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Author
Lee, Hae Ok

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Hae-Ok Lee

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FATIGUE IN MYOCARDIAL INFARCTION PATIENTS

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FATIGUE IN MYOCARDIAL INFARCTION PATIENTS

abstract

Hae-Ok Lee

The purpose of this study was to: 1)describe the severity and the patterns of fatigue experienced by myocardial infarction patients from acute phase to recover; 2)describe the physiological and psychological factors that influence fatigue such as ejection fraction, cardiac output, anxiety, and depression; and 3)to determine the relationships between fatigue perception and demographic and clinical variables such as gender, age, severity of MI and treatment protocols.

A descriptive correlational design with repeated measures was used to describe the patterns of fatigue and physiopsychological variables over a three-week period. Fatigue and psychological variables were measured daily over the 17 day period with the VAS-Fatigue scale and the Profile of Mood States. Quantitative two-dimensional echocardiography was performed serially four times. The sample of 22 MI patients had a mean age of 54 ± 13 years and 5 were women.

The presence of fatigue severity in MI patients across 17 days ranged from 32 to 45 on the 100 mm VAS-Fatigue scale. Although the severity of fatigue remained the same for the total group over time, cardiac function improved and patients

sexperienced more energy and less anxiety at the third week following an MI.

Results showed that there were five fatigue patterns among the total number of MI patients: decreasing, increasing, unchanged with low fatigue or high fatigue, and curve-linear shaped pattern of fatigue groups over time. Fatigue was significantly and positively related to anxiety and depression, and negatively related to energy and vigor. In addition, there was a trend of relationship between fatigue and EF, peak CPK at admission, and being female.

These results described the severity, duration, and patterns of fatigue in patients with MI. The study finding of five different fatigue patterns after an MI suggests that patients after MI should not be treated as a uniform group who assume to have decreasing fatigue with the passage of time. Also, the findings of this study enhance understanding of the specific variables that relate to fatigue in MI and assist to develop theory for fatigue in order to assess and intervene to reduce perceived fatigue.

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INTRODUCTION

The symptom of fatigue is a distressing and significant problem for patients who suffer from myocardial infarction (MI). (Appels & Mulder, 1989; Hentinen, 1986; Ibsen, 1975; Trelawny-Ross & Russel, 1986; Whishinie, 1971). However, our understanding of the frequency, severity, etiology, pattern, and therapeutics for fatigue in MI patients is limited. Although fatigue is a multidimensional phenomenon, little attention has been given to its physiological, psychological, and sociological influences. Rather, the focus has been on fatigue as a side effect of medication or angina pain, or as a psychological reaction to the MI or hospitalization (Dellipini, 1976; Fletcher, et al., 1992; Sykes, 1989).

The phenomenon of fatigue in patients with MI is of special interest to nurses because of its physiological, psychological, and behavioral components. Fatigue is a subjective sensation and results from physical, psychological, and sociological factors. All types of people can feel fatigue: the young and the old, the sick and the healthy. It occurs in different conditions and on a continuum from tiredness to exhaustion throughout life. In the same environment, certain people complain about fatigue, but others do not. Individuals, groups, and races may have different perceptions and manifestations of fatigue. Nonetheless, fatigue becomes significant when it begins to have an adverse effect on a person's well being and creates an inability to accomplish tasks through sustained effort and focused attention.

Hart and Freel (1982) acclaimed that since fatigue is a common harbinger of the presence of illness and disease progression, it is important that nurses identify fatigue severity and its impact in clinical monitoring. The North American Nursing Diagnosis Association (NANDA) defined fatigue as "an overwhelming sustained sense of exhaustion and decreased capacity for physical and mental work" (Carroll-Johnson, 1989).

Fatigue is one of the most frequently reported symptoms among a variety of patient populations such as those with endocrine disorders, infection, anemia, congestive heart failure, multiple sclerosis, sleep disorder, cancer and those who have experienced surgery (Hart, 1983; Jerret, 1981; Lee, et al., 1992; Rhoten, 1982, Rockwell, 1977). There are many published studies to explore the symptom of fatigue in cancer patients, the frequency and the severity of fatigue are fairly well established in cancer patients (Blesh et al., 1991; Cassileth, et al., 1984; King, et al., 1985; Knobf, 1986; Rodes et al., 1988). Moreover, studies have been examined regarding how the stage of disease, the length of treatment, the types of treatments, as well as physical and psychological variables influence the symptoms of fatigue in various cancer patients (Haylock & Hart, 1979; Holley, 1991;

McCorkle & Young, 1978; Piper, et al., 1992; Strauman, 1986). Fatigue is also a common problem in the healthy population and in primary care settings. In a survey (Chen, 1987) about 30% of women and 20% of men admitted to "always feeling tired" during the previous week, and similar data have been reported from Cox and colleagues (1987). An investigation of fatigue (kroenke, et al., 1988) in an Army Primary Medical Care Center found that 28% of women and 19% of men indicated that fatigue has been a "major problem" for a month or more. Morrison (1980) reviewed 31,000 patients' medical charts from family physicians in private practice and university family medicine centers over a 12-month period. One hundred seventy-six patients suffered from fatigue. Of these patients, thirty-nine percent had a physical diagnosis associated with their fatigue, while 41% had an associated psychosocial diagnosis. Only 8% had no discernable explanation for their fatigue.

PROBLEM STATEMENT

Myocardial infarction is an illness which threatens life and often results in premature death. This life-threatening event results usually appears with little advance warning. In the United States, nearly 1.5 million people suffer annually from myocardial infarction (MI), and approximately one-fourth of all deaths are due to MI. Although the mortality from MI has declined in the last decade, there are over five million MI survivors living in the

United States; half of those survivors are physically limited by their disease (The National Center for Health Statistics, 1990). Moreover, although many patients recover physically, a significant number are unable to return to their previous levels of functioning in everyday life (Cay, et al., 1973; Mayou 1978; Mealand & Havic, 1987; Steinhart, 1991).

Myocardial infarction represents a catastrophic blow to body and mind which may drastically affect the patient's physiological and psychological health. Myocardial infarction patients suffer not only from physiological but also psychological distress. Depression and anxiety which may accompany, cause or be result from fatigue, are very common psychological responses after MI. Several reports have emphasized the frequency of these symptoms and their psychological outcomes early after MI and in the long-term recovery period after MI (Charmey, 1988; Havic & Mealand, 1989; Mayou, Foster & Williamson, 1978; Trelawny-Ross & Ressell, 1986).

Although several researchers have indicated the coexistence of fatigue and psychological symptoms after MI (Cassem, 1971; Lagult, 1992; Mayou, et al., 1978; Stern, 1979), to date there is no study which describes or identifies the relationship between fatigue and physiological variables in post-MI patients. However, a major contraction abnormality and low cardiac output are very common hemodynamic problems in post-MI patients (Bhatnager, et al., 1988; Grines, 1988). Thus, the limitation of cardiac contraction and cardiac output may be fatigue-moderating factors in MI patients.

The literature published in the last two decades has shown significant refinement in the measurement of psychological variables in post MI patients (Beck, et al., 1987; Thompson, 1982). However, few attempts have been made to study fatigue (Cassem, 1971, Stern, 1979; Trelawny-Ross & Russell, 1986; Rigel, et al., 1992). The severity and patterns of fatigue in MI patients were not described, and factors that may influence fatigue have not been studied. The symptom of fatigue was considered in these studies as part of the psychological or physiological symptoms rather than a unique component.

In summary, in spite of a high prevalence of fatigue in MI patients and the presence of many physiological, psychological and sociological factors that influence the fatigue experience, the symptom of fatigue has not yet been studied in depth. Little is known about etiology, severity, duration, frequency, and correlates of fatigue in patients with MI. Measurement is a consistent problem in studies investigating fatigue in MI patients. Fatigue has typically been measured with a one item questionnaire for just fatigue frequency. This limited approach does not consider the multidimensional features of fatigue measures. Thus, well-designed prospective research which measured with multi-dimensional fatigue measurement tools and measured with fatigue-related variables simultaneously is needed to explicate the MI patient's fatigue experience.

PURPOSE OF THIS STUDY

The purpose of this study is to describe the severity and the patterns of fatigue experienced by myocardial infarction patients from acute phase to recovery. In addition, physiological and psychological factors that influence fatigue such as ejection fraction, cardiac output, anxiety, and depression are measured and described. The final purpose of this study is to determine the relationships among the perceived symptoms of fatigue and demographic variables such as gender and age and clinical variables such as severity of myocardial infarction and treatment protocol. The specific research questions are:

1. What is the severity and pattern of fatigue after occurrence of MI?
2. What is the severity and pattern of energy, vigor, anxiety, and depression?
3. What is the severity and pattern of physiological variables such as ejection fraction (EF) and cardiac output (CO) as measured by echocardiography?
4. Is there a relationship between fatigue and demographic (age, gender) and clinical variables (severity of MI)?
5. What is the relationship between fatigue and psychological variables such as anxiety and depression?
6. What is the relationship between fatigue and physiological variables such as cardiac output and ejection fraction?

