MEASUREMENT OF PAIN

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Pain is a personal, subjective experience influenced by cultural learning, the meaning of the situation, attention, and other psychological variables.[66] Pain processes do not begin with the stimulation of receptors. Rather, injury or disease produces neural signals that enter an active nervous system that (in the adult organism) is the substrate of past experience, culture, anxiety, and depression. These brain processes actively participate in the selection, abstraction, and synthesis of information from the total sensory input. Pain, then, is not simply the end product of a linear sensory transmission system; rather, it is a dynamic process that involves continuous interactions among complex ascending and descending systems.

DIMENSIONS OF PAIN EXPERIENCE

Research on pain, since the beginning of this century, has been dominated by the concept that pain is purely a sensory experience. Yet pain also has a distinctly unpleasant, affective quality. It becomes overwhelming, demands immediate attention, and disrupts ongoing behavior and thought. It motivates or drives the organism into activity aimed at stopping the pain as quickly as possible. To consider only the sensory features of pain and ignore its motivational-affective properties is to look at only part of the problem. Even the concept of pain as a perception, with full recognition of past experience, attention, and other cognitive influences, still neglects the crucial motivational dimension.

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These considerations led Melzack and Casey[61] to suggest that there are three major psychological dimensions of pain: sensory-discriminative, motivational-affective, and cognitive-evaluative. They proposed that these dimensions of pain experience are subserved by physiologically specialized systems in the brain. Melzack and Casey[61] proposed that the sensory-discriminative dimension of pain is influenced primarily by the rapidly conducting spinal systems. The powerful motivational drive and unpleasant effects, characteristic of pain, are subserved by activities in reticular and limbic structures that are influenced primarily by the slowly conducting spinal systems. Neocortical or higher central nervous system (CNS) processes, such as evaluation of the input in terms of past experience, exert control over activity in both the discriminative and motivational systems.

It is assumed that these three categories of activity interact with one another to provide perceptual information on the location, magnitude, and spatiotemporal properties of the noxious stimuli, motivational tendency toward escape or attack, cognitive information based on past experience, and probability of outcome of different response strategies.[61] All three forms of activity could then influence motor mechanisms responsible for the complex pattern of overt responses that characterize pain.

THE LANGUAGE OF PAIN

Clinical investigators have long recognized the varieties of pain experience. Descriptions of the burning qualities of pain after peripheral nerve injury, or the stabbing, cramping qualities of visceral pains frequently provide the key to diagnosis and may even suggest the course of therapy. Despite the frequency of such descriptions and the seemingly high agreement that such adjectives are valid descriptive words, studies of their use and meaning are relatively recent.

Anyone who has suffered severe pain and tried to describe the experience to a friend or to the doctor often finds himself or herself at a loss for words. The reason for this difficulty in expressing pain experience is not because the words do not exist. As we shall soon see, there is an abundance of appropriate words. Rather, the main reason is that, fortunately, they are not words that we have occasion to use often. Another reason is that the words may seem absurd. We may use descriptors such as splitting, shooting, gnawing, wrenching, or stinging, but there are no external objective references for these words. If we talk about a blue pen or a yellow pencil we can point to an object and say "that is what I mean by yellow" or "this color of the pen is blue." But what can we point to to tell another person precisely what we mean by smarting, tingling, or rasping? A person who suffers terrible pain may say that the pain is burning and add that "it feels as if someone is shoving a red-hot poker through my toes and slowly twisting it around." These "as if" statements are often essential to convey the qualities of the experience.

If the study of pain in people is to have a scientific foundation, it is essential to measure it. If we want to know how effective a new drug is, we need numbers to say that the pain decreased by some amount. Yet, while this is important to know, we also want to know whether the drug specifically decreased the burning quality of the pain, or if the especially miserable, tight, cramping feeling is gone.

APPROACHES TO THE MEASUREMENT OF PAIN

Until recently, the methods that were used for pain measurement treated pain as though it were a single unique quality that varies only in intensity.[2] These methods include the use of verbal rating scales (e.g., mild, moderate, severe), numerical rating scales (1–100), and visual analogue scales (VAS).[36, 39] These simple methods have all been used effectively in hospital clinics and have provided valuable information about pain and analgesia. The visual analogue pain scale[36] and the McGill Pain Questionnaire[57] have been used extensively in clinical settings. The Descriptor Differential Scale[25] has been used mainly in studies of experimental pain, but has recently been extended to pain measurement in a clinical setting.[22] These three instruments offer several advantages over other self-rating scales.

