

Special Article

Low Back Pain

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Low back pain is one of the most common and costly afflictions of our society. The majority of adults will have at least one episode of acute low back pain that will likely resolve regardless of treatment. Lumbar spine radiographs are overused and there is little scientific support for many of the therapeutic interventions advocated. Even for those patients with symptomatic herniated disc, only a small fraction will ultimately require surgical intervention.

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Low back pain (LBP) is a problem frequently encountered by primary care and emergency room physicians. In the National Ambulatory Medical Care Survey, LBP was the number one symptomatic complaint expressed by patients 25 to 60 years old seeing office-based physicians,¹ and it is the most costly medical problem in our society for the age group 30 to 60 years.² Poor understanding of this common syndrome leads to overuse of resources and the prescription of poorly validated treatment methods. In this review I will cover those aspects of LBP that are germane to an internist's practice and will discuss surgical intervention only as it pertains to decision-making about referral.

Epidemiology

LBP is the most common cause of limitation of activity for those under 45 years of age and is surpassed only by heart disease, arthritis and rheumatism in the age group 45 to 64 years.³ In all, 60% to 80% of the population will experience at least one episode of acute back pain,⁴⁻⁶ and a prolapsed disc is second only to schizophrenia as the most frequent condition for which disability payment is allowed by the Social Security Administration in those under 40 years of age.⁷

LBP represents a major issue for industry, where it is second only to upper respiratory illness in accounting for lost time from work—93 million days annually.⁸ In the state of Oregon, the back was the injured body part in 31% of all claims accepted by Workers' Compensation, a frequency 2.5 times greater than that of any other body area.⁹ Of such injuries, 75% involve the age group 20 to 44 years and the average amount of time lost from work is 14 days.

Vocational factors implicated in workplace-related back pain include physically heavy work, static work positions such as sitting and driving, frequent bending and twisting, lifting and forceful movements, repetitive work and vibration.^{8,10,11} At the Kodak Company, back pain developed in 35% of sedentary workers and 47% of manual material hand-

lers, with only 15% of cases being related to a definite injury.¹²

Biomechanics

The lumbar spine consists of a series of motion units each having an anterior and posterior segment. The anterior segment, composed of two vertebral bodies and the intervertebral disc, bears weight and absorbs shock.⁴ The posterior segment, consisting of the vertebral arches, transverse and spinous processes and the inferior and superior articular facets, protects the neural structures and directs movement of the unit in flexion and extension. The disc is composed of the nucleus pulposus and a circumferential, intertwining fibroelastic mesh, the annulus fibrosus, which attaches to the vertebral bodies and permits a rocker motion. The unit is stabilized by a series of ligaments that minimize shearing forces and the paravertebral muscle bundles that provide balance for the static spine and strength for the kinetic spine.

Several factors relate to the stress on the motion unit. Disc pressure reflects the response to shearing and rotational loads, abdominal cavity pressure supports the trunk anteriorly and the myoelectric back muscle activity balances the gravitational forces in upright posture and forward flexion. Using intradiscal pressure measurements, Nachemson has shown marked variations in forces in various positions and activities.^{13,14} For example, when a person is lying supine in the semi-Fowler position, a force of 100 Newtons is exerted on the L-3 disc. A person sitting upright without support generates seven times this force and when the same person bends forward and rotates while holding a 10-kg weight, the force increases 20-fold.

Causes of Low Back Pain

Though most patients experiencing LBP will have benign, nonemergent mechanical problems for which specific diagnoses will not be made, it is imperative to consider other

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ABBREVIATIONS USED IN TEXT

CT = computed tomography
HNP = herniated nucleus pulposus
LBP = low back pain

disorders that may appear to be back pain. These may be classified as infectious (pyogenic osteomyelitis, epidural abscess), inflammatory (spondyloarthropathy), metabolic (osteoporosis, osteomalacia, Paget's disease), neoplastic (metastatic, primary cord tumor) and visceral (abdominal aortic aneurysm, urinary tract infection, pancreatic disease).^{15,16} It is not within the scope of this review to address every potential cause of back pain, but selective entities representing common problems or areas of confusion are highlighted below.