CHAPTER 2. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

INTRODUCTION

Related knowledge from the study of fatigue in other areas will be selected in order to contribute to the development of knowledge of fatigue in patients with MI. First, the definition of fatigue, including relevant literature from each discipline's perspective, is discussed with emphasis on interdisciplinary differences. Measurement of fatigue and measurement issues related to fatigue will be discussed also.

Second, since there are only few articles pertinent to the subject of fatigue among MI patients, this literature review will include the subject of fatigue in a variety of clinical populations as well as MI patients. Finally, mechanisms of fatigue and fatigue related factors, such as left ventricle (LV) function and psychological responses to MI, are reviewed without emphasizing either empirical data or detailed clinical impression. However, a number of substantive areas only tangentially related to this review's focus were excluded. Psychological variables which frequently occur after acute MI such as anger/hostility, denial and stress will not be covered.

BODY OF KNOWLEDGE OF FATIGUE

DEFINITION OF FATIGUE

Because of the multiplicity and variability of the phenomenon of fatigue, the characteristics and expressions of fatigue vary from person to person, from group to group, and from place to place. The definitions of fatigue are different from one discipline to another discipline. Researchers in various disciplines have their own definitions of fatigue according to their own experiences and perspectives. There is no general or comprehensive definition of fatigue across all disciplines. Webster's dictionary gives the following general definition of fatigue:

"Weariness from labor or exertion: exhaustion of strength; also, tiredness or physical or nervous exhaustion from causes other than physical or intellectual exertion; loss of power resulting from continued workout removable by rest: exhaustion in productive power: the transitory refractory state induced in a sensory receptor or motor end organ by continued or repeated stimulation, or tiring duty such as labor or toil."

Grandjean (1968) proposed that fatigue in daily experience is "general fatigue" and described the sensation of fatigue as follows:

> "When a person is tired the subjective sensation of fatigue predominates: feelings are hampered and activities are reduced until we are forced to give up. There is no desire either for physical or mental work, and we feel heavy and sluggish. The sensation of fatigue is not unpleasant when we are able to rest. But it is painful when rest is not permitted. We have learned through experience that the sensation of fatigue has a protective function similar to those of hunger and thirst. The sensation of fatigue forces us to avoid further stress, and allows recovery to take place."

These definitions represent a particular aspect of fatigue, and the words "tiredness", "exhaustion", and "weariness" refer to the same condition. Fatigue is generally considered synonymous with these words.

There are several types of definitions of fatigue. The terminology differs across the various disciplines and researchers who have different perspectives related to the study of fatigue.

The study of fatigue by neuromuscular physiologists involves peripheral fatigue and central fatigue which pertains to the nature of the processes within the body and not the person's performance. Research related to peripheral fatigue focuses on impairment of the function of the peripheral nerves, neuromuscular junction transmission, and electrical activity of muscle fiber (Gibson & Edwards, 1985). This research helps us understand fatigue only on the basis of changes in a part of the body. However central fatigue caused by lack of motivation, impaired transmission down the spinal cord, impaired recruitment of motor neurons (Akerstedt, Gillberg & Wetterberg, 1982; Arendet, Borbely, Franey & Wright, 1984; Poteliakhoff, 1981) explains total body changes and is not limited to one organ system or just to cells but to the performance of the whole person.

Other physiologists are focusing on fatigue of specific muscles or groups of muscles, such as diagram fatigue, leg fatigue, or cardiac muscle fatigue (Katz, 1991; Wilson, et al., 1992). Muscle fatigue is defined as a failure to maintain the required force or a reduction in the force-generating capacity of the neuro-muscular system (Katz, 1991). Muscle fatigue has been attributed to many factors, including a decrease in pH, inadequate blood supply,
a decrease in blood glucose, excitation-contraction coupling failure, a decrease in the discharge frequency of motor units, failure of propagation of muscle action potentials, and impaired transmission at the neuromuscular junction (Gibson and Edwards, 1985, Miller-Brown and Miller, 1986, 1987). Gibson and Edwards (1985) consider fatigue as a self-protective mechanism against damage of rigor which occurs if the energy stores are depleted. When fatigue is viewed as a state that protects an individual from overwork, or from an unbalanced state of the homeostatic mechanisms, it functions as an involuntary monitor.

Psychologists describe fatigue as a condition affecting the whole organism. They include in their descriptions factors such as the subjective feelings of fatigue, motivation, and the resulting deterioration of mental and physical activities (Grandjean, 1971, 1980, Tracy, 1967). Tracy defined the psychosomatic fatigue syndrome by saying that it did not come from physical exertion, but from nervous tension. This nervous tension gradually develops into a mild type of endogenous depression. This kind of fatigue is seldom relieved by either sleep or bed-rest but may frequently improve by following an exercise program.

Research on fatigue in industry has concentrated on the effects of long hours of work and arduous conditions. The effects of fatiguing conditions on employee performance have been considered only in broad, overall terms (Cameron, 1973; Yoshitake, 1978). However, Davis (1948) recognized early that the effects of fatigue might be reflected by qualitative changes in performance rather than by quantitative insufficiency.

Another way to classify fatigue is by duration; acute versus chronic fatigue. Acute fatigue results in a loss of efficiency which is temporary and may be relieved by rest. Chronic fatigue is not able to be relieved by rest or sleep and is cumulative in its effect. Acute fatigue may be seen as a protective mechanism rather than a problem because the acute pattern of fatigue protects us from exhaustion, preserves energy balance, and stimulates or alarms us to take an action for energy restoration or reparation. After rest or nourishment, the body is refreshed and ready to continue activity. However, when fatigue is not relieved by rest or nourishment, or when the human being denies or resists feeling fatigued, he becomes chronic fatigue. Pathologic fatigue or chronic fatigue cannot be relieved by rest or nourishment without eliminating the etiological problem. Piper (1986) considered when fatigue is acute it serves a protective function; however, when fatigue becomes constant (chronic), it no longer serves this function and may lead to aversion to activity with the desire of escape.

Fatigue is a subjective sensation and is related to many factors. Several definitions of fatigue are derived from different disciplines based on their respective viewpoints, but no universal definition has been proposed that can apply in every situation across the disciplines. The fatigue definition from other disciplines may not be applicable to the nursing discipline. The goal of nursing is not to increase the patient's ability to work or to produce more goods, or is it to help the patient play faster and better. During illness, and/or recovery periods, not only does the ill person's perception and experience of fatigue differ from that of the healthy person's, but also the etiology of fatigue differs from the healthy person's.

From a nursing discipline, fatigue is conceptualized as the inability to continue to function in a given situation (Srivastave, 1987). Piper (1986) defined fatigue as subjective feeling of tiredness that is influenced by circadian rhythm. It can vary in unpleasantness, duration, and intensity.

For this study, this author defines fatigue as follow; fatigue is a subjective sensation of tiredness, weariness, or exhaustion resulting from physiological, psychological, and social factors. Fatigue results from the inability of body and mind to maintain a balance between energy generation and energy consumption. This imbalance creates to accomplish tasks through sustained effort and focused attention.

MEASUREMENT OF FATIGUE

Fatigue tools were developed based on the assumption that it is possible to measure human fatigue physiologically, psychologically, and behaviorally. This assumption has led to the development of subjective and objective measurement tools. The symptom of fatigue may be affected also by various factors directly or indirectly, so concurrent testing with instruments to measure related variables such as depression, anxiety, stress, and motivation has been done (Piper, 1987; Lee, 1992, Yoshitake, 1971, 1978). The measurement of the subjective nature of fatigue is primarily based on the self-estimation of fatigue and the perception of individuals. The subjective sensation of fatigue has been measured as the unidimensional feeling of fatigue and as a multidimensional construct.

One-item unidimensional self-rating fatigue scales (either categorical or visual analogue scale(VAS)) and multiple items-multidimensional self-rating fatigue scales (both categorical or VAS) have been most frequently used for measuring fatigue in nursing and other disciplines (Pearson & Byars, 1956, Rhoten, 1982; Christensten, 1982; Lee, et al., 1992; Piper, 1987; Yoshitake, 1978). In contrast to unidimensional measures of subjective fatigue, multidimensional measures of subjective change during fatigue permit topological analysis of subjective fatigue. Various subdimensions have been identified such as Yoshitake's (1978) fatigue symptom checklist which includes the three factors of general fatigue, mental fatigue, and localized fatigue. In nursing, the Piper fatigue scale (PFS) consists of 75 items with seven dimensions of fatigue symptoms which include temporal, intensity/severity, affective, sensory, evaluative, associated symptoms, and relief dimensions (1987). Lee's VAS-F (vidual analogue scale for fatigue) consists of 18 items of 100 mm horizontal visual analogue scales with fatigue and energy dimensions (1992).

