Psychophysiology of Pain: Diagnostic and Therapeutic Implications

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Pain problems occupy much of the time and therapeutic efforts of physicians. Nonmedical practitioners and cultists have likewise attracted many people seeking pain relief. In many cases the cultists seem to do as well as the ethical practitioner.

A realistic view of pain takes into account the significance of the pain to the individual, the degree of anxiety and/or depression that contributes to the aggravation and perpetuation of the pain, and finally the manipulative and defensive value that the pain may have to the individual. A purely mechanistic approach which would attempt to distinguish "real pain," ie, pain associated with a demonstrable lesion, and "imagined pain" will prove counterproductive. Likewise accusations of consciously pretended pain or malingering tend to be nontherapeutic.

A sound therapeutic approach is to regard all pain as real, realizing that the pain of depression may be the most unendurable type of pain. Major psychotropic drugs for relief of anxiety and for treatment of depression have application in the management of selected pain problems.

Pain is one of the most common problems facing the physician. Attempts to relieve complaints of pain and painful conditions dominate much of the history of medicine. Physicians have been joined by holy men, curanderos, medicine men, cultists, and magicians in their efforts to provide relief, comfort, and solace to patients. Indications are that highly respected, scientific, ethical practitioners have not enjoyed any greater success in solving this problem than those irregular practitioners, who compensate for their lack of scientific knowledge and technology by their skill in allaying anxiety, stimulating hope, offering support and empathy – in effect offering a helping hand. This, after all, is the essence of "laying on of hands."

When a patient comes to the physician with a complaint of persistent pain, the patient runs the risk of beginning a seemingly endless round of mechanistic and surgical attempts to end the pain. It is the family physician's responsibility to evaluate the emotional as well as the physical aspects of the patient's complaint, and further to prevent futile attempts to expunge a nonexistent constitutional cause. The family physician should develop a philosophy and approach to the patient with pain. He/she must consider each complaint individually and evaluate all factors contributing to the patient's complaint.

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The purpose of this article is to first review physiological and psychological mechanisms involved in chronic pain. Against this background, the important implications relating to diagnosis and therapy of patients with chronic pain problems will be outlined.

Psychophysiologic Basis of Chronic Pain

Pain is a highly subjective and individual complaint. Pain has been described by Sternbach as a "purely personal feeling. . . . Each man's perception is unique and cannot be shared completely with another."[1] Responses to pain may be verbal – "I hurt," physical – simple withdrawal of the hand or body part from the painful stimulus, or symbolic – grimacing, assuming postural changes, banging the head, writhing, or other commonly accepted symbols or demonstrations of pain.

1. Physiological Considerations. Physiological changes may give objective measurements of pain, especially the autonomic responses such as the change in heart rate or blood pressure and sweating that may accompany severe pain. Other physiological changes include those in muscle tone and tension as well as changes in hormone secretion. It is well known, for example, that painful states can influence the diurnal secretion of cortisol as well as other hormones, such as the catecholamines.

Neurological responses are intimately related to the physiological. It is worthwhile to review the contributions of the neurologist to the studies of pain and in particular to the func-

tional anatomy of the pain fibers and the pain tracts.

A great deal of effort has been expended in attempts to identify specific types of nerve fibers as pain fibers. Thinly myelinated fibers which serve for pain reception in the eye and in the cornea appear to be the purest kind of pain fiber. The bare ends of these thinly myelinated fibers appear to be their own receptors.

Large myelinated fibers have also been demonstrated which transmit various types of sensations, including touch, pain, and heat. Stimulation of these large myelinated fibers to a degree short of acute pain tends to suppress or mask the sensation of pain being transmitted by the thinly myelinated fibers. Melzack and Wall have developed a gate-control theory of pain transmission which can account for this neurophysiological observation.[2] In practical terms, their theory holds that stimulation of the myelinated tract at a less than acutely painful level suppresses the transmission of, or the recognition of, pain as transmitted in the "non" myelinated fibers. For example, if you exert pressure with a circular object on the palm of your hand, thereby loading the myelinated fibers with a sensation of pressure, you may then be unable to recognize a pin prick that is applied inside this circle. Likewise, an expectant father pressing his fist over the sacrum of his parturient wife during a uterine contraction may send stimuli up the dorsal column through the myelinated tract and tend to suppress her painful sensation from the contraction. It has been estimated that the pressure of the fist so applied is equivalent to 50-100 mg of Demerol in its potential for relief of pain. This principle may also be related to the claimed effectiveness of acupuncture whereby the needle inserted through the skin may overload the sensory tract and make the suitably prepared patient unaware of pain.