Visual Analogue Scales

The VAS provides a simple, efficient, and minimally intrusive measure of pain intensity that has been used widely in clinical and research settings where a quick index of pain is required and to which a numerical value can be assigned. The VAS consists of a 10-cm horizontal[37] or vertical[75, 76] line with the two endpoints labeled "no pain" and "worst pain ever" (or a similar verbal descriptor representing the upper pole). The patient is required to mark the 10-cm line at a point that corresponds to the level of pain intensity he or she presently feels. The distance in centimeters from the low end of the VAS and the patient's mark is used as a numerical index of the severity of pain.

The VAS is sensitive to pharmacologic and nonpharmacologic procedures that alter the experience of pain[1, 3, 8, 14, 86] and correlates highly with pain measured on verbal and numerical rating scales.[17, 49, 68] Instructions to patients to rate the amount or percentage of pain relief using a VAS (e.g., following administration of a treatment designed to reduce pain) may introduce unnecessary bias (e.g., expectancy for change and reliance on memory), which reduces the validity of the measure.[5] It has been suggested,[5] therefore, that a more appropriate measure of change may be obtained by having patients rate the absolute amount of pain at different points in time (e.g., before and after the intervention, but see Ekblom and Hansson[17]).

A major advantage of the VAS as a measure of sensory pain

intensity is its ratio scale properties.[69, 70] In contrast to many other pain measurement tools, equality of ratios is implied, making it appropriate to speak meaningfully about percentage differences between VAS measurements obtained either at multiple points in time or from independent samples of subjects. Thus, ratio statements may be made that describe pain in one group of patients as being several times that of another or as being reduced by a certain percentage. The ratio scale property of the VAS also means the measurements are suitable for description using parametric statistics (such as the mean, standard deviation, and Pearson product-moment correlation coefficient) and are amenable to parametric inferential statistical procedures (such as analysis of variance and regression analysis). Other advantages of the VAS include (1) its ease and brevity of administration and scoring,[38] (2) minimal intrusiveness, and, (3) providing that adequately clear instructions are given to the patient, its conceptual simplicity.[6, 37]

The major disadvantage of the VAS is its assumption that pain is a unidimensional experience.[22, 57] Although intensity is, without a doubt, a salient dimension of pain, it is clear that the word *pain* refers to an endless variety of qualities that are categorized under a single linguistic label, not to a specific, single sensation that varies only in intensity. Each pain has unique qualities. The pain of a toothache is obviously different from that of a pinprick, just as the pain of a coronary occlusion is uniquely different from the pain of a broken leg. To describe pain solely in terms of intensity is like specifying the visual world only in terms of light flux, without regard to pattern, color, texture, and the many other dimensions of visual experience.

The McGill Pain Questionnaire

Development and Description

Melzack and Torgerson[65] have made a start toward specifying the qualities of pain. In the first part of their study, physicians and other university graduates were asked to classify 102 words, obtained from the clinical literature, into small groups that describe distinctly different aspects of the experience of pain. On the basis of the data, the words were categorized into three major classes and 16 subclasses (Fig. 1). The classes are (1) words that describe the *sensory qualities* of the experience in terms of temporal, spatial, pressure, thermal, and other properties; (2) words that describe *affective qualities* in terms of tension, fear, and autonomic properties that are part of the pain experience; and (3) *evaluative* words that describe the subjective overall intensity of the total pain experience. Each subclass, which was given a descriptive label, consists of a group of words that were considered by most subjects to be qualitatively similar. Some of these words are undoubtedly synonyms, others seem to be synonymous but vary in intensity, whereas many provide subtle differences or nuances (despite their