However, there are several problems with measuring a subjective phenomenon. In using self-rating scales with different groups, it was found that initial scores at the beginning of the work were not the same across the group. Thus, an individual's social background and morale may influence the rating scores(Grandjean, 1971). Another problem is that when fatigue was measured repeatedly, the subject can remember which score they marked on a previous test, and this may affect the rating on the next test. Also, the difference between before and after work may be affected by suggestion. That is to say, a subject may think consciously or unconsciously that the feeling of fatigue after work should be more severe than before work. Also, one's standard judgment before work may be different from one's judgment after work.

The objective measurement of fatigue is an attempt to evaluate a number of physiological or biochemical changes to the state of fatigue. Fatigue behaviors are also measured by a trained observer to assess their appearance. The measurement of physiological or biochemical changes is carried out by a trained observer or by calibrated mechanical equipment of physiological variables. These include hydrogen ions or pH changes(Karlsson, et al., 1981), muscle biopsy (Miller et al. 1987) lactate and pyruvate (Poulus & Westraa, 1974) or the electromyogram (EMG)(Brown & Miller, 1986), oxygen consumption (Christensen, 1982), and hormonal change (Akerstedt, 1982). The measurement of fatigue behaviors is intended to measure observable fatigue signs objectively. These include a behavioral checklist (Rhoten, 1982) and task performance indicators; such as critical fusion frequency, tapping test, and grid tapping test (Greandjean, Schaad & Gilgen, 1971; Kashiqagi, 1971).

In conclusion, several major factors contribute to the difficult task of measuring fatigue. The subjective and multidimensional nature of fatigue or a combination of the physiological and psychological dimensions, and the difference in the meaning of fatigue to individuals constitute the major problems. Although some researchers have tried to measure and identify a subjective feeling of fatigue, others have pointed out that it is not possible to verify such measurements. The subjective nature of fatigue also makes it difficult for researchers to make verifiable reports on a patient's feelings of fatigue. Therefore, studies using a combination of subjective ratings, observations and physiological parameters which are related to fatigue symptoms are needed.

FATIGUE STUDY IN A VARIETY OF PATIENTS POPULATIONS

Understanding fatigue is important to nurses and to patients since it is one of the most prevalent symptoms of mental and physical illness, and it is a common problem associated with most health-related disorders (Valdini, 1985). There is evidence in the literature that fatigue has been one of the most frequently reported symptoms among a variety of patient populations.

One large study (David et al., 1990, N = 611) in general practice showed that 10.2% of men and 10.6% of women had substantial fatigue for one month or more measured by 10-items with four-point likert scale. There was no relationship between age, occupation, marital status and fatigue. Subjects attributed fatigue equally to physical and non-physical causes. Women blamed family responsibilities for their fatigue more often. Kroeke and colleagues (1988) studied fatigue and correlates of fatigue in primary-care clinic (N = 1159). They found that 24%

(n = 276) indicated fatigue was a major problem. Fatigue was more prevalent in women than in men (28% vs 19%). To find the fatigue related factors, laboratory and psychologic variables were measured for 100 fatigue patients and 26 control health subjects. Fatigue was measured by Montgomery true-false questionnaires and Cardenas & Kutner's five-point ordinal fatigue scale. Depression was measured by The Beck Depression Inventory (BDl), and somatic anxiety was measured by The Modified Somatic Perception Questionnaire (MSPQ). Depression and somatic anxiety scores were higher in the fatigue group than in the control group (depression: 56% vs 0%; anxiety: 57% vs 12%, p <.001). In contrast, laboratory testings showed no significant difference except ESR (12% vs 4%, p <.05).

In nursing research, Hart (1978) studied fatigue in multiple sclerosis (MS) patients (n = 335) and found that MS patients experienced more severe fatigue throughout the day than did the healthy controls (n = 30), and the severity of fatigue was related to the patient's mobility. Fatigue was measured by the Pearson & Byar's Fatigue Checklist and The Fatigue Symptoms Checklist. Average fatigue ratings were similar for men and women (190.5 vs 184.6). No correlation was found between fatigue rating and any laboratory variables such as hemoglobin, hematocrit, BUN, creatine. In addition there was no correlation between fatigue and age. Cardenas and Kutner (1982) found that 58.3% of their sample (n = 137) of dialysis patients experienced moderate or severe fatigue measured by linear scale ranging from

0 to 100. Depression was pronounced among patients who reported feeling fatigued upon awakening ($p < .001$). Srivastava (1987) interviewed 27 hemodialysis patients. The Pearson and Byar's Fatigue Checklist was employed to measure daily variations in fatigue. Srivastava found that the level of fatigue was lowest an hour after awaken and highest prior to going to bed. The average level of fatigue was 49 out of 100. There was a negative relationship between fatigue and the subjective quality of life measured by a visual analogue scale for subjective quality of life.

Several researchers studied fatigue in cancer populations. King and colleagues (1985) described the symptoms experienced by patients who received radiation treatment to the chest ($n = 15$), head and neck ($n = 25$), and pelvic areas (male, $n = 26$; female; $n = 30$). The symptoms were measured by The Symptom Impact Profile (SIP) which consists of 13 symptoms. Although fatigue, skin irritation, anorexia, sore throat, and cough were the most commonly identified symptoms, the only symptom experienced by the majority of subjects in all four groups (65% to 93%) was fatigue. Rhodes, Watson, and Hanson's descriptive study (1988) described fatigue and weakness as the symptoms that most interfered with self-care activities for 20 chemotherapy patents.

Many factors may contribute to chronic fatigue in cancer patients. Fatigue may represent an associated side effects of radiation and chemotherapy. It may be associated with bone marrow suppression and/or gastrointestinal toxicities which cause nausea and vomiting and compromise nutritional status (Haylock & Hart, 1979; Nunally, Donoghue & Yasko, 1982; Piper, 1987)). Haylock and Hart (1979) investigated factors that may moderate the experience of fatigue in patients (N = 30) who received radiation therapy. The Pearson & Byars Fatigue Checklist was used to obtain a description of the level of fatigue. Fatigue increased significantly from the first to the last day of radiation treatment. The negative correlation ($r = -.54$, $p<.01$) occurred with the weight variable but there was no relationship found with age and blood pressure. Although, sixteen major symptoms, both physiological and psychological, were associated with the severity of fatigue in this sample, the symptoms that were significantly related to fatigue: tired body, tired legs, heavy load, and eye strain, supported a physical rather than a psychological etiology to fatigue.

Blesch and colleagues (1991) studied 77 cancer patients undergoing radiation therapy and/or chemotherapy for lung (n = 33) and breast cancer (n = 44). The severity of fatigue was measured by the Rhoten Fatigue Scale, a visual analogue scale, and mood disturbance was measured by the shorted profile of mood status (POMS). The authors reported that although fatigue was reported by 99% of patients, there was no difference in the level and/or severity of fatigue between lung and breast cancer patients. Significant correlates of fatigue included the level of pain ($r = .48$), anxiety ($r = .40$), depression ($r = .46$), vigor ($r = -.30$), and global mood ($r = .48$) as measured by the POMS.

There were no significant statistical correlations with any of the physiological and biochemical variables except pain severity ($r = .48$, $p<.001$).

The above studies support the fact that not only is fatigue a prevalent problem for cancer patients receiving radiation or chemotherapy but it is also the most disturbing symptom experienced during treatment (McCorkle, 1981; Rhodes et al., 1988). There is a consistent relationship between cumulative doses of radiation and interferon and fatigue. However, other variables such as weight loss, anemia, insomnia, laboratory testing, and psychotic distress did not show consistent relationships with the symptom of fatigue (Blesch, et al., 1991; Nually, Donoghye & Yaskjo, 1982; Piper, 1987).

Post-surgical fatigue is a subject of considerable interest for nurses and surgeons. A qualitative nursing research study was conducted by Rhoten (1978) who utilized interviews to define the phenomenon of postoperative fatigue and to identify the characteristics of those patients at high risk for developing fatigue. In addition, she explored information about the patient's illness, treatment, socioeconomic levels, demographic data, extent of surgery, length of anesthesia, amount of pain medication, and number of abnormal laboratory values as related to the symptom of fatigue. There was a positive relationship between level of fatigue and the number of variables reported.