2. *Psychological Considerations.* From the behavioral viewpoint it is essential to recognize the significance of chronic pain to the patient. Is the patient seeking relief because the particular symptom has reached the limit of tolerance, has the patient exceeded his/her limit of anxiety due to concern about the implications of the pain, or does the patient's complaint represent problems of living manifested as symptoms?[3] Szasz reminds us that some patients make a career of pain.[4] He further indicates that the typical medical model of a painful lesion producing a symptom that can be eradicated by the removal of the lesion is an oversimplification and often a source of error. The concern is not to deal with painful lesions, but to deal with people with pain. They may or may not have a painful lesion. They may well have a need for pain. Headache, backache, neck or shoulder pain may be a socially acceptable defense against situations in the patient's life that are far more impossible to bear than the pain used as a defense. The person whose life is dreary, whose work is boring and unrewarding, who lives a life isolated from friends and relatives, who feels dejected and hopeless, may complain of unremitting pain from a seemingly trivial lesion or injury.

Some patients with chronic pain have never outgrown the role of parental dependency. Our oldest known "dependent child" was a 62-year-old man who was admitted to the Back Service at Rancho Los Amigos Hospital in Los Angeles with intractable pain a few weeks after the illness of his sister had deprived him of the complete attention and care of his mother. His one brief trial of marriage had failed and he had lived his entire life with the mother. Many times chronic pain has been demonstrated to be based on an acting out of a dependency role.

Chronic pain of a constant nature is frequently associated with depression, loss of ego strength, low self-image, and loss of libido. Such chronic suffering is accompanied by feelings of guilt, futility, worthlessness, and hopelessness.

When the breadwinner of a family suffers a painful injury and becomes disabled, our society provides various support mechanisms including industrial compensation and state and federal disability programs. Once the problem becomes chronic, the level of support afforded by these agencies becomes insufficient and the wife becomes the breadwinner. Subtle role changes may then begin to develop within the family. When one attempts, after one or more years, to change this situation and rehabilitate the chronic pain victim, these new roles may be fixed and there may be great resistance to changing them. Consider this example.

A very attractive woman of 34, mother of two, who has had eight major back surgeries and who now has severe arachnoiditis, is emerging through therapy from her role of a totally disabled person to an active role of both mother and career woman. She has resumed her education and is making excellent progress toward becoming a qualified medical social worker. Her husband has for many years rationalized his own failures as "I'd have been rich if I hadn't spent all my money getting the best surgeons to operate on my little wife." As the wife began to demonstrate her new role, the husband was seen twice in the Emergency Room over a relatively brief period of time with "heart attacks." He had collapsed at work in a state of severe anxiety and hyperventilation and was transported to the Emergency Room with full honors including the ambulance with red lights and siren.

Diagnostic Implications

What practical lessons can be learned from this theoretical discussion of pain and the "painful person"? Most important, an in-depth understanding of the psychodynamics of pain will warn away from radical and usually unsuccessful surgery. It cannot be assumed that removal of the painful lesion will remove the patient's pain. The family physician is obliged to identify the behavioral and social factors underlying the complaint of pain before major surgery and not after multiple operations have failed. It is tragic to make such diagnoses as "poor protoplasm," "crock," "neurotic," or "hypochondriac" after multiple major surgical procedures have failed. Such a belated categorization fails to help the patient and subjects him or her to unnecessary risk, morbidity, and expense. Often then, the physician is dealing with a patient who has substantial organic iatrogenic disability.