Intervertebral Disc Disease

Though most structures in the back have been assigned roles in the causation of back pain, the disc has been implicated, at least indirectly, as the primary agent. Among reasons are the observations that true herniation is preceded by attacks of back pain, intradiscal injection reproduces pain and the anatomic changes in the disc and annular ruptures are first seen at younger ages, the same time that LBP becomes a clinical problem.¹⁷

At autopsy, herniated nucleus pulposus (HNP) is seen in 15% to 30% of specimens and degenerative changes are observed in the motion segments of all persons over the age of 60 years.^{18,19} With age, the meshwork of the annulus becomes fibrotic, lessening the recoil properties of the hydraulic mechanism. These changes, coupled with microscopic fracturing of the end plates and facets, reduce the overall torsional strength of the unit and its capacity to absorb energy. Although pain produced by true herniation impinging on the nerve root is easily understood, the role of the changing mechanical behavior of the disc, the alteration of the height and protrusion of the disc on other sensitive tissues is not well defined vis-à-vis LBP. These age-related degenerative changes are often present in the absence of LBP.

HNP is generally a disorder of younger people, most frequently involving the L5-S1 and L4-5 discs.^{20,21} The classic

syndrome contains the following features: leg pain is dominant, unilateral and in a sciatic distribution, often aggravated by coughing, sneezing and forward flexion; paresthesias are localized to a dermatomal distribution; positive tension signs are present, including straight-leg raising, crossed-straight-leg raising and bowstring; at least two neurologic signs are demonstrable, including muscle wasting, motor weakness, diminished sensation and diminished reflex, and a contrast study will be positive for disc herniation at a level corresponding to the clinical features.²² Table 1 lists the findings in the three commonly encountered disc syndromes.

Several pitfalls are inherent in the diagnosis of HNP. Other disorders may mimic some of the above features, and the straight-leg raising test, or one of its variants, manifested by radicular leg (not back) pain upon passive stretching of the sciatic nerve, is not specific to HNP. Though virtually all patients under age 30 with a symptomatic herniation will have a positive straight-leg raising (true-positive) test result, the majority of patients with a positive test do not have a disc herniation (false-positive).²¹ Additionally, older patients with confirmed herniation or those with higher root lesions (above L5 root) may have negative straight-leg raising test results (false-negative). The neurologic findings should be used as guidelines only in identifying the level of involvement, because overlap in innervation may lead to misinterpretation. The sensory examination must be mapped carefully to distinguish dermatomal from nondermatomal impairments.

Ankylosing Spondylitis

Ankylosing spondylitis, an inflammatory arthropathy with a strong predominance in men, has an age distribution similar to that of HNP and mechanical LBP.²³ Suggestive historical features are an age of onset of less than 40 years, insidious onset, duration longer than three months, morning stiffness and improvement with exercise. Positive responses to four of these features have a 95% sensitivity and 85% sensitivity for the disease.²⁴ A past history of iritis would further heighten suspicion. Maneuvers to assess spinal mobility, chest expansion and sacroiliac joint tenderness may be useful,²⁵ though in a recent series these tests did not have any clinical value in helping to distinguish between ankylosing spondylitis and noninflammatory back disorders.²⁶ The diagnosis is confirmed by plain radiographs of the sacroiliac joints that show bilateral sclerosis. In most instances, a single anteroposterior view of the pelvis will demonstrate the abnormalities by the time the patient first seeks medical attention. Nuclide scintigraphy and computed tomography have been reported to be useful in reaching a diagnosis in suspected cases when plain films are not yet abnormal, but their operating characteristics remain to be defined. Though results of the human leukocyte antigen B27 study are positive in 90% of white Americans with primary ankylosing spondylitis, the test does not confirm or exclude the presence of the syndrome, the diagnosis of which must be based on radiographic findings.²⁷ Exercises and anti-inflammatory drugs are the mainstays of therapy.