Christensen and colleagues (1982, 1984, 1985) examined the symptom of fatigue in post-surgical patients. In three different studies, the authors reported that fatigue increased significantly ($p<.001$) from levels measured preoperatively to levels measured postoperatively following major abdominal surgery. There was no preoperative versus postoperative change in the level of fatigue in patients who had minor otologic surgical procedures. No correlation was found between subjective feelings of post-operative fatigue, post-operative blood studies, and pre-operative nutritional status. However, the increased pulse rates during orthostatic stress testing was positively related to the level of post-operative feelings of fatigue ($r = .53$, $p<.001$). One of the studies assessed the relationship between fatigue and anxiety in abdominal surgery patients ($N = 15$). They found that fatigue increased with the passage of time while anxiety decreased.

Sleep complaints and irregular sleep patterns have been commonly found to increase the symptom of fatigue in healthy and clinical populations. Lee, Hicks & Nino-Murcia (1992), utilizing the visual analogue scales for fatigue (VAS-F), assessed subjective feelings of fatigue in 57 patients undergoing medical evaluation for sleep disorders and 75 healthy subjects. The healthy subjects demonstrated significant differences in the level of fatigue severity between the evening and the morning (55.6 ± 18.74 vs 31.6 ± 23.22). Sleep-disorder patients reported no such differences (24.6 ± 45.89 vs 26.4 ± 35.4).

King and Parrinello (1988) studied 34 post-hospital discharge, coronary artery bypass surgery patients through repeated telephone interviews over a two month-period. Sixty-two percent of patients reported feeling tired during the week before surgery. One week post-hospital discharge, 94% of patients reported feeling tired, but incidence of tiredness gradually decreased over time with only 50% of patients reporting feeling tired 8 weeks post-hospital discharge. The majority (76%) of patients reported that sleeping or resting in the afternoon was helpful in dealing with the fatigue.

Schaefer (1990), utilizing open-ended questions and a visual analogue scale, investigated the symptoms of fatigue in 23 patients with congested heart failure (CHF) secondary to myocardial injury. Thirteen patients (57%) were fatigued on admission to the hospital. Seventeen patients (74%) said that their fatigue occurred only once in a while, and the remaining six patients stated that they were tired all the time. To investigate the related influence of certain factors of the occurrence of fatigue in this sample, data such as vital signs, blood tests, and ejection fraction (EF) were collected from chart reviews. Three physiological variables, EF ($r = -.72$), Ph ($r = -.42$), and oxygen saturation ($r = -.43$) had a significantly negative relationship to the severity of fatigue. Qualitative data analysis indicated that 18 of the 23 patients defined fatigue as "being tired." Other definitions included "being weak through and through," "lack of energy, not being able to move around." Ten of 23 patients stated that being fatigued was an annoyance, a frustration, a bitter disappointment, scary, and made them angry. Nine patients thought that their heart condition caused their fatigue, and seven patients said they had no idea why they were so tired.

Schaefer and Potylycki (1993) employed the fatigue interview schedule (FIS) and visual analogue scales to assess both severity of fatigue and prevalence of fatigue in CHF patients secondary to myocardial injury and valvular disorders. Seventy-one percent of patients were fatigued on admission to the hospital, and 55% of the patients said that fatigue occurred only once in a while. Although there were no significant differences in severity of fatigue between groups, the patients with myocardial injury reported more severe fatigue(63 ± 25.2) than those patients with valvular disorders (56.2 ± 12.1). Age ($r=-.39$, $p < .01$) had a significant statistical relationship to severity of fatigue. However, there were no significant correlations between the severity of fatigue and physiological variables, such as pH and oxygen saturation.

The relationship of muscle fatigue in CHF has been studied by cardiologists. In related studies, investigators reported that patients with CHF are frequently limited in both normal daily activities and maximal exercise testing. This may be caused by the inadequate skeletal muscle blood flow which is secondary to decreased cardiac output and lower extremity blood flow (Sullibvan, et al., 1989, Wilson, et al., 1993) or caused by skeletal muscle abnormalities (Wison, et al., 1990; Drexler, et al., 1989; Mancini, et al., 1992).

FATIGUE IN MYOCARDIAL INFARCTION PATIENTS

Although, fatigue is a common occurrence in patients with MI, there is a paucity of information about the prevalence, the severity, and the duration as well as the etiology of fatigue. Early in 1970, Cassem and Hacket (1970) were interested in psychological responses after MI. In their study, fatigue was treated as one of the psychological variables. They reported several classic studies which included the frequency and the severity of psychological problems and psychological trajectory after MI based on their clinical interview data. These studies still frequently cited references for psychological responses after MI. However, since the Cassem and Hacket group moved their interest to pharmaceutical intervention for psychological disorder patients, there were not meany studies focusing on psychological response and fatigue after MI reported.

Recently, nursing researchers started focusing on the symptom of fatigue in patients with MI. Therefore, the review of literature on fatigue and psychological responses in patients with MI included the studies from 1970 to present, primarily psychology discipline studies.

Mayou and colleagues (1978) interviewed 100 MI patients for psychological distress and social activities on three occasions (during hospital admission, two months and one year after discharge). They found that 45% of MI patients (N = 100) experienced mild to severe fatigue at two months and 69 % of these patients experienced mild to severe fatigue one year after infarction. Hentinen (1986) studied psychiatric rehabilitation for 42 MI patients in 1980 and 38 MI patients in 1982. They reported that 84% of patients experienced "some" to "severe" fatigue two months after MI. The psychiatric state including fatigue was measured with Psychological Problem in Cardiac (PPC) which was developed by The International Cardiology Association.

Wiklund and colleagues (1984) assessed the relative level of emotional instability which included fatigue for post-MI patients at two months (n = 177), one year after MI (n = 177). The emotional instability was measured by the manual of Eysenck Personality Inventory and interview. Although, the incidence of most emotional symptoms, which included easily fatigued, irritable, anxious, emotional, depressed, restless, and anguished was higher than those of reference groups, fatigue was the most frequently symptom among emotional symptoms in cardiac groups at two months and one year (2 months; 79%, 1 year; 70%, and Reference; 29%) compared to a normal sample of 175 people.

Trelawny-Ross and Russel (1987) studied fatigue as part of somatic symptoms. They compared the frequency of somatic symptoms which included chest pain, breathlessness, and extreme fatigue among 31 MI patients over time. The findings showed that there was no significant changes in somatic symptoms over time (10 days: 48%, 2 months: 46%, and 6 months: 42%).

Rigel and colleagues (1992) compared the mood status which included fatigue of an overprotected group (n = 81) to that of an inadequately supported group (n = 28). Overprotection was measured with the UCLA social support inventory. The authors reported that overprotected patients were significantly less fatigued than inadequately supported patients at one month after MI using the POMS fatigue subscale (Mean; 7.74 vs 9.54, $p<.05$). However, the mean fatigue scores at four months after MI were not significantly different between the two groups.

All of the previously cited studies focused on psychological or sociological variables as main components, and they treated fatigue as a related variable or subcomponent. Furthermore, there were considerable differences among studies with regard to instruments used to measure the symptom of fatigue. None of the studies reported validity or reliability of the instruments except Rigel and colleagues (1992). Most studies reported only the frequency of fatigue; they did not explore the severity of fatigue, explore the patterns or the trajectory of fatigue over time, or describe the potential moderating variables.

MECHANISM OF FATIGUE IN MI PATIENTS

While most researchers emphasize either the physical or mental aspects of fatigue, the phenomenon of fatigue can be better understood by studying not only the physiological aspects but also the psychological and social aspects simultaneously. So far, most theories of fatigue are tied to a particular perspective or a particular dimension of fatigue. However, when the nurse is working with a patient who complains of fatigue, he/she may have to look at this particular patient's complaint of fatigue from one of many angles.

CORRELATES OF FATIGUE IN MYOCARDIAL INFARCTION PATIENTS

The physical and psychological responses to MI and how these physiopsychological factors are related to the phenomenon of fatigue in MI patients are discussed in the following section.

PHYSIOLOGICAL FACTORS

Myocardial infarction is a life-threatening condition characterized by formation of localized necrotic areas within the myocardium. Sudden loss of previously functioning myocardial segments decreases cardiac efficacy. While the infarct size is the major determinant of the severity of cardiac dysfunction (Gadsbov, et al., 1990; Libberman, et al., 1981; Pfeffer, et al., 1978; Schineider, et al., 1985), factors other than the infarct size may also induce severe hemodynamic alterations and impairment of cardiac function. Location of the infarct (Hori, et al., 1979), changes in ventricular compliance (Richard et al., 1989), type and severity of asynergy (Rummel, 1990), effectiveness of the compensatory mechanisms (Rogers, et al., 1983; Weisman et, al., 1988), hypoxia (Forrester, et al., 1977), acidosis, and arrhythmias (Taylor, 1980) are all important determinants of the hemodynamic effect after MI.