It is disconcerting to realize that there is almost no correlation between x-ray findings and complaints of pain, whether it be in the neck, back, or shoulder. For example, the myelogram does not satisfactorily predict the potential success of operative intervention for herniated intervertebral disc. In myelograms done incidentally

with other studies, 30 percent of the patients who have no back pain will have distinctly "abnormal" myelograms.[5] Some 10 to 20 percent of people with back pain associated with sciatica have distinct neurological findings such as weakness of the toe and foot extensors, areas of hypesthesia, paraesthesia, and reflex changes. If this group alone is selected for surgical removal of the intervertebral disc, a very excellent percentage of success will be obtained. If the same procedure is expanded to include patients without objective findings, the percentage of success is much less than satisfactory.[6] Thus, the treatment should be for "painful persons" and not for x-ray findings.

At Rancho Los Amigos Hospital unsuccessful attempts have been made to identify cultural, ethnic, or racial factors that influence the diagnosis and management of pain syndromes. One can readily observe that people of different cultural backgrounds choose different modes of expression or different demonstrations of pain. Beyond this, however, generalizations break down. What is more evident is that similar patterns of unhealthy social and family dynamics occur in all ethnic groups where one member of a family is chronically affected.

There is some interesting new work now in progress exploring the relationship between personality structure and pain. For example, Wiltse has recently shown that the Minnesota Multiphasic Personality Inventory (MMPI) can predict the outcome of back surgery with greater accuracy than the surgeons themselves.[7]

Finally, any consideration of chronic pain must take into account the manipulative value that it may have for the patient. Compensation may be higher, settlements larger, attention from family and friends more rewarding, and interpersonal relationships more advantageous to the patient if he/she maintains the pain.

Therapeutic Implications

1. Relating to the Patient. It is important that the physician relate to the patient with chronic pain in an open and nonjudgmental manner. The patient should not be classified by the physician as malingering. Malingering is a nonmedical, accusatory term and is to be avoided. A patient who uses pain to manipulate his world and his environment may cause the physician frustration and anger. It is appropriate for one to point out to the patient that he is using his pain in a manipulative way and it is also appropriate to point out that there may be better ways to cope with the life's situation. An out-and-out diagnosis of malingering – an accusation of conscious falsification – puts an end to what otherwise might be a valuable therapeutic relationship. All pain is real, even that which provides the patient a manipulative mechanism and offers a socially undesirable but nevertheless, to the patient, satisfactory coping mechanism.

It is highly desirable that the physician identify the patient who is defensive, since the physician may decide the patient needs his/her pain. The physician can then enjoy a satisfactory relationship with this patient over many years by listening empathetically while trying to guide him/her to an understanding of the real problems. If instead the physician makes a frontal assault on the patient's protective facade, ruthlessly stripping it away, denying it, and labeling it as fraudulent, the physician will not be effective in helping the patient. It is not suggested that the patient be rewarded with increased attention for each complaint of pain. Quite the contrary, the patient should be praised for each increase in performance and improvement in function.[8] The physician may ignore or change the subject when the complaint is pain, but should not ruthlessly deny the patient his/her pain. A cardinal rule of the physician interested in the management of pain is that all pain is real. The supposed differentiations between real pain and "psychological" pain are invalid. All pain is real.

The physician is frequently working at cross purposes with the patient who needs his pain. The physician may feel a compulsion to eradicate the patient's pain; failing this, the physician may be further compelled to call in the neurosurgeon to destroy the patient's capacity to produce pain. It is this insistence of the physician to follow the medical model that often leads to unsuccessful and destructive operations – the singulectomies, cordotomies, rhizotomies, and various other procedures that have been popularized through the years. It is most interesting that these procedures have great efficacy and are successful when applied to psychologically sound individuals who have painful conditions such as terminal cancer. But the same procedures when carried out on "painful persons" who have various defensive needs for pain are not only unsuccessful but lead to substitute types of pain, usually described as burning, phantom pain, or autonomic disorders. Figure 1 illustrates potential outcomes for the patient with chronic pain.

Acute and chronic pain can be seen to disrupt the patient's useful career or gainful employment. Effective early therapy, including control of associated anxiety and/or depression, is seen as best insuring a patient's return to a useful and productive life. Dotted line arrows indicate possible indirect outcomes; for example, an accident may further complicate the patient's status if he is so preoccupied with threats to his career that he subconsciously seeks it. Psychological factors which may contribute to chronicity of pain and failure of therapy are shown in the boxes on each side of Figure 1. The return from pain as an ego defense through rehabilitation and therapy to a useful career is marked with a dotted line because it is such a precarious route. The physician must appreciate all of these factors and maintain a positive relationship with the patient if a career of chronic pain is to be avoided.