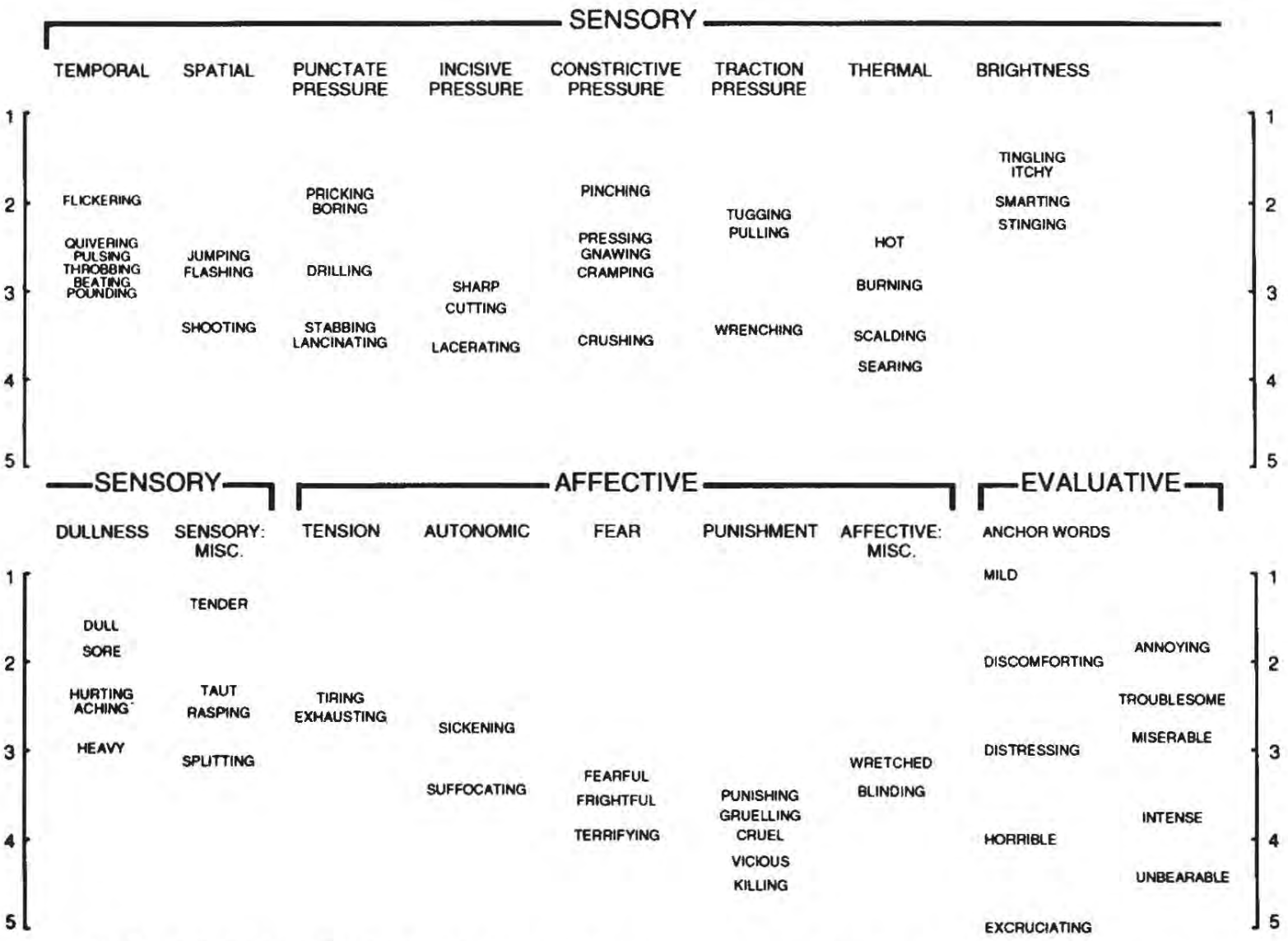


Figure 1. Spatial display of pain descriptors based on intensity ratings by patients. The intensity scale values range from 1 (mild) to 5 (excruciating). (From Melzack R, Torgerson WS: On the language of pain. Anesthesiology 34:50, 1971; with permission.)

similarities) that may be of importance to a patient who is trying desperately to communicate to a physician.

The second part of the study was an attempt to determine the pain intensities implied by the words within each subclass. Groups of physicians, patients, and students were asked to assign an intensity value to each word, using a numerical scale ranging from least (or mild) pain to worst (or excruciating) pain. When this was done, it was apparent that several words within each subclass had the same relative-intensity relationships in all three sets. For example, in the spatial subclass, "shooting" was found to represent more pain than "flashing," which in turn implied more pain than "jumping." Although the precise intensity scale values differed for the three groups, all three agreed on the positions of the words relative to each other. The scale values of the words for patients, based on the precise numerical values listed in Melzack and Torgerson,[65] are indicated in Figure 1.

Because of the high degree of agreement on the intensity relationships among pain descriptors by subjects who have different cultural, socioeconomic, and educational backgrounds, a pain questionnaire (Fig. 2) was developed as an experimental tool for studies of the effects of various methods of pain management. In addition to the list of pain descriptors, the questionnaire contains line drawings of the body to show the spatial distribution of the pain, words that describe temporal properties of pain, and descriptors of the overall present pain intensity. The present pain intensity is recorded as a number from 1 to 5, in which each number is associated with the following words: 1, mild; 2, discomforting; 3, distressing; 4, horrible; and 5, excruciating. The mean scale values of these words, which were chosen from the evaluative category, are approximately equally far apart[65] so that they represent equal scale intervals and thereby provide "anchors" for the specification of the overall pain intensity.

