PHYSIOLOGIC AND BEHAVIORAL RESPONSES TO ACUTE MYOCARDIAL ISCHEMIC PAIN IN MEXICAN MALE PATIENTS

by

Marilyn Kuhel Douglas, D.N.Sc., R.N., CCRN

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ABSTRACT

The verbal, non-verbal and physiologic responses of Mexican male patients to the pain of acute myocardial ischemia were studied as a basis for subsequent comparison with other cultural groups.

A sample of 57 patients was studied in the Emergency Department (ED) of a federal, tertiary health care facility in urban central Mexico. Inclusion criteria were: chief complaint of non-traumatic chest pain and subsequent admission to the Coronary Care Unit with a suspected acute myocardial infarction (AMI); Mexican birth and residence; male gender; 35 years or older; and, 12 or less years education. At the time of ED admission, a 12-Lead electrocardiogram, vital signs and serum creatine phosphokinase (CPK) levels were measured. Subjects were asked to describe the pain and give a numerical rating on a vertical, Spanish-language verbal descriptor pain scale. Non-verbal pain behaviors were assessed by two nurses and a negotiated score was given to each of seven categories and then totaled. The categories were: attention to pain, amount of restlessness, tenseness, anxiety, diaphoresis, facial grimacing, and vocalization, such as crying.

Higher pain scores were associated with greater amounts of non-verbal behavior ($p < .0001$), more ST segment elevation ($p < .001$), higher CPK levels ($p < .01$), and greater elevation in pressure-rate product ($p < .05$) and systolic blood pressure ($p < .05$). Patients with the discharge diagnosis of AMI had higher pain scores than those in which an AMI was ruled out ($p < .005$). However, multiple regression analysis determined that non-verbal behavior explained 42.4% of the variance in the pain score ($p < .0001$), while the physiologic variables were not significant in predicting the patient's pain intensity score.

These results indicate that nursing assessment of pain should include a behavioral assessment, which in turn requires validation with the patient and family members because of wide cultural variation in these behaviors.

DEDICATION

This study is dedicated to the patients and staff at the Instituto Nacional de Cardiologia (National Institute of Cardiology) in Mexico City, Mexico -- for their unquestioning willingness and enthusiasm to contribute to research in the hope of better care for future patients.

PREFACE

The phenomenon of pain is like a crystal. A view from each of its many perspectives casts light in a unique yet coordinated way. At least three major dimensions of pain have been acknowledged: physiological, psychological and sociocultural. This dissertation will focus on 2 of these: the physiological and the cultural responses to pain.

In the first chapter, the significance of pain as an area of nursing research is discussed. The next 3 chapters are devoted to presenting the theoretical bases for the responses to pain and role of nursing in its management. The design of the research study is described in chapter 5 and the results in the subsequent chapter. Finally, the discussion and conclusions of the study are presented as well as implications for practice and research.

A project of this length is not accomplished without the blind faith and support of so many. My gratitude to all who helped begins with my mentors at Stanford University Hospital, Lois Welches, DNSc, RN, FAAN, Phyllis McGrath, MS, RN, and Duane Walker, MSN, RN, FAAN for their direction and vision for nursing.

My appreciation extends to those mentors who persevered in their faith that this project would be completed. These include: the chair of this dissertation, Dr. Afaf Meleis, PhD, F.A.A.N., for her stimulation, challenge and high standards; Dr. Juliene Lipson, PhD, RN for her unique

perspective and gentleness; and Dr. Kathleen A. Dracup, DNSc, RN for her expertise and sense of professional sharing. My fellow doctoral students also deserve credit for a good deal of "blind faith" and support during this project.

And through all these years, I am most grateful of all for the patience and support of my husband, John, and the faith and love of my children Heather and Benjamin.

TABLE OF CONTENTS

CHAPTER 3

CHAPTER 4

CHAPTER 5

CHAPTER 5 (Continued)

CHAPTER 6

CHAPTER 7

APPENDICES (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Pain management is one of the most frequently performed nursing care activities, yet its implementation remains elusive (Hammond, Kelly, Schneider, Vancini, 1966; Martin & York, 1984; Silver, Halfmann, McShane & Hunt, 1984). Studies have shown only a moderate correlation, at best, between nurses' and patients' assessment of pain, despite its importance to nursing care. Inconsistent methods of assessment, a lack of accurate measurement tools (Taylor, 1987), wide variations in the degree of pain inferred by the nurses (Davitz, Davitz, & Higuchi, 1977), and inappropriately conservative administration of analgesic medications (Charap, 1978; Cohen, 1980; Marks & Sachar, 1978) help explain some of these results. This discrepancy between patients' and nurses' interpretation of pain highlights the need to investigate further the area of pain management.

Significance of the study

Studies of nurses and medical-surgical patients, in both out-patient clinics and in hospital settings, have documented a low to moderate correlation between the nurses' judgement of pain and the patients' self-report of pain. In one such study, 80% or more of the patients with significant disparity between nurse-patient ratings judged

their pain to be more severe than did the nurses (Graffam, 1981; Teske, Daut, & Cleeland, 1983).

Critical care nurses, in particular, have prioritized pain management and identified the need for more information on effective pain interventions. In a study of 50 patients in medical and surgical intensive care units, for example, pain was the second most frequently-identified nursing care problem, occurring in 66% of the cases (Suhayda & Kim, 1984). Furthermore, in a major nationwide survey of 206 critical care nurse experts, questions relating to pain assessment and pain management ranked twice in the top 15 research priority areas (Lewandowski & Kositsky, 1983).

Nursing research has just begun to identify the nature and scope of the problem. Nurses in one study reported that administration of pain-relieving medication was based primarily on patients' verbalization (Bagley, Falinski, Garnizo & Hooker, 1982). Yet, in another study, when 102 American patients were asked about how they usually respond to pain, nearly two-thirds reported that they try not to show they are in pain. More than 70% stated they did not want to talk about their pain with others. In contrast to the nurses in the first study, the latter nurses reported that physiological signs and behaviors were easier to use than verbal reports when assessing pain (Jacox, 1980). Thus, there is a lack of consistency in the measures nurses use to assess pain.

Cross-cultural factors also influence nurses' pain assessment. In one major continuing study, nurses from twelve different countries varied significantly in the amount of pain and distress inferred from the same disease situat·· ns and injuries (Davitz & Davitz, 1981; Davitz, Davitz & Higuchi, 1977). In comparison to nurses in other countries, American nurses tend to infer relatively low physical pain and moderate psychological pain. By contrast, physical pain was rated highest among the Korean and Japanese nurses. Psychological distress was rated significantly higher by the Korean and Puerto Rican nurses than by other groups. Thus, nurses bring to interactions their own set of culturally-learned attitudes about pain and suffering.

Interpreting the pain of another person, however, is not easily accomplished. Despite having several millennia of clinical experience, healing professionals continue to have difficulty defining and measuring this phenomenon. Its complexity and multifaceted nature has attracted scholars from such diverse disciplines as neurophysiology, philosophy, psychology and anthropology in search of its full nature and human expression.

In antiquity, some relationship between pain and harmful physical experiences has long been recognized. Homer described pain as due to the external intrusion of "arrows shot by the gods." Later, Aristotle identified an internal emotional aspect, when he classified pain as one of the

"passions of the soul," originating in the heart and distinct from the usual five senses. This duality -- the physical and emotional nature of pain -- was further refined in the Talmud and the Bible, and by Avicenna and Aquinas. As such, pain theory remained relatively unchanged from the time of Aristotle until the last century (Merskey, 1980).

Nineteenth century progress in anatomy and physiology, accompanied by a blinding faith in the observable, stimulated prolific investigation into the neurophysiology of pain. This emphasis on the physical aspects of pain continues until today, with a major focus of pain research on endorphins, for example. However, the psychosocial aspects of the pain response also have begun to attract the attention of investigators (Sternbach, 1974b; Zborowski, 1952 & 1969). Subsequently, a broader, multidimensional perspective of pain & its assessment has emerged (Melzack & Wall, 1965).

The evaluation of another person's pain is difficult for many reasons. A variety of beliefs -- shaped by social, cultural and personality factors -- can influence how the patient responds to and reports pain. Accurate interpretation of pain is especially difficult when behaviors vary greatly.

To give an example, in a coronary care unit in an urbanized area of the western United States, a nurse observes two of her patients, both admitted about 18 hours previously with the diagnosis of acute myocardial infarction (AMI). The serial electrocardiograms and cardiac enzymes

indicate that the size and location of the infarction is similar in both patients. However, in bed one is a 58 year old, Chinese-born man -- lying motionless, silent, eyes closed, with his wife at his side wiping his forehead with a damp washcloth. He has been having frequent extrasystoles and his heart rate is 112 beats/minute. The last time he received pain medication was when it was offered at admission 18 hours ago. In contrast, in bed two, is a 60 year old, second-generation, Italian gentleman who has complained of pain since admission. His vital signs are stable, except for a few extrasystoles. Thirty minutes prior to visiting hours he received 4 mg. Morphine Sulphate intravenously and appeared to be resting quietly until several members of his family arrived. He then began to describe to the family, in much detail and bodily motion, how much chest pain he has been having.

These seemingly contrasting behaviors, in the context of similar amounts and type of cellular pathology, illustrate the complexity of determining whether adequate pain management is being accomplished for each of these patients. Management of pain during acute myocardial infarction (AMI) is especially crucial because of the response of the sympathetic nervous system to the stress of pain. The catecholemines released as a result of the pain are detrimental in the setting of AMI because of at least three factors: they increase the myocardial demand for

oxygen, increase the possibility of extension of the infarction, and potentiate the risk of such lethal arrhythmias as ventricular tachycardia and ventricular fibrillation (Braunwald, 1971; Dracup, Breu & Tillisch, 1981; Riegel, 1985; Zaleska & Ceremuzynski, 1980). Misinterpretation or incorrect treatment of this type of pain can have serious, and even fatal, consequences.

The pain of acute myocardial ischemia is a good model for the study of pain for several reasons. First, the problem is the leading cause of death and morbidity in the United States. Nearly 5 million Americans have a history of angina pectoris or AMI or both, with more than 500,000 deaths/year from infarctions (American Heart Association, 1987).

This is not a problem confined solely to the U.S. or just the developed nations of the world. The Twenty-ninth World Health Assembly, in its resolution WHA29.49, recognized the emergence of a trend towards an increase in cardiovascular disease in the developing countries (World Health Organization, 1982). With a continuing decline in mortality from infectious and parasitic diseases, life expectancy in the developing countries as a group has improved. Because of this demographic change, a higher incidence of cardiovascular disease can occur even before the infectious and parasitic diseases have been fully brought under control.

A second reason ischemic pain serves as a good model to study pain is because ischemia can occur in a wide range of pathologies, such as limb ischemia in peripheral vascular disease or post-operative intestinal infarction. Similarities in the pattern of pain responses may be found among the various types of ischemias.

Thirdly, investigation of the problem can be relatively unobstrusive and inexpensive. Physiological and behavioral data is collected at frequent intervals as part of routine treatment and intensive surveillance by the nurses. In other words, the nature of the care facilitates data collection.

The various waves of immigration of the past two decades are bringing clients from increasingly more diverse cultures to American health care facilities. Hence, an even wider range of pain behaviors may be seen. Nurses caring for these clients need to understand cultural variations in pain responses in order to assess the pain accurately and then deliver culturally-appropriate therapeutic interventions. Yet, there is a relative paucity of studies addressing the concept of pain from a cultural perspective.

The cross cultural differences in the nursing care needs of clients have been recognized by both national and state level nursing organizations. The generation of knowledge to insure "that the care needs of.... individuals from diverse cultures ....are met in effective and acceptable ways" has been identified as a research priority by the American Nurses Association (1985, p.4). Similarly, a

California Nurses Association (1987, p.14) position statement supports utilizing "..culturally-appropriate delivery methods."

Hispanics present a potentially significant model for studying the cross cultural discrepancy of pain behaviors. One reason is the size of this population. Today the nation's 18 million Hispanics make up 7% of the total U.S. population (Bureau of Statistics, 1984). The U. S. Census Bureau predicts that Hispanics will surpass blacks to become the largest minority not long after the turn of the century (San Jose Mercury News, 1987). In California, the largest minority is classified as of Mexican origin, accounting for 15% of the population (Bureau of Statistics, 1982).

In addition, significant cultural differences in the meaning, causation, and treatment of pain between Hispanics and the dominant Anglo culture in the U.S have have been reported (Fabrega, 1980; Kay, 1972; Rose, 1978). No previous study, however, has focused on the expression of solely one type of pain within one subgroup of Hispanics, such as those patients of Mexican origin.

In Mexico, as in other developing countries, cardiovascular disease (CVD) is rapidly replacing parasitic intestinal diseases as the second (Secretaria de la Salubridad y Assistencia, 1984) or third (Pan American Health Organization, 1982) leading cause of death. In 1970, enteritis and diarrheal diseases ranked 2nd and heart disease ranked 4th as the most prevalent causes of death in

Mexico. By 1981, however, that order was reversed. Although questions have been raised regarding the validity and accuracy of some of these figures, they are nevertheless the best available. Also, this change is consistent with the findings from many developing countries worldwide, which show that as progress is made against the infectious and parasitic diseases, the death rate rises from chronic illnesses, such as heart disease and cancer (Dodu, 1984).

Purpose of the study

The purpose of this study is to describe and analyze the pain behaviors exhibited by Mexican patients in response to acute myocardial ischemic pain. Ultimately, these findings will be compared with other cultural groups in response to the same pathology. This study will thus serve as a component of a larger investigation of cross cultural variations in pain behaviors and pain management strategies.

Results of this study may contribute to nursing science by increasing our knowledge about assessing pain by elucidating the physiologic and behavioral correlates of the pain responses in one culture. Subsequent comparative studies in other cultures may contribute to answering the question of whether cultural differences do exist. Furthermore, ineffectual nursing interventions can be identified and revised nursing interventions can then be tested in the clinical setting. The ultimate goal of both nursing care and research is effective pain management for patients from all cultures.

CHAPTER 2

THEORETICAL FRAMEWORK: PAIN AS A PHYSIOLOGIC RESPONSE

The theoretical framework of a study provides a model of structured, interrelated concepts that guide the interpretation of the study's results. However, in order to study the phenomenon of pain responses, a number of theories need to be explored. Pain theory has been evolving for more than two millennia. Although it has been defined from a number of positions, no single theory yet integrates all the diverse concepts and mechanisms necessary to explain the complex nature of this phenomenon.

Pain Theories

Three classical views of pain -- affect, specificity, and pattern theories -- have provided the bases for the more contemporary "gate control" mechanism of pain. More recently, the discovery of endorphins has subsequently provided information for the further evolution of pain theory.

Affect theory

The most enduring hypotheses date back to Aristotle (384-322 BC), who postulated that pain is the antithesis of pleasure (Wolf, 1980). Proponents of the contemporary affect theory of pain, while acknowledging the importance of physical sensation, primarily describe the psychological and

sociocultural aspects of the pain experience. They attribute the amount and quality of pain to a number of variables, such as anxiety (Beecher, 1969; Schalling, 1985), suggestion, past experience (Beecher, 1956; Holm, Cohen, Dudas, Medema, & Allen, 1989) and the meaning of pain to an individual in a specific situation (Leventhal & Everhart, 1979; Zborowski, 1969).

Specificity Theory

The classical specificity approach has its roots in the hypotheses of Descartes (1664) and later of Muller (1842) and von Frey (1895). In this theory, a direct anatomical and physiological connection between peripheral pain-specific receptors and a pain center in the brain is proposed. According to this proposition, when specific peripheral sensory nerve fibers are given a stimulus, they respond by transmitting an impulse by way of specific pain fibers and pathways directly to the cerebral cortex for interpretation. The existence of such pathways implies that stimulation of certain nerve fibers must always elicit pain and only the sensation of pain (Melzack & Wall, 1977).

To date, a specific structural feature that would distinguish nociceptors (pain sensing fibers) from all other types of somatic and visceral free nerve endings in the periphery has not been identified (Casey, 1982), nor has the existence of a specific cortical pain center been clearly proven (Mense, 1983). Also tending to refute this theory is the occasional occurrence of pain in the clear absence of a

complete neurological pathway. Common examples in the clinical setting include phantom limb pain, peripheral neuralgias and causalgias. In addition, the specificity theory fails to explain the effect of such variables as denial of pain, past pain experience, and cultural influences on the pain response.

Pattern Theory

The third classical explanation of a mechanism of pain developed as a reaction against the hypotheses of the specificists. In 1894, Goldscheider claimed it was the intensity of the stimulus and the summation of the action potentials that were the critical determinants of pain. According to this theory, all nerve fibers are essentially the same, so it is the intensity and frequency of the stimulation that produces the pattern of pain. Also proposed was a system of large and small fibers converging and summating the impulse on the dorsal horn of the spinal cord before transmitting the impulse to the brain (Noordenbos, 1959; Sinclair, 1955; Weddell, 1955). Subsequent physiological evidence, however, has revealed a high degree of specialization of receptor fibers, contradicting the non-specific nature proposed by the pattern theorists (Melzack & Wall, 1962).

Gate Control Theory

In 1965, Melzack & Wall combined elements of the three classical theories and introduced the concept of a "gate control" system, which modulates both incoming afferent

impulses and descending signals from the cerebral cortex. This theory is based on the assumption that impulses transmitted along the sensory afferent nerves, such as the large (A-beta and A-gamma) and small (A-delta and C) fibers, are eventually conducted to the substantia gelatinosa (SG) and the central transmission (T) cells located in the dorsal horn of the spinal cord (Melzack & Wall, 1965).

The theory has several stages. First, the substantia gelatinosa (SG) function as the gate control system by modulating the impulses before they are conducted to the transmission cells (Melzack & Wall, 1965). Stimulation from the large fibers, carrying impulses from the mechanoreceptors and the baroreceptors, act directly on the presynaptic axon terminals of the SG cells -- either to block impulses in these terminals or to decrease the amount of neurotransmitter released. This action closes the "gate," decreasing the level of transmission to the T cells and subsequently to the cerebrum. Conversely, impulses from the small A delta and C fibers, which carry painful stimuli, opens the "gate." This facilitates the transmission of impulses to the SG and T cells, and consequently to the cerebrum (Mense, 1983).

An everyday example of the gate control theory in action is the rubbing of a mildly injured area in an attempt to relieve the pain. The rubbing causes stimulation of the mechanoreceptors, sending impulses along the large fibers. The barrage of impulses coming from the large fibers then

overrides the pain impulses arriving at the SG cells via the small A delta and C fibers.

A second proposition of the gate control theory states that a central control system receives impulses from the ascending fibers of the dorsal column, integrates a response, and also transmits impulses back to the gate control system via the descending fibers. In this manner, cortical processes, such as evaluation of input in terms of past experience, exert control over both the motivational and sensory discrimination systems (Melzack & Casey, 1968).

A third proposition states that both the T cells and the central control processes influence an action system, which comprises the behavioral and motor mechanisms responsible for the pattern of overt responses to pain. Gate control theory thus suggests that pain phenomena are ultimately determined by interactions among the three systems: sensory, motivational and evaluative (Melzack & Wall, 1970).

The more recent discovery of endorphins provides a further explanation of the mechanism of pain modulation, originally outlined in the gate control propositions. Naturally-occuring peptides with opiate activity, i.e., producing an analgesic effect, were first isolated in the pituitary gland. The generic term "endorphin" -- a contraction of endogenous (from within the organism) and morphine -- was formed to name these substances. Since their first discovery, many different types of endorphins have

been isolated. They have been found to exist primarily in the central nervous system, including the dorsal horn of the spinal cord, the site of the proposed "gate control system" (Terenius and Tamsen, 1982). However, the precise role of endorphins and beta-enkephalin in the syndrome of angina has yet to be identified (Bach, Fahrenkrug, Jensen, Dahlstom, Ekman, 1987; Sheps, Hinderliter, Bragden, Adams, Herbst, & Koch, 1988).

More than any other model, the gate control theory of pain mechanisms emphasizes a multidimensional approach to the understanding and management of pain. The physiological aspects of the theory are also more highly developed and continue to stimulate research that tends to validate its postulates. The psychological tenets of the theory, however, are more rudimentary and represent a challenge to researchers to investigate further the cognitive and affective variables that influence the response to pain.

Pain as a Physiological Response

When pain is described using physiological concepts, it is defined as a sensory response to noxious stimuli or tissue damage (Lim, 1970, NIH, 1986; Perl, 1984; Zimmerman, 1984). In 1906, Sherrington observed that pain is usually evoked by events that are destructive of body tissue. He introduced the term "nociception" to describe the neural processes involved in the recognition of painful stimuli. Currently, an afferent sensory neuron is defined as

nociceptive if it "shows a strong response to stimuli that produce pain in humans and the equivalent reactions in animals (retreat, defense reflexes and vocalization)" (Mense, 1983). This neurophysiological response to pain can be examined by studying its components: the stimuli, receptors, neural pathways and the physiological responses to pain.

Peripheral pain receptors

The sensory receptors that respond to pain are generally free nerve endings located in the surface of the skin, deep tissue and visceral organs. These receptors are not specific for pain, since they also respond to mechanical and thermal stimuli. Nor are the free nerve endings the only pain receptors, since intense stimulation of most sensory receptors will elicit pain (Afifi & Bergman, 1986).

Specific nociceptors were first isolated by Zotterman in 1936, when he made direct recordings from the lingual nerve fibers in a cat after applying heavy pressure or a jet of hot water. Action potentials were recorded on both the thinly-myelinated A delta fibers and the small, non-myelinated C fibers of the sensory afferent nerves. These were labeled "pain fibers" (Zotterman, 1936).

Similar results were found in humans, and expanded on the discrimination of these two types of fibers (Burgess & Perl, 1973; Collins, Nulsen, & Randt, 1960). When the A delta fibers alone were stimulated, the subjects complained of sharp, pricking pain. When the C fibers were activated,

the pain changed, becoming dull and burning in nature. In contrast, the large A beta and A gamma fibers did not respond to noxious stimuli, but have since been implicated in the modulation of the stimulation at the level of the spinal cord (Melzack & Wall, 1965).

In the viscera, the nociceptors lie within the organs themselves. Specifically, in the heart, the sympathetic nervous system serves as the primary pathway for the afferent nociceptive impulses. Cardiac pain impulses originate at the terminal sympathetic receptor sites within the myocardium. Figure 1 illustrates their routes of transmission through the ganglia in the sympathetic chain before terminating in the spinal cord at the level of T1 through T3 or T4 (Afifi & Bergman, 1986; Carpenter, 1984; White, 1957).

Types of nociceptive stimuli. Peripheral nociceptors can respond to a variety of stimuli in their microenvironments. Strong mechanical, thermal or chemical stimuli can initiate an action potential in these fibers (Zimmerman, 1984). However, not all nociceptors respond alike. Unlike cutaneous tissue, the viscera are not sensitive to cutting, heat and cold. Rather, the nociceptors in visceral organs, such as the intestines and heart, respond to ischemia, spasm, distention and stretching (Afifi & Bergman, 1980).