Facet Arthropathy

The lumbar zygapophyseal (facet) joints, located posterior to the plane of the intertransverse ligament and innervated by the dorsal primary ramus of the spinal nerve, have been

TABLE 1.—Root Compression Syndromes

L5-S1 Disc (S1 Root)	
A.	Pain/numbness—Posterior thigh and leg; posterolateral foot, lateral toes
B.	Weakness/atrophy—Plantar flexion foot, toes decreased; atrophy posterior compartment
C.	Reflex—Depressed Achilles' reflex
L4-5 Disc (L5 Root)	
A.	Pain/numbness—Posterior thigh, anterolateral leg, medial foot and great toe
B.	Weakness/atrophy—Dorsiflexion foot, toes decreased; atrophy anterior compartment
C.	Reflex—No change
L3-4 Disc (L4 Root)	
A.	Pain/numbness—Posterolateral aspect thigh, across patella, anteromedial leg
B.	Weakness/atrophy—Knee extension weak; quadriceps atrophy
C.	Reflex—Depressed patellar reflex

implicated as a common cause of LBP that mimics HNP.²⁸ The pain in this syndrome is intermittent, exacerbated by extremes of sudden movement and associated with diffuse thigh pain, often terminating at the knee. Physical findings are limited to tenderness over the facet joints magnified by hyperextension. Intraarticular facet block done with fluoroscopic guidance may confirm the diagnosis and injection may provide relief in selected patients.^{29,30}

Spinal Stenosis

The term spinal stenosis includes narrowing of the spinal canal, nerve root canals and intervertebral foramina, all of which cause nerve root entrapment.³¹ All forms of stenosis are characterized by a shallow lateral recess, that area bordered anteriorly by the vertebral body, laterally by the pedicle and posteriorly by the superior articular facet.³² Those with the spinal stenosis syndrome experience back pain, transient motor deficits, tingling and intermittent pain in one or both legs, worsened by standing or walking (neurogenic claudication) and relieved by sitting or squatting, in contradistinction to HNP. Objective neurologic signs are absent at rest but may be present upon examination after exercise.^{33,34} The diagnosis may be confirmed by a computed tomographic (CT) scan and, in some patients, symptoms may be relieved by surgical correction.^{34,35}

Myofascial Syndromes

Myofascial pain syndromes arise from trigger points, focal areas of hyperirritability located in skeletal muscle and fascia which, when palpated, produce referred pain to distant sites.³⁶ The characteristics of trigger points have been delineated and the resultant syndromes causing LBP, including the quadratus lumborum, iliolumbar and piriformis syndromes, have been described.³⁷⁻⁴¹ Pain and weakness are elicited by maneuvers that cause the involved muscle to contract. Effective treatment may result from application of vapocoolant spray, injection of local anesthetic into the trigger point or ischemic compression of the area.³⁶

Fibrositis, a related and common form of nonarticular rheumatism, is characterized by ill-defined musculoskeletal pain—often worsened by stress, cold and exercise—depression, nonrestorative sleep, chronic fatigue and early morning stiffness, and a physical examination will show no abnormalities except for tender spots located over muscles and ligamentous bony insertions.^{42,43} The cause of the syndrome is unknown and its effective treatment is difficult. Antidepressants, centrally acting muscle relaxants and local injections may be of benefit.

Clinical Evaluation

The evaluation of LBP focuses on the differential diagnosis discussed above. Known malignancy, a history of intravenous drug abuse and constitutional symptoms such as anorexia, weight loss and fevers suggest metastatic cancer, vertebral osteomyelitis or epidural abscess. Inquiry about other organ-specific symptoms may uncover a nonmechanical cause of LBP, particularly urinary tract infection.¹⁶ Age greater than 60 years and corticosteroid use have associated osteopenia and resultant compression fractures as a cause of LBP. The character of the pain pattern may suggest one of the syndromes discussed above, and bowel, bladder or sexual

dysfunction may be clues to central midline disc herniation, carcinomatous extradural cord compression or cord tumor. A past history of LBP and related interventions, disabilities and litigation aid in placing the problem in perspective and planning a management strategy.

The physical examination should include observation of gait, trunk mobility and deformities and inequality of leg lengths.²¹ In addition to a detailed neuromuscular examination, abdominal and vascular evaluations should be included, particularly in the elderly and those with symptoms suggesting neurogenic claudication. Localization of trigger points may lead to immediate therapeutic intervention.