In a preliminary study, the pain questionnaire consisted of the 16 subclasses of descriptors shown in Figure 1, as well as the additional information deemed necessary for the evaluation of pain. It soon became clear, however, that many of the patients found certain key words to be absent. These words were then selected from the original word list used by Melzack and Torgerson,[65] categorized appropriately, and ranked according to their mean scale values. A further set of words—cool, cold, freezing—was used by patients on rare occasions but was indicated to be essential for an adequate description of some types of pain. Thus, four supplementary, or "miscellaneous," subclasses were added to the word lists of the questionnaire (Fig. 2). The final classification, then, appeared to represent the most parsimonious and meaningful set of subclasses without at the same time losing subclasses that represent important qualitative properties. A description of the properties and scoring methods of the questionnaire, which is referred to as the McGill Pain Questionnaire, has been published,[57] and it has become a widely used clinical and research tool.[58, 73, 87]

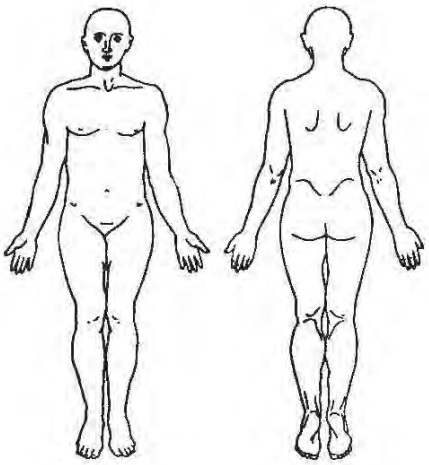
McGill Pain Questionnaire

Patient's Name _____ Date _____ Time _____ am/pm

PRI: S _____ (1-10) A _____ (11-15) E _____ (16) M _____ (17-20) PRI(T) _____ (1-20) PPI _____

1 FLICKERING	11 TIRING	
QUIVERING	EXHAUSTING	
PULSING		
THROBBING	12 SICKENING	
BEATING	SUFFOCATING	
POUNDING		
2 JUMPING	13 FEARFUL	
FLASHING	FRIGHTFUL	
SHOOTING	TERRIFYING	
3 PRICKING	14 PUNISHING	
BORING	GRUELLING	
DRILLING	CRUEL	
STABBING	VICIOUS	
LANCINATING	KILLING	
4 SHARP	15 WRETCHED	
CUTTING	BLINDING	
LACERATING		
5 PINCHING	16 ANNOYING	
PRESSING	TROUBLESOME	
GNAWING	MISERABLE	
CRAMPING	INTENSE	
CRUSHING	UNBEARABLE	
6 TUGGING	17 SPREADING	
PULLING	RADIATING	
WRENCHING	PENETRATING	
7 HOT	PIERCING	
BURNING	18 TIGHT	
SCALDING	NUMB	
SEARING	DRAWING	
8 TINGLING	SQUEEZING	
ITCHY	TEARING	
SMARTING	19 COOL	
STINGING	COLD	
9 DULL	FREEZING	
SORE	20 NAGGING	
HURTING	NAUSEATING	
ACHING	AGONIZING	
HEAVY	DREADFUL	
10 TENDER	TORTURING	
TAUT	PPI	
RASPING	0 NO PAIN	
SPLITTING	1 MILD	
	2 DISCOMFORTING	
	3 DISTRESSING	
	4 HORRIBLE	
	5 EXCRUCIATING	

BRIEF	RHYTHMIC	CONTINUOUS
MOMENTARY	PERIODIC	STEADY
TRANSIENT	INTERMITTENT	CONSTANT



E = EXTERNAL
I = INTERNAL

COMMENTS:

Figure 2. McGill Pain Questionnaire. The descriptors fall into four major groups: sensory, 1 to 10; affective, 11–15; evaluative, 16; and miscellaneous, 17–20. The rank value for each descriptor is based on its position in the word set. The sum of the rank values is the pain rating index (PRI). The present pain intensity is based on a scale of 0 to 5. (*From* Melzack R: Psychological aspects of pain: Implications for neural blockade. *In* Cousins MJ, Bridenbaugh PO (eds): Neural Blockade in Clinical Anesthesia and Management of Pain, ed 2. Philadelphia, Lippincott, 1988, p 845; with permission.)

The descriptor lists of the McGill Pain Questionnaire are read to a patient, with the explicit instruction that he or she choose only those words that describe his or her feelings and sensations at that moment. Three major indices are obtained:

1. The pain rating index based on the rank values of the words: In this scoring system, the word in each subclass implying the least pain is given a value of 1, the next word is given a value of 2, and so forth. The values of the words chosen by a patient are summed to obtain a score separately for the sensory (subclasses 1–10), affective (subclasses 11–15), evaluative (subclass 16), and miscellaneous (subclasses 17–20) words, in addition to providing a total score (subclasses 1–20). Figure 3 shows McGill Pain Questionnaire scores (total score from subclasses 1–20) obtained by patients with a variety of acute and chronic pains.
2. The number of words chosen.
3. The present pain intensity: the number-word combination chosen as the indicator of overall pain intensity at the time of administration of the questionnaire.