The most typical cardiac pain is due to acute irreversible ischemia (myocardial infarction) or recurrent

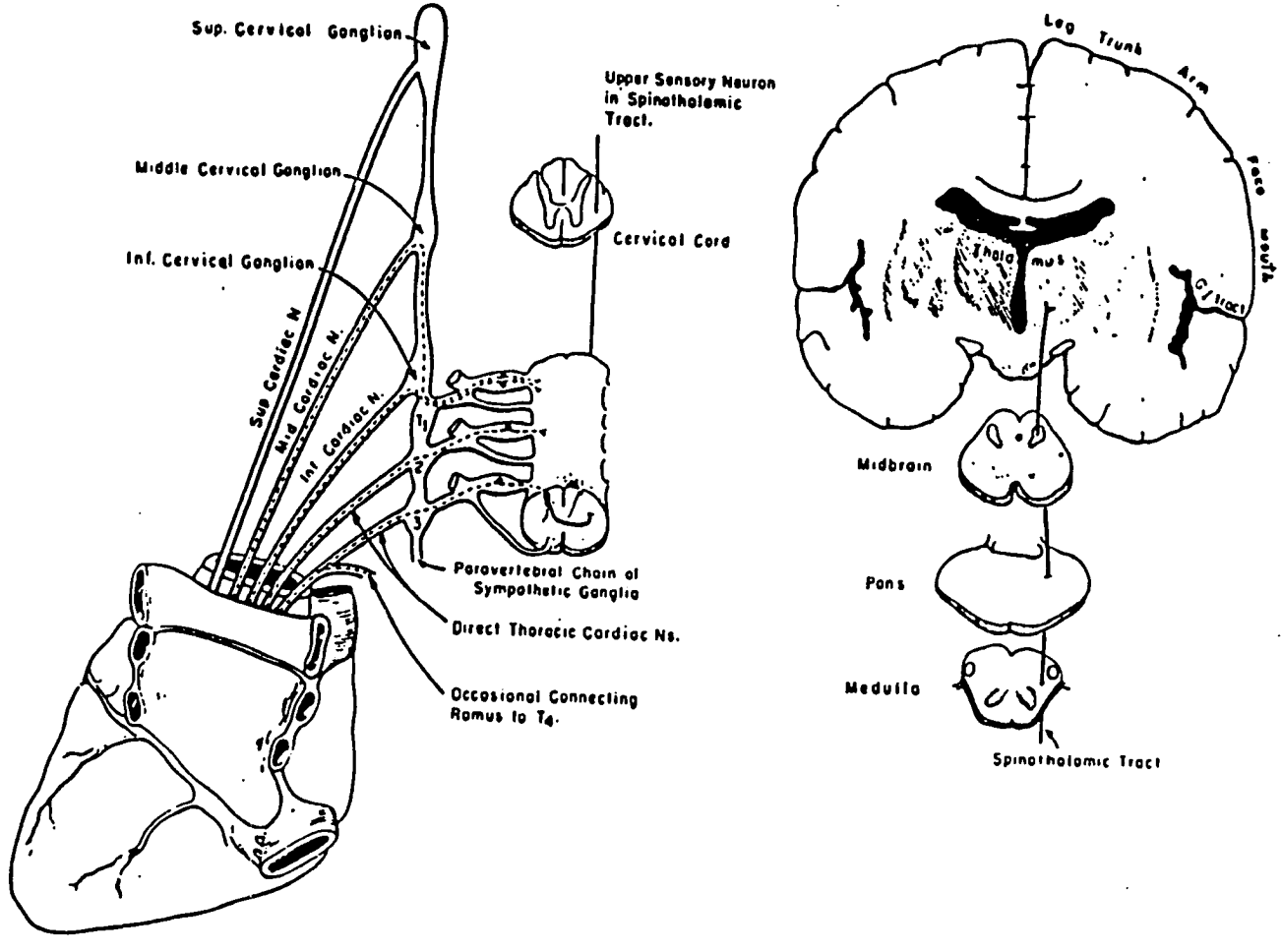

Figure 1. Diagrammatic representation of the cardiac pain pathways. Pain from coronary insuffiency in the left ventricle is transmitted centrally via the cardiac nerves. Reprinted from White, J. C. (1957). Cardiac pain: Anatomic pathways and phsiologic mechanisms. Circulation, 16, p. 646, with permission of the American Heart Association.

reversible ischemia (angina pectoris). The pathophysiology of the specific pain of myocardial ischemia and infarction has been ascribed to at least two mechanisms: the action of chemically noxious stimuli on the myocardial nociceptors, and the mechanical stimulation of these receptors by increased diastolic pressure in the left ventricle during an anginal episode.

Chemical stimuli. A wide variety of chemical substances have been implicated in the initiation of a nociceptive response. In vascular and myocardial ischemia, possible candidates as these chemical stimuli include the following: increased concentrations of extracellular hydrogen and potassium ions, lactic acid, proteolytic enzymes, histamines, serotonin, kinins such as bradykinin, prostaglandins, and endogenous catecholamines. (Afifi & Bergman, 1986; Chaudry, 1985; Del Bianco, Del Bene, & Sicuteri, 1974; Evers, Murphree, Saffitz, Jakschik, & Needleman, 1985; Lindahl, 1974; Mela, 1982; Mergner, Mergner, Yim, Chang, & Trump 1979; Romson, Hook, Kunkel, Abrams, Schork, & Lucchesi, 1983; Schomig, Dart, Dietz, Mayer, & Kubler, 1984; Uchida & Murao, 1974a; Werle, 1972; Zimmerman, 1984).

Animal studies of myocardial ischemia show an accumulation of hydrogen ions and a significant reduction in intracellular stores of glycogen within 30 to 60 seconds after coronary ligation (Chaudry, 1985; Saba & Jaffee, 1980; Sobel, 1974). In normal states, glucose and free fatty acids

provide the heart with a source of energy in the form of adenosine triphosphate (ATP). Large amounts are used to provide metabolic energy for the contractile activity of the heart. In the event of ischemia, however, glucose delivery is reduced and energy production is changed to the much less efficient mechanism of the anaerobic pathway, with severely reduced amounts of ATP being produced. Lactic acid accumulates as a by-product of anaerobic glycolysis and the resultant acidosis contributes to further cell function depression, such as decreased myocardial contractility (Chaudry, 1983; Kubler & Spieckermann, 1970).

Within minutes of coronary occlusion, marked electrolyte imbalances also occur in the myocardium, due to changes in cell membrane permeability. Animal experiments have demonstrated acute increases in the potassium levels of the coronary sinus blood draining the ischemic area (Jennings, Baum, & Herdson, 1965). The lack of ATP to drive the sodium-potassium pump causes large amounts of intracellular potassium to be lost.

Ischemia provokes a local activation of kinins and serotonin, both powerful vasoconstrictors and pain-producing substances. Serotonin (5-HT), in particular, plays an important role in circulatory disorders such as myocardial thrombosis. In such states, 5-HT is released from the platelets that are aggregated at the site of the thrombosis. Furthermore, both bradykinin and serotonin potentiate the

pain-producing activity of histamines and potassium (Del Bianco et al, 1974; Sicuteri, Franchi, & Michelacci, 1974).

The precise mechanism by which these noxious stimuli activate the nociceptors is not fully known. It is hypothesized, however, that these substances accumulate during ischemia as a consequence of tissue and capillary damage. Due to the lack of an adequate blood flow, they are not diluted and removed from the ischemic zone. Subsequently, these accumulated substances cause a change in membrane permeability of the nociceptors. The resulting influx of positive ions raises the membrane potential to the threshold level, thus initiating an action potential along the neuron (Afifi & Bergman, 1986; Burgess & Perl, 1973; Casey, 1982; Del Bianco et al, 1974; Guyton, 1981; Lim, 1970).

Mechanical stimuli. Although cardiac afferent nerves contain both thinly-myelinated and unmyelinated fibers, most of the cardiac sensory activity observed thus far arises from activity in the A delta fibers, which also respond to direct mechanical pressure during the normal course of the cardiac cycle (Brown, 1967; Brown & Malliani, 1971; Malliani, Recordati & Schwartz, 1973; Uchida, Kamisaka, Murao, & Ueda, 1974; Uchida & Murao, 1974b).

During coronary occlusion and myocardial ischemia, the activity of the cardiac mechanoreceptors reportedly increases significantly. It is postulated that dilatation of the ventricles and the mechanical stimulation caused by

increased left ventricular pressure account for this activity (Brown & Malliani, 1971; Procacci, Zoppi, & Maresca, 1974; Uchida & Murao, 1974b).

In summary, much of the pain research devoted to peripheral nociception has focused on cutaneous tissue rather than visceral organs, and peripheral vascular ischemic pain more than myocardial ischemic pain. However, the degree of similarity in the phenomena has led to inferred similarities in physiological mechanisms. Although the precise characteristics of the nociceptors involved in myocardial ischemic pain continue to remain uncertain (Perl, 1984), strong chemical and mechanical stimuli have been implicated as the initiators of the nociceptive activity in the myocardium.

Spinal Cord Processes

After an action potential has been initiated at the terminal receptor sites, it travels toward the spinal cord by way of the afferent sensory fibers. Cardiac afferent fibers terminate in the dorsal horn of the thoracic spinal segments T1 through T4, as seen in Figure 1.

Dorsal horn. Both anatomically and physiologically, the dorsal horn of the spinal cord is similar to a central railroad switching station -- receiving, coordinating and transmitting multiple neural impulses. Within this area of laminated gray matter, both mechanopressive and nociceptive afferent fibers terminate and synapse with interneurons, such as the small substantia gelatinosa (SG) cells in Lamina

II and the larger transmission (T) cells in Lamina V. Some impulses are then transmitted to the cell bodies of neurons whose axons cross over to the contralateral side of the cord and ascend to the thalamus via the large spinothalamic nerve fibers (Carpenter, 1984; Willis & Grossman, 1977).

Motor nociceptive reflexes. Within the spinal segments, afferent fibers also synapse directly with the efferent motor neurons exiting the ventral horn. This pathway, called a reflex arc, provides the transmission route to initiate the motor nociceptive reflexes (Guyton, 1971; Vander & Sherman, 1980). In the case of myocardial ischemic pain, these motor responses include the withdrawal reflex of pain and reflex muscle rigidity, e.g., guarding of left arm or shoulder.

Referred pain. The "misinterpretation" of referred pain, such as that seen in angina pectoris, also has its origins in the dorsal horn of the spinal cord. Electrophysiologic studies have supported the hypothesis that sensory afferent fibers from both the skin and the viscera converge on the same spinal neurons in Lamina V (Fields, Meyer, & Partridge Jr., 1970; Hancock, Rigamonte, & Bryan, 1973; Pomeranz, Wall, & Weber, 1968).

In the case of referred left shoulder and upper arm pain of angina, the axon terminals of the visceral afferent fibers from the heart converge at the same thoracic spinal cord segments as those cutaneous sensory afferents from the left shoulder and arm, as illustrated in Figure 2. Also,

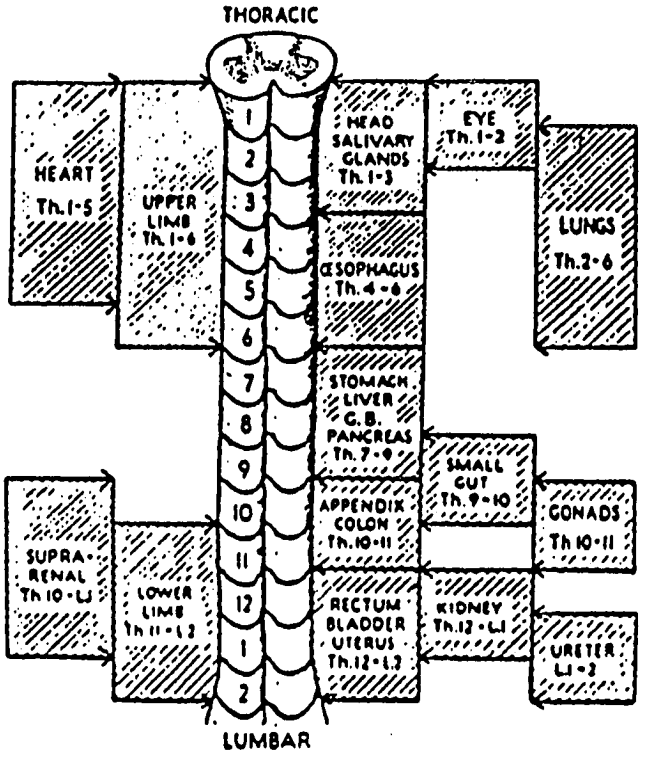

Figure 2. Relationship between the spinal levels of various sympathetic nervous system connector cells. Note that the sympathetic innervation of the heart overlaps with the upper limbs, head, lungs and esophagus. Reprinted from Anatomy, Regional and Applied, 7th ed. by R. J. Last, p. 35, with permission of Churchill-Livingstone, 1984.

these fibers may turn up or down a segment before they synapse in the cord, thus confusing their origin.

The line of demarcation from each dermatome -- the region projecting from each dorsal root (Figure 3) -- is not sharp and fixed. Considerable overlap exists between the regions. Such overlap would help explain the variable descriptions of referred anginal pain, such as to the jaw, mandible, arms and shoulders. Since these dorsal cells are usually activated by cutaneous input, the brain misinterprets the discharge as arising from the cutaneous receptors, giving rise to the perception of pain in these areas (Carpenter, 1984).

The dorsal horn continues to be the subject of investigation of pain mechanisms because of its recently discovered role in the modulation of descending impulses. This role will be discussed in a subsequent section.

Ascending tracts. After synapsing with the interneurons in the dorsal horn, the pain impulse is transmitted centrally by means of large bundles of interwoven fibers. These fibers form the ascending pathway for nociceptive impulses by way of the lateral spinothalamic tract. The cell bodies of this tract are found primarily in laminae I, V, VI VII, and VIII of the dorsal horn. The axons of these neurons cross over to the contralateral side of the cord and form the tract. Once this tract reaches the brainstem it begins to send branches into the reticular formation of the medulla, pons and midbrain. The main fibers terminate,

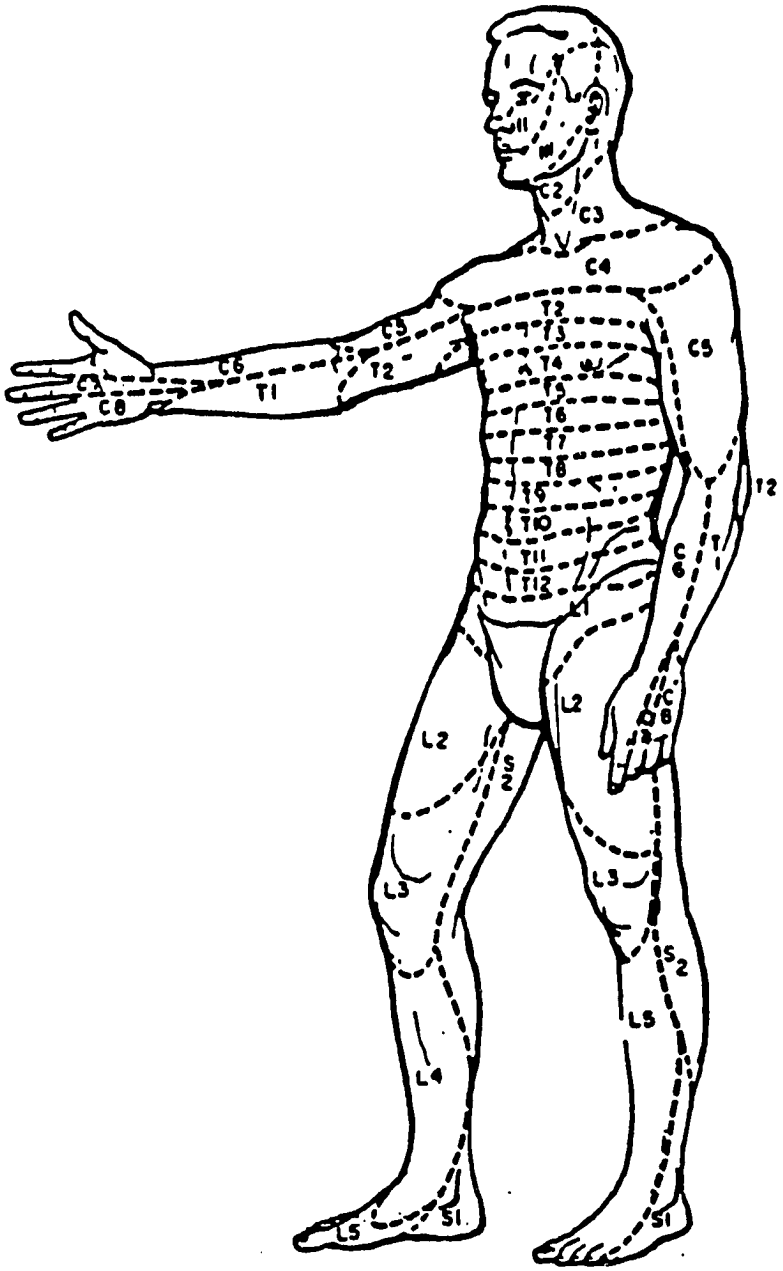

Figure 3. Segmental innervation of the skin dermatomes. Each dorsal (sensory)spinal root innervates one dermatome. Reprinted from C. R. Noback & R. J. Demarest (1981). The Human Nervous System. Basic Principles of Neurobiology. 3rd edition., with permission of McGraw-Hill Book Company.

though, in the ventral posterolateral (VPL) nucleus of the thalamus (Carpenter, 1978; Mense, 1983).

Although the anterolateral spinothalamic tract has been considered the classical "pain pathway," there is evidence that other ascending tracts, such as the spinoreticular and spinotectal pathways, also carry nociceptive information. Another one of these is the Secondary Ascending Visceral Gray ascending tract, which transmits pain stimuli from such visceral organs as the heart (Carpenter, 1978; Casey, 1982; Kerr, 1975).

Central transmission and integration

Much information on cerebral involvement in pain reception and mediation is still rudimentary. The ascending fibers have numerous points of termination and subsequent relays, making a theory of a central pain center or single pain tract implausible. Once the impulse reaches the brainstem and thalamus, several courses can be taken.

Sensory discriminative pathway. The sensory appreciation of pain occurs in the parietal lobe of the cerebral cortex. All ascending fibers terminate in the ventral posterolateral (VPL) nuclei. These neurons subsequently relay impulses to the somatosensory areas in the postcentral gyrus of the parietal lobe. In the primary somatosensory area, histologically composed of three narrow strips of cortex (Areas 3, 1, 2 of Brodmann), all regions of the body are represented. The cortical area that is anatomically related to sensations from the heart and arm,

like those experienced with angina, lies approximately four to five centimeters from the dorsal exit of this sensory strip from the paracentral lobule (Afifi & Bergman, 1986; Carpenter, 1978).

This primary somatosensory area of the cerebral cortex serves the function of discriminating and localizing the site of sharp, well-defined pain. However, pain can still be perceived after ablation of the somesthetic cortex, indicating that this area is not solely responsible for pain perception (Afifi & Bergman, 1986).

A secondary sensory association area, located in adjacent sections of the parietal area of the cortex, appears to contribute to the analysis of the more intricate patterns of the painful sensory experience. More complex meanings and associations are added here. The exact mechanisms of this integration remain unknown.

Affective evaluative reaction. The thalamus plays a central role in integrating sensory input. Besides its projections to the somatosensory areas in the parietal lobe, the thalamus relays nociceptive input to the frontal cortex for intellectual interpretation and the affective reaction to pain. The thalamus also transmits nociceptive information to the limbic system. One of its structures, the hypothalamus, is concerned with both the behavioral and emotional reaction to pain, as well as the integration of autonomic responses to painful stimuli. The precise origins

and course of integration and the role of the hypothalamus in nociception are not well understood.

Almost nothing is known about how nociceptive input is coordinated and then converted into a pattern of neuronal discharges that result in an action or a behavior, such as a reaction to pain. The areas of the brain suspected of having the most integrative functions are the least understood. And while the sensory aspect (pain threshold) is similar in most individuals, the affective aspect (pain tolerance) is quite variable -- depending on situational, personality and cultural factors. As a result, this conversion of thinking and conscious intent into cortical impulse patterns and behaviors remains, for the present time, far beyond the limits of our understanding (Schmidt, 1985).

The Modulation of Pain

Modulators of the pain response are factors that interrupt and in some way change the course of transmission of nociceptive impulses. Clinical experience confirms that there are both central and peripheral modulating factors. For example, rubbing an injured area often lessens the pain; or, in the case of great emotional excitement or stress, even severe injury causes little or no pain. Activity involving such modulation has been observed at both the segmental level of the spinal cord and in supraspinal areas in the brainstem and limbic system (Perl, 1984).

Afferent modulation. Empirical evidence suggests that various types of manipulations, such as massage,

transcutaneous electrical nerve stimulation (TENS) and acupuncture, may relieve pain from injury or disease (Perl, 1984). In these cases, the modulatory mechanism is attributed to the stimulation of the thick, myelinated fibers, which inhibit the transmission of nociceptive input from the thin fibers at the level of the dorsal horn (Fields, 1984).

Descending influence. Descending control of sensory input has also long been recognized (Head & Holmes, 1911). There are many possible sites where impulses from higher centers -- particularly the cortex, thalamus, and brainstem -- can be interrupted and modified as they descend to the dorsal horn of the cord (Hilgard, 1978).

Animal models and clinical experience have demonstrated that peripheral analgesia is produced by electrical stimulation of various subcortical areas, including the thalamus and the hypothalamus. But the most potent and generalized antinociceptive effects are noticed when the periaqueductal gray (PAG) area of the midbrain (Reynolds, 1969) or the medullary midline raphe nuclei (Liebeskind, 1976) are stimulated. These findings demonstrated central areas that can affect peripheral pain responses.

At the level of the medulla, both the reticular formation cells and the serotonin (5HT)-containing nucleus raphe cells serve as possible modulation pathways, since they both receive input from the PAG in the midbrain. The axons of these neurons descend by way of the dorsolateral

fasciculus (DLF) and terminate in the lamina of the dorsal horn of the spinal cord -- the same area where afferent nociceptive impulses also converge. The reticular formation neurons, with their ascending projections to the thalamus and their descending projections to the spinal cord, may mediate both sensory and motor functions related to pain and the pain response (Casey, 1982). By utilizing these descending pathways from the cortex and subcortical regions, various cognitive, evaluative and affective factors exert control over ascending stimuli.

Opiate receptors and endorphins. Further exploration of the periaqueductal and periventricular regions led to the discovery of opiate binding sites. First, morphine injected directly into the periaqueductal gray was found to markedly reduce the withdrawal reflexes to peripheral noxious stimulation (Lewis & Gebhart, 1977; Pert & Yaksh, 1974; Sharpe, Garnett & Cicero, 1974; Tsou & Jang, 1964). Later, specific opiate binding sites were identified in several subcortical areas and in the dorsal horn of the cord. These sites were found to be most dense in the limbic system, medial thalamus and the periaqueductal grey (PAG) of the midbrain (Kuhar, 1973; Pert & Snyder, 1973; Terenius, 1973) and in the afferent terminals of the substantia gelatinosa in the dorsal horn (LaMotte, 1976).

Once the receptor sites were found, the search for endogenous substances with morphine-like properties began. The generic term endorphin was given to those peptides with

opiate activity. First isolated were the enkephalins, which were found to be widely distributed throughout the central nervous system, particularly in the PAG of the midbrain, in the limbic system, hypothalamus, and dorsal horn of the cord (Hughes, 1973). All of these sites are points of intersection for nociceptive impulses and hence possible sites for modulation.

Another endorphin, named dynorphin, is found in high concentrations in the neurohypophysis, the hypothalamus and the spinal cord. Dynorphin is reported to be 300 times more potent than morphine if injected into the brain (Goldstein & Tachibana, 1979).

In the spinal cord, the majority of endorphins are released from the terminal fibers of the interneurons in the laminae of the dorsal horn. Their exact mechanism remains unknown; however, they are thought to modulate the effect of another peptide, Substance P, which is also present in this area and is believed to facilitate the transmission of pain. The present hypothesis, not yet validated by electron microscope or other methods, is that enkephlins block the release of Substance P by means of presynaptic inhibition (Terenius & Tamsen, 1982).

There is additional speculation about the effect of endorphins on the neural functions of mood, emotion and behavior. This speculation arises because of the widespread distribution of endorphins in the limbic portion of the brain and because of the numerous side effects opiate

alkaloids have on neural functions. But to date, the best evidence for the involvement of the endorphin-opiate receptor system exists only for sensory modulation.

The anatomical and physiological mechanisms of the endogenous pain modulating processes occur at three major levels. In the midbrain, the periaqueductal gray area is rich in endorphins and opiate receptor sites and responds to stimulation-produced analgesia. In the medulla, the major neurons extend between the PAG and the dorsal spinal cord. Finally, at the spinal level, both endorphins and substance P are found at the site of intersection of the afferent nocioceptive input and the efferent impulses from the brainstem. The neurological structures and processes in these three areas are therefore implicated in the modulation of pain.