Lumbar Spine Radiography

LBP is the most frequent symptom leading to diagnostic roentgenograms in an ambulatory care setting, with an estimated 7 million films done annually in the United States at a cost of \$350 to \$500 million.^{44,45} Lumbosacral radiography is the largest contributor to gonadal irradiation and, unfortunately, the majority of specific findings (osteophytes, narrowed disc space, spondylolisthesis) do not correlate with the presence of LBP or predict its cause.⁴⁶ LaRocca and Macnab showed that only 7% of 150 asymptomatic laborers over the age of 35 years had normal radiographs and that the prevalence of degenerative changes (84%), congenital anatomic variations (64%) or both (57%) was comparable to a similar group with LBP.⁴⁷

Liang and Komaroff, applying a formal decision analysis, compared a strategy that included radiographs on the first visit for acute, uncomplicated LBP with one in which films were delayed four to eight weeks.⁴⁸ Using prior probabilities of diseases causing LBP that could be diagnosed radiographically (disc space infection, osteomyelitis) and for which a specific treatment was available, the former strategy led to a decrease in suffering of only 58 minutes while generating a tenfold increase in cost and radiation exposure. Clinical studies have confirmed the conclusion that lumbosacral spine roentgenograms are of negligible diagnostic value in otherwise healthy patients with LBP under age 60 unless major direct spinal trauma, malignancy or infection is a concern or the pain has persisted for more than six to eight weeks.^{16,44,49,50} The benefit of having oblique lumbar radiographs in addition to a single frontal and lateral view is negligible.^{44,45}

Management of Acute LBP

Acute LBP is a self-limited disorder, with 50% of patients pain-free by one week, 80% by two weeks and 90% by eight weeks regardless of therapy.⁵¹ Although innumerable therapeutic modalities have been advocated, the rate of spontaneous resolution, the diverse causes of LBP and the difficulty in measuring the symptom, pain, represent problems in evaluating efficacy of a given therapy.⁵²⁻⁵⁴ Deyo has recently reviewed these methodologic pitfalls.⁵⁵

The supine position maintained during bed rest has a theoretical advantage for instances of disc protrusion, considering disc pressure measurements discussed above.¹⁴ Whether bed rest is useful in other causes of LBP is even less clear. Bed rest for 7 to 14 days, using a firm mattress and keeping hips and knees flexed, is an appropriate trial, acknowledging that the recommendations for duration are entirely empirical.^{21,56}

Bathroom privileges should be allowed since the contortions associated with use of a bed pan are discouraging and biomechanically counterproductive. Lifting, bending and prolonged sitting should be avoided.

Because postulated mechanisms for LBP of soft tissue or disc origin implicate an inflammatory response, an anti-inflammatory agent is recommended. None of the nonsteroidal anti-inflammatory drugs has been shown to be more effective than aspirin and all are more expensive.^{21,51,55,57,58} Antispasmodics and muscle relaxants probably act more by a sedative effect than at a specific neuromuscular site, are expensive and, again, none has been shown to be clearly efficacious.⁵⁹⁻⁶⁵

In addition to aspirin in therapeutic doses and bed rest, we recommend local heat, using a moist, hot towel, or cold applications, using a small wet towel placed in the freezer until malleable; these are simple adjuncts having theoretical support.⁶⁶⁻⁶⁸ The traditional traction apparatus using small weights does little more than keep the patient in bed, because it has been shown that at least 25% of body weight must be applied to even begin to lower intradiscal pressure.^{21,51,55} Spinal manipulation, of which several methods are used, has also not been proved to be effective.^{21,69-71} Most important is reassuring the patient that LBP is generally self-limited and the prognosis for return to usual activities is good.

Surgical Procedures

Failure of a conservative therapeutic program for acute back pain frequently leads primary care providers to consider orthopedic or neurosurgical referral. Unfortunately, expectations of the referring physician and patient are often unrealistic with respect to the success of surgical treatment for symptomatic HNP. Though details of various surgical procedures for the lumbar spine are not germane to this review, an understanding of the natural history of conservatively treated and surgically treated disc disease is important.

In general, acute cauda equina syndrome and major or progressive paralysis represent clear indications for surgical intervention.²¹ Other indications are relative, and patient selection remains a most important determinant of outcome of surgical therapy.^{21,72,73} Operative procedures should be reserved for patients with symptoms of sciatica and neurological findings on examination, who have continued problems after 6 to 12 weeks of conservative therapy.^{21,74} The goals of operations for HNP are to relieve sciatic and low back pain and to improve physiologic function, employment status, social functioning and the ability to perform activities of daily living.²¹ The younger the patient and the greater the degree of herniation seen during the surgical procedure, the more likely it is that the pain will be relieved. Complete relief of back and sciatic pain occurs in approximately 60% of operative patients, with sciatic pain being relieved more frequently than back pain.⁷⁵ However, long-term follow-up of patients with sciatica and neurological findings who did not undergo surgical procedures showed that 52% were without symptoms and an additional 27% had only mild symptoms.⁷⁶ Work capacity and activity restriction were also similar in surgically versus conservatively treated groups.⁷⁶ Additionally, up to 10% of patients having operations for classic, severe sciatica will have a negative exploration.⁷⁵ This group has the worst prognosis. In general, only about 20% of patients with herniated nucleus pulposus require surgical intervention.²¹ Indica-