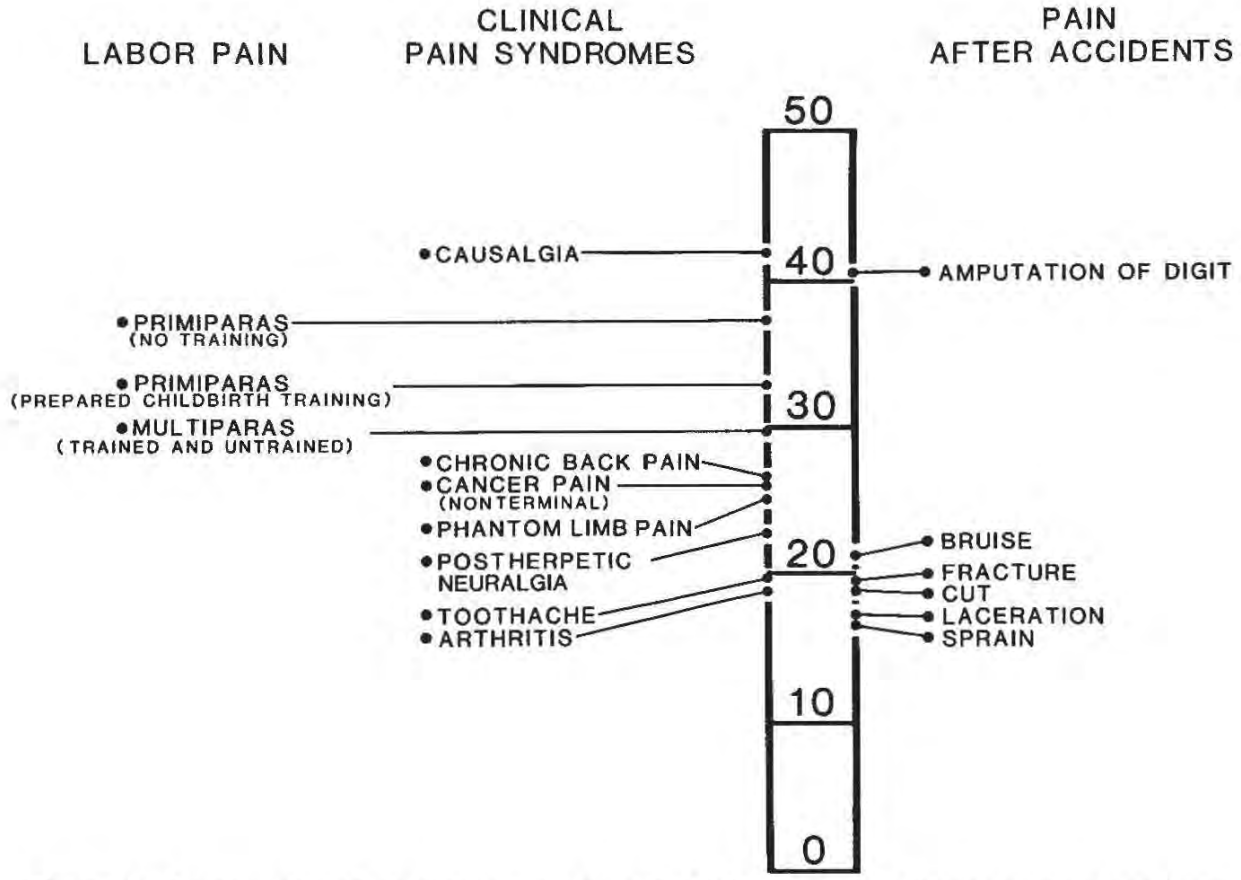


Figure 3. Comparison of pain scores using the McGill Pain Questionnaire obtained from women during labor[63] and from patients in a general hospital pain clinic[57] and an emergency department.[67] The pain score for causalgic pain is reported by Tahmoush.[79] (*From* Melzack R: Psychological aspects of pain: Implications for neural blockade. *In* Cousins MJ, Bridenbaugh PO (eds): Neural Blockade in Clinical Anesthesia and Management of Pain, ed 2. Philadelphia, Lippincott, 1988, p 845; with permission.)

Recently, several additional scoring procedures have been suggested.[7, 33, 50, 62] Hartman and Ainsworth[33] have proposed transforming the data into a pain ratio or fraction: the "pain ratio was calculated for each session by dividing post-session rating by the sum of the pre- and postsession ratings." Kremer et al[50] suggested dividing the sum of the obtained ranks within each dimension by the total possible score for a particular dimension, thus making differences between the sensory, affective, evaluative, and miscellaneous dimensions more interpretable.