2. Role of Drug Therapy. Though there is no question that drug therapy of patients with chronic pain is a large area of abuse and ineffective prescribing, there is certainly a place for the use of carefully selected drugs based on the individual needs of each patient and as an adjunct to more comprehensive patient management.

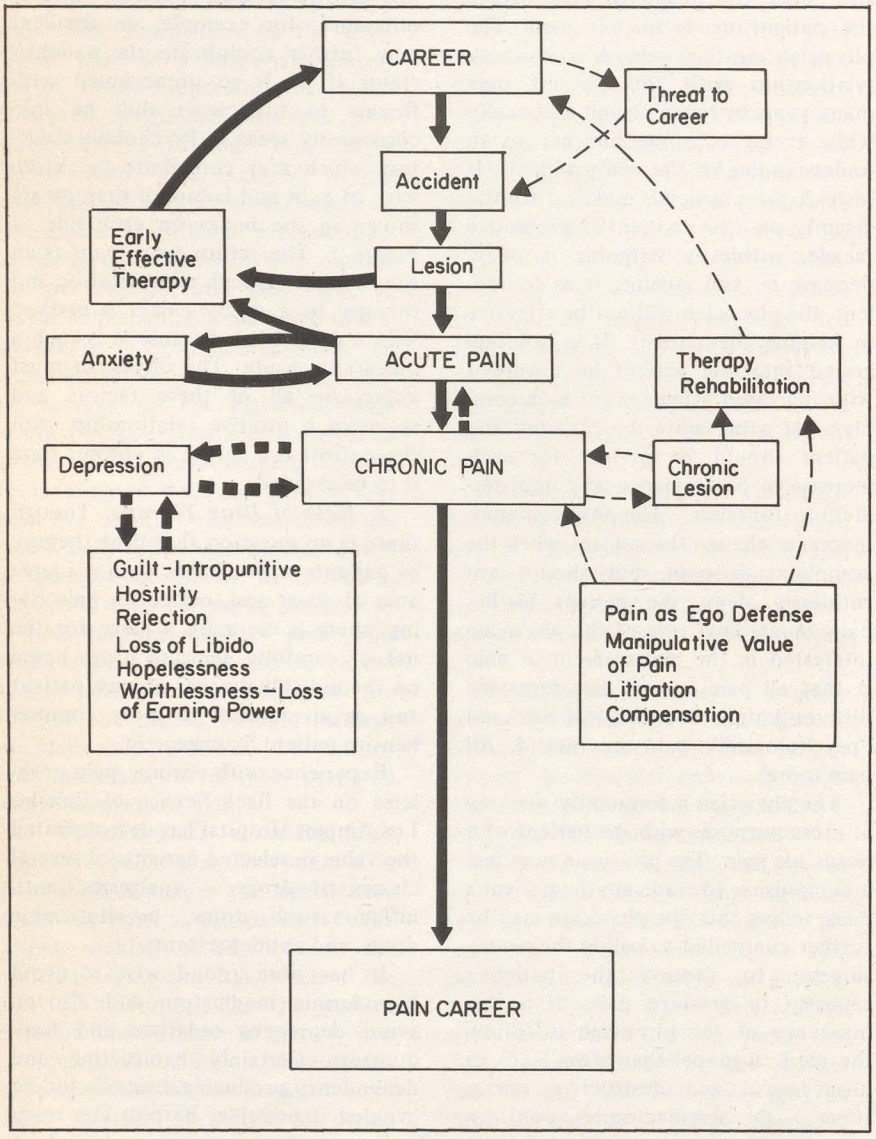
Experience with chronic pain problems on the Back Service of Rancho Los Amigos Hospital has demonstrated the value in selected patients of several classes of drugs – analgesics, anti-inflammatory drugs, psychotrophic drugs, and antidepressants.

It has been found wise to avoid hypodermic medication and also to avoid depressing sedatives and tranquilizers. Certainly habituating and dependency producing drugs should be avoided if possible. Barbiturates seem

to have no place at all in the management of chronic pain or chronic disability patients of any type.

