven market, the customer determines which medical services are produced, how (and where) they are delivered, and what price they will carry.

This market transition is gaining momentum; evidence for this is abundant. Let us look at medical services offered. Using a pricing strategy, Blue Cross in California is seeking to reduce the number of caesarean sections performed (*Wall Street Journal*. May 26, 1993:A1). In Michigan, customers no less distinguished than the chief executive officer of General Motors, in conjunction with some union officials, have sought (successfully to date) to determine which hospitals can provide open-heart surgery in that state (*Wall Street Journal*. May 24, 1993:A1). Note that customers are a heterogeneous group, composed of individuals and large organizations responsible for paying the bills. This increasingly involves corporate America, which is becoming an aggressive consumer. How about the delivery of these medical services? This used to be the sole purview of professionals. Blue Cross of California is now using a pricing strategy to influence delivery by trying to increase the number of generalists vis-a-vis the number of specialists (*Wall Street Journal*. May 24, 1993:A1). In Minneapolis, committees composed of physicians and customers have drawn up guidelines that determine how and when medical services are delivered, and in particular, services for low back pain (*Wall Street Journal*. February 26, 1993:A1). The state of Oregon deals with services and their delivery by generating a list of conditions and treatments that are covered (*Barrows*. March 6, 1993:10). A treatment falling below a cut-off threshold is not reimbursed, which is a rather effective way of determining what services are delivered. Of interest is that "acute and chronic disorders of the

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back without spinal cord injury," that is, low back pain, fall below the cut-off and are not reimbursed (*Barrons*. March 6, 1993:10). Medicare is instituting new rules whereby reimbursement is contingent on certain, specific service criteria being met; criteria such as requiring clinics to see patients within 6 weeks of their request for an appointment (effective 1995) or having waiting times of less than 45 minutes (*San Francisco Examiner*. May 30, 1993:B1). There is little doubt the customer is influencing how medical care is delivered. What about pricing? Pricing faces similar and well-known consumer pressure. We are all familiar with the government's imposition of reimbursement limits; private insurers such as Blue Cross are taking a similar tack (*San Francisco Examiner*. May 30, 1993:B1). Diagnosis related groups and capitation payment schemes all reflect the customer taking charge of pricing. There is little doubt that the customer is now in a position to influence and change the fundamental features of the health care system: what services are offered, how they are delivered, and what they will cost.

In a customer-driven market the pricing lever is in hands of the customer. Dr. Brody's excellent editorial (1) points out two basic pricing mechanisms and the current trend of medical services being priced like a commodity. A commodity has certain features, one of which is that quality is not a factor and is assumed to be essentially the same across individual products and services. The move toward standards in medical care reflects this line of thinking. If the standards are followed the outcome will be equivalent. There are no doubt some basic medical services that fall into this category, but there are many others of which quality is a salient feature even in light of standards. Quality does not get much air time these days, but it will because we as physicians are well aware of quality differences, and so will the consumer become aware. For many physicians, it is not their quality of service that will predominate but rather it will be the quality of the organizations in which they practice. Although physicians contribute to such a quality measurement, so do many other types of individuals—even the quality of management will be a determinant. Quality will be measured along several lines: by hospital, by program or disease (eg, AIDS and cancer), by functional department, and even by individual doctor for high-risk procedures such as bypass surgery (*U.S. News & World Report*. July 12, 1993:66-74). Measuring this

quality is a business opportunity (*U.S. News & World Report*. April 19, 1993:46-48).

Unfortunately, the current pricing schemes favored by the customer do not allow value-added pricing as a means of reflecting quality differences. The market at present will allow quality differences to be expressed only by volume changes. The health-care provider will see increased enrollment or more referrals as a benefit of high quality. Increased profits will result not from higher prices but from higher volume. Higher volume will require efficiency and management skills. Because customers also believe that better quality is positively correlated with higher volume, they will reward quality by further increased volume. In addition to cost, quality is used as a rationale for limiting cardiac surgery sites in Michigan (*Wall Street Journal*. May 24, 1993:A1). The measure of health service quality is a growth industry with early results already being seen in cities such as Cleveland (*Wall Street Journal*. April 29, 1993:B8) and Cincinnati (*Wall Street Journal*. April 2, 1993:B1). Many other states and different organizations will join this trend (*U.S. News & World Report*. July 12, 1993:66-74, April 19, 1993:46-48, July 12, 1993:76-77). Despite the disclaimers from health-care providers about not being able to measure quality, the market will find a way for them (*U.S. News & World Report*. April 19, 1993:46-48, July 12, 1993:66-74, 76-77, *Wall Street Journal*. April 29, 1993:B8). By using this information, customers will make informed decisions and create a competitive health-care market. The need for this type of information will drive the growth of outcome research so that accurate data will be available. Health-care providers have an opportunity in generating accurate quality data—it will be needed.