A final form of computation[62] may be useful because it has been argued[7] that the McGill Pain Questionnaire fails to take into account the true relative intensity of verbal descriptors because the rank-order scoring system loses the precise intensity of the scale values obtained by Melzack and Torgerson.[65] For example, Figure 1 shows that the affective descriptors generally have higher scale values than the sensory words. This is clear when we consider the fact that the words "throbbing" and "vicious" receive a rank value of 4, but have scale values of 2.68 and 4.26, respectively, indicating that the latter descriptor implies considerably more pain intensity than the former. A simple technique was developed[62] to convert rank values to weighted rank values that more closely approximate the original scaled values obtained by Melzack and Torgerson.[65] Use of this procedure appears to provide enhanced sensitivity under certain circumstances.[62]

Usefulness of the McGill Pain Questionnaire

The most important requirement of a measure is that it be valid, reliable, consistent, and above all, useful. The McGill Pain Questionnaire appears to meet all of these requirements[6, 58, 73, 87] and provides a relatively rapid way of measuring subjective pain experience.[57] When administered to a patient by reading each subclass, it can be completed in about 5 minutes. It can also be filled out by the patient in a more leisurely way as a paper-and-pencil test, though the scores are somewhat different.[47]

Since its introduction in 1975, the McGill Pain Questionnaire has been used in over 100 studies of acute, chronic, and laboratory-produced pains. It has been translated into several languages and has also spawned the development of similar pain questionnaires in other languages. Pain questionnaires have appeared in Arabic,[32] Chinese,[34] Finnish,[45] German,[46, 71, 77] Dutch,[83, 85] Italian,[15, 54] and Spanish.[51]

Because pain is a private, personal experience, it is impossible for us to know precisely what someone else's pain feels like. No man can possibly know what it is like to have menstrual cramps or labor pain. Nor can a psychologically healthy person know what a psychotic patient is feeling when the patient says he or she has excruciating pain.[84] But the McGill Pain Questionnaire provides us with an insight into the qualities that are experienced. Recent studies indicate that each kind of pain is characterized by a distinctive constellation of words. There is a remarkable consistency in the choice of words by patients suffering the same or similar pain syndromes.[28, 30, 40, 63, 81]

Discriminative Capacity of the McGill Pain Questionnaire

One of the most exciting features of the McGill Pain Questionnaire is its potential value as an aid in the differential diagnosis between various pain syndromes.[16, 29, 35, 52, 64] The first study to demonstrate the discriminative capacity of the McGill Pain Questionnaire was carried out by Dubuisson and Melzack,[16] who administered the questionnaire to 95 patients suffering from one of eight known pain syndromes: postherpetic neuralgia, phantom limb pain, metastatic carcinoma, toothache, degenerative disk disease, rheumatoid arthritis or osteoarthritis, labor pain, and menstrual pain. A multiple-group discriminant analysis revealed that each type of pain is characterized by a distinctive constellation of verbal descriptors. Further, when the descriptor set for each patient was classified into one of the eight diagnostic categories, a correct classification was made in 77% of cases.

Descriptor patterns can also provide the basis for discriminating between two major types of low back pain. Some patients have clear physical causes such as degenerative disk disease, whereas others suffer low back pain even though no physical causes can be found. Using a modified version of the McGill Pain Questionnaire, Leavitt and Garron[52] found that patients with physical, organic, causes use distinctly different patterns of words from patients whose pain has no detectable cause and is labeled functional. A concordance of 87% was found between established medical diagnosis and classification based on the patients' choice of word patterns from the McGill Pain Questionnaire. Specific verbal descriptors of the McGill Pain Questionnaire have also been shown recently to discriminate between reversible and irreversible damage of the nerve fibers in a tooth.[29]

More recently, Melzack et al[64] provided further evidence of the discriminative capacity of the McGill Pain Questionnaire to differentiate between trigeminal neuralgia and atypical facial pain. Fifty-three patients were given a thorough neurologic examination that led to a diagnosis of either trigeminal neuralgia or atypical facial pain. Each patient rated his or her pain using the McGill Pain Questionnaire, and the scores were submitted to a discriminant analysis. Ninety-one percent of the patients were correctly classified using seven key descriptors. To determine how well the key descriptors were able to predict either diagnosis, the discriminant function derived from the 53 patients was applied to McGill Pain Questionnaire scores obtained from a second, independent validation sample of patients with trigeminal neuralgia or atypical facial pain. The results showed a correct prediction for 90% of the patients.