The most common cause of hemodynamic compromise is left ventricular (LV) contractile failure. Myocardial Infarction may cause alteration of LV performance due to diminished ejection during systole (Marsoll, et al., 1991; Sabhach, et al., 1987; Schneider, 1985) and changes in diastolic compliance (Chenzbraan, 1992; Oh, et al., 1992; Stewart, 1992; Stoddard, et al., 1992).

Battler and colleagues (1979) evaluated left ventricle ejection fraction (LV EF) using radionuclide angiography in 98 MI patients Day 1 to Day 4 after admission. Thirty patients' EFs were less than 52% and 68 patients' EFs were more than 52%. Marsoll and his colleagues (1991) studied 137 MI patients to find which factors contribute to the improvement of LVEF within 24 hours of acute infarction (baseline study) and before hospital discharge. There was an inverse linear relationship between baseline EF and changes in EF ($r = -.39$, $p < .01$). The mean baseline global EF was 45.7% and the mean predischarge EF was 49.6%. When patients were separated into two group (baseline EF < 45% vs baseline EF >45%) the lower the baseline EF, the higher the probability that EF changed (lower baseline group; 34.3% to 42.1% vs. higher baseline group: 55.7% to 56.1%) were reported.

To determine the rate and extent of recovery of LV performance following MI, Sabbah and colleagues (1987) measured global LV performance using Doppler-echocardiography immediately after infarction and repeated daily for six consecutive days. The systolic velocity integral (SVI) increased from 6.7 ± .6cm Day 1 to 9.7 ± .8cm Day 6 ($p < .001$). The quantification of LV volume was performed by Seals and colleagues (1988) by radionuclide angiography performed 24 hours from symptom onset and was repeated Day 10 after MI. They found that substantial LV dilation occurred within the initial 24 hours of MI (n = 56; EDV: 106 ± 10 ml, ESV: 56 ± 10 ml, and SV; 30 ± 11 ml), even in those patients with a normal EF. On repeat study (n = 16) EDV and ESV increased further (EDV 93 ± 11 ml to 99 ± 11 ml, ESV 50 ± 8 ml to 58 ± 9 ml, $p < .05$) but EF was not changed.

The main purpose of cardiac contraction is to pump the blood to organs which need oxygen and metabolic substrate, but with insufficient cardiac contraction, the heart cannot supply enough blood to meet organ demands. Therefore, it is proposed that reduced oxygen supply to organ due to decreased cardiac function precipitates perceived fatigue in MI patients. Also, there is not a sufficient resting period for the cardiac muscle due to tachycardia or ventricular fibrillation which may lead to cardiac muscle fatigue. In the case of left ventricle failure, a heart will consume more substrate when it has to work at higher pressures, but energy supply is limited which may lead to fatigue also.

PSYCHOLOGICAL FACTORS

For the patients, MI signifies not only infarction of the cardiac muscle itself but also infarction of one's self-esteem. Several authors in nursing and other health sciences have described psychological reactions following an MI, and there is wide agreement that the most frequent reactions are anxiety, depression, and denial of the illness. (Anderoll & Foster, 1970; Bigos, 1981; Cassem & Hackett, 1973, 1975; Forrester, et al., 1992; Harrington, 1989, McCorkle & Quint-Bendiel, 1983).

The onset of acute MI produces sudden separation from family and friends, loss of one's job, a fear of death, placement in a strange hospital unit, a changed body image, as well as physical distress (Klein, 1975). In addition, performance is impaired by lowered reserve energy and loss of energy or inadequate blood and oxygen supply. These sudden changes in the internal and external environment, impaired performance, and loss of control may cause one to experience anxiety, depression, and fatigue.

Cassem and Hacket (1971; 1973) found that 145 patients (33%) of 441 patients admitted to a CCU after MI were referred by nurses or physicians for psychiatric consultation. The three most frequent reasons for referral were anxiety (47%), depression (44%), and management of behavior (32%). The focus of anxiety was on impending death or death's heralds: pain, breathlessness, weakness, and other new symptoms or complications. Consultation requests for each problem followed different time distributions, with an early peak of anxiety on Day 1 and 2, and a later peak for depression on Day 3 and 4. More nurses than physicians referred patients, but patients referred by physicians were referred (usually earlier) by the nurses also.

Schileifer and colleagues (1989) interviewed 282 MI patients and found that 18% had symptoms of "probable or definite" major depression (The proportion of "definite" cases was not specified) and 27% had symptoms of minor depression. Seventy-seven percent of the hospitalized patients with major depression continued to have major or minor depression at three months' follow-up. Stern and colleagues (1977) identified that 22% of 68 MI patients were anxious (defined as a score of 19+ on the Taylor Manifest Anxiety Scale). Billing and colleagues (1980) also reported that 19% of 93 MI patients were anxious. However, Cay and colleagues (1972) reported that 62% of 203 MI patents (n = 203) were "emotionally upset" (a term including both depression and anxiety).

Some studies have assessed the relative level of anxiety or depression in MI patients by making group comparisons such as MI versus non-MI or first MI versus second MI. Cay and colleagues (1972) found that 55% of first-time MI patients experienced anxiety while 42% of second-time MI patients experienced anxiety. Thirty-seven percent of first MI patients experienced depression while 58% of subsequent MI patients experienced depression. Legault and colleagues (1987) compared the patients with and without MI who were admitted for the first time with presumed MI

(MI; 52%, non-MI; 40%). It was found that the confirmed MI patients were more depressed than non-MI patients (MI; 17%, non-MI; 5%) in the early course of hospitalization. However, anxiety was equally prevalent in those with and without confirmed MI (MI; 30%,
non-MI; 32%). Anxiety was more prevalent during the early course of an MI (Day 2; 30%, 3 months; 18%).

Forester and colleagues (1992) interviewed MI patients (n = 129) within ten days after an infarction. They identified that major depression was present in 19% of the patients and was significantly associated with a prior history of mood disorder, being female, large infarcts, and functional physical impairment (Stepwise multiple regression; R2 = .32, p<.05).

PATTERNS OF PSYCHOLOGICAL RESPONSE AFTER MI

The studies dealing with the patterns of psychological responses after MI fall into three broad categories: the early period usually in CCU; the intermediate period usually from the step-down unit to the discharge period; and the long term period.

A classic trajectory model for the early psychological responses after MI was developed by Cassem and Hacket (1971) based on the clinical interview data from MI patients in the CCU. The trajectory pattern indicated that the patient feels heightened anxiety during the first one to two days after the MI and later experiences a peak for depression. Findings from several studies (Cassem & Hackett, 1979; Sykes, et al., 1989; Thompson, et al., 1982) supported Casssem and Hackett's model (1971) that there was prominence of anxiety in MI patients initially, with a decline within five or six days. However, no researches have found a significant change in depression in the early period.

During the intermediate period, several studies have been conducted regarding the extent of emotional reactions to change in the hospital environment. Admittance to the CCU, transfer from the CCU to a general unit and discharge from the hospital are other stressful events for MI patients. Although transfer from CCU to step-down units is clearly a sign of improvement and progress, it is often accompanied by adverse psychological reactions. Some patients become more anxious because they no longer have the intensive observation from the nurses and physicians and the sophisticated cardiac monitoring systems. Several researchers (Dellipini, 1976; Havic & Maeland, 1990; Philip, 1979; Sykes, et al., 1989) reported that the patient's level of anxiety was high immediately after transfer from the CCU and then fell quite rapidly over the next week, than rising again at discharge from the hospital.

In relation to the long term period, Wishinie and colleagues (1971) interviewed 24 patients who were between 3 and 9 months after discharge. Although each of the 24 patients was eager to go home, 11 felt totally unprepared for the physical limitations they experienced, and nine recalled wishing they were back in the hospital during their first week at home. The majority (89%) rated themselves as anxious, depressed, or both during the first month at home.

Two papers compared the psychological reactions to MI over time from the early period to the long-term period. Havic and Mealand (1990) prospectively studied anxiety, depression, and irritability in 283 MI patients twice during their hospital stays, and four times during a three to five year follow-up. A K-mean cluster analysis identified six subgroups of MI patients with different patterns of emotional reactions. Two groups (n = 131) had low emotional reactions at every assessment. One group (n = 60) had a high initial emotional upset that subsided during the first six months after discharge, whereas one group (n = 45) showed increasing emotional distress in long-term follow-up. The last two groups (n = 47) failed to achieve long-term emotional readjustment. The high levels of emotional upset preceded both failure in resuming work and longer length of rehospitalization.