tions for chymopapain injection are similar to those for surgical intervention.^{22,77-79} Response to injection may not be complete for up to six weeks, and failure of chymopapain therapy does not obviate a subsequent operation. The referring physician, surgeon and patient must discuss the expectations of surgical intervention and the limitations and risks of the planned procedure.⁸⁰

Diagnostic Studies

If it is agreed that an operation should be offered to and accepted by the patient, further diagnostic studies are indicated, remembering that up to 30% of asymptomatic persons have myelographically proved disc herniations.^{72,81} It is important to do further studies because the correlation between the predicted level of herniation based upon neurological deficits on examination and the level of herniation on study is only 50% to 60%.

Much controversy exists today as to whether metrizamide myelography or computed tomography is the method of choice to establish the diagnosis and location of lumbar disc herniation.⁸² Myelography permits direct visualization of the lumbar and sacral nerve rootlets. It is often difficult, however, for the myelographer to distinguish between a bulging disc, which does not cause nerve root compression, and a herniated disc. Also, symptomatic lateral herniations, particularly at the L5-S1 level, may be missed with myelography.^{83,84}

With high-resolution CT scanners, a noninvasive diagnosis of HNP is possible. In series comparing CT with myelography in evaluating HNP in patients who underwent surgical exploration, CT has been shown to be of equal accuracy.^{84,85} CT is particularly useful in evaluation of the vertebral bodies, posterior elements and paravertebral soft tissue mass and is the most precise method for assessing spinal stenosis. Also, CT is more accurate in detecting lateral herniations.⁸⁴ However, other extradural processes, such as scars, masses and spondylosis, may mimic focal disc protrusion and, as in myelography, it may be difficult to distinguish true herniation from a bulging disc.

Presently, the choice of initial diagnostic method for evaluation of HNP remains one of opinion. Review of the clinical information with the radiological and surgical consultants is important in determining a diagnostic strategy. An unequivocally abnormal or unequivocally normal CT scan may obviate the need for myelography unless the clinical evaluation contradicts the CT findings.⁸⁴ If neither the CT scan nor the myelogram provide a satisfactory answer, CT and metrizamide myelography done concomitantly may give additional clarification of the anatomy.

In difficult situations where a strong functional component appears to be present in patients with symptoms and signs suggesting nerve root compression, differential spinal anesthesia may be useful. This procedure consists of an injection of saline followed by injection of increasing concentrations of procaine hydrochloride into the subarachnoid space, causing sympathetic, sensory and motor blockage. If pain is relieved with saline or not relieved despite administration of 1% procaine hydrochloride, a strong psychological component to the pain problem is suggested.²¹

Management of Chronic LBP

The management of a patient with chronic LBP is often a vexing problem for physicians.⁸⁶ These patients often fall into

the category of "undesirable," arousing animosity in, and the use of pejorative terms by, their physicians. As in other non-malignant chronic pain syndromes, narcotic analgesics are to be avoided and alternative therapeutic modalities have been used, including biofeedback, acupuncture, transcutaneous nerve stimulation, implanted neurostimulators and ablative neurosurgical procedures, all with varying success and all fraught with methodologic problems.⁵⁵ For selected patients, trigger-point injections may provide relief. In smaller subsets of patients, epidural corticosteroids⁸⁷⁻⁸⁹ and corsets or braces^{21,51,55} may be beneficial.