Autonomic response to myocardial pain

A major physiological response to pain is the activation of the autonomic nervous system (Mitchell & Lausten, 1981). In the heart, this system serves as both the conduit for afferent sensory (pain) impulses from the heart, as well as the efferent route for the sympathetic response back to the heart.

The autonomic nervous system regulates cardiac function from numerous sites and has the ability to initiate a coordinated reaction -- such as the "fight or flight" sympathetic response -- when intense noxious stimuli are registered. Stimulation of the sympathetic response elicits

multiple physiologic changes, which contribute to many of the overt signs and symptoms observed during anginal ischemic pain.

Sites of influence. The spinal autonomic reflex arc (Figure 4) is an example of the first and simplest connection between the cardiac afferent and efferent neurons. Myocardial nociceptive impulses are transmitted through the afferent fibers to the dorsal horn of the spinal cord. There they synapse at two points: first with the interneurons and then with the preganglionic fibers of the efferent sympathetic neurons. Their axons exit by way of the ventral horn and terminate in the thoracic sympathetic ganglia. A third synapse within these autonomic ganglia transmits the impulse along the postganglionic sympathetic fibers, ultimately terminating in their effector sites, such as the SA node or myofibrils (Janig, 1985).

Additional spinal reflexes are shown in Figure 5. The spinal autonomic reflex of the heart is represented as the viscero-autonomic reflex (example 4). This reflex arc represents one possible route for the sympathetic response to myocardial pain.

Autonomic influence on cardiac function also originates from the brainstem and higher centers. The vasomotor center, located in the lower third of the pons and upper two thirds of the medulla, controls vascular tone, heart rate and myocardial contractility. This center, in turn, is influenced by widespread areas in the cerebral cortex and

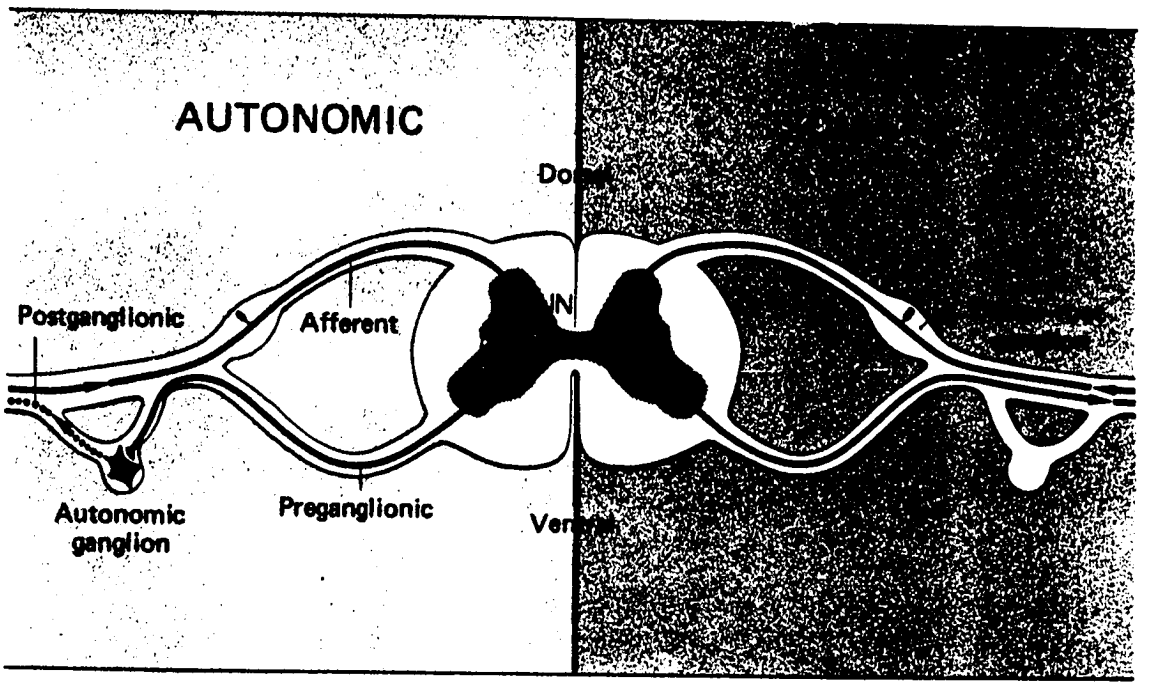

Figure 4. Autonomic reflex arc (left) compared with the monosynaptic reflex arc. IN = interneuron. Reprinted from Janig, W. (1985). The autonomic nervous system. In R. F. Schmidt (Ed.). Fundamentals of Neurophysiology. 3rd edit. p.239, with permission of Springer-Verlag.

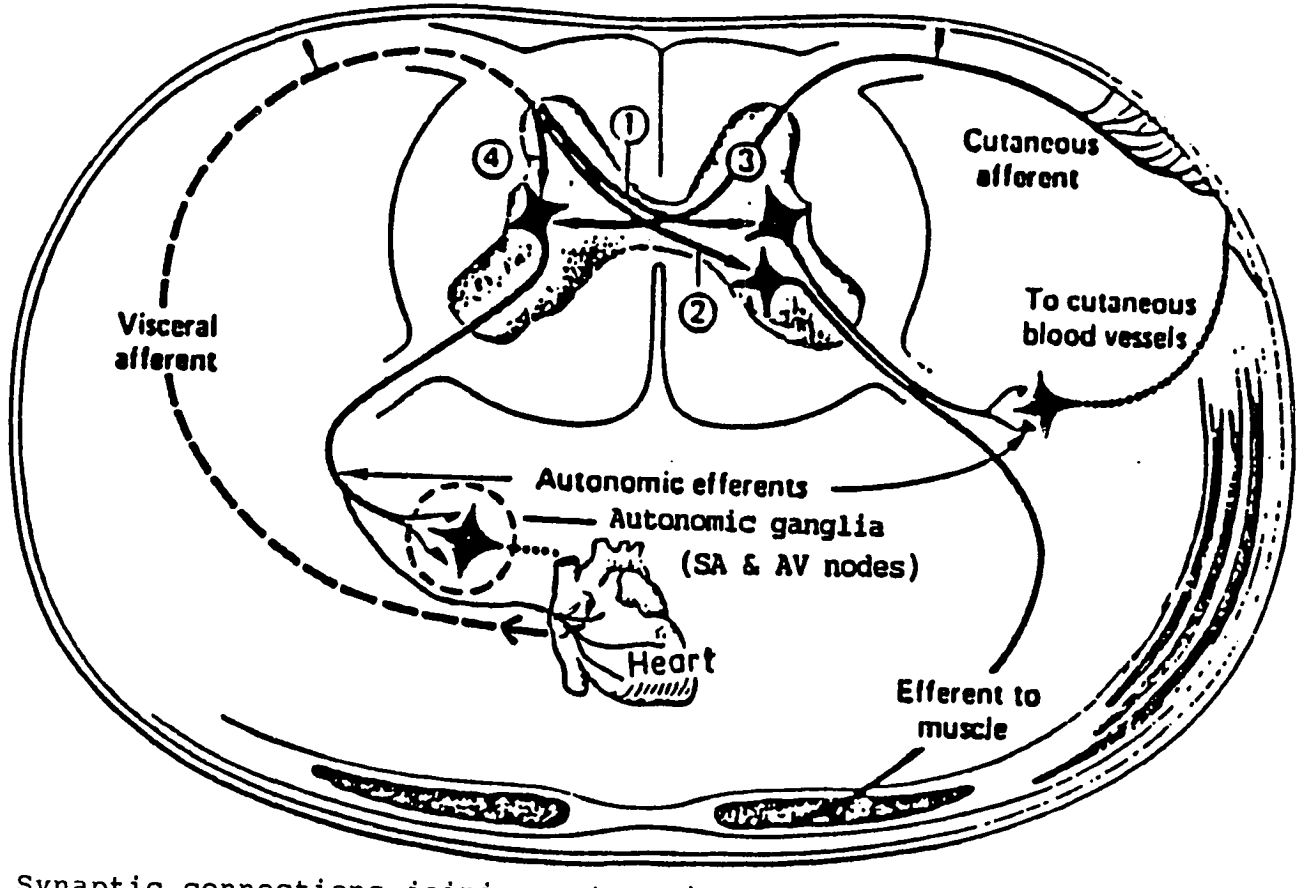

Figure 5. Synaptic connections joining autonomic and somatic efferents and somatic and visceral afferents in the spinal cord to form reflex arcs. (1) visceral-cutaneous reflex; (2) viscero-somatic reflex; (3) cutaneo-visceral reflex; (4) viscero-autonomic reflex. Interneurons in the spinal cord have been omitted. Adaptation reprinted from Janig, W. (1985) The autonomic nervous system. In. R. F. Schmidt (Ed.) Fundamentals of Neurophysiology. 3rd edit. p. 240. Reprinted with permission of Springer-Verlag.

the limbic system -- where emotional behavior, memory, and the integration of homeostatic processes, such as the fight or flight sympathetic response, occur. The hypothalamus plays a central role in integrating the autonomic response, although the exact mechanism of this integration remains unknown. The physiological explanation of how emotions, such as the fear and anxiety observed with acute myocardial ischemic pain, influence autonomic response has not been outlined (Afifi & Bergman, 1986; Carpenter, 1978; Guyton, 1981; Janig, 1985).

Mechanism of autonomic influence. Stimulation of the sympathetic system results in the release of neurotransmitters from the terminal fibers of the post-ganglionic neurons in the effector organs. In the heart, the alpha and beta adrenergic receptors are stimulated by the catecholamine norepinephrine, which is the sympathetic neurotransmitter available at the receptor sites.

Catecholamines such as epinephrine and norepinephrine are also released from the adrenal medulla when sympathetic stimulation occurs. They act to reinforce the effects of the sympathetic neurons on the heart and other organs, but the primary function of adrenal catecholamines is the mobilization of glucose and fatty acids to provide the fuel for increased activity (Janig, 1985).

Autonomic response pattern. Sympathetic stimulation of the alpha and beta receptors in the heart causes multiple

effects: an increase in sinus node discharge rate, faster AV conduction, increased automaticity, greater myofibril shortening, and increased arterial constriction (Braunwald, 1980). These increase myocardial oxygen demand and aggravate the supply/demand imbalance present during myocardial ischemia and infarction.

Clinically, the cardiac response to sympathetic stimulation is reflected in an increase in heart rate, an increased tendency to ventricular ectopy, and an increase in systemic blood pressure. Additional physiological signs of sympathetic stimulation, which also often accompany the pain of myocardial infarction, include the following: increased respiratory rate and depth, diaphoresis, dilatation of the pupils, decreased gastric motility and increase skeletal muscle tension. Many of these cardiovascular and other physiological changes observed after sympathetic stimulation are also evident during myocardial ischemic pain. Effective pain management aimed at decreasing the sympathetic input on the cardiovascular system results in a decrease in myocardial oxygen demand and restoration of a more optimal supply/demand ratio.

Summary

Pain as a physiological phenomenon has been investigated extensively over the past century. Neuronal structures and processes involved in the recognition and transmission of painful stimuli, as well as some of the ascending and descending spinal tracts carrying nociceptive

impulses have begun to be be outlined. Furthermore, the recent discovery of endorphins has provided a major impetus for the continued study of the physiological and biochemical mechanisms of the phenomenon of pain.

However, major areas of the central nervous system, such as the limbic system, brainstem and cerebral cortex, influence the response to pain in ways that have not yet been completely explained in physiological terms. Present evidence indicates that these central areas integrate and modulate the pain response, but their mechanisms have not been described. There are large gaps in knowledge about these central processes, especially between the mechanism of nociceptive stimulation and the integration of a coordinated behavioral, motor and sympathetic response to pain. At present, physiological mechanisms fail to adequately explain the wide variation seen in the coordinated behavioral response to pain.

CHAPTER 3

THEORETICAL FRAMEWORK:
PAIN AS A PSYCHOSOCIOCULTURAL RESPONSE

Sensory perception is neither solely sufficient, nor always necessary, for the experience of pain. An emotional, reactive component of pain has also been acknowledged since at least the time of Aristotle. The classical division of pain into two components -- somatosensory (body) and reactive ("mind") -- has served as a convenient framework to examine the multifaceted nature of this phenomenon. However, a strict separation of these two components should be avoided, since this constructs an artificial duality that neglects their interdependence and integrative mechanisms.

In the past, it was assumed that there was a 1:1 relationship between the sensory perception of pain and the expression of it. Experimental and clinical studies have shown, though, that both psychological and sociocultural factors influence the style of communicating or expressing the complaint of pain (Sternbach, 1986).

Psychological Variables

Opinions vary as to the ability to objectively document and measure the psychological correlates of the response to painful stimuli. While some investigators (Brown, Fader & Barber, 1973; Mumford, Newton & Ley, 1973) have concluded that the perception of pain does <u>not</u> possess psychometric

correlates, others, however, have reported that pain responsivity is correlated, in part, with a number of personality traits and psychological states.

Personality characteristics

One major determinant of pain expression appears to be the degree to which the person is extroverted or introverted. Extroversion is associated with expression of pain, whereas introversion is associated with inhibition of expression (Lynn & Eysenck, 1961; Morgan & Horstman, 1978; Sternbach, 1986).

Others have claimed a positive relationship between the amount of perceived pain and the degree of neuroticism (Bond, 1973; Lynn & Eysenck, 1961; Sternbach & Timmermans, 1975; Woodforde & Merskey, 1972). But, when both neuroticism and the degree of extroversion were correlated with perceived pain and requests for analgesia, the amount of pain expression appeared to be more a function of extroversion than neuroticism (Bond, 1973).

Others have correlated aspects of the response to pain with such personality traits as perceptual style, i.e. augmentation vs. reduction (Petrie, 1978), field dependence (Sweeney & Fine, 1965), self-concept (Luken & Ray, 1982), and trait anxiety (Elton, Vagg & Stanley, 1978). However, the inconsistency in the methods and results of these studies threaten external validity. These differences may be due to the multiple types of stimuli used (heat, cold, electrical, mechanical and ischemic) and the use of

bivariate rather than multivariate analysis. Another limitation to generalization to clinical pain is that most of these studies were conducted on healthy college-age students in experimental rather than clinical settings.

Psychiatric symptoms and disorders

The degree of pain perception appears to be affected by psychiatric disorders. Several studies have indicated that the incidence of pain as a symptom is high (61% and 65.6%) in psychiatric outpatient clinic patients, but lower (38%) in inpatients in a psychiatric hospital or unit (Klee, Ozelis, Greenberg & Gallant, 1959; Spear, 1967). In comparison to normal subjects, the perception of pain was found to be increased in neurotic patients, but decreased in those with transient situational disorders and such psychotic disorders as schizophrenia (Mersky, 1986; Petrie, 1978).

The psychological state of situational anxiety has been correlated with increased sensitivity to pain (Christensen, 1980; Elton et al, 1978; Hall & Stride, 1954). Rises in anxiety are associated with rises in pain perception, particularly in the case of acute pain (Parbrook, Steel & Dalrymple, 1973; Sternbach, 1974a). Interventions utilized to decrease anxiety, such as explanations or reassurance, tended to diminish pain perception (Egbert, Battit, Welch, & Bartlett, 1964).

Whereas pain may be a symptom of depression, depression may also be a secondary consequence of pain, particularly

with chronic pain (Bond, 1981; Sternbach, 1974b). Psychological testing of chronic pain patients usually shows them to be depressed (Krishman, France, Pelton, McCann, Davidson & Urban, 1985; Sternbach, 1974b). However, treatment of their depression usually results in the reduction of pain (Mersky & Hester, 1972; Taub & Collins, 1974). There is also some evidence that reduction of their pain reverses the depression caused by the pain (Bond, 1973; Sternbach & Timmermans, 1975).

The distinction between acute and chronic pain is necessary for the recognition of psychiatric symptoms or disorders. This is particularly important in the case of myocardial ischemic pain since it has both acute and chronic elements.

Severe acute pain, such as the type seen with an acute myocardial infarction, is usually accompanied by situational anxiety and the signs of sympathetic stimulation. Chronic pain, in contrast, is more often accompanied by depression, increased somatization and irritability (Mersky, 1986). These psychological symptoms are seen as consequences of the pain, and usually abate with pain reduction. Neuroticism is also found to be elevated in chronic pain patients, but this too decreased with pain reduction (Sternbach & Timmermans, 1975). However, in those patients who have an underlying depression or anxiety disorder, these symptoms may be exacerbated in the event of pain.

Sociological Variables

Variations in the response to pain have been attributed, in some measure, to such sociological variables as age, gender, ethnic group, religion and socioeconomic status. Group differences in sick role (Parsons, 1951) and illness behavior (Mechanic & Volkart, 1961) have been offered as possible explanations for these variations.

Age

Several studies have identified a relationship between age and pain perception, with lower sensation of pain increasing with age (Sherman & Robillard, 1964; Woodrow, Friedman, Siegelaub, & Collen, 1972). In one such study, which utilized relief of pain as an index, the investigators found that the younger subjects (<58 years old) reported more pain and less pain relief than the subjects older than 58 years of age (Belville, Forrest, Miller, & Brown, 1971).

Yet other studies have not confirmed these findings (Herlitz, Richter, Hjalmarson, & Holmberg, 1986; Weisenberg, 1977). One group of researchers reported that while tolerance toward superficial pain sensations increases with age, the tolerance toward deep pain, such as visceral and cardiac anginal pain, may actually decrease with age (Woodrow, Freidman, Siegelaub & Collen, 1972). Furthermore, in a study of the initial pain course of acute myocardial infarction, age did not appear to influence the patient's assessment of the pain or requirement for analgesics

(Hofgren, Bodestram, Johansson, Jern, Herlitz & Holmberg, 1988).

Gender

Similar studies have also identified gender as contributing to the variation in pain response. Females have been found to rate the intensity of their pain significantly higher than males (Glynn & Lloyd, 1976; Notermans & Tophoff, 1967; Woodrow et al, 1972). However, methodology limitations such as the interaction effect between the all-male experimenters and the male and female groups, as well as possible different interpretations of the visual analogue scale used, may threaten the validity of these studies.

Socioeconomic status

A relationship between socioeconomic status and illness behaviors has been reported (Koos, 1953). But whether this relationship also extends to pain behaviors still remains a hypothesis. Nevertheless, in a study of nurses' inferences of pain, the patient's socioeconomic status was consistently related to the degree of inferred pain (Davitz & Davitz, 1981). Lower class patients were generally seen as suffering the greatest pain, especially if the condition was moderate or severe. However, there was a significant interaction effect by gender and nature of illness. Hence, the socioeconomic variable represents only one portion of the nurses' belief system regarding the inference of pain.

Cultural variables

> "Being ill [in Spain] calls for loud complaint -- an exercise of Latin spontaneity rather than Anglo-Saxon self-control" (Kenny, 1962, p. 284).

Many bedside clinicians as well as laboratory investigators studying the reaction to pain have noted a cultural dimension to the pain response. Only a relatively few investigators, however, have explored this cultural dimension in any depth. A review of the literature on cross-cultural responses to pain reveals a notable scarcity of adequately-controlled experimental studies. The anthropological studies lack experimental control of pain while the few experimental studies that exist are anthropologically naive.

Experimental studies

In some of the earliest cross cultural studies, Chapman (1944) and Chapman and Jones (1944) utilized a radiant heat technique developed by Hardy, Wolff and Goodell (1940) to experimentally stimulate pain on the forehead of each subject. In one study, the pain responses of 18 Southern Blacks were compared to those of 18 Americans of North European ancestry. In the second study, Russian Jews and Italians were studied.

The Northern-European Americans were found to have the highest pain perception threshold -- the point at which pain begins -- as well as the highest pain tolerance -- the point

at which the subject winces and tends to withdraw. And while the Blacks and the Italians had similarly low pain tolerances, the Blacks tended not to complain about the pain while the Italian subjects complained loudly. Chapman and Jones concluded that there were pain sensitivity and pain tolerance differences due to ethnicity.

Several serious limitations of these studies make these conclusions questionable. First, the Americans of Northern European ancestry were all grouped together, neglecting the intercultural differences between groups from that region. Second, the investigators did not correct their results for skin temperature differences. Johnson and Corah (1963) measured significant differences in basal skin resistance between 141 white and 75 Black subjects, suggesting that there may be basic differences of certain physiological skin variables between groups.

In another cross cultural study, using a similar heat radiant technique, but this time correcting for skin temperature differences, Meehan, Stoll and Hardy (1954) found no significant differences in pain threshold for three ethnic groups. In this study, the pain responses of groups of Alaskan Indians, Whites and Eskimos were compared. However, other experimental problems, such as the use of interpreters for some of the subjects, testing of subjects in settings with dramatically different environmental temperatures, and categorizing all white subjects (from such

a heterogeneous mix as a nearby Air Force base) into one cultural group threaten the validity of these findings.

Mersky and Spear (1964) used a pressure algometer instead of radiant heat to test both cross cultural and gender differences. The pressure algometer is a device used for experimental pain induction by pressure, which is placed against the forehead or a bony surface. The study, conducted in England, consisted of 48 white males, 11 African-Asian males (colonial immigrants) and 11 white female subjects, controlled for socioeconomic class, in that they were all medical students. They concluded that both the pain perception and pain reaction threshold points were significantly lower in women than men, but that there were no cross cultural differences within the same sex. However, their use of the statistical test ANOVA instead of the t test would have made their results more plausible.

Sternbach and Tursky (1965) studied ethnic differences in the response to the pain of electric shock in 60 women, controlled for age, socioeconomic class and height-weight ratio. The groups studied included "Yankees" (Protestants of British descent), and first-generation Irish, Italians and Jews. No statistically significant differences were noted with pain threshold, but cultural differences emerged for the pain tolerance levels, with the "Yankees" recording the highest tolerance levels and the Italian subjects the lowest.

These few studies, which attempt to directly and experimentally control pain induction, offer inconclusive evidence. Methodological problems invalidate many of the conclusions drawn. In addition, the differences in the groups studied and methods used make comparisons impossible and generalizations risky. And while the pain in the laboratory setting is experimentally controlled, the meaning and setting of the pain experience is very different from the clinical situation. Despite these inadequacies, however, there is some evidence to suggest that attitudinal differences (such as high or low pain tolerance levels) tend to influence the pain response of different cultural groups.

Clinical pain studies

The anthropology literature is rich in indirect and tangential references to cultural factors in the pain response. But these references are scattered among the descriptions of the health belief systems of various cultural groups (Clark & Clark, 1980; Reizian & Meleis, 1986) and cross cultural comparisons are scarce.

Hospitalized patients. The work of Zborowski (1952 & 1969) remains the principal and classic study of cross cultural pain responses in a clinical setting. He studied 103 hospitalized subjects of four cultural groups: "Old American", Italian, Irish and Jewish. These subjects were controlled for age but not for socioeconomic status, sex nor pain-causing pathology.

A variety of qualitative methods were used in this study, including questionnaires, unstructured interviews and direct observation of patients' behaviors and manner in describing their perceptions and feelings about pain. The specific elements of the pain experience, such as its intensity, duration, quality and its interpretation and significance were compared across the four cultural groups.

From these observations Zborowski makes the following conclusions. The "Old American" tends be very precise in the description of pain and its significance, displays little emotion and prefers to withdraw from other people when in pain. The Irish patients were similar to the "Old Americans" in that they showed little emotion with pain and tended to deemphasize the pain. But they differed from that group in that they had difficulty in describing and talking about their pain.

Both the Jewish and Italian patients shared a lack of inhibitions in expressing pain, admitting freely that they show their pain and they do it by crying, moaning, complaining about the pain and by being more demanding. Both groups also preferred the the company of others, especially relatives, while they were experiencing pain. The difference between these two groups was manifested in their response to treatment. Once the pain was alleviated, the Italian patients reported no further symptoms, while the Jewish patients continued to complain after their pain had diminished.