Trelawny-Ross and Russel (1987) interviewed suspected MI patients on four occasions: in the hospital, ten days after discharge, two months after discharge, and six months after discharge. They reported that the frequency of anxiety did not change significantly over time (10 days = 39%, 2 months = 52%, and 6 months = 33%). Anxiety peaked at two months.

Although the majority of depressed or anxious patients recovered two months after MI, if patients are persistently depressed or anxious they should be correctly identified and given appropriate treatment. Several factors may account for the discrepancies of the reported frequency and severity of depression and anxiety, such as the type of measurement tools (interview or questionnaire); the diagnostic characteristics ("some emotional upset" or "need for psychiatric consultation" or major depression/anxiety); the characteristics of the study population (first MI or second MI); and the time of the measurement after onset of MI (in CCU, in step down unit, after discharge).

The relationship between various psychological variables and fatigue has been studied in both healthy and clinical populations (Chen, 1986; Hart, 1979; Lee, 1992; Montgomery, 1983; Piper, 1989). Generally there was agreement that anxiety and depression were fatigue-correlated variables. Although, the direction of the relationship between fatigue and depression or anxiety is not clear. However, whether these variables are causally related is not necessarily important, since the existence of either state may react or intensify the other. The most important fact is that we know that fatigue, anxiety, and depression are related in other clinical populations, therefore, this relationship may also be true in the MI patients.

CONCEPTUAL FRAMEWORK OF FATIGUE IN MI PATIENTS

In summary, fatigue is a muti-dimensional phenomenon which is intricately affected by several factors which associated with

MI. There are very limited studies on fatigue to date, moreover these studies just reported the frequency of fatigue without reporting reliability and validity of the tools. There is no clear understanding of the severity, duration, and patterns of fatigue and potential moderating variables. While several correlates of fatigue have been proposed and studied in other clinical populations, no research of this kind has been conducted in patients with MI.

Many factors, both physiological and psychological, may contribute to fatigue in MI patients. Characteristics of the individual (gender, age, ethnicity, marital status, occupations, annual income), the severity of MI (the severity of infarction and the number of involved vessels), ejection fraction, cardiac output, the individual's treatment response (the status of reperfusion, the treatment regimen, and complications) as well as the individual's perception of MI must be considered.

Well-designed prospective research is needed to explicate the severity, patterns, and correlates of fatigue in patients with MI. A theoretical perspective of this study is that units what is understood about physiological and psychological changes after MI and how these MI-related variables influence the patient's subjective experience of fatigue. Figure 2.1 presents a multifactorial conceptual model which guided this research in MI patients.

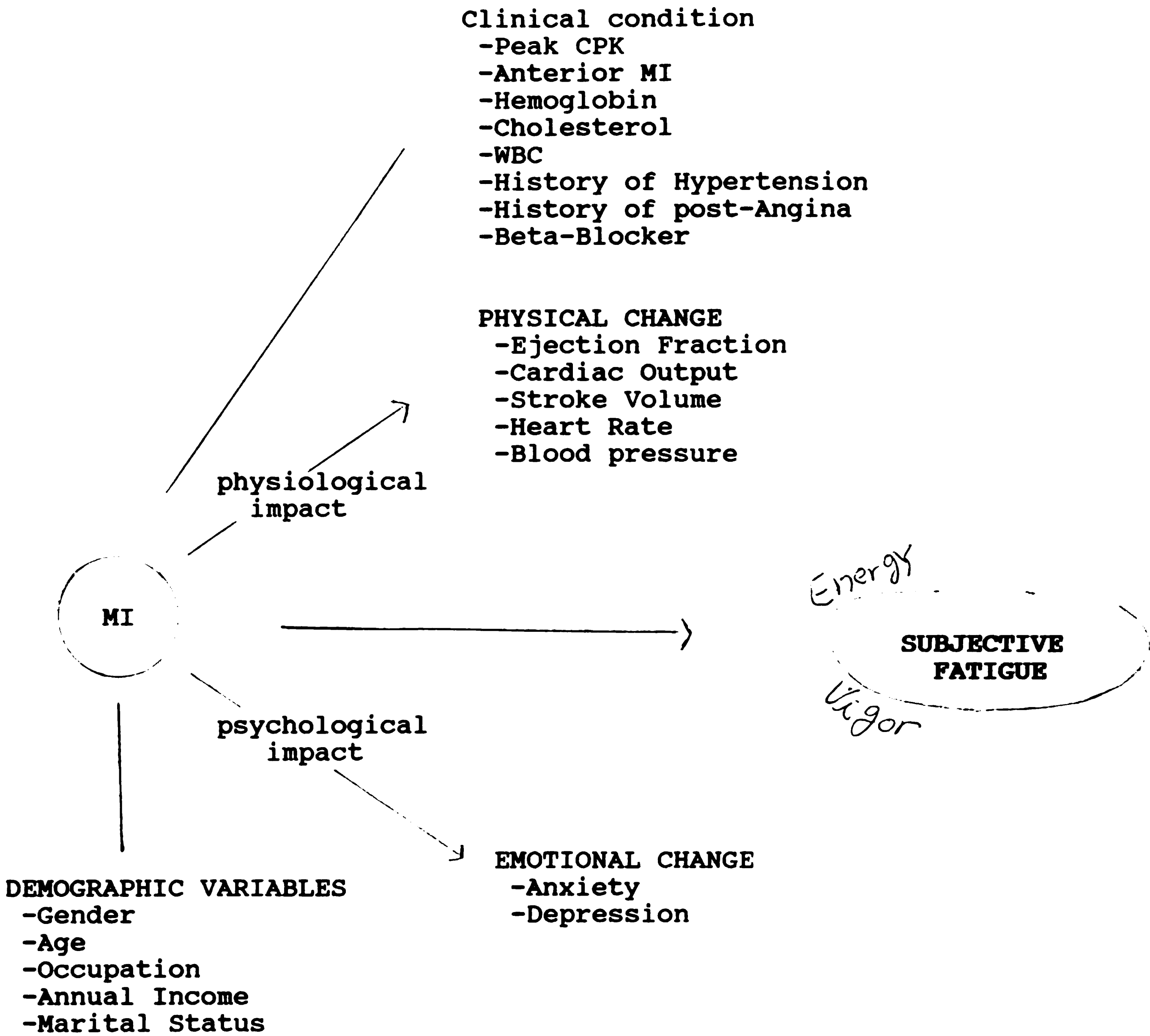


FIGURE 2.1 CONCEPTUALIZATION OF FATIGUE IN MI PATIENTS

CHAPTER 3. METHODOLOGY

RESEARCH DESIGN

A descriptive correlational design with repeated measures was used to describe the patterns of fatigue and psychological and physiological variables over a three-week period. Fatigue was measured with the VAS-Fatigue scale and the Profile of Mood States (POMS). Psychological variables were measured with the POMS. These questionnaires were completed by subjects once a day, from Day 5 to Day 21 post-admission to the hospital. There were 17 measurement times over the 17 day period. To assess hemodynamic function, quantitative, two-dimensional echocardiography was performed serially four times during the same three week period. The echocardiography study within 48 hours post admission was done by sonographers and the studies on Week 1, 2, and 3 were performed by the investigator. However, the quantitation of all studies was completed by the investigator.

SETTING AND SAMPLE

HUMAN SUBJECT ASSURANCE

This study was approved by the University of California San

Francisco Committee on Human Research and by the review boards for protection of human subjects of Alameda Hospital and Marine General Hospital. Informed consent was obtained from each subject in accordance with the guidelines of the Committee on Human Research (see Appendix B).

SETTING

The study was conducted in the coronary care unit (CCU) and cardiology wards of three San Francisco Bay Area hospitals (SFBA). One of these is a university teaching hospital, and the others are community hospitals. The study was conducted over a 10 month period from September 1991 to July 1992.

SAMPLE AND METHOD OF SELECTION

All subjects were recruited by convenience sampling from the CCU or cardiology units and had diagnoses of acute MI.

Criteria for the presence of acute MI was the existence of at least two of the following abnormalities in the patient's medical record.

1) Characteristic clinical presentation of acute MI
2) Pathologic Q waves in ECG (transmural infarction) or serial ST-segment and T-wave changes without pathologic Q-waves (subendocardial infarction)
3) An increase in the serum CPK above normal levels.