However, it is evident that the discriminative capacity of the McGill Pain Questionnaire has limits. High levels of anxiety and other psychological disturbance, which may produce high affective scores, may obscure the discriminative capacity.[48] Moreover, certain key words that discriminate among specific syndromes may be absent.[72] Nevertheless, it is clear that there are appreciable and quantifiable differences in the way various types of pain are described, and that patients with the

same disease or pain syndrome tend to use remarkably similar words to communicate what they feel.

The Short-Form McGill Pain Questionnaire

The short-form McGill Pain Questionnaire[60] (Fig. 4) was developed for use in specific research settings when the time to obtain information from patients is limited and when more information is desired than that provided by intensity measures such as the VAS or present pain intensity. The short-form McGill Pain Questionnaire consists of 15 representative words from the sensory (n = 11) and affective (n = 4) categories of the standard long form. The present pain intensity and a VAS are included to provide indices of overall pain intensity. The 15 descriptors making up the short-form McGill Pain Questionnaire were selected on the basis of their frequency of endorsement by patients with a variety of acute, intermittent, and chronic pains. An additional word, "splitting," was added because it was reported to be a key discriminative word for dental pain.[29] Each descriptor is ranked by the patient on an intensity scale of 0 = none, 1 = mild, 2 = moderate, and 3 = severe.

The short-form McGill Pain Questionnaire correlates very highly with the major pain rating indices (sensory, affective, and total) of the long-form and is sensitive to traditional clinical therapies—analgesic drugs, epidural blocks, and transcutaneous electrical nerve stimulation.[60] Preliminary results from a study designed to examine the qualities of pain experienced by patients in a physical rehabilitation hospital indicate that the sensory dimension of the short-form McGill Pain Questionnaire correlates highly with analgesic use among a subgroup of patients with high pain scores.[41] Furthermore, initial data[60] suggest that the short form may be capable of discriminating among different pain syndromes, which is an important property of the long form.

The Descriptor Differential Scale

Recently, simple but sophisticated psychophysical techniques have been applied to the development of pain measurement instruments used to assess clinical and experimentally induced pain.[19–21, 24, 31, 69] The psychophysical approach uses cross-modality matching procedures to determine the relative magnitudes of verbal descriptors of pain.[25]

The Descriptor Differential Scale was developed by Gracely et al[25] to remedy a number of deficiencies associated with existing pain measurement instruments. It was designed to reduce bias, assess the sensory intensity and "unpleasantness" (hedonic) dimensions of pain, and provide quantification by ratio-scaling procedures).[18] The Descriptor

SHORT-FORM McGILL PAIN QUESTIONNAIRE

RONALD MELZACK

PATIENT'S NAME: _____ DATE: _____

	NONE	MILD	MODERATE	SEVERE
THROBBING	0) _____	1) _____	2) _____	3) _____
SHOOTING	0) _____	1) _____	2) _____	3) _____
STABBING	0) _____	1) _____	2) _____	3) _____
SHARP	0) _____	1) _____	2) _____	3) _____
CRAMPING	0) _____	1) _____	2) _____	3) _____
GNAWING	0) _____	1) _____	2) _____	3) _____
HOT-BURNING	0) _____	1) _____	2) _____	3) _____
ACHING	0) _____	1) _____	2) _____	3) _____
HEAVY	0) _____	1) _____	2) _____	3) _____
TENDER	0) _____	1) _____	2) _____	3) _____
SPLITTING	0) _____	1) _____	2) _____	3) _____
TIRING-EXHAUSTING	0) _____	1) _____	2) _____	3) _____
SICKENING	0) _____	1) _____	2) _____	3) _____
FEARFUL	0) _____	1) _____	2) _____	3) _____
PUNISHING-CRUEL	0) _____	1) _____	2) _____	3) _____

NO PAIN |——————————————————————| WORST POSSIBLE PAIN

P P I

0 NO PAIN _____
1 MILD _____
2 DISCOMFORTING _____
3 DISTRESSING _____
4 HORRIBLE _____
5 EXCRUCIATING _____

Figure 4. The short-form McGill Pain Questionnaire. Descriptors 1–11 represent the sensory dimension of pain experience, and 12–15 represent the affective dimension. Each descriptor is ranked on an intensity scale of 0 = none, 1 = mild, 2 = moderate, and 3 = severe. The PPI of the standard long-form McGill Pain Questionnaire and the visual analogue scale are also included to provide overall pain intensity scores. (*From* Melzack R: The short-form McGill Pain Questionnaire. Pain 30:191, 1987; with permission.)

Differential Scale consists of two forms that measure separately the sensory intensity and unpleasant qualities of pain. Each form consists of 12 verbal descriptors. Each descriptor is centered over a 21-point scale with a minus sign at the low end and a plus sign at the high end. The patients rate the magnitude of pain they are presently experiencing in relation to each descriptor by selecting 1 of the 21 possibilities associated with each descriptor. A separate score is obtained for the sensory intensity and unpleasantness dimensions by averaging the patient's choices on each 12-item form.