Zborowski interpreted these differences to reflect the time orientation of their respective cultures. The Italians' present-orientation is reflected in their demand for immediate relief. A future-orientation is attributed to both the Jewish and "Old American" groups, and thus indicates a concern over the significance and implications of the pain. But unlike their Jewish counterparts, the "Old Americans" tended to be more optimistic.

The major deficiencies of this study arise from the lack of control of the pain-causing pathology as well as such intervening variables as gender, level of education and socioeconomic status. In addition, the analysis focused more on the traits in each culture that contribute to the observed behaviors rather than analyzing the discrete differences in overt behavior. Nevertheless, this work remains the cornerstone of cross cultural comparisons of pain responses.

Zola (1983) also studied the differences in pain response between 63 Italian and 81 Irish hospitalized subjects. Both males and females were included and the pain-causing pathologies consisted of 18 distinct diagnoses. In substantiating Zborowski's findings, this study concluded that the Irish more often tended to deny pain whereas the Italians would more readily admit the presence of pain. Compared to the Irish, the Italians presented significantly more symptoms, in more bodily locations, and noted more types of bodily dysfunction. Cluster analysis revealed that

the variable, which most consistently correlated highest with the "illness behavior", was the ethnic group membership of the subject.

Obstetrical patients. However, conflicting results have also been reported. Flannery, Sos and McGovern (1981) found no significant differences in the pain response to an episiotomy among 75 women in 5 cultural groups -- Black, Italian, Jewish, Irish and Anglo-Saxon Protestant. Interviewers administered 6 self-assessment measures of anxiety and pain as well as made behavioral observations. This is one of only a few studies controlling for the type of pain as well as for sex, and age. The subjects varied, however, in religion and socioeconomic status.

Dental Pain and Anxiety. In another study in which the type of pain was held constant (Weisenberg, Kreindler, Schachat & Werboff, 1975), pain anxiety and pain attitudes were studied in Black, White and Puerto Rican dental patients. No significant between-group differences were obtained in amount of pain, or the number and type of symptoms the patient experienced. But significant cross cultural differences were recorded on the State-Trait Anxiety Inventory and the Dental Anxiety Scale. The Puerto Rican patients were more anxious by most measures and most interested in denying, getting rid of, and not dealing with the pain. The White patients reported significantly less anxiety and were most willing to face and deal with the pain. The Black subjects fell between these groups. One

limitation of this study is the lack of control for socioeconomic status, and level of education, which are variables suggested to affect the pain response.

Children in pain. Children of various cultural groups have also been studied. Abu-Saad (1984) explored how Arab-American, Asian-American and Latin-American school age children perceive, describe and respond to painful experiences. The range of physical and psychological causes of pain did not differ widely among the groups, but the descriptions about the feelings when in pain varied by cultural group. The Arab-American and Latin-American children were more likely to use sensory words to describe pain, whereas the Asian-American children tended to use relatively more words in the affective and evaluative domains.

In summary, well-controlled studies on the relationship between culture and pain responses are lacking in both the physiological and anthropological literature. On the one hand, ethnographic data is rich with regard to cultural attitudes toward illness, sick role and pain behaviors, but unfortunately, it is scattered throughout the literature. On the other hand, the few physiological studies of cultural differences in the response to experimentally-induced pain have yielded conflicting results, partially because different methods of pain induction were used, and, in some cases, because their design was anthropologically naive. Findings from both of these areas reveal inconclusive and

conflicting results. Thus the question as to whether there are cultural differences in the response to pain remains essentially unanswered (Wolff & Langley, 1977). Empirical evidence from clinicians and trends in the studies conducted thus far indicate the value of pursuing the answer further.

Relevant theories of human behavior

Two disciplines provide complimentary theories that help explain and direct research on the cultural aspects of this communication of pain. Medical anthropologists have provided the idea of explanatory models of illness (EMs), while sociologists propose a theory about the symbolic meanings of communication.

Culture and illness behaviors

> "There is no human activity which we could regard as purely physiological, that is 'natural' or 'untutored'.... Not even the simplest need, nor yet the physiological function most independent of environmental influences, can be regarded as completely unaffected by culture" (Malinowski, 1944, p. 34).

To anthropologists, culture is defined as "the set of learned beliefs, values and behaviors generally shared by a society" (Ember & Ember, 1973, p. 24). Culture can also be defined as "patterned behavior [both mental and physical] that individuals learn and are taught as members of groups,

and that is transmitted from generation to generation" (Hunter & Whitten, 1976, p. 582).

Within each culture are belief systems that provide generally uncritically-accepted truths about the universe and that address central questions of existence. These beliefs, which are organized around central components of survival -- such as eating, shelter, and health and illness -- give meaning to life experiences. Within a health-belief system are attitudes about health and illness, how the community maintains health, who helps them when they are ill and what folk remedies and curing techniques they use (Foster & Anderson, 1978). Specifically, pain behaviors, as part of a health belief system, represent a complex system of meanings, values and behavioral norms around a defined illness.

Medical anthropologists make the distinction between disease -- the psychophysiologic malfunctioning of the organism -- and illness, the individual's perception of disease: "Illness is the way the sick person, his family and his social network perceive, label, explain, valuate and respond to disease" (Kleinman, Eisenberg & Good, 1978, p. 88).

Explanatory models of illness (EMs)

Kleinman (1978) employs the idea of explanatory models (EMs) to articulate the cultural expression of illness. EMs are sets of beliefs about disease causation, the experience of symptoms, the severity of the illness, the sick role,

treatment alternatives and outcome criteria. These explanatory models exist in all cultures and tend to encompass broad concepts such as the nature of illness and the reason for its existence, as well as specific details on curing practices. Every individual, as well as the members of the health care team, has explanatory models about health and illness. Frequently, especially when the client and the health care professional are from different cultures, these explanatory models conflict and miscommunication results.

The sick role and illness behaviors of these explanatory models have particular relevance to analyzing the phenomenon of pain. Medical sociologists have defined illness behaviors as "the way in which symptoms are perceived, evaluated and acted upon" (Mechanic & Volkart, 1961, p. 52). A person, for example, may experience pain, self-treat it with aspirin, and continue working. The sick role, however, is not assumed until a person is unable to fulfill some of his or her normal roles, thereby adding extra demands to the roles of others. In this role the person decides to stay home from work and be cared for by family members. A further extension of the sick role is the patient role. Once the person consults a formal therapeutic organization for advice and treatment, the patient role is assumed.

At this point, when the individual decides to become a patient, a "hierarchy of resort" provides alternative choices and potential order for choosing treatments of

illness or symptoms such as pain (Romanucci-Schwartz, 1969). For example, the first preference may be to seek a medical physician, followed by prayers and other religious rituals if the pain is seen as a punishment for sins. A subsequent alternative may be to visit a folk healer to determine whether a curse is the cause of the illness or pain. The individual has utilized various treatment options in a specific order of preference to deal with all the aspects of the illness, physical, spiritual and social.

Sick roles and illness behaviors are strongly influenced by socioeconomic class (Koos, 1954) and culture (Zborowski, 1969). The concept of illness is culturally constructed by the systems of meanings used to explain, label and value disease (Fabrega, 1972). An example of this is illustrated in a Native-American hospital in southwestern United States, where a nurse commenting on pain responses states, "We have learned from experience that when a Papago complains of pain or requests medication, such requests should receive prompt attention, for he is usually in serious trouble" (Christopherson, 1971, p.36).

Morse (1982) found that the perceived severity of painful events differed between cultures. When given a list of nine painful events, one group ranked "heart attack" as number one, i.e., producing the most severe pain, whereas another cultural group ranked the pain of a heart attack as eighth in severity. The perceived severity of the event may

influence the decision-making process to seek medical assistance.

Good (1977) utilized the explanatory model approach to study the meaning of "heart distress" (narahatiye qalb) in an Iranian city. In pursuing disease causation he found that the causes of heart distress were attributed to multiple things, including emotional or interpersonal problems, in at least 40% of the population. He uses the term "semantic illness networks" to label the "network of words, situations, symptoms and feelings that are associated with the illness and give it meaning for the sufferer" (Good, 1977, p.40).

In one case study, heart distress signified old age, sorrow, sadness, ritual mourning, and worries over poverty. In another case, in which a young women on birth control pills was experiencing tachycardia, the core symbol of heart distress linked childbirth, miscarriage, pregnancy, oral contraceptives, infertility, sorrow and old age. The complete meaning of the illness or symptom to the individual is derived from this network of symbols, within the context of the illness experience.

The anthropological models of the health and illness belief systems are useful in directing the following research questions about the phenomenon of pain: Are there cultural differences in the definition of the existence of pain and/or in the perceived cause of the pain? Are there cultural differences in the expression of pain (sick role

and illness behaviors), treatment of pain and different criteria for the successful management of pain? In the care of a culturally diverse population, the nurse needs to determine the network of meanings about pain and illness for the specific client within his or her cultural context in order to provide effective and therapeutic pain management.

Symbolic interactionism (SI)

Such sociologists as Mead (1934) and Blumer (1969) offer another approach to studying human behavior such as pain responses. Their theory, named "symbolic interactionism," describes human interaction as based on the communication of symbols or gestures which have socially-derived meanings. People learn behaviors and their meanings and values by communicating in symbols. Since culture has also been defined as "a system of symbolic meanings that shapes both social reality and personal experience" (Kleinman, 1978, p. 86), these symbols may be seen as being culturally learned.

The interpretive process of this interaction is a crucial component. In order for communication to take place the symbols must be understood by both the patient and the nurse. When the gestures for pain have the same meaning for both, the two parties understand each other. On the other hand, the nursing staff may become upset if there is more expression than they calculate is appropriate to the amount of pain being experienced (Strauss, Fagerhaugh & Glaser, 1974). In observing pain behaviors in a burn unit,

Fagerhaugh (1974) observed that both the nursing staff and the other patients in the ward helped shape the nature of pain expression of new patients coming to the unit. Through the interaction with staff and patients "acceptable" pain behaviors were learned.

Zborowski (1952 & 1969) suggests that behavioral responses to pain are culturally learned and culturally specific. Each culture has patterned attitudes toward pain behaviors which are passed down from one generation to another. The gestures and symbols of stoicism, for example, may be sanctioned in one culture whereas more expressive symbols are encouraged in another culture.

Symbolic Interactionism provides a theoretical and conceptual means to ascertain the cultural and social meanings attributed to the situation in which the individual experiences pain and how the experience is interpreted and communicated. It is a conceptual perspective which enables one to analyze how the individual defines pain and how it is communicated.

Pain behaviors represent a complex system of meanings, values and behavioral norms around a specific illness. Due to this complexity, several theoretical frameworks are needed to help explain this phenomenon. The explanatory models of the anthropologists provide a mechanism for analyzing pain within the cultural context of the illness experience, while symbolic interactionism provides a means for analyzing how the individual communicates pain.

Conflicting conclusions and inadequately controlled studies have yet to provide unequivocal evidence of a relationship between culture and the response to pain. These inconsistent findings provide the stimulus for further research in this area.

Mexican Health Beliefs Related to Pain

Since culture is such a strong variable in the response to pain, any study of the pain response must control for the cultural element. Therefore, all subjects of the study should identify themselves as from the same cultural group.

Mexican-Americans constitute a major subgroup in the American population, especially in the southwestern region of the nation. Yet, their health care beliefs and practices are relatively unfamiliar to dominant society health care professionals in the United States (Hazuda, Stern, Gaskill, Haffner, & Gardner, 1983; Kosko & Flaskerud, 1987). Pain is the most common presenting symptom brought to the attention of the health care professional. In particular, chest pain is a common presenting symptom of Mexican-American clients in ambulatory settings (Kosko & Flaskerud, 1987).

Numerous reports of Mexican health beliefs and practices appear in the literature (Baca, 1969; Clark, 1959; Cohen, 1979; Fabrega, 1980; Kay, 1972; Rose, 1978), but studies specifically focused on pain attitudes and pain responses are notably absent. The medical belief systems of this ethnic group will be explored in order to explicate

those beliefs that may have relevance to the phenomenon of pain, in particular, cardiac pain.

Explanatory models

Anthropologists have frequently described the hot-cold concepts as important and widespread explanatory elements in the medical systems of rural and lower class urban peoples in large parts of Latin America, including Mexico (Beals, 1946; Foster, 1948; Lewis, 1960). Similar concepts of hot-cold theory have also been reported in Mexican-American communities (Clark, 1959; Rubel, 1960).

The hot-cold dichotomy in medicine is derived from the Greek humoral theory, which arrived in the New World by way of the Spanish conquistadores. The hot and cold classifications refer to the intrinsic quality rather than thermal temperature of food, medicine or particular body conditions. Foods, for example, are called hot or cold in relation to their effect on the body. Hot foods, such as animal products and fatty foods, are usually thought to keep the body warm (Manerson, 1987).

Illness is often attributed to an imbalance between heat and cold; consequently, curing is directed toward the restoration of the proper balance. Hot illness, for example, would be treated with cold foods and medicines, and/or the abstinence of hot foods. The organs of the body are also believed to have these qualities. The heart and blood, for example, are considered to be hot (Maduro, 1983; Rose, 1978). Within this framework, the concept of a low fat, low

cholesterol diet as treatment for atherosclerotic heart disease (a hot illness caused by ingestion of too many hot foods) could be introduced with little resistance.

Despite its antiquity, the hot/cold dichotomy remains a dynamic and dominant explanatory model of health and illness in many parts of the world (Foster, 1984; Menderson, 1987). Some have asserted that the hot-cold distinction is not as important as once assumed, among both urban and rural persons (Weller, 1983; Young, 1980). But others disagree by showing that hot and cold properties are attributed to such "modern" foods as ice cream, canned foods, and coca-cola (Madsen, 1964), and to Western pharmaceuticals.

Disease causation

Strong emotional experiences are seen as causing disorders of the heart, such as palpitations and hypertension. The amount and persistence of a certain emotion appear to be more critical than the pleasantness or unpleasantness of that emotion. These symptoms usually call for self-imposed discipline ("controlarse") or avoidance of the problems (Cohen, 1979). However, in the case of the early symptoms of acute myocardial infarction, the use of denial may be life-threatening.

The heart is seen as the center of psychological balance. Terms associated with complaints of the heart often reflect anxiety, worries, fatigue or "colico de aire" (air colic). In general, the words used to describe disorders of the heart correlate with the western biomedical terms, such

as "palpitaciones" (palpitations), "picadas" (sharp or piercing pains), and "reflejos" (strong impulses or pulsations). However, a folk syndrome, called "aire en el corazon" (air in the heart), which is characterized by weakness, nausea, and stabbing pains in the heart, is thought to be caused by breathing cold air (Kay, 1972).

Besides reflecting emotional and interpersonal considerations, the cause of illness can also attributed to supernatural causes. Illness may be seen as an act of God, and healing as a gift from God. And particularly in the southern rural areas of Mexico, the cause of illness can also be attributed to witchcraft (Adams & Rubel, 1967; Fabrega & Silver, 1973). However, the more westernized and urbanized persons invoke this cause less often than the rural clients.

The experience of pain

According to Fabrega (1980), the ladino -- who is said to be of direct Spanish descent -- describes pain in a constellation of elements. Pain is not viewed as a distinct sensation, but rather as a part of a complex whole.

Instead of simply stating "I have pain in my chest", the response would more likely include a cluster of meanings and interpretations about that pain. For example, "I am having the pain of 'X' (aire en el corazon), brought on by doing 'Y' (breathing in of cold air) after having experienced 'Z' ("susto" - fright).

The word "pain" itself (dolor) seemed to have limited use: "What we observe frequently are 'heaviness', 'burningness', 'squeezingness' etc., which (although viewed as instances of pain by the observer) are often seen as phenomena different from "pain" by the ladino" (Fabrega, 1980, p.240). Thus the description of pain may include many of the following: an emotional and/or an interpersonnally incited cause; the mechanism and components of the process that resulted; a description of the pain viewed as a bodily, psychic and social entity; the duration of all of these; and, finally, various ways of controlling the pain.

Folk Treatments

In most cases, symptoms of chest pain and most cardiac disorders are brought to the western health practitioner rather than to a "curandero" (Cohen, 1979). Similarly, there appear to be few home-remedies or herbs used for the symptoms of anginal pain. In a sample of 1225 case examples of remedios caseros (home remedies) used by Mexican-Americans in the Rio Grande Valley, only 1.1% of the cases were used for heart problems (Trotter, 1981). Therefore, it may be possible to assume that folk treatments will not interfere with or confound the syndrome of anginal pain in the Mexican client.

In summary, the Mexican-American client may have a health belief system which differs from the predominant culture's beliefs. Especially if the client is from a rural or newly urbanized area, the symptom of chest pain may be

attributed to the following etiologies: an imbalance of the hot and cold forces; a punishment from God; or resulting from a strong emotional experience. The mind and body are seen as less dichotomous than in western medicine. This is reflected in more global and extensive descriptions of pain episodes.

Summary

Nurses caring for patients of cultural groups other than their own need a broad knowledge of health beliefs and practices in order to accurately interpret their patients' pain and control it effectively. American nurses in particular, because of the cultural diversity of the U.S. population, are confronted with a broad range of pain beliefs and behaviors. Miscommunication is possible because of differences in language, expressive patterns, and meanings of pain. Continuous validation with the patient is necessary for accurate communication and assessment, and ultimately for adequate pain control to occur.

Chapter 4

PAIN FROM A NURSING PERSPECTIVE: A FRAMEWORK FOR STUDY

"Nursing is the diagnosis and treatment of human responses to actual or potential health problems" (American Nurses' Association, 1980, p. 9). Pain, especially in the case of acute myocardial ischemic pain, is most often a warning to the individual that an actual or potential health problem exists. The nurse, as one of the health team members most accessible to the patient in the acute care setting, is ultimately responsible for the continuous diagnosis and treatment of the patient's pain.

Nurse-Patient Interaction

Several studies of the professional role of nurses have reported that the complaint of pain is the most frequent cause for the patient to request the nurse (Hammond, 1966a & 1966b; Skipper, 1965). Yet, the means by which nurses assess pain is not at all standard.

Communication of pain

Nurses use a variety of verbal, nonverbal and physiological indices to assess pain, but their use is inconsistent. While some investigators, who used case studies and patient descriptions, reported that nurses inferred more pain from the verbal report of the patient than the nonverbal communication (Baer, Davitz, & Lieb,

1970), others have reported the opposite (Jacox & Stewart, 1973; Oberst, 1978).

Nurses' attitudes about pain

Nurses bring to the interaction their own set of attitudes about pain and its expression. These attitudes, often culturally-learned, may ultimately be manifested in how the nurse controls the pain behaviors of the patient.

In a study conducted in a British hospital, Bond (1980) described how the staff reinforced or discouraged various pain behaviors: "Stoicism in a pain sufferer is rewarded with admiration, sympathy, and more material expressions of approval, notably administration of pain relieving medications. In contrast, complaints of pain, especially if regarded as excessive or unnecessary, are punished by expressions of disapproval, both verbal and practical, in the form of withholding analgesics or administration of placebo substances" (Bond, 1980, p.86).

Similar attitudes and management of pain expression were found among the nursing staff of a burn unit in western United States (Fagerhaugh, 1974). Patients were encouraged to tolerate their pain, even during the painful tubbing treatments, and not overtly express it. In general, the nursing staff tended to underestimate the pain, i.e. assess the pain as less severe than the patient's own report. Furthermore, the more experienced nurses on the unit tended to use less analgesia than the nurses new to the unit.

A large scale, continuing study on the cross cultural differences in pain inferences among nurses has been conducted in up to 13 countries (Davitz, Davitz, & Higuchi 1977a & 1977b; Davitz & Davitz, 1980; Davitz & Davitz, 1981). The original sample consisted of 544 female registered nurses currently employed in the United States, Japan, Puerto Rico, Korea, Thailand and Taiwan. The sample was later extended to include nurses in Uganda, India, Nigeria, England, Israel, Belgium and Nepal.

The instrument, the "Standard Measure of Inferences of Suffering," was translated into the native languages of all subjects. It consisted of 60 brief case studies describing the following: a particular illness or injury (5 categories), sex, and age (3 age groups). The nurse was asked to rate, on a seven point magnitude estimation scale, the degree of both psychological and physical pain for each of these case studies.

Korean and Japanese nurses inferred the highest amount of physical pain for these cases. They ranked 1st and 2nd among all the nurses in the amount of physical pain inferred; and, 1st and 3rd respectively in the amount of psychological distress inferred for patients in their countries.

The nurses from the United States and England ranked the lowest among all the nurses, 12th and 13th respectively, in the amount of inferred physical pain. These findings are consistent with those of Bond (1980) and Fagerhaugh (1974)

that found that British and American nurses tended to value stoicism and minimal expression of pain. However, in the category of psychological distress, the American and British nurses ranked 7th and 9th among the 13 countries.

The Puerto Rican nurses were the only representatives from Latin America. This group of nurses inferred a relatively low (10th rank) amount of physical pain but high (2nd rank) amounts of psychological distress for the case studies presented.

However, there was also considerable difference in seemingly similar groups. Nurses from Taiwan and Thailand differed significantly from the top ranking Korean and Japanese nurses. The Taiwanese and Thai nurses ranked 6th and 9th in the amount of physical pain inferred and 12th and 8th respectively for psychological distress. Hence, the western assumption that all oriental groups view pain similarly was not substantiated by these findings.

In a smaller segment of this study (Davitz & Davitz, 1981), American nurses were given the ethnic background of the patients in the case studies. For both physical pain and psychological distress, cultural differences were evident. The Jewish patients were seen as suffering the greatest amount of pain, the Spanish patients second, while the Oriental and Anglo/Saxon Germanic patients were seen as experiencing the least amount of pain.

In summary, significant cross-cultural differences were found in nurses' perception of the amount of physical pain

and psychological distress experienced by their patients. This perception is a crucial component of pain assessment and forms the basis of subsequent decision-making regarding the mode and efficacy of treatment. Therefore, nurses caring for patients of cultural groups other than their own need an expanded theory of pain behaviors in order to accurately interpret their patients' pain. Also, in investigational studies of the interaction of the nurse and the patient with pain, the phenomenon will be less distorted if both the patient and the nurse are of similar cultural backgrounds.

Nursing theories

Several nursing theories are useful in analyzing the phenomenon of pain assessment.

The "interaction" theorists view the focus of nursing to be the nurse/patient interaction (King, 1981; Orlando, 1961), and the goals of nursing to be the relief of distress or unmet needs (Orlando, 1961). These concepts are congruent with the goal of accurate assessment and management of pain.

It is in the realm of communication that the "interactionists" contribute to the explanation of the dynamics involved in pain assessment. King (1981) includes perception as a concept, using it as a major component of the interaction process. Both Wiedenbach (1964) and Orlando (1961) include the concept of validating, with the patients, their perception of reality. This validation process involves the nurse and patient jointly exploring the meaning

of the pain and together identifying a need and course of action.

The outcome theorists, such as Johnson, Rogers and Roy, also provide guidance in understanding the process of pain assessment. The Roy Adaptation model, perhaps because it is the most fully developed, is the most useful.

The concepts of balance and conservation of energy in the Roy model are compatible with those shared in the nursing management of anginal pain. In this model, goal of nursing is "to promote adaptation" (Roy, 1984, p.36) and to "decrease ineffective responses" (Roy, 1984, p.37). In the care of the patient with myocardial ischemia, the goal of nursing is to promote an optimal myocardial oxygen supply/demand ratio (homeostatic balance) and to decrease the incidence of arrhythmias, failure and further tissue damage (ineffective responses).

The assumptions and some of the propositions are also congruent with the manifestations of angina (Roy and Roberts, 1981). For example, the concept of the "Regulator" system and its propositions easily parallels the pathophysiology and neurophysiology of myocardial ischemic pain.

Roy's four modes of adaptation -- physiological, role function, interdependence and self-concept -- provide a framework for assessing the nature and expression of the pain and evaluating whether an optimal oxygen supply/demand balance has been maintained by effective nursing

interventions. However, only the physiological mode is developed with any depth. The other three modes of adaptation need further development and testing.