For most patients, however, there is little specific that one can offer. Although psychological profiling may be of some use in predicting responses to surgical intervention,^{90,91} it is counterproductive to attempt to assign patients to organic or psychogenic categories.^{86,91,92} In contradistinction to the disease model, the learning model, in which illness is comprised primarily of behavior and chronicity insures the need for behavior change, provides a more rational view of the chronic pain syndrome.⁹³ It can be assumed that the longer the patient has pain, the more the psychological factors become important in influencing neurophysiologic mechanisms underlying pain behavior. In this context, symptoms are to the disease model as behavior is to the learning model. Using scales of reliability such as the Minnesota Multiphasic Personality Inventory does not help to distinguish patients with organic or psychological pain. Both groups have increased scores for hypochondriasis, depression and hysteria indistinguishable from those of psychoneurotic patients.⁸⁶ These observations underscore the point that it matters little whether or not pain is real, but identifying those factors that influence pain is critical. The concept of chronic pain programs utilizes the principles of behavior modification, with goals being to identify and eliminate positive reinforcers for pain behavior, increase physical activity and decrease drug usage. These programs require commitment and motivation on the part of the patient and family and considerable financial expenditure. The long-term results of such programs vary.^{94,95}

For most patients with chronic LBP, education and an exercise program are the foundations of successful therapy. Exercises, which may begin after the acute exacerbation abates, aim to minimize lumbar lordosis, thereby decreasing subluxation of the overriding facet joints, to decrease shearing stresses, to widen the intervertebral foramina and to strengthen abdominal and spinal musculature. Several types have been advocated, including extension and lumbar isometric flexion exercises, but no single program has clear superiority over another.^{4,96-98} One of the most successful and widely available back programs is the Young Men's Christian Association's Healthy Back Program.⁹⁹ This course, offered throughout the United States, consists of six weeks of twice-a-week sessions, each of which include relaxation exercises and an increasing sequence of limbering, strengthening and stretching exercises. The charge is nominal, and the skills learned are continued at home indefinitely to minimize chronic pain and prevent acute attacks of LBP. The details have recently been published in an inexpensive book.¹⁰⁰

Disability

Because LBP is such an important malady in the workplace, the issues of disability and compensation frequently

arise.¹⁰¹ The statutory definitions of a compensable personal injury are that it was out of, and in the course of, employment and occurred accidentally.¹⁰² In most cases, physicians have no role in these decisions except in clear instances of extreme force or overt trauma, a small fraction of the occupationally related LBP. A physician may attend to the degree and nature of the impairment—that is, an objective assessment of anatomical or functional loss. However, there are often no objective means by which to assess many forms of impairment, particularly in LBP, and to establish the point at which healing is complete.¹⁰³ Disability, the loss of capacity to engage in gainful employment owing to the impairment, is in large measure behavioral and its determination is an administrative decision.¹⁰³⁻¹⁰⁵ Hadler has reviewed the major points of interpretation of Workers' Compensation Law as related to LBP.¹⁰²

Prevention

Given the staggering costs in dollars and reduced productivity resulting from LBP, prevention must be a major focus. Pre-employment screening by x-ray studies is not useful for identifying workers at high risk.^{106,107} A history of prior LBP, however, and inability to demonstrate an isometric lifting strength equal to that required for a worker's job may have greater predictive value.¹⁰⁸⁻¹¹⁰ The study of ergonomics, the science of energy utilization in the workplace, has led to recommendations that minimize risk of back injury, including use of substitution devices, such as hoists, cranes and dollies, improved equipment and task designs to decrease vibration and stress and variation of work practices.¹¹¹ These principles have also been incorporated into car seats, furniture and leisure-time equipment design.

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Medical Practice Question

EDITOR'S NOTE: From time to time medical practice questions from organizations with a legitimate interest in the information are referred to the Scientific Board by the Quality Care Review Commission of the California Medical Association. The opinions offered are based on training, experience and literature reviewed by specialists. These opinions are, however, informational only and should not be interpreted as directives, instructions or policy statements.

Percutaneous Transluminal Coronary Angioplasty

QUESTION:

Is Percutaneous Transluminal Coronary Angioplasty (PTCA) considered accepted medical treatment?

OPINION:

In the opinion of the Scientific Advisory Panels on Chest Diseases, Internal Medicine and Radiology, single vessel and multi-vessel percutaneous transluminal coronary angioplasty (PTCA) is considered established medical practice for patients who have coronary artery atherosclerosis.

PTCA should be done on carefully selected patients by physicians specially trained in the procedure and in facilities where the training of the PTCA team has been approved by medical staff or other peer reviewers. A cardiac surgery team should be immediately available in facilities where PTCA is done, in the event of complications.