Analgesics. Of the simple analgesics, all are familiar with aspirin, acetaminophen (Tylenol), codeine, propoxyphene (Darvon), and pentazocine (Talwin). Aspirin and Tylenol, which have about equal analgesic effects, are in use at Rancho Los Amigos Hospital. Tylenol is better tolerated by the gastrointestinal tract but lacks the anti-inflammatory effect of aspirin. Darvon is expensive and little better than aspirin.[9] Talwin is not better than aspirin when administered orally.[10] Codeine is effective and relatively nonaddicting. It is difficult to justify the continued promotion of codeine in combination with Empirin or APC. It would be more rational to combine it directly with Tylenol or aspirin.

In administering major narcotics for severe and intractable pain, an attempt has been made to develop a single solvent which would make oral administration of narcotics in varying dilutions possible. The best found so far is cranberry juice. With a tiny addition of quinine to make it bitter, it covers almost everything. Methadon is essentially as effective orally as by hypodermic. It causes a minimal amount of euphoria and is therefore minimally addicting. The dosage levels in use, ranging from 15 mg down to 1 mg and to straight cranberry juice, have thus far not produced addiction. They are far short of the usual dosages administered in the control of heroin addiction. Demerol, morphine, pantopon, and all of the usual hypodermic medications are avoided. The second most effective major oral narcotic available is Leritine. This is a close relative to Demerol, but like Methadon, it is equally effective whether administered orally or by injection. It is compatible in a mixture with Methadon.



Anti-inflammatory Drugs: The field of nonsteroidal anti-inflammatory analgesic drugs has expanded rather dramatically in the past year. Tolmetin (Tolectin-McNeil) is reported to be synergistic with acetaminophen (Tylenol) and adds a new dimension. There are three and soon to be four phenyl-alkanoic acid derivatives available: naproxyn (Naprosyn), fenoprofen (Nalfon), and ibuprofen (Motrin). Ketoprofen will soon be released. These drugs are similar but Naprosyn has the longest half-life and is suitable for b.i.d. dosage. A two-week trial is justifiable. If the response is poor, a different drug of the same general group may be successful.

Phenylbutazone has a very dramatic effect on the small joints of the back and a short course of this potent anti-inflammatory drug may prove both therapeutic and diagnostic. Prompt response to phenylbutazone localizes the back pain to the small joints (facet joints). A short course of this valuable drug may restore a patient to full function and return him/her to work, thus avoiding prolonged bedrest, increasing deconditioning, and unbearable expense.

Psychotrophic Drugs: One cannot deal with the chronically defeated, depressed, or manipulative pain patient without a sound knowledge of major psychotrophic drugs. This type of patient, so thoroughly set in the sick role, requires mind-changing drugs, physical reconditioning, and psychological retraining.

Minor sedative tranquilizers are not of value in chronic pain problems and have become generally recognized as a

negative influence on the behavior of patients with chronic pain. The combination of disinhibition and increased hostility and depression seen consistently with such agents as diazepam (Valium), chlordiazepoxide (Librium), and meprobamate (Miltown) make these agents totally unacceptable.

In the relief of anxiety, one must also be prepared to use the major tranquilizers. Three are in use at Rancho Los Amigos Hospital: (1) Trifluoperazine (Stelazine), which is relatively nonsedative and never depressing, and is long acting and very potent in small doses; (2) Chlorpromazine (Thorazine), which is far more sedative and is useful in agitated patients; and (3) Thioradazine (Mellaril), which is intermediate in sedative qualities and has the additional advantage of being less likely to produce rigidity and Parkinson-like tremors.[12] There is absolutely no habituation or dependency developed on any of these highly effective drugs for anxiety. It is difficult to understand why the so-called minor tranquilizers are considered minor with their great potential for habituation and why they tend to be used when these drugs of great effectiveness are often ignored or neglected.