Nevertheless, questions about these adaptive modes might still be asked. Questions about the role function mode include: What is the pattern of adaptive sick role behavior for the client with myocardial ischemic pain? How does this behavior differ among different cultures? Questions can also be raised to test the internal consistency of this model, i.e., the integration between the modes of adaptation. For example: how do the physiologic adaptive responses of myocardial ischemic pain correlate to the role function, self-concept, and interdependence modes of adaptation? The potential here is to test relationships between these modes of adaptation.

The indicators of myocardial ischemia and infarction include both behavioral and physiological components. Correlation of both behavioral and physiologic components may increase accuracy in assessment of myocardial ischemia and infarction and assist in determining the appropriate nursing intervention.

Conceptual Framework of Study

A combination of gate theory, interaction and outcome theories is used as a conceptual framework for this study.

Assumptions

1. Human beings are biopsychosociocultural entities.

2. Pain is a multidimensional experience, having sensory, affective and cognitive components.
3. Pain is a subjective experience that can only be observed indirectly.
4. Pain behaviors are a result of physiological, psychological, social and cultural factors.
5. Pain behaviors are originally taught, then later reinforced by the family and society.
6. Pain behaviors are observable.
7. Communication, both verbal and nonverbal, is a useful tool for the assessment and management of pain.
8. Relief of pain, if desired by the patient, is the goal of nursing intervention for the patient in pain.

Concepts

The concepts of the framework and their relationships are illustrated in Figures 6 and 7. These concepts can be summarized as follows.

The process of myocardial ischemia initiates sensory stimulation and the transmission of a neuronal impulse to the spinal cord. There, in the dorsal horn, the impulse passes through the SG and T cells and then both stimulates the spinal reflexes and transmits the impulse across the cord to the ascending tracts.

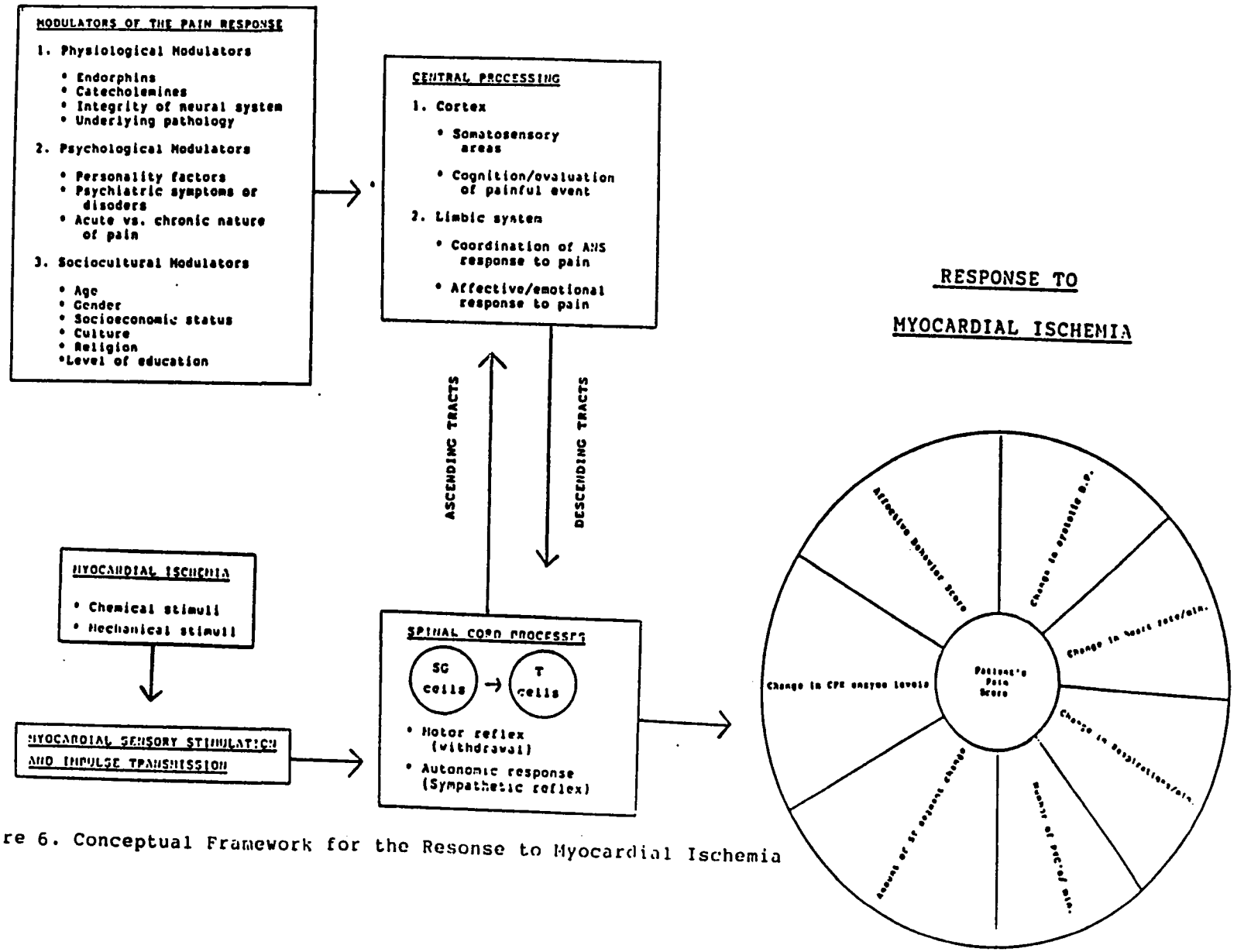

Figure 6. Conceptual Framework for the Resonse to Myocardial Ischemia

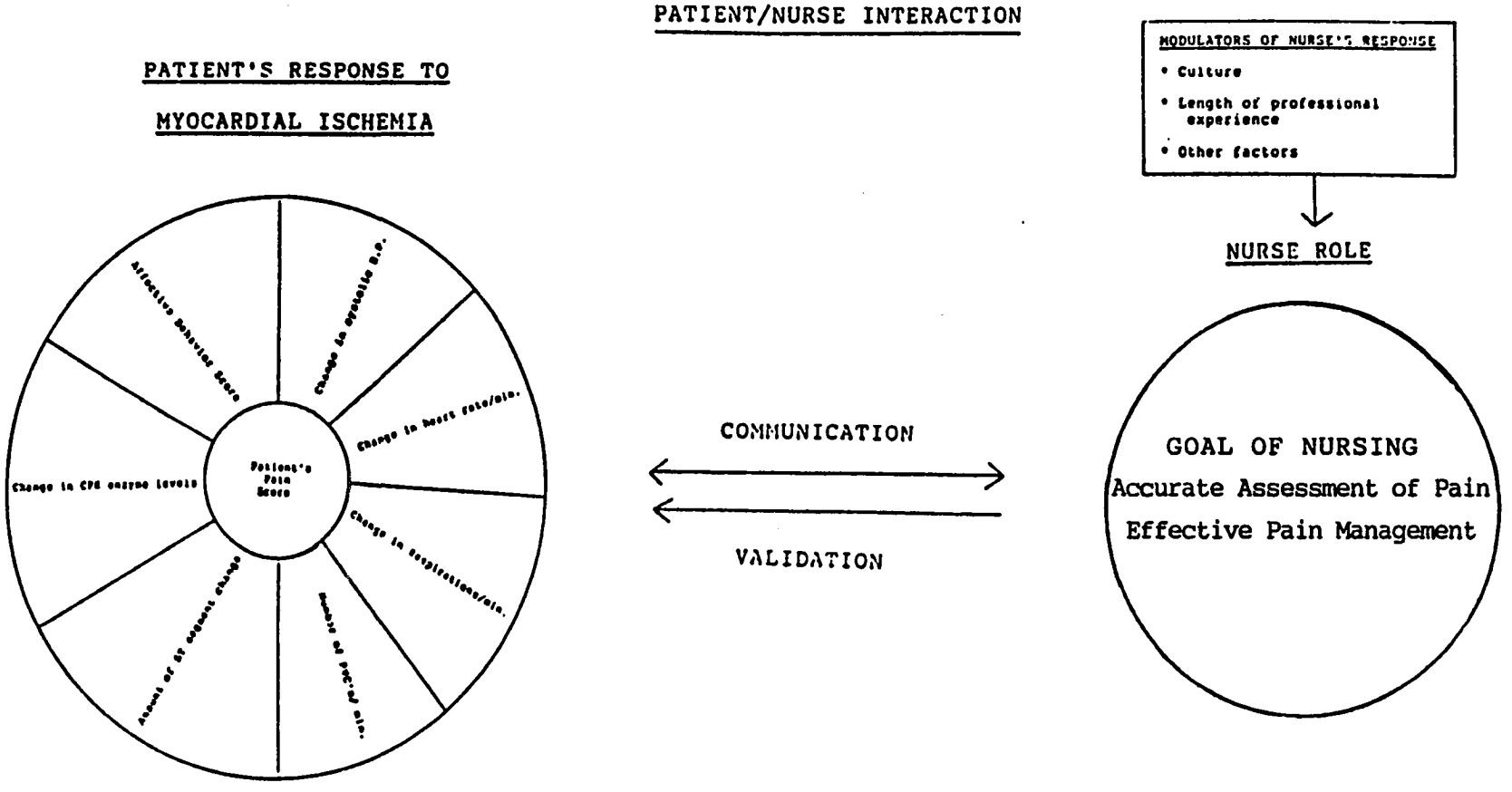

Figure 7. Conceptual Framework for Patient/Nurse Interaction in the Assessment of Myocardial Ischemia

Once the impulse reaches the cortex, a variety of integrative processes occur. The cortex integrates the sensory and cognitive responses whereas the limbic system coordinates the autonomic and affective responses to pain. All of these cortical processes can be modulated by physiologic, psychologic and sociocultural factors.

Once integration has occurred, the impulses descend the cord and are transmitted to the rest of the body. The resulting integrated response can be observed as a pattern of physiologic, verbal and non-verbal behaviors. The nurse's role is to assess these behaviors and validate with the patient in order to accurately diagnose and effectively manage the pain.

Propositions

1. There is no one single indicator of pain; rather, the response to pain is a composite of physiological indices and verbal and nonverbal communication.
2. There is a correlation between the patient's self-report of pain and physiological indices of myocardial ischemic pain.
3. There is a correlation between the patient's self report of pain and non-verbal behaviors.
4. Each culture has a unique composite of acceptable pain behaviors.
5. Communication of pain behaviors is more complex when the cultures of the patient and nurse differ.

Research Questions

1. What is the relationship between the physiologic and behavioral responses to acute myocardial ischemia and the patient's self-report of anginal pain intensity?
2. What is the optimal combination of these physiologic and behavioral responses to predict the patient's self-report of the pain's intensity?
3. How is the pain of acute myocardial ischemia described by the Mexican male patient?
4. What are the responses exhibited by the family members of a Mexican patient experiencing acute myocardial ischemia in the emergency department?

Operational Definitions of Concepts

1. Pain: An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage [International Association for the Study of Pain] (Merskey, 1979).

2. Chest pain: a pain, tightness, pressure or discomfort in the chest, not associated with traumatic injury.

3. Angina Pectoris: a syndrome characterized by the onset of episodes of dull, retrosternal pressure or pain that radiates to the left upper extremity or adjacent areas, usually initiated by exercise, emotion or other causes, and relieved by rest or nitrates. If there have been no changes in its frequency, duration or precipitating causes within

the last 60 days, this type of angina is classified as stable (Hurst, 1982).

4. Acute Myocardial Ischemia (Unstable Angina): anginal symptoms that occur for the first time or have been present for less than sixty days, or when there is a change in the frequency, duration or the precipitating factors of previously stable angina. Other terms used to describe this situation are pre-infarction angina, crescendo angina and acute coronary insufficiency. The symptoms of unstable angina closely resemble those of acute myocardial infarction. The pain or discomfort is usually more severe, difficult to relieve with nitroglycerin and lasts longer than stable exertional angina.

5. Acute Myocardial Infarction. The pain of acute myocardial infarction (AMI) is usually identical in nature to that of stable or unstable angina pectoris, but the pain lasts longer -- i.e., for hours to days -- is more intense, is unrelieved by rest or nitrates, and may be accompanied by nausea, vomiting and diaphoresis. Serial electrocardiograms and serum creatine kinase levels are needed for the diagnosis of infarction to be substantiated.

6. Physiological responses to acute myocardial ischemia include a) elevated systolic blood pressure b) tachycardia c) ST segment >.5mm and d) serum creatine kinase levels greater than 85 IU.

7. Behavioral responses to acute pain include the following: a) skeletal muscle restlessness, b) muscle

tenseness, c) grimacing or frowning, d) vocalization (crying, moaning, sobbing), e) diaphoresis, f) anxiety, and g) attention directed toward the pain.

8. Patient's self-report of pain intensity is the value given by the patient to describe the intensity of the pain on a vertical graduated scale, where zero is equal to no pain and 10 is equal to the worst possible pain.

Conclusion

The phenomenon of pain is a complex human experience not yet fully understood. No single theory is complete enough to encompass both the breadth and the depth needed to guide the interpretation of the investigation of this phenomenon. However, a combination of theories from several disciplines, with congruent assumptions, can be used.

A major gap in the knowledge of pain concerns those processes that lead individuals experiencing the same type of pain to respond in very different ways. Pain threshold and tolerance varies widely among humans, as well within the same individual under different conditions. Yet nurses are faced daily with the task of interpreting these responses in an attempt to monitor the efficacy of their pain-relieving interventions. American nurses in particular, because of the cultural diversity of the U.S. population, are confronted with a broad range of pain beliefs and behaviors. A clearer understanding of the patterns of pain responses and measures to gauge pain relief is needed.

CHAPTER 5

METHODOLOGY

There are several ways to "measure" pain, but there is not yet a purely objective physiological measure that can be used the way a thermometer is used to determine a fever. Because of its subjective nature, pain can only be measured indirectly, through the person experiencing it. The wide variability in the response to pain, and the lack of a single indicator of pain make it imperative that the phenomenon is studied with multiple measures.

Research Design

A descriptive correlational design was used to describe, measure and analyze the verbal, non-verbal and physiologic responses of Mexican patients to acute anginal pain. Qualitative methods, such as participant-observation and limited interview, were used for the following purposes: to describe the personal meaning of the anginal pain; to record the verbal and non-verbal behavioral responses; and to describe the context of the pain experience. Quantitative methods were used to measure the physiologic indicators of myocardial ischemia and the autonomic response to anginal pain and to intercorrelate the patient's perception of pain with the other variables.

Acute anginal pain is most predictably observed when the patient first arrives in the emergency department. For

this reason, the major observation period and measurement portions of the study took place while the patient was in this department. Follow-up data, such as serum creatine phosphokinase (CPK) levels, were gathered later, after the patient was in the coronary care unit.

Description of Research Setting

In order to avoid the confounding effects of immigration and acculturation on health practices and to provide a basis for later comparison, the study was conducted in Mexico, the country of origin of the subjects. In this manner, the patient, the nurse and the health care delivery system were all from the same culture.

Establishing Entry to an International Site

Because the researcher had no prior contacts in the country chosen for study, the selection of the research setting required planning for extra time to establish entry. Additional time also was allotted for postal service delays, translation of all written communication, and obtaining a special business visa.

In 1983, initial contact was made at the institutional level, utilizing the university's international exchange program ("Education Abroad") as a vehicle. The U.S.-based office of this program provided support in three areas: 1) letters of introduction to establish legitimacy; 2) support of the goals of the research project; and, 3) a request for its Mexican-based office to arrange introductory

appointments for the researcher. The Mexican Study Center, the office of the Education Abroad program in Mexico City, arranged these appointments as well as assisted in the location of inexpensive, short-term housing needed during the various phases of the project.

During the first of a series of preliminary visits later that year, the researcher met with the Dean of the School of Nursing at the Universidad Nacional Autonoma de Mexico [National University of Mexico] in Mexico City. Her office subsequently scheduled meetings for the researcher with the directors of nursing service in four different types of tertiary-care hospitals in the capitol: federal, municipal, social security and private. At each hospital, the frequency and type of care given to patients with acute myocardial infarction was evaluated for suitability to the research design. The site was also evaluated for its feasibility in carrying out the project.

Another goal of the researcher was to spend a two-month residency period with the nurse consultant in the regional office of Pan American Health Organization (PAHO) in Mexico City. The purpose was to study the structure and assess the needs of nursing practice and education in Mexico from the perspective of an international health care organization. The residency provided an opportunity to collaborate with Mexican nursing leaders in assessing nursing educational needs and to reciprocate by providing training courses for practicing nurses.

During the process of this initial two-month residency, during the summer of 1984, the researcher was sent by the PAHO nurse consultant to nursing faculties and nursing organizations in four different urban areas: Mexico City, Monterrey, Leon and Guadalajara. At each site, the researcher presented a continuing education course on cardiovascular nursing care to practicing nurses and nursing students of the local schools. Afternoon sessions included clinical rounds and practice in the intensive care or coronary care units of the local hospitals.

This two-month residency served several purposes directly related to the research study. First, the researcher was able to refresh her Spanish speaking ability because of the necessity to teach in Spanish. Second, the afternoon practicums within the hospitals gave the researcher an opportunity to assess the site for suitability of study subjects. Third, the concentrated time involved in teaching a six-day, 10 hour/day course afforded the researcher the opportunity to establish professional credibility and relationships with the nursing managers within a relatively short period of time. As a result of these relationships, the researcher was able to assess the political climate of the institution in order to determine the feasibility of conducting the research project at that site.

Selection of the Research Setting

After a total of nine hospitals in four cities were reviewed, the Instituto Nacional de Cardiologia [National Institute of Cardiology] in Mexico City was chosen as the setting of this study because of its research and teaching atmosphere and because it provided the highest concentration of patients experiencing the phenomenon under study.

An initial brief proposal sent to the Institute was rejected because they considered the study to be too expensive. The original proposal included the use of CPK-MB isoenzyme determination as an indicator of myocardial tissue injury. A revised version, using the less specific, but inexpensive, routinely-ordered total CPK serum enzyme examination was subsequently approved.

The Institute is a 300-bed, federally supported, acute care facility dedicated solely to the study and treatment of cardiovascular disorders. The vast majority of the patients treated in this institute have no health insurance and are in the lower socioeconomic class.

Approximately 3500 patients, one third of whom present with the chief complaint of chest pain, are seen in its emergency department every month. Patients with a diagnosis of possible acute myocardial infarction are admitted directly to an adjacent 16-bed Coronary Care Unit.

The nursing department of the Institute is administered by a group of Catholic sisters. A special exception to the strict separation of church and state in Mexico was made in

order to allow the religious order to manage the nursing services of this particular institute alone. The Institute's first medical director requested the Catholic sisters more than 40 years ago because of their reputation for maintaining cleanliness and order in the hospital and discipline of the nursing staff. Today the positions of director of nursing and almost all of the floor supervisors are held by sisters. One of the few exceptions was the lay nursing supervisor of the combined Emergency Department/ Coronary Care Unit where the study was conducted. Most of the nursing staff of the Institute, in contrast, are lay nurses and aides.

The Institute also maintains a school of nursing affiliated with the National Autonomous University of Mexico. The Institute's school, however, teaches only a 10-month post-graduate course in cardiovascular nursing. Students in the program work in the Institute during their course of study and also find positions in the Institute after completion of their studies. Hence, many of the nurses share a similar nursing instruction on the management of patients with anginal pain.

Description of Emergency Department Setting

The floor plan of the combined 5 bed emergency department and 16-bed CCU is shown in Figure 8. The entrance way, reception and waiting areas are separated from the main patient care area by large double doors that are usually

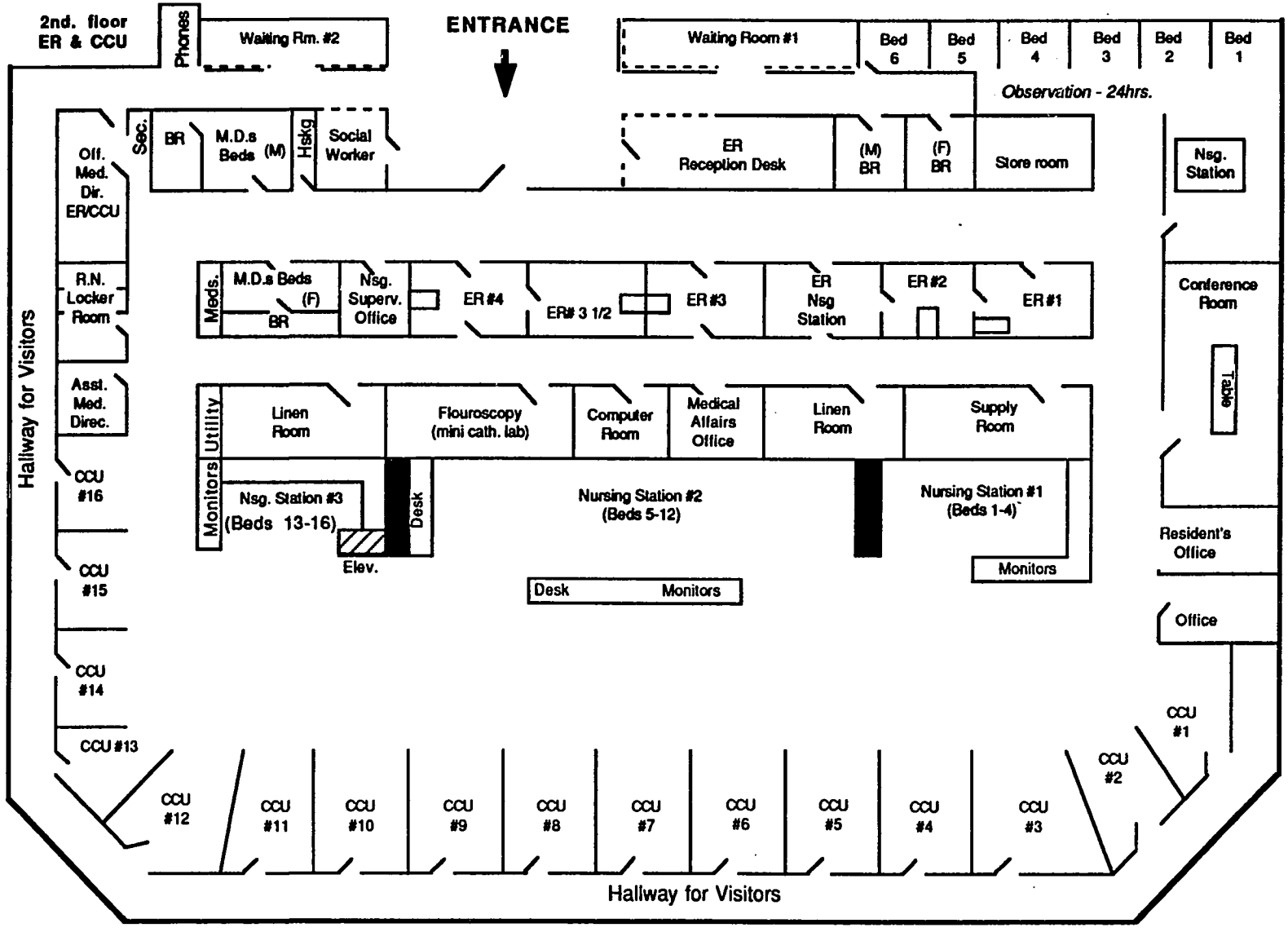

Figure 8. Floor plan of combined Emergency Department/CCU at the National Institute of Cardiology, Mexico City

kept closed. Patients enter the main examination area only after being called in order of their arrival time.

The researcher volunteered to act in the role of reception clerk/triage nurse in the emergency department, as the position was unfilled at the time. In Figure 8, the person in this position was located in the room with the label "ER Reception Desk" at the top of the diagram, to the right of the entrance. Two walls of the reception room were glass, thus enabling the nurse at the reception desk to see all persons arriving through the entrance. In addition, most persons in the two large waiting rooms across the hall from the reception area were also visible from this desk.