Outcome analysis can be focused at several different levels in the health-care delivery system. The three major areas, at present, are therapeutic outcomes, patient outcomes, and societal outcomes. In such outcome-oriented environments, imaging becomes part of the medical "production process." Imaging can have significant effects on the production process, and although it may be useful, its contribution to final outcome may be diluted by the length and complexity of the entire process. It may be far enough removed from the final outcome (therapeutic or patient) to have no measurable effect on it. In order to assess imaging's contribution to the production process accurately, radiology outcome analysis may require

modification by disarticulating the entire process into sequential stages. The value of imaging will need to be measured by its effect on intermediate decision nodes embedded in the production process. A basic question therefore may be, "Does the imaging information change a clinical decision?" The value of this information needs to be measured. The value of imaging, if not adequately reflected by the final outcome, will need to be measured by its improvement of the production process: improvement by speeding diagnosis, decreasing cost, or decreasing pain or risk. The importance of this type of production process improvement has been shown by the Japanese, who term this *Kaizen* (12).

So what does this long preamble have to do with low back pain? Because the forest has moved, the question, "Which MR pulse sequences are best for imaging the lumbar spine?", although still useful, is no longer the most important; rather it is, "Is imaging necessary for the workup of low back pain?" Many customers, including those in Minnesota and Oregon, have decided that it is not (*Wall Street Journal*. May 24, 1993:A1, *Barrons*. March 6, 1993:10). Because radiology derives significant revenues from plain films, myelograms, computed tomography (CT) scans, and MR scans in the workup of low back pain, these statewide policy statements will have a significant impact on radiologic practices. In Minneapolis, practice guidelines have been established that eliminate imaging studies and physical therapy for the first 6 weeks of back pain treatment (*Wall Street Journal*. May 24, 1993:A1). This is based on a literature review, and the finding that 90% of patients with back pain improve within 6 weeks on conservative treatment (*Wall Street Journal*. May 24, 1993:A1). In Oregon, the health plan numerically lists diagnoses and treatments in rank order, reflecting the state's willingness to cover treatment. There is a numerical cut-off, and conditions below that number are not covered. In the latest iteration the cut-off was 568; low back pain was 587 and therefore not covered. If treatment is not covered, expensive diagnostic tests are not likely to be warranted (*Barrons*. March 6, 1993:10). The tea leaves indicate that if your imaging center is heavily dependent on lumbar-spine studies, it is time to consider diversifying your patient population.

How have we reached this point? Money! The drive to reduce health-care costs is inexorable. Expensive, high-volume expenditures are going to attract attention, and low back pain fits that

profile. But is the data with regard to low back pain treatment insufficient and/or inconclusive? Treatment and coverage decisions will be made even if data are incomplete. The incompleteness of data is in large part medicine's own fault. Indeed, good outcome studies will be needed for the foreseeable future. What follows is not a formal analysis of low back pain treatment but rather a few observations that are thought-provoking and also the likely basis of current policy decisions. It is well known in spine imaging (cervical and lumbar) that approximately 30% to 35% of asymptomatic patients will show disk abnormalities on either CT (3) or MR scans (4). The connection between disk disease as defined by imaging and clinical symptoms is somewhat loose. In an analysis of the natural history of sciatica, a surprisingly high number of patients responded to conservative therapy, with 94% of patients experiencing reduction in pain and 95% showing improvement in motor and sensory findings, that is, objective neurologic findings (5). Of interest is that two studies in two different countries of conservative low back pain treatment showed remarkably similar findings. In one study of 120 patients by Bozzao et al in Italy, 82% had only conservative treatment; and of those 71% had a "good outcome" (6). Only 18% of patients went on to surgery. Of those patients treated conservatively and rescanned by CT, 63% showed a decrease in the herniated nucleus pulposus, 29% showed no change, and 8% had an increase in the herniated nucleus pulposus. In a comparable study performed in the United Kingdom by Bush et al with 165 patients, 82% required only conservative treatment, with 14% ultimately going to surgery (5). Of the conservatively treated patients who were rescanned with CT, 64% showed a decrease in the herniated nucleus pulposus, whereas 36% showed no change. These are remarkably similar outcome percentages for patients with low back pain in two different countries with regard to response to conservative treatment, the need for surgery, and the improvement (or lack thereof) in the imaging findings of herniated nucleus pulposes.

One interesting radiologic question that arises from these studies is, "What explains the decrease in the herniated nucleus pulposus on the CT scan in the face of conservative treatment?" The herniated disk material actually may be resorbed. Portions of it may regress back into the native disk space over time. Another possibility is that on the CT scan, what is called herniated disk in

fact may be inflammatory tissue plus disk, making the initial assessment of the disk appear larger than it really is. When the inflammatory tissue regresses, the disk will appear to have regressed. In our experience the use of gadopentetate dimeglumine on MR scans of unoperated lumbar disks has shown significant areas of contrast enhancement suggesting inflammatory tissue associated with unoperated herniated nucleus pulposus. Even an unusual cause such as a local epidural hematoma associated with an acute disk may result in an apparent decrease in size of the herniated nucleus pulposus (7). Regression of the herniated nucleus pulposus, therefore, in some instances may not be regression at all.