Antidepressant Drugs: The most important aspect of the management of the depressed patient with chronic pain is the recognition by the physician of the depression itself and its potentially devastating nature. Tricylic antidepressants are of major importance in the care of selected patients with significant depression. Success with antidepressants relates directly to how well the physician understands these drugs and "sells" them to the patient, the physician's understanding of their potential toxicity and side effects, and the adequacy of dosage regimen. Rancho Los Amigos Hospital uses a three-stage description of the drug in explaining it to patients. Patients are told that during the first five days they may expect dry mouth, drowsiness, and perhaps some improvement in sleep. The second five days they may expect a sensation of shakiness, insecurity, and anxiety. As they emerge from deep depression they seem frightened by their greater degree of awareness of the world. The third five days, or in any case, 15 days after an effective dosage level is reached, patients are told to expect real improvement in mood and they are seldom disappointed. The question of what constitutes an adequate dose frightens many physicians. Overdosages are possible and are manifestations of anticholinergic effects, such as disturbed cardiac rhythm, inability to empty the bladder, and constipation. It is frequently the anticholinergic effects that limit the dosage. The usual effective dose for adults, using amitriptyline (Elavil) as a model, is 100 mg to 300 mg daily with an average requirement of approximately 175 mg. Psychiatrists may go as high as 600 mg daily. Insomnia is one of the manifestations of these people's depression and it is very useful to start right off with 100 mg of Elavil at bedtime. The usual routine at Rancho Los Amigos Hospital is to combine Elavil with Stelazine or Mellaril to allay both anxiety and depression. Fixed combinations have not been used.

Comment

This article has stressed the importance of the physician's awareness and knowledge of the behavioral, social, psychological, and personality aspects that make each patient with the complaint of persistent pain a new and different challenge. It is suggested that the family physician can test his/her capability to understand patients with chronic pain by asking him/herself the following ten questions:

1. Are you sure that you are getting the message that the patient is trying to send you with the pain?

2. Have you recognized that pain or disability may be an important ego defense mechanism to the patient?

3. Are you aware of the manipulative value that the pain and disability may possess for the patient?

4. Can you recognize when the patient is asking for another operation in order to validate a career of pain and disability?

5. Have you recognized the degree of anxiety in the patient and the part it plays in increasing pain?

6. Have you thought of what the implications of the pain are to the patient in terms of job, earning capacity, or career?

7. Are you sensitive to the patient's low self-image, poor ego strength, disturbed sleep patterns, and loss of libido that are the earmarks of depression and which may be the major factors in the pain and disability?

8. Have you found a way to involve the patient in his/her own recovery process?

9. Have you developed some skill in confronting the patient with the realistic nature of the problem without developing hostility within yourself?

10. Can you approach with a generous and understanding heart and find joy and challenge in this most difficult, obstinate, defensive, depressive, and often defeating patient?

If you can answer "Yes" to most of these questions, you are indeed an effective physician in caring for patients with chronic pain problems.

References

1. Sternbach RA: Pain, A Psychophysiological Analysis. Academic Press, New York, 1968

2. Melzack R, Wall PD: Gate Control Theory of Pain. In Soulairac AJ: International Symposium on Pain, Academic Press, London-New York, 1968, pp 11-31

3. McWhinney IR: Beyond diagnosis: An approach to the integration of behavioral science and clinical medicine. N Engl J Med 288:384, 1972

4. Szasz TR: The Psychology of Persistent Pain: A Portrait of L'Homme-Douloureaux. In Soulairac AJ: International Symposium on Pain, Academic Press, London-New York, 1968, pp 93-113

5. Hitselberger WE, Witten RM: Abnormal myelograms in asymptomatic patients. J Neurosurgery 28:204, 1968

6. Dunkerly GE: The results of surgery for low back and leg pain due to presumptive prolapsed intervertebral disc. Postgrad Med J 47:120, 1971

7. Wiltse LL: Psychological testing in predicting the success of low back surgery. Orthop Clin N Amer 6(1):317, 1975

8. Fordyce WE, Fowler RS Jr, Lehmann JF, et al: Some implications of learning in problems of chronic pain. J Chron Dis 21:178, 1968

9. Medical Letter, Darvon equivalent to aspirin in comparable dose. 15(15): July 20, 1973

10. Medical Letter, Pentazocine orally comparable to aspirin. 15(13): June 23, 1973

11. Medical Letter, Diazepam as a muscle relaxant. 15(14): July 6, 1973

12. Jarvik, MD: Chapter 12, "Psychopharmacology." In Goodman LS, Gilman AZ (eds): Pharmacological Basis of Therapeutics. New York, Macmillan Company, 1970