As potential patients and families arrived at the entrance to the emergency department, they were directed to the reception desk to be assessed and registered by the triage nurse/researcher. Information collected included: time of arrival, chief complaint, secondary symptoms, name and age of patient, and any past hospitalization at the Institute. If the patient was a potential candidate for the study, the researcher explained the study and provided the information sheet. Then the vital signs, pain score, and behavior score were measured and recorded, both as a baseline and as a means of interacting with the patient and family. Later, after the potential study subject was called into an examining room, the vital signs and scores were measured again during the time the 12-Lead electrocardiogram was being taken.

There was no standard protocol for the triage of patients with chest pain unless the patient was critically ill. In most cases, the patients would wait to be seen on a first-come, first-serve basis. During busy times such as during the day shift, this wait could last several hours.

Patients and families spent this time waiting in the large rooms across from the reception desk. These waiting rooms were also used by the families of the patients in the coronary care unit (CCU). At night, family members of CCU patients would often sleep on the couches in these rooms.

The role and physical location of the reception clerk/triage nurse was advantageous for many reasons. During the course of normal activity, the researcher was able to screen the population for study subjects, recruit study subjects, instruct subjects in the use of the pain scale, obtain qualitative data on the description of the pain, and perform baseline measurements of study variables. This location was also a particularly good vantage point for observing family interactions both during the time of arrival at the emergency department and during the subsequent critical days of hospitalization.

Sample

Nature and Size of Sample

A sample of the first 57 patients meeting the criteria was drawn from a population of 1098 consecutive patients presenting in the emergency department with the chief complaint of chest pain. This was a convenience sample in

that no random sampling of eligible patients was performed, but rather the first 57 to meet the criteria were included in the study.

For this sample size of 57, and estimating an effect size of .25, the power = .84. The effect size (f^2) was determined in the following manner: Previous research correlating similar behavior scores with pain scores and the amount of analgesics has reported single Pearson correlations ranging from .38 to .87 (Chambers & Price, 1967; Bruegel, 1977). A conservative value of r =.45 was selected to represent the correlation for a single variable. Since multiple regression was being performed, however, this value was squared $(.45)^2$ to give a multiple R (R^2) of .20. This value of R^2 = .20 was subsequently used in the equation to determine f^2, the population effect size (Cohen & Cohen, 1983, p.117).

Criteria for Sample Selection

The selection criteria for induction into the study at the time of emergency room admission were the following: 1) chief presenting problem: acute chest pain; 2) age > 35 years; 3) male gender; 4) subject was born, raised, and was presently living in Mexico; 5) subject had no private or public health insurance; 6) education <= 12 years; and 7) subsequent admission to the coronary care unit with the diagnoses of Acute Myocardial Infarction (AMI) or Rule/Out Acute Myocardial Infarction. Subjects were excluded in the event of the following diagnoses or complications occurring

within 72 hours of admission: chest pain of non-cardiac etiology; congenital or valvular heart disease; pericarditis, congestive heart failure, cardiogenic shock, cardiac arrest and/or countershock, and death.

The demographic characteristics of the sample are presented in Table 1. The mean age of the subjects was 56.2 years, with a range from 35 to 78 years. The average amount of education completed was 5.7 years, with a standard deviation of 3.2 years and ranged from 0 to 12 years. More than 40 % of the sample was unemployed, either because of retirement or lack of employment, while another 50.9% were self-employed as day workers. All lacked any form of union, government or employee health insurance. Although more than 92% of the subjects were presently living in an urban or semi-urban area, almost 44% of the subjects had been born in rural areas of Mexico, in towns of less than 20,000 persons.

Almost two-thirds of the subjects (63%) were subsequently confirmed as having experienced an acute myocardial infarction (AMI) while the remaining 37% received the discharge diagnosis of unstable angina. For nearly three-fourths of the sample (74%), this was the first AMI experienced by the subject.

Descriptive statistics of the quantitative indicators of acute myocardial ischemia are also included in Table 1. The mean pain score was 5.7 with a SD of 2.8 and a range of 0.0 to 10.0. Systolic blood pressure and heart rate were only slightly elevated above their normal values, as was

Table 1

Demographic Characteristics of the Sample and Descriptive Statistics of Study Variables (n=57)

Variable	M	SD	Range
Age (Yrs)	56.2	11.9	35.0 - 78.0
Education (Yrs)	5.7	3.2	0.0 - 12.0
Pain Score	5.7	2.8	0.0 - 10.0
Behavior Score	17.4	4.3	9.0 - 25.0
ST Segment (mm)	2.4	1.6	0.5 - 7.0
Peak CPK (U/I)	722.9	653.6	33.0 - 2255.0
Systolic BP	135.0	23.7	60.0 - 180.0
Heart Rate	83.9	23.6	55.0 - 181.0
PRP*	11268.2	3545.8	5100.0 - 22500.0

		n	%
Final Dx: Acute Myocardial Infarction		36	63.2
Unstable Angina		21	36.8
Previous Myocardial Infarction (n=53):	Yes	14	26.4
	No	39	73.6
Occupation: Unemployed		24	42.1
Per Diem Workers		26	45.6
Factory Workers		7	12.3
Residence:			
Urban/Semi-Urban (> 20,000 population)		53	92.8
Rural (Less than 20,000 population)		4	7.2

*PRP=Pressure-Rate Product (Normal: 5,400-15,000; mn: 9600)

their product, Pressure-Rate Product (PRP). The mean serum CPK level was 722.9 I/U; but since 36.8% of the sample experienced angina rather than an infarction, the distribution is skewed toward the lower levels. The median serum CPK level was 551. In this lab, the normal value for serum creatine phosphokinase (CPK) for the laboratory analyzing the serum sample was less than 85 I/U.

Human Subjects Provisions

Permission to conduct the study was requested and granted from the Human Subjects Committee and the Research Committee of the Instituto Nacional de Cardiolgia in Mexico City. Permission also was granted by the director of nursing and the head nurse of the combined emergency department/ coronary care unit. This proposal was also approved by the Institutional Review Board of the University of California, San Francisco.

Due to the nature of the population being studied, many of whom would be unable to read and reluctant to sign forms, and due to the acute nature of the clinical situation being studied, an information sheet (Appendix F) rather than a signed consent form was utilized. The subjects were informed about the study by being read aloud the Spanish translation of the "Information Sheet" before being asked to participate in the study. They were offered a copy of the information sheet, if desired. Few subjects took a copy of the information sheet for their personal copy. No subject refused to participate in the study.

In order to protect the anonymity of the subjects, the name of the subject was attached only until the chart reviews and follow-up data had been collected for 72 hours. After that time, the name was cut off the upper right hand corner of the instruments and data collection forms, and thereafter the data was only identified by code number.

Instruments

Verbal Pain Rating Scale

The Visual Analogue Scale (VAS) and the Verbal Descriptor scale (VDS) represent attempts to quantify and assess the subjective nature of pain. A visual analogue scale is a straight line, usually 10 cm in length, the ends of which are defined as the extremes of the sensation (no pain to worst possible pain). The subject marks a point along the line that best indicates the intensity of the pain. As a type of the VAS, the verbal descriptor scale places descriptive terms and/or numbers at intervals along the line, to assist the individual in rating the pain (Scott & Huskisson, 1976).

Although the VAS may be a more precise measurement of the response, because it avoids forced choices, the VDS may be more sensitive in some instances. The VAS may be too abstract for some patients with lower educational levels or who are experiencing acute severe pain (McGuire, 1984). In studies comparing VAS and VDS, the reliability of the scales was found to vary according to patient characteristics and clinical context (Reading, 1980).

Despite the differences in reliability between the scales, the validity of these scales seems well established, at least for the dimension of pain intensity. Construct validity of these scales has been verified by utilizing the techniques of factor analysis (Downie, Leatham, Rhind, Wright, Branco & Anderson, 1978) and cross-modality matching (Gracely & Dubner, 1987).

In this study, a verbal descriptor scale, with a scale of 0 to 10, (Appendix A) was used because the descriptive terms and numbers may provide additional assistance to the subjects who may be unfamiliar with such instruments. This type of tool has proven useful in the clinical assessment of the acute pain of angina and myocardial infarction because of its simplicity and ease of administration. The validity of the Spanish translation version of the specific instrument used in the study was tested using the "translation-back translation" strategy.

The major limitation of this tool is that it only measures the intensity of the pain. Multidimensional measures do exist, such as the highly reliable and valid McGill Pain Questionnaire (MPQ) (Melzack, 1975; Melzack & Torgerson, 1971). However, because of the 15-30 minutes that is required for explanation and administration of the test, the MPQ is inappropriate in the setting of acute myocardial ischemic pain.

Non-Verbal Pain Behavior Scale

Under the assumption that an individual experiencing pain has observable behaviors and physiologic responses, a non-verbal pain behavior scale (Appendix B) was used for all subjects in the study.

Several groups of nurse researchers have used different versions of such an instrument, primarily in the setting of acute post-operative pain. Hanken & McDowell (1964) developed a tool which used a five-level rating system to evaluate 6 variables: attention to pain, anxiety, verbal description of degree of pain, skeletal muscle response, respirations, and amount of perspiration.

The reliability of their instrument was stated as good, but no reliability coefficients were given. A correlation matrix revealed positive relationships (r=.44 to .71) between attention, anxiety, verbal response and skeletal muscle response. Factor analysis indicated that attention to pain and verbal statement of degree of pain had the highest factor loadings (r = .64) (Hanken & McDowell, 1964).

The instrument was later modified by Chambers and Price (1967). Variables such as muscle tension, facial expression and nausea were added, while respirations were deleted. No reliability or validity coefficients were reported for this modified version. However, the correlation between the total score of this tool and the pain rating score ranged from r=.66 to .87. In another study, in which this modified version was also used, Bruegel (1977) reported a correlation

of r = .38 between the total score of this tool and the numbers of analgesics used.

A modified version of the Price & Chambers tool (1967) was used for this study. The advantages of using this type of tool was its ease of use, its history in the study of acute pain, and its assessment of more than the one dimension of intensity of pain. This instrument has a Cronbach internal consistency reliability coefficient of 0.7650.

The Non-Verbal Pain Behavior Scale was completed by both the investigator, who in an American nurse, and the Mexican nurse caring for the patient. After completing the tool, the scores from each of seven categories were compared. Interrater reliability on these categories are given in Table 2. Whenever different scores were encountered, a negotiated score was established. The total of all negotiated and agreed scores equaled a composite total score. This composite score was labeled "Behavior Score" and entered as such is the regression formula.

While the same American nurse investigator collected data on all patients, six different Mexican nurses used the tool during the study. However, one Mexican nurse in particular -- the day-shift charge nurse -- completed the scale in the majority of cases. The interrater correlation between the total scores of the American and Mexican nurses was r = 0.9066 ($p<.001$).

Table 2

Interrater Reliability on Categories within the Non-Verbal Pain Behavior Instrument (n=39)

Behavior Instrument Category	Cohen's Kappa	p value	Observed % of agreement	Expected % by chance*
Attention to Pain	0.4291	<.001	58.97%	28.14%
Amount of Anxiety	0.1986	<.02	38.46%	23.21%
Amount of Restlessness	0.4434	<.001	61.54%	30.90%
Skeletal Muscle Tenseness	0.3043	<.003	53.85%	33.66%
Amount of Facial Grimacing	0.4920	<.001	66.67%	34.39%
Amount of Vocalization	0.7320	<.001	89.74%	61.74%
Amount of Diaphoresis	0.3979	<.001	53.85%	23.34%

* what would be the expected % of agreement by chance alone based on the marginal distributions

Observation Protocol

Since pain behaviors are socially learned and reinforced, one aspect of this study was to look at the interaction between the patient and those in the environment, particularly the family members and the health care professionals. An observation guide (Appendix C) was used to direct the observations to questions regarding the patient-family interaction, their coping mechanisms, their health-seeking behaviors, and their responses to the environment and to hospitalization.

Sphygmomanometer

The systemic blood pressure was measured indirectly by means of the same calibrated McCoy aneroid manometer for all subjects at the time of admission to the emergency department. Since only one investigator recorded the blood pressure on all subjects, the reliability of the recordings was periodically assessed by comparison to the recordings by a staff nurse of the unit.

The timing and magnitude of hemodynamic changes associated with myocardial ischemia vary according to its cause and the surface involved. The circulatory changes most often follow the electrocardiographic alterations.

In the majority of cases of exertional angina, in which ischemia is caused by an increase in oxygen demand, there is an increase in both arterial pressure and heart rate with the onset of pain (Carrieri, Lindsey & West, 1986; Julian, 1977; Roughgarden & Newman, 1966). Robinson (1967) found

that a critical level of pressure-rate product (systolic arterial pressure x heart rate divided by 100) correlated with the onset of anginal pain in a given individual.

The site of myocardial ischemia has been reported to affect the hemodynamic response. Several studies of variant angina have shown that ischemia of the inferior surface of the heart is accompanied by a decrease in both heart rate and blood pressure, whereas anterior ischemia more often is reflected in a rise in pressure and heart rate. The same responses were observed during ST segment elevations with and without pain (Araki, et al, 1984; Perez-Gomez, DeDios, Rey, Garcia, & Aguado, 1979).

Electrocardiogram (ECG)

A 12-lead electrocardiogram was used for the purpose of identifying the signs and location of myocardial ischemia or infarction, detecting the presence of arrhythmias, and measuring any change in the ST segment.

Arrhythmias. An important consequence of both myocardial ischemia and infarction is the occurrence of various disturbances of cardiac rhythm, including the potentially lethal arrhythmias of ventricular tachycardia and fibrillation (Manning & Hearse, 1984). Cardiac arrhythmias are almost universal in patients with acute myocardial infarction. Between 80% and 100% of these patients will experience some type of cardiac rhythm disturbance while in the coronary care unit, and 30% to 50% will continue to demonstrate complicated ventricular ectopy

at 2 to 3 weeks after infarction (Bigger, Dresdale, Heissenbutal, Weld & Wit, 1977; Lie, Wellens, Dorsnar & Durrer, 1975; Olson et al, 1984).

Arrhythmias are also seen in myocardial ischemia without infarction. More than half of all patients with ischemic heart disease die suddenly, probably from ventricular arrhythmias. In nearly one third of all with ischemic heart disease, sudden death is the first and final event (Hurst, 1985). The majority of these patients do not have an infarction.

The intercellular changes occurring during ischemia, such as changes in intracellular fluid and ionic balance, release of catecholamines and the production of free radicals, contribute to the electrophysiological changes in ischemia-induced arrhythmias. Arrhythmias occurring early in ischemia result from enhanced automaticity, whereas the reperfusion-induced arrhythmias and those occurring in the post-acute phase are more likely due to reentry mechanisms (Manning, Coltart & Hearse, 1984).

ST segment changes. Shifts in the ST segment after experimental coronary artery ligations were demonstrated more than 60 years ago (Pardee, 1920). Within 30 to 60 seconds after occlusion, ST segment elevation is recorded from epicardial leads within the area of cyanosis (Braunwald & Maroko, 1976; Ekmekci, Toyoshima, Dowczynski, Nagaya & Prinzmetal, 1961; Rakita, 1954).

Although the electrophysiologic basis of the ST segment changes has not been fully explained, the underlying mechanism is thought to be related to acutely impaired ion transport across the cell membrane. Because of decreased ATP delivery during ischemia, the sodium-potassium pump activity during diastole is reduced. This results in an excess of Na+ ions within the cell and elevated extracellular levels of K+. Since small changes in the transmembrane potassium concentrations have a marked effect on the polarity of the cell membrane, this ionic imbalance is thought to be the cause of the ST segment changes seen during ischemia (Braunwald, 1980; Holland & Brooks, 1976).

In contrast to the progressive and often persistent ECG changes of myocardial infarction, those recorded during a spontaneous or induced attack of angina are transient, and are usually associated with a normal ECG before and after the episode. ST segment depression of 1 mm or greater below baseline is the characteristic alteration of transient subendocardial ischemia. The depressed ST segment may be upward sloping, horizontal or downward sloping. Abnormalities of T wave morphology, such as inversion or diminution in amplitude can also be seen during an anginal episode, but are not diagnostically significant unless accompanied by ST segment depression (Davies, Subramanian, Cashman & Raftery, 1983; Markham, et al, 1983; Varnauska, 1985;).

ST segment elevation, on the other hand, is usually indicative of more extensive and severe ischemia which extends through the myocardial wall. This type of ST segment alteration is more commonly seen in Prinzmetal's angina or in the first few hours of a transmural acute myocardial infarction. In the case of angina without infarction, though, when the chest pain subsides, the ST segment changes disappear (Goldman, 1973; Hurst, 1985; Julian, 1985).

Although seen with myocardial ischemia, a variety of ST segment and T wave changes are also seen in a wide range of other cardiac diseases, and with electrolyte imbalances and some drug effects. In addition, ST segment elevation may also appear in the absence of pain (Ellestad, 1975; Guazzi, et al, 1971).

Q waves. If adequate circulation is not restored to ischemic cells, infarction or death of muscle cells ensues. As the infarction evolves, characteristic EKG changes include persistent ST elevation, development of new pathological Q waves (0.04 sec or greater or greater than 1/3 the amplitude of the QRS complex) and T wave inversions in the leads over the infarcted area. The ST segment and T wave changes revert to normal within weeks or months, but the Q wave usually remains as a permanent ECG indicator of infarction.

Possible sources of instrument error of the electrocardiogram occur in 3 areas: the equipment; the consistency of the recording procedure; and inter-reader

variability in the interpretation of the ECG. A pilot study done at the site revealed that, due to limited resources, only one electrocardiogram machine was in use at the time of the study, and that it was shared by both emergency room and coronary care unit. This same machine was used by the nursing staff of both areas to record all the admission and subsequent daily ECG's of the study subjects.

Cardiac enzyme determination

In the event of irreversible cellular injury, the integrity of the cell wall is threatened and the membrane becomes more porous to larger molecules. Therefore, the release of cell proteins such as the cardiac enzymes into the circulation should signify the presence of necrotic cells and hence infarction. In the myocardial cell, the enzymes which are normally involved in glycolysis and the production of ATP and which leak into the serum during necrosis include: creatine kinase (CK or CPK), lactate dehydrogenase (LDH), and serum glutamic oxaloacetic transaminase (SGOT). Determination of the serum levels of these enzymes has been used to differentiate between temporary ischemia and infarction (Hurst, 1982; Hurst, 1985).

Since these enzymes occur in other organs besides the heart, their specificity for cardiac injury is not high. The sensitivity of the assay methods and the rich supply of enzymes in the myocardium enable even small amounts of necrosis to result in increased enzyme levels (Sobel, 1985).

Creatine kinase (CK) is found primarily in the brain, skeletal muscle and the myocardium. Diagnostic specificity has been greatly enhanced by the discovery that different molecular forms of this enzyme (isoenzymes) are found in each organ: CK-BB in the brain, CK-MM in the muscle, and CK-MB in the myocardium. Although CK-MB is found in minor amounts in other organs, the myocardium is the only tissue containing sufficient CK-MB to account for the serum increases specific for myocardial infarction (Lott, 1984; Tsung, 1976). Of all the enzymes, CK-MB remains the most specific and sensitive in the diagnosis of myocardial infarction and in the estimation of infarct size and extension (Blomberg, Kimber & Burke, 1975; Goe, 1987; Lott & Stang, 1980; Roberts, Henry & Sobel, 1975; Wagner, Roe, Limbird, Rosati & Wallace, 1973).

SGOT and LDH are both quite sensitive to infarction but are also elevated in a variety of hepatic, pulmonary or skeletal muscle diseases or injuries. Specificity is increased with LDH if elevated levels of the isoenzyme LHD-1 are identified.

Serial measurements of these enzymes are necessary because each has a different plasma activity profile. Serum CK levels begin to rise 4 to 6 hours after the onset of symptoms, peak at about 24 hours and return to normal levels within 3 to 4 days. Serum CK-MB rises earlier and declines sooner than the total CK level. SGOT levels follow a similar pattern, but peak slightly later than total CK.

The levels of LDH do not begin to rise until 24 to 48 hours after the onset of pain, peak at 3 to 6 days and then return to normal within eight to fourteen days. Due to this delayed action, this measurement is particularly useful for patients who delayed seeking medical attention until several days after the onset of symptoms.

Myocardial infarction is not the only cardiac injury detected by these enzymes. Serum levels of these enzymes may increase after cardiac trauma or in other pathological conditions (cardiac resuscitation, cardioversion, cardiac surgery or pericarditis) and may confound the results. Therefore, as with the others indices of ischemia and infarction, the serum enzymes must be evaluated not alone but in conjunction with the history and ECG findings.

The serum levels of three enzymes -- CPK, SGOT, and LDH -- were collected on admission and every 24 hours for 72 hours. Although CPK-MB fraction would be a more specific indicator of myocardial tissue damage, and CPK enzyme determination would be better assessed if drawn every six hours after admission, the prohibitive cost of these diagnostic tests at the site of the study precluded their use. Only results from tests routinely ordered for establishing the diagnosis of the subjects could be used. A condition of conducting research at the site was that no additional patient costs could be generated.

Possible sources of error for the laboratory determination of serum enzymes include the similar issues of

equipment, procedure and interpretation errors. All serum enzyme samples were analyzed at the site of the study and by the personnel in the same laboratory with the same procedure. No attempt was made to establish reliability and validity of their procedures, however.

The concepts and variables measured by instruments in this study are summarized in the Table 3. The reliability of these instruments is stated where that information is available.

Data collection procedures

Patients arriving at the emergency department with the chief complaint of chest pain were evaluated by the investigator for inclusion in the study according to selection criteria #1-6. The procedure for data collection is summarized in Appendix D.

Admission data

For those subjects selected, the following physiological data were collected by the investigator at the time of the subjects' arrival in the emergency department: 1) blood pressure (mmHg) by means of a McCoy anaeroid manometer; 2) apical pulse (beats/min); 3) respirations/ minute; 4) ventricular extrasystoles (PVC's)/min. by means of ECG rhythm strip; 5) cardiac rhythm; 6) ST segment change (mm) by means of a 12-Lead ECG. These data were recorded on the Data Collection Form-A (Appendix E).

At the same time as the physiological data were being recorded, the technique of participant observation with

Table 3.

Instrument Table

Concept	Variable	Instrument	
		Name	Reliability
Physiologic Responses to Acute Myocardial Ischemia	Systolic Blood Pressure	Sphygmo-manometer	n.a.
	Heart Rate	Apical Pulse	n.a.
	Creatine Kinase	Serum CPK Level	n.a.
	ST segment changes	12-Lead Electro-cardiogram	n.a.
Behavioral Responses to Pain	Verbal Self-Report	Verbal Pain Scale	r = .92
	Non-verbal Behavior	Non-Verbal Behavior Scale	r = .7650
	Family Interaction	Observation Protocol	n.a.

n.a. = not available

limited interviewing was utilized to assess the behavioral responses. The subject was asked two questions: How would you describe your pain? and, How would you rate its intensity on a scale of 0 to 10 (Appendix A)? The descriptive data were recorded directly on the instrument, whereas the subject's pain intensity rating was recorded on the scale itself and then transcribed to the Data Collection Form-A (Appendix E) under "Pain Score".

During the collection of the vital signs and other physiological data, the behavior assessment was also done. The Non-Verbal Pain Behavior Scale (Appendices B1-English and B2-Spanish) were scored by both the investigator and the Mexican nurse caring for the subject. Whenever a discrepancy occurred in the scores of a particular category, a negotiated, composite score was given that category. Lastly, all agreed upon scores of the seven categories were summed to give one total composite "Behavior Score" for each subject. This total score was then recorded on the Data Collection Form-A (Appendix E) under "Behavior Score".

Participant observation was used by the investigator to observe patient-family interaction. The Observation Guide (Appendix C) was used to direct and document these observations. Post-observation discussions were held with the staff nurses to validate the observations of the investigator. A separate set of field notes was maintained for the purpose of describing the context of the situation

and the broader, overall impressions and themes as they emerged.