For radiologists, another interesting question posed by the above two studies is, "Why didn't CT findings discriminate between outcomes, that is, between patients requiring surgery and those who responded to conservative treatment?" As a result of this observation, one legitimately can ask what the purpose of an imaging study is if it does not impact treatment or outcome. In Bush et al's study, the factors that predicted surgery were not imaging findings but included the following: greater severity of the positive straight leg-raising (SLR) sign, more epidural injections, and being female (5). The initial imaging findings also did not predict which patients would show CT resolution of the herniated nucleus pulposus. The factors that discriminated between these latter two groups of patients were: younger age, shorter duration of symptoms, and greater severity of the straight leg-raising sign; again, all nonimaging findings. In Bush et al's study, even in the six patients who showed an increase in the herniated nucleus pulposus by CT, the imaging studies did not predict outcome (5). Three of these six patients ultimately went to surgery, and three had further conservative treatment with subsequent regression of the herniated nucleus pulposus (5). Given these patient outcomes for low back pain, CT imaging did not play a differential role. It did not affect any important intermediate decision node.

What does all this mean? First of all, it indicates we still have only a crude understanding of the pathophysiology of low back pain. What we are imaging is not directly related to the clinical problem. The clinical symptoms may be truly related to compression of the nerve root (8). Although imaging could be useful in patients with actual physical nerve compression who require surgery, imaging does not currently identify such

patients. The clinical symptoms, however, may be related to inflammatory changes or chemical mediators of pain rather than nerve compression. Imaging, especially CT imaging, may not be expected to contribute much here. This basis of pain would fit with the good response seen with conservative treatment methods. As seen in Bush et al's study, there was no particular clinical sign that predicted surgical or conservative treatment response (5). For example, the straight leg-raising sign correlated with both surgery and with resolution of the herniated nucleus pulposus in conservatively treated patients. Not surprisingly, there is no correlation between straight leg-raising sign and the CT findings of size, shape and position of the HNP (9). Does this mean what we think it means—yes, current imaging (at least CT) does not add much to the treatment of low back pain.

Why in fact are imaging findings and even physical findings so ineffective at predicting the need for surgery in patients with low back pain? Why do so many patients improve with little or no treatment? The reason appears to be the prominent role of nonorganic factors in low back pain. For example, if outcome is defined as returning to work, then for worker's compensation patients, imaging studies have no predictive value, precisely because nonorganic factors play such a dominant role (10). How outcome is defined and what patient population is studied becomes important in making these correlations. Outcome measurements should be as objective as possible (11, 12). With low back pain patients, in general, imaging appears to have little effect on outcome precisely because nonorganic factors often dominate the clinical problem. If inflammatory changes are responsible for symptoms, the imaging studies investigated so far, primarily CT, have failed to differentiate these patients from those with nerve compression. MR with contrast enhancement could play a role here but only if the detection of inflammatory tissue would change treatment, as the lack of it ultimately identified patients who require surgery. From an imaging point of view, such clinical investigations may be warranted.

Although several states and organizations have already done so, health-care providers will be pushed into developing practice guidelines for low back pain. This is one manifestation of the customer influencing medical service delivery. We can expect the customer to experiment with different influence techniques to determine which

is most effective in reducing cost while maintaining or increasing quality. Ideally, practice guidelines should be generated by professionals spanning the relevant subspecialties and by informed customers. I do not pretend to have defined such a guideline for low back pain, but given that, if only conservative treatment is warranted, the first important decision node is categorizing the low back pain as sciatica. For this, clinical diagnostic criteria will need to be developed (13). For patients with sciatica, at present no imaging studies appear warranted, because they do not have any predictive value and do not change treatment. It is not yet clear whether imaging is even indicated in those patients who fail the initial course of conservative treatment. On the other hand, for low back pain that is not or is atypical of sciatica, imaging is likely to be indicated. It is, therefore, important for the radiologist in conjunction with other subspecialists to develop guidelines for primary care physicians as to when an imaging study is appropriate in the workup of back pain. Radiologists should feel responsible for such an educational effort. Radiology as a subspecialty needs to be actively involved in the development of standards of practice in which imaging plays a prominent role. Accurate data will be important in making such guidelines efficacious. Organized radiology should encourage the generation and sharing of data necessary for practice guidelines. Lack of such data, however, will not retard the formation of guidelines.

A standard of practice for low back pain is needed now because several states and organizations have one already or are well on their way to defining one. Using a Pareto analysis it should not be difficult to determine what other standards of practice will soon be necessary. Although there is no reason to panic, it is urgent that radiology not be left in the starting blocks. If radiology is not active, it will be left out of the loop as ingenious ways are developed to make and enforce standards. For example, in Maine the lawmakers themselves are writing checklists (stand-

ards) into law and linking compliance to malpractice relief (*Wall Street Journal*, May 3, 1993:A1). Increasingly, use of imaging studies will be governed by customers' wishes, rules, policies, and so forth. Ideally, these would be based on accurate data. Radiology needs to be vigilant so that imaging's true contributions to the final (treatment or patient) outcome or to the intermediary steps in the patient's care are accurately measured and duly credited.

As I stood my watch upon the hill, I looked toward Birnam Woods, and I thought the wood began to move.

*Macbeth* (Act 4, Scene 5)

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