Subject inclusion criteria included:

1) Clinical diagnosis of acute MI
2) Age between 30 and 80 years
3) Ability to speak English and sign voluntary consent
4) Ability to reliably complete VAS
5) Absence of tremor, paralysis, or visual impairment
6) Not currently under treatment for depression and no psychiatric history
7) Consent to participate

Subject exclusion criteria included

1) All patients with atrial fibrillation
2) A-V heart block
3) Intrinsic aortic valve disease
4) Other active symptomatic illness, such as cancer, liver disease, renal disease, or infectious diseases.

DATA COLLECTION METHODS

PROCEDURES

For the UCSF site, the investigator visited the CCU or cardiology unit every other day in order to identify MI patients. For the Alameda Hospital and Marine General Hospital sites recruitment was accomplished with the assistance of the head nurses of the CCUs, who were taught by the investigator to identify subjects eligible for this study and were given a checklist of subject eligibility criteria. When these head nurses were not on duty, they appointed other staff nurses to follow this procedure. When subjects were identified, nurses from the CCU called the investigator. The investigator visited and checked the chart to confirm subject eligibility based on subject inclusion and exclusion criteria.

Once subject eligibility was determined, the approval of a physician was obtained. The subjects were then approached by the investigator, and the study was described. If a subject were still in "critical" condition or heavily medicated or sleeping, the investigator waited until the next day to obtain the patient consent. In general, the first visit to obtain consent was done on Day 2 or Day 3 after admission. At this time, the investigator briefly explained who she was, the purpose of the visit and study, and the procedures used measure during the study. If subjects were interested in this study, a follow-up meeting was arranged, which was usually scheduled for Day 3 to Day 5 post admission. At the second meeting, the procedure, risks and benefits of the study were explained in detail and all questions were answered. Then consent was obtained.

The subjects were instructed as to how to answer the self-rating questionnaires. The investigator demonstrated how to fill out two to three items on the questionnaires. A bound file of questionnaires which included 17 copies of VAS-F, POMS for each of the 17 day measurements, and one copy of the demographic profile was given to the subjects. Subjects were asked to fill out the questionnaires of VAS-F and POMS from 4 pm to 7 pm every day for 17 days beginning with the fifth day after admission. The third visit was made on Day 5 to Day 7 after admission for the first Doppler-echocardiography test which was done either at the patients bedside or in the EC laboratory.

The reports of the levels of fatigue and other mood variables varied depending upon when these variables were measured during the course of the day (Hart &   1978; Lee, 1990: Unpublished; Lee, et al., 1992). Therefore, the measurement time was fixed between 4 pm to 7 pm which was generally equivalent to before dinner time. Fatigue was measured before dinner daily for 17 days with VAS-F, which rates severity of fatigue and energy level and POMS Fatigue subscale. Psychological variables were measured before dinner daily for 17 days with the POMS. To assess hemodynamic function, quantitative 2-dimensional echocardiography was performed at the same time of day (before dinner) at a Doppler-echocardiography laboratory or in the patients room serially three times between Days 5 and 7, 12 and 14, and 19 and 21 of post MI (see Figure 3.1).

VARIABLES MEASUREMENT

PATIENT PROFILE

A demographic profile (appendix A) was administered during the first measurement period. It included variables such as age, sex, ethnicity, religion, smoking history, educational background, occupation and annual income.

The patients medical record was reviewed twice for clinical variables. The first review was done at admission. A second review was done three to ten months after hospital discharge. Variables recorded included peak CPK, the site of MI, cholesterol, WBC, hemoglobin (HB), hematocrit (HCT), heart rate (HR), blood pressure (BP), previous history of MI, history of hypertension and diabetic mellitus, the type of reperfusion treatment, length of hospitalization, and discharge medication as well as post-angina history.

FATIGUE AND PSYCHOLOGICAL VARIABLES

VISUAL ANALOGUE SCALE FOR FATIGUE (VAS-F)

The VAS-F is a self-rating scale which provides a quantifiable score of perceived subjective fatigue symptoms (Appendix B). This 18 item scale consists of two subscales: an energy subscale (7 items) and a fatigue subscale (11 items), and is measured by visual analogue lines 100 mm in length. Each line has bipolar anchors with related descriptors. These discriptors include aspects of energy and vigor as well as fatigue. After demonstration of how to complete VAS lines, subjects are asked to place a mark along each of the 17 lines to indicate how they currently feel. Since there are very few words to read, subjects are able to complete the instrument in less than two minutes.

Internal consistency reliability coefficients have been reported for this scale for healthy subjects and sleep disorder patient groups (r = 0.94 to 0.96) (Lee, et al., 1992). The VAS-F scale shows concurrent validity by correlation with the POMS (VAS-F fatigue and POMS fatigue r = .58 $p<.01$; VAS-F fatigue and POMS confusion-bewilderment r = .41, $p<0.01$; VAS-F energy and POMS vigor r = .8, $p<0.01$) for the healthy group.

Using Cronbach's alpha in Crunch 4.1, the internal consistancy reliability for Fatigue subscale was .86 while the Energy subscale had an internal consistancy reliability .83 on the Day 5 measurement of this study (N = 22).

PROFILE OF MOOD STATES (POMS)

The POMS is a 65-item adjective rating scale designed to measure six factors of relatively transient mood state: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment (Appendix C). The subject is asked to respond to 65 adjectives using a 5-point scale rated from 0(not at all) to 4(extremely). Subjects are instructed to describe the feelings they have experienced during the past week including that day. Scores of each mood factor are obtained by summing up the responses for the adjectives defining the factor. A total mood disturbance score is obtained by calculating the sum of the scores of the factors. Since this scale includes a reverse-scored subscale of positive items, the scale has no natural zero, and the total score may be positive or negative. The scale ranges from -32 (low disturbance) to 204 (high mood disturbance). The scale has been tested extensively on various populations. (Pillard, Atkinson & Fisher, 1967; Piper, 1987). After six factor analytic replications of the POMS scale were done, it was judged to be valid and reliable. McNair and his colleagues (1971) have demonstrated both predictive and construct validity. Predictive validity of the scale was established by showing that one or more of the POMS factor scores have proven sensitive to change associated with psychotherapy and drug therapy. Concurrent validity was shown by correlation with the Hopkins Symptom Distress Scales (Parloff, Delman & Frank, 1954). To meet the demands of a particular study, other time sets can be and have been used with the POMS. Shorter rating periods such as "TODAY" and "RIGHT NOW" have been utilized (Pillard, et al. 1967; Piper, 1990). Using the Cronbach's alpha in Crunch 4.1, internal consistence reliability was determined in day the 5 measurement of this study (n = 21) and it was Fatigue = .82, Anxiety = .68, Depression = .84, Vigor = .80, and Global mood disturbance =.80 respectively.

CARDIAC OUTPUT (CO) AND EJECTION FRACTION (EF)

TWO-DIMENSIONAL DOPPLER ECHOCARDIOGRAPHY

The Doppler-Echocardiography has become an important noninvasive diagnostic tool to assess cardiac structure and function. Measurement of EF and CO by Doppler-Echocardiography are efficient for repeated measurement of these variables (Moulinier, 1991; Metha, 1986, Sabbach, 1987).

The reliability of interobserver, intraobserver, intertechenician and intratechenician ranges is from 70% for stroke volume (SV) with interobserver to 99% for EF with intertechenician (Kuecherch, et al., 1991). Wahr and his colleagues (1983) provide LV volume norms (Table 1) from 52 randomly and prospectively-selected volunteers without cardiovascular problems.

Table 1

	Female Mean ± SD	Male Mean ± SD
EF (%)	67	69
EDV (ml)	80 ± 12	111 ± 22
ESV (ml)	29 ± 10	34 ± 12

EF: ejection fraction EDV: end diastolic volume
ESV: end systolic volume
Volumes were determined by Modified Simpson's rule.

The doppler technique provides a measure of CO as an estimation of the flow of a sampled volume of aortic blood in the left ventricle outflow tract. The Doppler signal is velocity (distance per unit time) varying with time during ventricular ejection. The area under the velocity-time curve (i.e., the velocity-time integral)(Figure 3.1) sums up the continuously changing values of distance over the duration of the ventricular ejection. Thus when integrated, the velocity-time curve yields a summated distance, specifically, the stroke distance, i.e. the distance travelled by the average red blood cell in the aortic sample volume with each heart beat. When multiplied by heart rate, stroke distance yields aortic flow minute-distance, or distance travelled per minute. When multiplied by outflow-tract or aortic ring across-sectional area, stroke distance yields stroke volume and minute distance yields cardiac output. The Doppler CO is computed by the following equation:

$$CO = ACSA \times SVI \times HR$$

CO: cardiac output
ACSA: aortic cross-sectional area
SVI: systolic velocity integral
HR: heart rate

Doppler calculation of cardiac output: Integration of the area within the "envelope" of velocities recorded at Doppler examination yields the quantity known as "stroke distance." Stroke volume is the product of stroke distance and cross-sectional area. Cardiac output is the product of heart rate and stroke volume.