Subsequent data collection

The following data were collected from the patient chart for 72 hours after admission: 1) serum creatine phosphokinase (CPK) levels (units/liter); 2) serum glutamic oxaloacetic transaminase (SGOT) levels (units/liter); 3) serum lactic dehydrogenase (LDH) levels (IU/liter); 4) total amount of pain medication, tranquilizers and antiarrhythmics received; 5) vital signs; 6)interpretation of the 12-Lead ECG; 6) site of infarction; and finally, 7) the discharge diagnosis. These data were recorded on Data Collection Form-A.

Data Analysis

The quantitative data were analyzed with both descriptive and inferential statistics. The qualitative data were coded and content analysis performed by cultural validation of emerging themes and concepts.

Descriptive statistics were used to describe the characteristics of the sample. Pearson correlations were calculated between the pain score and the independent variables of pressure-rate product, ST segment change, final diagnosis, and the non-verbal pain behavior score. Inter-correlations of the independent variables were obtained to check for redundancy.

Regression analysis was used to answer the question: What is the optimal combination of these indices to predict

the patient's self-report of pain intensity? Hierarchical multiple regression was used, with the pain score entered as the dependent variable and the independent variables entered in the following order: pressure-rate product; ST segment change; final diagnosis; and non-verbal behavior score. The significance of the complete prediction equation was evaluated with an overall *F* test. Then, the unique contribution (sr^2) of each independent variable was tested for significance at each step in the analysis.

CHAPTER 6

RESULTS

In this chapter the results will be presented according to each specific research question. First, the questions utilizing quantitative data and analytical methods will be presented. Then, the two qualitative questions and their analyses will be presented.

Correlation of Study Variables

Pearson product-moment correlations were calculated to answer research question #1:

> What is the relationship between the physiologic and behavioral responses to acute myocardial ischemia and the patient's self-report of pain intensity?

Two-tailed p values were selected as the normative criteria. There were significant positive correlations between the patient's pain intensity score and six variables: behavior score ($r = .6456$, $p < .0001$); the amount of ST segment elevation on the electrocardiogram ($r = .4427$, $p < .001$); final diagnosis - angina vs infarction ($r = .4198$, $p < .0012$); serum CPK levels ($r = .3443$, $p < .01$); pressure-rate product ($r = .3080$, $p < .05$); and systolic blood pressure ($r = .2914$, $p < .05$). There were no significant correlations between the pain score and heart rate, education, age, or whether or not the patient had had a previous AMI. The correlation matrix of all variables are shown in Table 4.

Table 4

Intercorrelations among Selected Indicators of Acute Myocardial Ischemia* (n=57).

Variable	1	2	3	4	5	6	7	8	9	10
1.Pain Score	--	.64	.44	.29	--	.31	.34	.42	--	--
2.Behavior		--	.42	--	--	.34	.53	.43	.31	--
3.ST segment			--	--	--	.35	.48	.46	--	--
4.Systolic BP				--	--	.53	--	--	--	--
5.Heart Rate					--	.76	--	--	--	--
6.PRP**						--	--	--	--	--
7.CPK level							--	.76	--	--
8.Final Dx								--	--	--
9.Previous MI									--	--
10.Age										--

* Only correlations significant at $p < .05$ are listed

**PRP = Pressure-Rate Product (Systolic BP X Heart Rate)

Pain Score Predictors

Multiple regression analysis was used to answer the second research question:

> What is the optimal combination of the physiologic and behavioral responses to acute myocardial ischemia to predict the patient's self-report of pain intensity?

From the variables with significant correlation coefficients, four were selected for regression analysis: 1) ST segment elevation, 2) Pressure-Rate Product, 3) Final Diagnosis (Angina vs Infarction) and 4) Behavior Score.

Initially, hierarchical multiple regression was performed in order to explore how much each of the predictors contributed to the variance of the pain score. At step 1, the amount of ST segment elevation was entered because theoretically it occurs first. In animal models it occurs within 30 to 60 seconds of coronary occlusion, possibly even before pain is experienced. At the end of step 1, the amount of ST segment elevation explained 19.6% ($p<.001$) of the Pain Score variance.

At step 2, the product of the systolic blood pressure and the heart rate (PRP) was entered, as an indicator of rising oxygen demand with acute myocardial ischemia. When entered at this step of the equation, PRP did not make a significant contribution to explaining the variance of the pain score (2.6% p NS).

At step 3, the severity of cell damage, as reflected in the final diagnosis, was entered into the equation. With present-day routine diagnostic tests, this information is

usually not available at the time of admission and during the first hours of the infarction when the patient is experiencing the most severe pain. Therefore its usefulness as a predictor for a specific patient is questionable. Analysis of this group of subjects, however, showed that the final diagnosis contributed 7.1% ($p < .05$) more to the variance at this step. Subjects with the diagnosis of acute myocardial infarction (irreversible ischemia) had higher pain scores than those with angina (reversible ischemia).

Due to the subjective nature of the behavior assessment instrument, the most conservative analysis method was desired. Therefore the Behavior Score was entered into the fourth and final step of the analysis. After the contributions of the other independent variables were taken into account, Behavior Score contributed 17.7% ($p < .001$) more to the explained variance in the pain score.

The total amount of explained variance was 47%. The summary table for the hierarchical regression analysis is presented in Table 5.

Next, a forward stepwise method of regression analysis was performed to determine the optimal combination of these variables to predict pain score. When the regression was performed with an entry requirement of $F > 1$, only the Behavior Score was significant ($p < .001$). That is, with all four independent variables available, Behavior Score explained such a significant amount of the variance in pain

Table 5

Summary Table for Hierarchical Multiple Regression Analysis of Pain Score on Selected Predictors of Acute Myocardial Ischemic Pain (n=57)

Step	Source	Cumulative R^2	R^2 change	F	p
1	ST segment elevation	0.1960	0.1960	19.233	<.001
2	Pressure-Rate Prod. (Systolic BP X HR)	0.2221	0.0261	2.565	NS
3	Final Diagnosis (Angina vs Infarct)	0.2937	0.0716	7.025	<.05
4	Behavior Score	0.4702	0.1765	17.324	<.001

score (42.4%), that the others add too little further information to be significant. The summary table for the forward stepwise regression analysis is presented in Table 6.

Pain Descriptors

"How is the pain of acute myocardial ischemia described by the Mexican male patient?" is the third research question. The responses of the subjects to the question "Como describiria usted el dolor que siente? [How would you describe the pain that you are feeling]?" are listed in Spanish and English in Table 7.

The words most frequently used to describe this pain were "dolor del pecho" [pain of the chest]. In most cases, the description was accompanied by hand movement showing location and radiation of the pain. Other words used were punzados [sudden, stabbing pains] and piquetes [pricks, punctures].

The location and extent of radiation of the pain sensation varied widely among the subjects, as expected with visceral pain. For example, one patient described pain as originating in the center of his chest and spreading to the left shoulder and back, down the left arm "en la carne" [in the muscle] to the level of the elbow. Another patient described pain only in the upper sternal area, with radiation to the neck and lower jaw. In a more unusual case, the patient described pain only in the right side of the

Table 6

Summary Table for Stepwise Forward Regression Analysis of Pain Score on Selected Predictors of Acute Myocardial Ischemic Pain (n=57)

Step	Source	Cumulative R^2	R^2 change	F*	p
1	Behavior	0.4168	0.4168	41.045	0.0000
2	ST segment	0.4517	0.0349	3.440	0.0691

* F-to-enter = 1, F-to-remove = 1.

Table 7

Descriptors of the Pain of Acute Myocardial Ischemia by Mexican Patients in the Emergency Department (n=57)

Spanish term(s) used	English translation
Dolor del pecho	Chest pain
Dolor en el brazo izquirdo	Left arm pain
Dolor del espalda	Pain in back, shoulders
Dolor en la quijada	Jaw pain
El brazo se sentía dormido	The arm felt asleep
Dolor de punzada (Punzadas)	Stabbing pain; sharp, sudden, shooting pain
Piquetes	Pricks; punctures; pain caused by a needle
Me pega	It hits me
Como un cuchillo directo en mi pecho	Like a knife straight into my chest
Sensación de hormigueos en el brazo	Tingling sensation; like ants walking on my arm
Ardoroso	Burning sensation
Intensivo	Intensive
Muy intenso	Very intense
Tipo purgativo	Like a purgative
Muy fuerte	Very strong
El dolor era insoportable	The pain was unbearable
Más leve, más ligero	Much softer or milder

chest, spreading to the right shoulder and right arm only. In general, however, the pattern described by the most subjects was similar to the classical pattern of angina, as seen in Table 8.

The accompanying symptoms of acute myocardial ischemia were also described. The terms used to describe these symptoms are given in Table 9.

Family Role in Health Emergencies

Participant-observation techniques were used to answer the final research question: "What are the responses exhibited by the family members of Mexican patients experiencing acute myocardial ischemic pain?" Case examples taken from the field notes illustrate several themes of the family's role in such an emergency situation.

The Family as Protector/Supporter.

"An elderly man arrives at the reception area of the emergency department accompanied by what appears to be his family [later confirmed as family members]. These include his wife and four grown children, 3 sons and 1 daughter. The gentleman was walking but is supported on each arm by one of the sons. All family members walk very close together, completely surrounding the man."

"A woman, approximately 50 years old and in no apparent distress, is being pushed in a wheelchair by two younger persons, one on each side of her. Both the young man and young woman are bent over so that they are in very close

Table 8

Patterns of Pain Presentation of Acute Myocardial Ischemia (n=57)

Origin/Site of Pain	Freq	Radiation to:	Freq
* Precordial area	13	* Left arm	16
* Retrosternal and/or midsternal area	29	* Left shoulder	11
* Entire anterior thorax	7	* Anterior surface of neck	15
* Right side of chest only	2	* Both arms to elbow or wrist	11
* Left subclavicular area	2	* Left and/or right scapular area	10
* Left shoulder	1	* No radiation at all	9
* Left arm	1	* Inferior maxillary area	5
* Upper sternal area only	1	* Both sides of neck	3
* Inferior maxillary area	1	* Right shoulder	2
		* Right arm only	2
		* Left arm and fingers	2
		* Only the inner portion of left arm	2
		* Both arms to 4th & 5th fingers only	1
		* Right side of chest	1
		* Entire head	1

Table 9

Symptoms Described by Mexican Patients as Accompanying the Pain of Acute Myocardial Ischemia (n=57)

Spanish term(s) used	English translation
Angustia	Anguish
Ansiedad	Anxiety
Falta del aire	Shortness of breath
Nausea	Nausea
Vómito	Vomiting
Mareo	Dizziness
Pálida	Paleness
Diafóresis	Diaphoresis
Debilidad	Weakness
Inquietud	Restlessness
Como que me íba a morir	"Like I was going to die"
Constricción del cuello	Constriction around the neck
Visión obscura	Dark or dim vision
Visión borrosa	Blurred vision
Zumbido de oídos	Ringing in the ears
Escalofríos	Chills
Malestar	Discomfort
Ganas de defecar	Urge to defecate
Perdida de fuerzas en las piernas	Unable to stand; lost power in the legs
Se me sube la presión	"My (blood) pressure went up"
Se me baja la presión	"My (blood) pressure fell"

proximity to the older woman's face. The young woman [daughter] is at her mother's left side, pushing the wheelchair with her right hand and holding her mother's left arm. The young man [son] is on the right side, pushing the chair with his left hand and holding his mother's right arm.

The Family as Interceptor and Communicator.

"When summoned to the registration area, at first the man does not respond, but rather, his wife comes alone to this triage area.... A second summons is necessary to entice the man to come forth to be evaluated and registered. At this point, the rest of the family members also accompany the gentleman.... After each question addressed to the man, two family members add their comments, expanding and repeating the man's words."

Another case example is given to illustrate the communicator role. "When the patient is shown the Pain Scale and asked to rate his pain, first the wife interjected that the pain was "muy fuerte [very strong], number 9 or 10". But then patient counters with, "no, not really so bad, a number 3 or 4". The wife continued with a description of his pain and the other symptoms he experienced over the previous 12 hours, while the man sits quietly, head and eyes down."

Expectation of Family Solidarity.

"Subject #27 is admitted to the coronary care unit (CCU) with the diagnosis of unstable angina....a total of 16 members of the his family arrive throughout the day and remain at the hospital... Day 2.... 12 family members are

present all day... Day #3.... 15 family members arrive before 12:00pm noon, they include cousins, aunts, uncles as well as the immediate family and in-laws.

"During the three days that the patient is in the CCU, most of the family members stay for 10 to 12 hours/day in the outer waiting room, even though visiting hours are limited to three one-hour sessions per day. Only one visitor is allowed with the patient at any one time.

"The immediate family members, such as his wife and children, spend each day and sleep each night in the waiting room... "[Of course I'm going to stay 24 hours a day]," states the wife."

"Other family members, such as two of the patient's brothers and their wives, also spend each night in the waiting room. They seemed to be in charge of taking care of the patient's spouse and children. In addition, many of the extended family members, such as the patient's cousins, their spouses and children, came to the waiting room. Many do not actually visit the patient, but rather spend the time being with the other family members."

A Mexican staff nurse explains: "We are expected to come.... If you don't come....it means you don't care."

Family Interaction with Institutional Structure

" [staff nurse] comes out of the double doors that separate the waiting/reception area from the rest of the emergency department. She calls out name of next patient to be seen...The woman called rises from her seat and

approaches the nurse, along with five members of her family...Family tries to enter with patient....[staff nurse] holds up her hand and states, "[No, no, only one person is permitted to come with the patient]."

This hospital policy is enforced in another case example. "88 year old man arrives...long history of heart disease...many medications...probably in mild congestive heart failure...accompanied by elderly wife, son and daughter-in-law.

"The patient is called and his wife accompanies him into the examining room....Son asks if he could go into the examining room (35 minutes after father has been gone)...[Staff nurse] says "Only one person per patient"....15 minutes later, son again asks to go into examining room. He states that both his father and mother are very old and don't understand the doctors very well...It took two more approaches before son was allowed into the examining room."

Other Findings

During the data collection period, 1098 persons came to the emergency department with the chief complaint of chest pain, 514 men (47%) and 584 women (53%). Six categories were made of the diagnoses given to chest pain, as illustrated in Table 10. The frequencies within each diagnosis were calculated for each gender. A 6x2 chi-square indicated that there is a significant relationship between gender and diagnosis ($p < .001$).

Table 10

Gender Differences in Emergency Department Diagnosis of Chest Pain (N=1098).

Diagnosis	Males		Females	
	n	%	n	%
AMI or R/O AMI (Admitted to CCU)	117*	22.7	50*	8.5
Other Major pathology +	260	50.6	326	55.8
No cardiac pathology	74	14.4	76	13.0
Osteochondritis	46*	8.9	104*	17.8
Anxiety/Hysteria	12	2.3	20	3.4
Neurosis	5	0.9	8	1.3
TOTAL:	514	100.0	584	100.0

* $p < .05$

+ all other pathological diagnoses except Acute Myocardial Infarction (AMI) and Rule/Out AMI (Unstable Angina)

Six post-hoc contrasts were done to isolate the differences. Two categories of diagnosis were found to have significant gender differences.

First, there was a significantly higher percentage of men ($p < .05$) with the diagnosis of AMI or R/O AMI than the percentage of women with those diagnoses. Specifically, in the emergency department, 22.7% of the men with the complaint of chest pain received the diagnosis of AMI or R/O AMI and were admitted to the CCU. On the other hand, only 8.5% of the women with the complaint of chest pain received either of those diagnoses. These percentages were reflected in the gender composition of the patients in the CCU. During the time of the study, 70% of the patients in CCU with the diagnosis of either AMI or R/O AMI were men, whereas only 30% were women.

In addition, there was a significantly higher percentage of women with the diagnosis of osteochondritis than the percentage of men with that same diagnosis. In particular, 17.8% of the women with chest pain were diagnosed as having osteochondritis, whereas 8.9% of the men with chest pain received this diagnosis.

CHAPTER 7

DISCUSSION AND CONCLUSIONS

When the relationship between the pain intensity score given by the patient and selected physiologic and behavioral correlates of acute MI pain was analyzed, significant individual correlations were identified. Higher pain scores were associated with higher scores on the behavior scale, more ST segment elevation, higher CPK levels, and greater elevation in pressure-rate product and systolic blood pressure. Patients with the discharge diagnosis of AMI had higher pain scores than those in which an AMI was ruled out.

However, when pain was studied as a complex pattern of multiple indices, the patient's behavior was so highly predictive of the patient's self-report of pain intensity, contributing 41.7% of the variance, that the physiological variables alone were not significant. These physiological variables only predicted a significant amount of variance in the pain score when they were combined as a group and the behavior score was not considered. Hence, the behavioral indices of pain were significantly more predictive of the patient's self-report of pain intensity than the physiologic indices.

Sample Characteristics

Of the 3040 persons arriving at the Emergency Department at the Instituto Nacional de Cardiologia during

the 3 month study period, 1098 (36.1%) reported a chief complaint of chest pain. The high frequency of complaints of chest pain in this study reflects the specialized nature of the institution in treating cardiovascular diseases, rather than a higher incidence in the general Mexican population. According to the most recent statistics available, the age-adjusted rate of cardiovascular deaths in Mexico is approximately 66.4/100,000 (Direccion General de Epidemiologia, 1982). This is relatively low compared with the 183.3/100,000 rate in the United States (National Center for Health Statistics, 1985). However, in Mexico, where greater than 50% of the population is under the age of 15, and only 15% is over the age of 45 (Alvarez & Gutierrez, 1979), cardiovascular disease still ranks as second leading cause of all death in that country. For the age group over 45 years, heart disease is the leading cause of death (Secretaria de la Salubridad y Assistencia, 1984).

Of the 1098 patients in the emergency department with chest pain, 167 (15.2%) were admitted to the Coronary Care Unit (CCU) with a suspected myocardial infarction. This figure is considerably lower than 50% to 70% admission rate reported by U.S. hospitals (Hedges & Kobernick, 1988; Tierney, Fitzgerald & McHenry, 1986), perhaps reflecting more rigid admission criteria in the context of limited resources and less threat of lawsuits in Mexico.

Of all the patients with chest pain admitted to the CCU in this study, 70% were men and 30% were women. This unequal

gender distribution is similar in the U.S., where the incidence of diagnosed AMI under the age of 65 years is 3.9 males to 1 female. After the age of 65, this male:female ratio narrows to 1.1:1 (American Heart Association, 1985). The findings from this study showed approximately equal numbers of men and woman with the complaint of chest pain, however, with a disproportionately higher number of woman receiving the diagnosis of osteochondritis and a higher percentage of men were admitted to the CCU with the diagnosis of AMI or R/O MI. These differences indicate a need to investigate gender differences further, first by comparing them with statistics in a U.S. hospital, and second, by follow-up of the women discharged from the emergency department.

Pain Correlates

Pain Score

The mean pain score of this sample of Mexican male subjects at the time of admission was 5.7. No U.S. figures are available for comparison. However, in a study of the initial pain of AMI at a Swedish hospital, the mean pain score at admission was 4.5 (Hofgren, Bondestam, Johansonn, Jern, Herlitz, & Homberg, 1988).

The Swedish score was lower despite the fact that all the subjects in that study were diagnosed with AMI. In contrast, only 63% of the study sample of Mexican subjects received the diagnosis of AMI, and higher pain scores were given by those subjects with a diagnosis of AMI (mean=6.6)

than those in which an infarction had been ruled out (mean=4.2). In addition, the Swedish study had both men and women, whereas the Mexican sample contained only male subjects. If the confounding effects of higher females' score were removed, the mean of the Swedish men may be even lower. Further investigation of this difference in the mean admission pain scores needs to be done to determine if they reflect cultural variability.

Age

No relationship between age and the intensity of pain was found in this study. Although studies of experimental pain report age differences in sensitivity to pain (Woodrow, 1972), this study confirms two other clinical studies of acute MI pain in which no such relationship was found (Hofgren, Bondestam, Johansson, Jern, Herlitz, & Holmberg, 1988; Herlitz, Richter, Hjalmarson, & Holmberg, 1986).

Physiologic variables

In this study, heart rate also had no correlation with the intensity of the pain reported, even though increases in heart rate with pain are well documented. This lack of a relationship between heart rate and pain may be specific to the pathophysiology of an acute myocardial infarction. One team of investigators reported reduced heart rate responses to most autonomic maneuvers, both in patients with coronary artery disease (CAD) and in anginal patients with normal coronary arteriograms, as compared to normal subjects (Ellestad, Thomas, Bortolozzo, Abate, & Greenberg, 1987).

Therefore, the heart rate response to pain may be blunted in the case of acute myocardial ischemia.

The significant positive relationship between pain score and ST segment elevation and peak CPK levels supports their use as estimators of infarct size. Systolic blood pressure elevation, on the other hand, had only a weak positive correlation with the pain score, possibly related to the muted autonomic response in patients with CAD as cited above.

Non-Verbal Pain Behaviors

The behavior score -- with lower values denoting fewer behaviors and higher values associated with more frequent and intense behaviors -- had a moderately strong positive correlation with the pain score. This is an expected finding, assuming that the subject's body language and verbal report were consistent.

The strength of the behavior score to predict the intensity of the patient's pain is one of the most important findings of the study. Behavior Score had the strongest correlation with and was the most significant predictor of the patient's pain score of all the variables studied. Even when entered in the last step of hierarchical regression, behavior retained highly significant predictive power.

Yet, behavioral assessment is difficult due to the multiple social norms and cultural values surrounding pain expression, as discussed in chapter 3. The instrument used in this study to score behavior had seven categories. The

categories with the greatest amount of agreement between the Mexican and American nurses were: the amount of vocalization (crying, sobbing); and the amount of facial grimacing. On the other hand, the category assessing the amount of anxiety the patient was experiencing had the least amount of agreement between the nurses of the two cultures. This supports the research of Davitz & Davitz (1980 & 1981) which described cultural differences in the nurses' assessment of physical pain and psychological distress. This discrepancy between the scores given by the American and Mexican nurses may reflect the different meanings of suffering of each culture. Further study of the instrument with nurses of different cultures is needed in order to substantiate these variations.

Pain Predictors

In constructing the regression analysis, two variables were eliminated because of redundancy. Systolic blood pressure was eliminated for its redundancy with Pressure-Rate Product and the serum CPK levels were eliminated because of their redundancy with the final diagnosis. In addition, a threat to the validity of the results of the CPK levels exists because the levels were analyzed at inconsistent number of hours after admission. Any future replication of this study should include determination of CPK levels every six hours, rather than once a day as in this study, in order to better identify the peak levels.

When the variables were analyzed with the hierarchical method, ST segment elevation and final diagnosis explained a significant percentage of the variance in the pain score only when they were entered before the behavior score. However, when both the physiologic and the behavioral variables are considered, the behavior score predicted so much of the variance that the contribution made by the other variables was not significant.

But in practice, pain behavior is apparent and capable of being assessed at the same time as the physiological tests are done, unless the patient is comatose or recovering from anesthesia. Therefore, behavior may be a better predictor of the patient's pain than vital sign changes or ECG changes.

Pain Description

The meaning of suffering and pain can greatly influence the quality and quality of the pain (Good, 1977). Alternate meanings may be given by different cultural groups to the same stimulus situation (Kirk & Miller, 1986; Trimble, Lonner & Boucher, 1983).

A simple translation of the words is not sufficient. The intention of pain descriptors, not their direct translation, appear to be key to their symbolic association with affect or meaning. This symbolic association may vary across various cultures (Moore & Dworkin, 1988).

The description of the chest pain and its radiation widely varied, but the subjects reported patterns and

frequencies similar to the classical pattern of angina (Hurst, 1982). The subjects in this study were more likely to describe what they were feeling as "dolor del pecho" [pain in the chest] than to use words such as pressure or tightness in the chest as the classical pattern describes (Tierney, Fitzgerald & McHenry, 1986). The term "punzadas" [sharp, stabbing pains] used by some subjects to describe their chest pain are also not typical. The meaning of these words then may have a different significance to the Mexican patient.