The Descriptor Differential Scale derived from cross-modality matching has been demonstrated to be differentially sensitive to pharmacologic interventions that alter the sensory or unpleasantness dimensions of pain.[23, 26, 27] Recent results point to the importance of using multidimensional measures of pain, with clear instructions to rate the sensory intensity and unpleasantness aspects of pain as opposed to the "painfulness" of the experience.[22] When used in conjunction with cross-modality matching techniques, the Descriptor Differential Scale has been shown to be a reliable and valid instrument with ratio-scale properties.[25, 26] More recently, Gracely and Kwilosz[24] assessed the psychometric properties of the Descriptor Differential Scale for use as a clinical pain measure.

Behavioral Approaches

Recent research into the development of behavioral measures of pain has produced a wide array of sophisticated observational techniques and rating scales designed to assess objective behaviors that accompany pain experience.[42] Techniques that have demonstrated high reliability and validity are especially useful for measuring pain in infants and preverbal children who lack language skills,[55, 56, 74] adults who have a poor command of language,[73] or when mental clouding or confusion limit the patient's ability to communicate meaningfully.[10] Under these circumstances, behavioral measures provide important information that is otherwise unavailable from patient self-report. Moreover, when administered in conjunction with a subjective, patient-rated measure, behavioral measures may provide a more complete picture of the total pain experience. However, behavioral measures of pain should not replace self-rated measures if the patient is capable of rating his or her subjective state and such administration is feasible.

The subjective experiences of pain and pain behaviors are, presumably, reflections of the same underlying neural processes. However, the complexity of the human brain indicates that, although experience and behavior are usually highly correlated, they are far from identical. One person may be stoic so that calm behavior belies his or her true subjective feelings. Another patient may seek sympathy (or analgesic medication or some other desirable goal) and in so doing exaggerate his or her complaints without also eliciting the behaviors that typically

accompany pain complaints of that degree. Concordance between patients' self-ratings of pain and ratings of the same patients by nurses or other medically trained personnel may be modestly low,[8, 10, 53, 80, 82] but even in the presence of a significant correlation between physician and patient ratings of patient pain, physicians significantly underestimated the degree of pain the patients reported experiencing.[78] Craig and Prkachin[12, 13] have noted that when discordance is observed between nonverbal pain behavior and verbal pain complaint, the discrepancy often is resolved by disregarding the self-report. These studies point to the importance of obtaining multiple measures of pain and should keep us mindful that because pain is a subjective experience, the patient's self-report is the most valid measure of that experience.

Physiologic Approaches

Profound physiologic changes often accompany the experience of pain, especially if the injury or noxious stimulus is acute.[11] Physiologic correlates of pain may serve to elucidate mechanisms that underlie the experience and thus may provide clues that may lead to novel treatments.[6, 69] Physiologic correlates of pain experience that frequently are measured include heart rate, blood pressure, electrodermal activity, electromyography, and cortical evoked potentials. Despite high initial correlations between pain onset and changes in these physiologic responses, many habituate with time despite the persistence of pain.[19] In addition, these responses are not specific to the experience of pain per se, and occur under conditions of general arousal and stress. Recent studies that examined the general endocrine-metabolic stress response to surgical incision indicate that under certain conditions it is possible to dissociate different aspects of the stress response and pain.[43, 44] On the one hand, severe injury to a denervated limb produces a significant adrenocortical response.[44] On the other hand, use of general anesthesia clearly eliminates the conscious experience of pain in response to surgical incision, but does little to alter the subsequent rapid increase in plasma cortisol levels.[4, 9] These studies indicate, that, although there are many physiologic events that occur concurrently with the experience of pain, many appear to be general responses to stress and are not unique to pain.

SUMMARY

Pain is a personal, subjective experience influenced by cultural learning, the meaning of the situation, attention, and other psychological variables. Approaches to the measurement of pain include verbal and numeric self-rating scales, behavioral observation scales, and physiologic responses. The complex nature of the experience of pain suggests that measurements from these domains may not always show high

concordance. But because pain is subjective, the patient's self-report provides the most valid measure of the experience. The VAS and the McGill Pain Questionnaire are probably the most frequently used self-rating instruments for the measurement of pain in clinical and research settings. The McGill Pain Questionnaire is designed to assess the multidimensional nature of pain experience and has been demonstrated to be a reliable, valid, and consistent measurement tool. A short-form McGill Pain Questionnaire is available for use in specific research settings when the time to obtain information from patients is limited and when more information than simply the intensity of pain is desired. Further development and refinement of pain measurement techniques will lead to increasingly accurate tools with greater predictive powers.

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