Family responses

The family is an integrated social system with interdependent parts, each having its own expected roles. A malfunction in one part may lead to disequilibrium of the total system (Schvaneveldt, 1966; Steinglass, 1980). Therefore, when a crisis affects one member of the family, all others are affected. This is demonstrated in one study of family stresses that reported spouses' levels of stress to be even higher than those reported by the patients during the acute phase (Gilliss, 1984). This finding was sustained even when the spouses scores were adjusted for gender.

The family of the Mexican patient serves many functions at the time of health emergencies. These roles can be categorized as that of protector, interceptor, negotiator/mediator, translator and tightly-knit support system.

In the role of protector, the Mexican family members interceded for the patient and attempted to shield the patient from unnecessary stresses. Rather than having the patient experience the stress of dealing with the bureaucracy, the family assumed some of the decision-making and made the initial contacts with the health care system.

This resulted in protecting the patient even from being questioned and evaluated by the triage nurse. On numerous occasions, the family members, rather than the patient, attempted to describe the symptoms and severity of the pain. In the U.S., where individualism is highly valued, health care professionals tend to direct their questions and assessment toward the patient primarily, and toward the family only secondarily.

Often the patient's family assisted the clinician in refining the clinical presentation. The ideal of the Mexican "macho" -- male -- is to "never crack, never give in." National heroes, such as Benito Juarez and Cuauhtemoc are revered for their stoicism, among other qualities (Gurza, 1976). Therefore, in the setting of acute pain, the Mexican male patient may deemphasize the severity of the pain in order to maintain the integrity of his male image and its projection to society. The family, on the other hand, in its role as protector of the patient, may be giving the more accurate account of his pain syndrome.

Not only does the family act as translator from the patient to the health care system, but also from the

hospital back to the patient and the rest of the extended family network. The decision for hospitalization is usually not left up to the patient by himself, but is rather a joint decision with other family members.

Expectation of Family Solidarity

Four key concepts to understanding the interpersonal relationships among Mexican-Americans were described by Roberts (1984): dignity, respect, hospitality and interpersonal interaction. The last concept particularly is reflected in the fact that when a Mexican family member becomes ill, all other members of the family are expected to provide support. In most cases, that means halting all other work and activities and coming to the side of the patient. This included the nuclear family and extended as well to aunts, uncles, cousins and in-laws. Non-appearance is construed as "you don't care", even if the illness is relatively minor.

The social expectation to provide support to an ill family member is so strong that very few excuses are acceptable. In particular, the obligations to a sick family member are much stronger and given a much higher priority that one's obligations to one's employer. This results in a high economic burden from loss of income during the many times of family crises.

In addition, in contrast to the U.S., greater numbers and generations of family members of the Mexican patients accompanied the patient to the hospital and stayed

continuously at the hospital, meeting their social responsibility. Hence, hospitals in the U.S. with visitor's rooms designed to accommodate the smaller numbers of visitors from an average American family may find their facilities insufficient and adequate to meet the needs of the Mexican or Mexican-American family.

Role of the Nurse

The emergency department triage nurse serves as the gatekeeper to hospital and implementer of its policies. This nurse assesses the pain behaviors, description and severity of the pain. Based on the nurse's assessment, the validity and urgency of the pain are evaluated and the patient granted access to the health system according to the nurse's assignment of priority.

Thus the nurse is in a very powerful position to grant entry into the system yet bases the assessment on tools with questionable reliability. The patient and family are in position of trying to convince the nurse that they need care. For example, if they appeared in very severe pain, they may be admitted with few questions and be seen immediately by a physician. But, if they stated that they had only moderate amount of chest pain and if they were restrained in the exhibition of pain behaviors, they may have to wait, maybe up to several hours, in order to be evaluated further. This may leave open the possibility of the patient or family exaggerating the pain in order to gain

entrance to the system and to advance their position in the line to be seen by a physician.

Limitations of the Study

The application of the findings of this study have several limitations. First, only one gender was studied because of the reported variability of pain behaviors between sexes. Since a considerably higher percentage of males were diagnoses with AMI or R/O AMI, they were chosen as study subjects. The continued use of this rationale to study cardiac disease will only promote research about one gender. As a consequence, little or no information about women's responses will be gained.

Second, this study was limited to one culture. Therefore, valid cross-cultural comparisons can not be made until the study is replicated in another culture.

This study was limited to the study of acute pain only, excluding aspects of chronic pain. In addition, these findings can be applied only to the population with ischemic heart disease. The meaning of this kind of pain differs from surgical, trauma or cancer pain.

A serious limitation of the study is the subjective nature of both the dependent measure (Pain Score) and its strongest predictor, the behavior score. Compounding this problem are the questions of cross cultural validity of the tools.

Finally, an etic view, rather than an emic one, is presented. The disadvantage of this approach is the

possibility of misinterpretation of words and symbols in another culture. Although a consensus of opinions from nurses with the culture, and other Latin American nurses was sought, consensus could only be determined regarding the observations the investigator chose to highlight. Behaviors which may have been meaningful to a nurse from the same culture as the patient may be completely disregarded by another nurse not from the same culture because they have no meaning to her.

Implication for clinical practice

The strength of the correlation of the behavior score to the patient's report of pain intensity and its strong predictive power highlights the need for nurses to include behavioral assessment of pain behaviors along with measuring the vital signs. When physiological and behavioral parameters give conflicting data, the behavior may be a more accurate reflection of the degree of pain experienced by the patient.

Nurses need to be aware that their own culturally sanctioned values surrounding the expression of pain may affect how they perceive their patient's response to pain, and ultimately, if and how they treat these patients. Validation with the patient is necessary to avoid the potential for miscommunication, and hence, inadequate control of the patient's pain. The tables of pain terms and symptoms (pp. 113 & 116) may be useful for non-Spanish speaking nurses caring for a population of Mexican patients.

The use of these tables may serve as an initial step in validating the patient's pain experience.

The Mexican family serves as a strong intercessor on the behalf of the family member in distress. Nurses may need to negotiate with family before gaining access to the patient. These family members can often supplement the patient's history and give valuable clues to accurately assessing the patient's behavior.

Within the Mexican culture, family obligations assume one of the highest priorities of daily life. As many family members as possible, extending far beyond the nuclear family, are expected to stay day and night near the ill member. Nurses have the opportunity to capitalize on this family solidarity to the benefit of the patient, family and even the nursing staff. A relaxation of rigid visiting policies would allow the isolated patient the benefit of the family's support while also meeting the highest priority needs of the spouses, namely to be near their loved ones, to be able to help them and to know their progress (Dracup & Breu, 1978; Heater, 1985). An increase in the morale of the ICU nurses was also noted after visiting hours were changed from short visits several times a day to unlimited visiting privileges throughout the day and night (Dracup & Breu, 1978).

Nurses should expect that large numbers of visitors are the rule rather the exception, and attempt to provide adequate space and accommodations for them. These might

include: couches that can be used as beds; large waiting rooms, near patient area but able to be closed off during the day so they can rest in daytime if necessary; phones with long distance charging capacity; a supply of blankets, books, magazines, coffee, juices, and an area designated for smoking. A private area, away from the visitors lounge, should be provided for transmitting very sensitive information to the family that is likely to be reacted to emotionally, such as death of a loved one.

Implications for further research

Since this study was intended as a baseline for future cross cultural comparisons of the pain response, a replication study is needed. The next most likely groups to test are the dominant Anglo culture in the U.S. and Mexican-Americans. The analysis should compare the results of all three groups. The study can then be expanded to include other groups.

Further testing and refinement of the behavior instrument is needed to address its reliability & validity issues. In particular, comparison of scores by nurses from different cultures may identify the degree and areas of mutual agreement and disagreement. Also, correlations between the patient's perception of pain and scores given by a nurse from his own culture could be compared to the patient's correlation with a nurse from a culture different from the patient. Finally, the regression analysis could be performed

separately with each nurse's scores and the results compared.

Concurrent pain scores by the family members and the patient should be investigated for significant differences. This may be able to identify the importance of family input when assessing the patient's pain.

Gender differences in diagnosis of chest pain and admission to CCU should be explored further for possible explanations. In addition, the pattern of pain behaviors in women with an AMI should be investigated to determine any significant differences from the behaviors or pain scores observed in the male sample. An "atypical" pattern in women may help explain the differences in emergency room diagnoses.

Summary

During the first 24 to 48 hours after a patient has sustained an AMI, a major goal of nursing care is effective pain management. In order to accomplish this goal, accurate pain assessment and subsequent validation of this assessment with the patient is necessary. The findings from this study indicate that pain behaviors, such as crying or restlessness, are more accurate indicators of the intensity of the pain than vital sign changes.

Pain behaviors, as components of sick role behaviors, can vary according to culture. Although this is a study of one culture, comparison of its findings with those reported

in the literature indicate there may be cultural differences in rating the intensity of pain. The Swedish sample of patients with an AMI, for example, had a significantly lower mean pain score on admission than the Mexican sample. For nurses at the bedside, this difference has the potential for confusion, misunderstanding and conflict of values surrounding the patient's evaluation and expression of pain.

The family is an integral extension of the patient in Mexico, and this tradition is likely to continue if the patient migrates to the U.S. The hospital in this study was well designed to accommodate the large numbers of family visitors. In many U.S. hospitals, however, the family waiting area would be too small and ill-equipped to accommodate all the family members required by tradition to be near the Mexican patient. Support to the family, who in turn provide psychological support to the patient, is also a component of nursing care. Therefore, the needs of the extended families of the Mexican and Mexican-American families also should be assessed and addressed.

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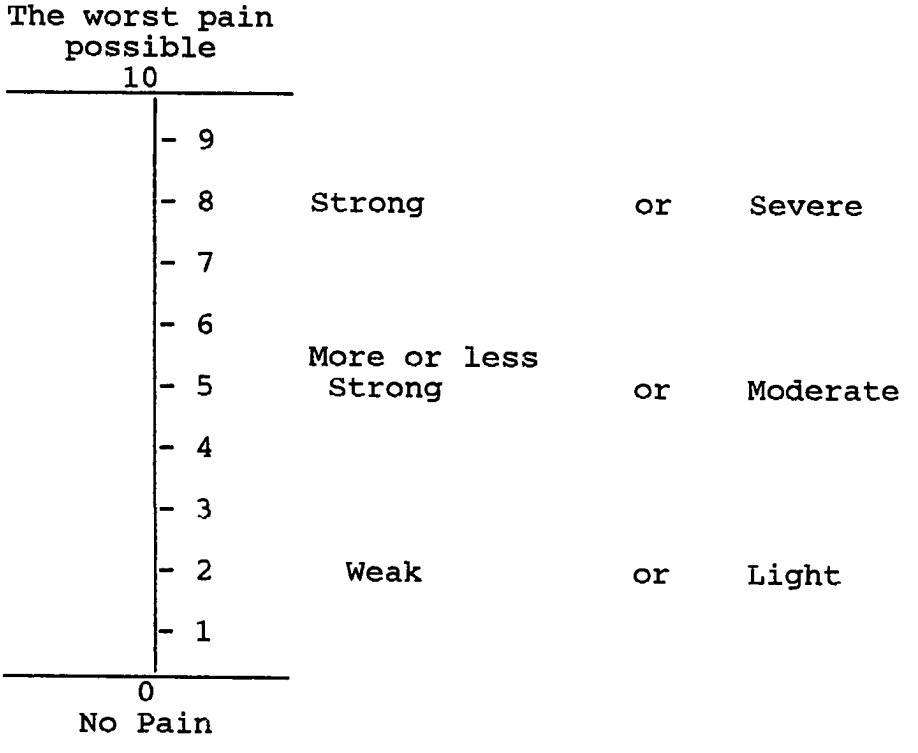
APPENDIX A-1
PATIENT INTERVIEW FORM

Subject Number: Date/Time of observation:

1. How would you describe your pain?

2. Using the this scale of 0 to 10, with 0 equal to no pain and 10 equal to the worst possible pain, how would you rate your pain? What number would you assign to your pain? How much does it hurt?

VERBAL PAIN RATING SCALE



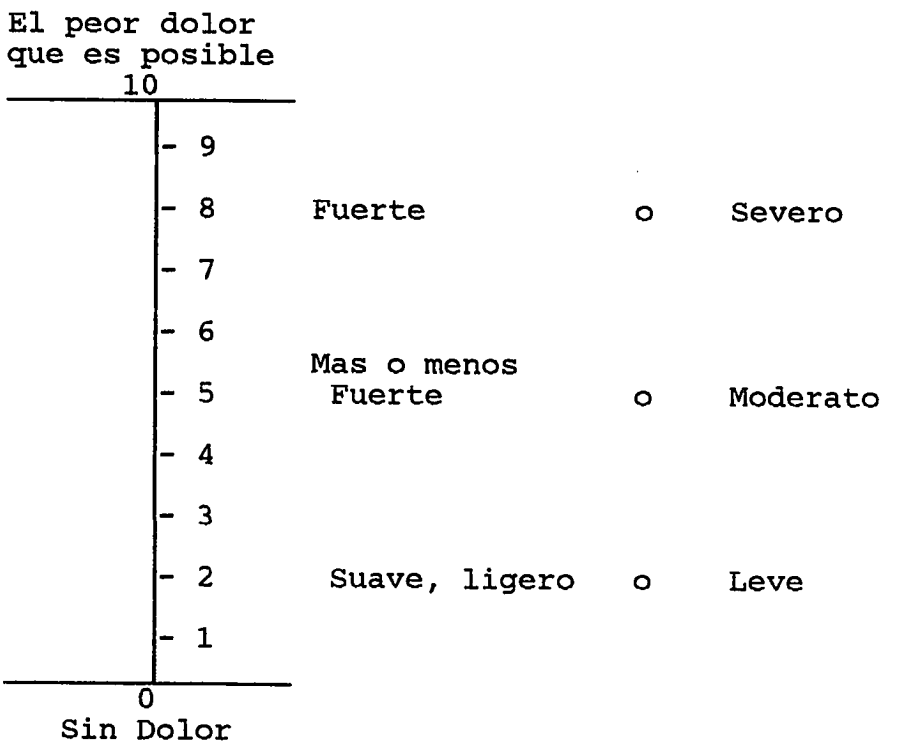
APPENDIX A-2
FORMULARIO DE ENTREVISTA CON EL PATIENTE

Numero de Sujecto: Fecha/Hora de Observacion:

1. Como describiria usted el dolor que siente?

2. Usando esta escala de 0 a 10, haciendo el cero equivalente a sin dolor y el 10 al peor dolor posible, como evaluaria el dolor que siente? Que numero le daria a su dolor? Cuanto le duele?

VERBAL PAIN RATING SCALE



APPENDIX B-1

NON-VERBAL PAIN BEHAVIOR SCALE*

Date/Time of Observation_____ Subject Number_____

1. **ATTENTION TO PAIN:**

Amount of attention directed toward pain:

1	2	3	4	5	
none	small	moderate	marked	complete	_____

2. **ANXIETY:**

Amount of irritability, tension or worry demonstrated:

1	2	3	4	5	
none	small	moderate	marked	complete	_____

3. **SKELETAL MUSCLE RESPONSE:**

Amount of restlessness demonstrated:

1	2	3	4	5	
none	small	moderate	marked	extreme	_____

Amount of muscle tenseness demonstrated:

1	2	3	4	5	
relaxed	slight	moderate	marked	extreme	_____

Amount of grimacing or frowning exhibited:

1	2	3	4	5	
none	slight	moderate	marked	constant	_____

4. **VOCALIZATIONS:**

Amount of crying, moaning, or sobbing:

1	2	3	4	5	
none	small	moderate	marked	constant	_____

5. **DIAPHORESIS:**

Amount of perspiration:

1	2	3	4	5	
none	small	moderate	marked	severe	_____

TOTAL SCORE _____

DOCUMENT ADDITIONAL COMMENTS ON THE REVERSE OF THIS FORM

*Adapted and reprinted from Chambers & Price, 1967, p.230, with permission of American Journal of Nursing Company.

APPENDIX B-2

ESCALA DE CONDUCTA DE DOLOR NO VERBAL*

Fecha/Hora de observacion_____ Numero de sujecto_____

---

1. **ATENCION AL DOLOR:**

Cantidad de atencion dirigida el dolor:

1	2	3	4	5	
ninguna	pequena	moderada	marcada	completa	_____

2. **ANSIEDAD:**

Cantidad de irritabilidad, tension o preoccupacion demostradas:

1	2	3	4	5	
ninguna	pequena	moderada	marcada	completa	_____

3. **RESPUESTA MUSCULO-ESQUELETAL:**

Cantidad de desasosiego demostrado:

1	2	3	4	5	
ninguno	pequeno	moderado	marcado	extremo	_____

Cantidad de tirantez muscular demonstrada:

1	2	3	4	5	
ninguna	pequena	moderada	marcada	extrema	_____

Cantidad de gesticulacion o ceno exhibidos:

1	2	3	4	5	
ninguno	pequeno	moderado	marcado	constante	_____

4. **VOCALIZACIONES:**

Cantidad de llanto, quejidos, o sollozos:

1	2	3	4	5	
ninguno	pequeno	moderado	marcado	constante	_____

5. **DIAFORESIS:**

Cantidad de transpiracion:

1	2	3	4	5	
ninguna	pequena	moderada	marcada	severa	_____

PUNTAJE TOTAL _____

DOCUMENTE COMENTARIOS ADIDIONALES EN EL REVERSO DE ESTE FORMULARIO (*Adaptado de Chambers y Price, 1967).

APPENDIX C
OBSERVATION PROTOCOL

1. How many family members accompanied patient?
2. What are their relationships to the patient?
3. Where do the family members stay?
4. How does the patient communicate to the family that he is experiencing pain?
5. What do the family members say to the patient when he is experiencing pain?
6. What affective behaviors are exhibited by the family when the patient is experiencing pain?
7. What other responses are exhibited by the family members when the patient is experiencing pain?
8. What effect does this have on the patient?
9. What types of questions do the family ask the physicians and nurses?
10. Which family members ask the questions?
11. Which family members are the decision-makers?
12. What are their expectations of the health care system?
13. What are their expectations of the nurses?
14. What effect does the emergency department environment have on their ability to cope?
15. What is their response to the decision for hospitalization?

NOTE: These observations were documented on Data Collection Form-B (Appendix E).

APPENDIX D

DATA COLLECTION PROCEDURE

1. Using Selection criteria #1 -6, screen all patients arriving in the emergency room with the chief complaint of chest pain.

2. Collaborate with the physician and nurse attending the patient regarding the optimal time to approach the patient for the purpose of the study.

3. Introduce self to patient and family members present.

4. Explain research project and read "Information Sheet" to patient.

5. Request permission to participate in the study and use tape recorder.

6. If permission is granted, proceed with data collection.

7. Measure the systemic blood pressure in mmHg from the right arm using a McCoy aneroid manometer. Take two measurements and average the readings. Record on Data Collection Form-A.

8. Auscultate the apical pulse for one full minute. Record on Data Collection Form-A.

9. Auscultate the respirations for one full minute. Record on Data Collection Form-A.

10. Ask patient to describe his pain. Record in indicated area on Appendix A.

11. Show the Verbal Pain Rating Scale (Appendix A) to the patient and read the descriptive words placed along side the numerical scale. Ask the patient to rate his pain using this scale. Record the number directly on instrument and also on the Data Collection Form-A.

12. Using the Non-Verbal Pain Behaviors Scale, determine the total score and record on the Data Collection Form-A.

13. Observe patient-family interactions. Record on Data Collection Form-B.

14. Only if the patient is admitted to the hospital, is he entered into the study. Screen the admitted patients for selection criteria #5 and the exclusion criteria.

APPENDIX D (Continued)

DATA COLLECTION PROCEDURE

15. Follow-up data collection: Review the patient chart for the next three days to record the following: serum levels of CPK, SGOT, and LDH; interpretation of the 12-Lead ECG; site of infarction or ischemia; and the amount and type of analgesia, antiarrhythmics and tranquilizers received. Record this data on the Data Collection Form-A.

16. Use a separate notebook for contexual descriptions and perceptions. Begin each day with day of week and date. Note time for each entry.

APPENDIX E

DATA COLLECTION FORM (A)

Subject Number:_____ Date/Time Arrived
Age:_____ in E.D._____
Sex: Male/Female Place of
Religion:_____ Birth_____
Occupation:_____ Place of present
Type of Health Insurance_____ Residence_____
_____ _____

Date:				
Time:				
Pain Score:				
Behavior Score:				
Blood Pressure: Syst/Diastole				
Apical Pulse:				
Respiration Rate:				
Cardiac Rhythm:				
# of PVC's/min.:				
ST segment change:				
Site of ischemia:				
Cardiac enzymes: CPK				
SGOT				
LDH				
Discharge Diagnosis:				
Pain Medication: Type				
Amount/route:				
Patient requested pain relief? Y/N				
Tranquilizers: Type				
Amount/route:				
Antiarrhythmics:				
Type				
Amount/Route				
Family present: Number				
Relationship				
Amt of time with patient				
Nurse actions: Type of intervention				
Amt of time with patient				
Other:				

APPENDIX E (Continued)

DATA COLLECTION FORM (B)

Subject Number:________________ Page Number:__________

DATE/TIME	OBSERVATIONS

APPENDIX F-1

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

INFORMATION SHEET
FOR PARTICIPATION IN A RESEARCH STUDY

A STUDY OF HEART PAIN

The purpose of this study is to describe how people tell us they have heart pain so that the nurses and doctors may more easily be able to treat pain.

If you agree to be a subject in this study, I will do the following: take your blood pressure with this cuff, listen to your heart and lungs, ask you two questions about your chest pain, and use some of the information from your chart.

I would also like to request your permission to use a tape recorder so that I may more correctly record your answers. These tapes will be erased immediately after your answers have been written down.

Your name will not be attached to anything you tell me and your answers will be kept confidential as far as possible. Your participation in this study is entirely voluntary, and will not affect your care in any way. You may choose to stop at any point.

You will not be paid for your participation in this study nor will you receive any other personal benefit. However, your participation may help nurse and doctors better treat heart pain.

If you have any questions or concerns regarding this study, you may call me at [redacted] or you may contact the Department of Nursing at [redacted] or the Human Subjects Committee at [redacted]

Thank you very much for your assistance in this study.

Sincerely,

Marilyn K. Douglas, RN, MSN, CCRN
Doctoral Candidate
School of Nursing

APPENDIX F-2

UNIVERSIDAD DE CALIFORNIA, SAN FRANCISCO

HOJA DE INFORMACION
PARA PARTICIPAR EN UN ESTUDIO DE INVESTIGACION

UN ESTUDIO DE DOLOR DE CORAZON

El propósito de este estudio es el de describir cómo nos dice la gente que tiene dolor en el corazón, de modo que los enfermeras y médicos puedan tratar el dolor mas fácilamente.

Si usted está de acuerdo en ser un sujecto en este estudio, haré lo siguiente: le tomaré la presión de la sangre con este aparato, oiré su corazón y pulmones, le haré dos preguntas con respecto a su dolor en el pecho, y usar alguna de la información clinica.

Tambien quisiera pedirle su permiso para usar una gravadora para que yo puedo tener sus respuestas todamente correcta. Estas cintas seran borradas tan pronto como sus respuestas sean transcitas.

Su nombre no va a estar unido a lo que me diga y sus respuestas serán confidenciales tanto como sea posible. Su participación en este estudio es voluntaria y no afectará su atención en ninguna forma. En cualquier momento usted puede dejar de participar.

No se le va a pagar por su participación en este estudio y no va a recibir ningún otro beneficio personal. Sin embargo, su participación puded ayudar a que los enfermos y medicos traten mejor el dolor de corozón.

Si usted tiene preguntas o inquietudes con respecto a este estudio, usted puede llamarme al [redacted] o puede ponerse en contacto con el Departamento de Enfermería al [redacted] o al Comité de Investigacciónes al [redacted].

Muchas gracias por su ayuda en este estudio.

Atentamente,

Marilyn K. Douglas, RN, MSN, CCRN
Candidata doctoral
Escuela de Enfermería