Ejection fraction (EF) is determined by using the following formula: End-Diastolic volume - End-Systolic volume/ end diastolic volume X 100. The left ventricle volume is measured by the computer from digitalizing two and four chamber end-diastole and end systole images. End-diastolic volume is traced at the peak of the R wave of the ECG or just after the mitral valve closure. End-systolic volume is traced at the frame preceding the mitral valve opening (Figure 3.2).

MEASUREMENT TECHNIQUE

Quantitative Doppler-Echocardiography was done by the investigator who has shown 93% of intra-scanner and intra-rater reliability based on healthy men.

Two-dimensional echocardiography (2DE) was performed with the use of a conventional phased-array sector scanner (Hewlett-Packard with 2.5 MHz transducer). Subjects were examined in the left lateral decubitus position, 90 degrees to the bed surface. When the study was done in an EC laboratory, a mattress has a removable section in the position of the left lower chest was used. Images were recorded in the following sequences: First, parasternal short-Axis (PSA) was obtained at the level of the papillary muscle tips. Then, an apical four chamber and two chamber view maximizing the distance from apex to mid-mitral angulus was obtained. Finally, pulsed doppler-echocardiography was performed and images were recorded on a videotape at a sweep speed of 100 mm/second. Each study was completed in 20 minutes. Image acquisition and quantitation was performed according to the recommendations of the American Society of Echocardiography (Schiller, et al., 1989). All parameters were automatically calculated with the Freeland Medical System software program. For measuring CO by Doppler, each image was measured on three or more cardiac cycles consecutively, and the mean of these numbers was used. One normal cardiac cycle image was selected for measuring EF. Left ventricular EDV and ESV were calculated with use of Simpson's rule (Figure 3.2). Ejection fraction was calculated by use of the standard formula:

$$EF = EDV - ESV / EDV \times 100.$$

DATA ANALYSIS

Descriptive statistics such as means, standard deviation, range, and frequency were used to provide a profile of demographic, fatigue, mood and hemodynamic characteristics.

Missing data were managed in the following ways: missing values from items on the VAS-F and POMS subscales were replaced with the mean value of other items on the same subscale when over 80% of the items were answered within each of the subscales. Missing values from items on instruments without subscales were left as missing and omitted from final analyses, which caused the sample size to vary. List-wise deletion was used when repeated

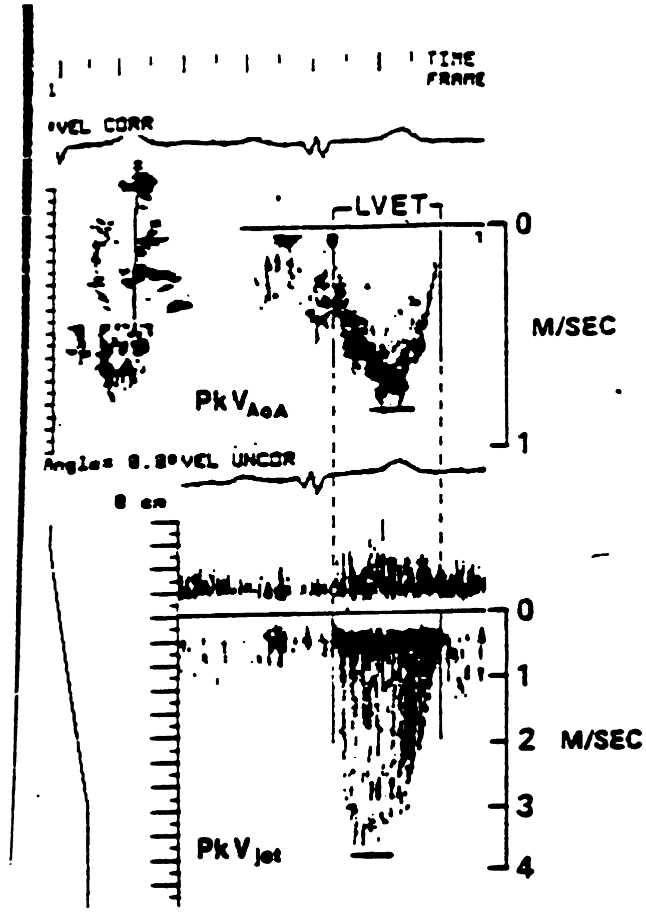


Figure 1. Pulsed Doppler recording of flow velocity at the aortic annulus and continuous-wave Doppler recording of the aortic jet are aligned in time phase, illustrating the mathematical basis for the simplified peak velocity method; LVOT = left ventricular ejection time; PkV jet = peak velocity of the aortic jet.

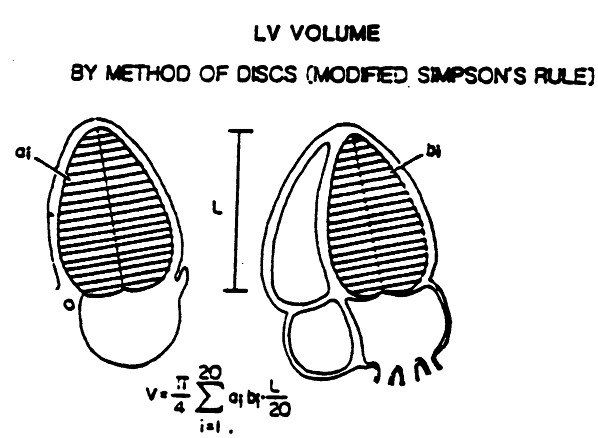


Figure 2. Biplane algorithms calculating chamber volume from two-dimensional echocaridograms. Biplane method of discs or disc summation method (modified Simpson's rule) based on nearly orthogonal planes from apical tow- and four-chamber view.

measure analysis was used.

Reliability coefficients (Cronbach alpha) for instruments of VAS-F and POMS were calculated. Also, Pearson correlation was used to test intra-scanner and intra-observer reliability of Doppler-Echocardiography. Statistical significance for all tests was set at $p<0.05$.

In order to understand the pattern or changes in pattern of fatigue and the psychological status of individuals, graphics were used. Scatter plot and correlations were used to uncover underlying patterns of fatigue and psychological variables within the repeated measurements.

Pearson correlation and Spearman correlation were used to define the relationships between fatigue and demographic variables, clinical variables, hemodynamic variables, and psychological variables. The association between variables of interest was examined for direction, size, and significance.

Two-way ANOVA was used to test differences within groups over-time for fatigue, vigor, anxiety, depression, and LV function such as EF, CO, SV, pulsed waved velocity total integrity (PWVTI) and continuous wave velocity total integrity (CWVTI) in addition to test the group differences.

Although daily patterns of fatigue changes after MI are important to describe, it is also clinically useful to know the weekly changes of those variables over time. Therefore, the following weekly means were calculated. The mean of Day 5, 6, and 7 for the first week, and mean of Day 12, 13, and 14 for the second week, and mean of Day 19, 20, and 21 for the third week were calculated and compared. However, because of multiple comparisons, a Bonferroni correction for the 18 dependent variables at alpha = .05 was done; this set significance at $p < .003$. For post-hoc analysis, the Scheffe' procedure with an alpha = .05 was used.

CHAPTER FOUR

FINDINGS

Introduction

The chapter on results is organized into three sections. The first section consists of an overview of the sampling strategy/protocol and a description of the sampling characteristics for those who participated in the study and for those who refused to participate. The second section presents findings for groups and individuals according to fatigue and fatigue-related physiologic and psychologic variables such as depression, anxiety, and ejection fraction. Finally, results from two-way ANOVA are presented, with the pattern of fatigue as a categorical between-subjects variable and time (or repeated observations) as the within-subject variable.

Sample Characteristics

A total of 31 MI patients from three San Francisco Bay Area (SFBA) hospitals who met the subject eligibility criteria were asked to participate in this study. Initially 26 subjects (86%) were enrolled. Three refused to participate, and two were transferred to other institutions during admission due to problems with health insurance. Among the 26 enrolled subjects, one subject did not reliably complete the questionnaires, one subject had another MI during admission, and one subject had severe congestive heart failure (CHF) and was in critical condition and ventilated until Day 5 after admission. One subject did not return for his second and third echocardiograms. However, he mailed the questionnaires for the period from Day 7 to Day 10. The final sample consisted of 22 subjects who were followed for three weeks after their infarction.

Demographic characteristics of the sample are presented in Table 4.1. The majority of the subjects were white (91%, n = 20), males (77%, n = 17), with a mean age of 54 years (range 28 to 77 years) and a college degree (68%). Religious affiliation was varied: Protestant (36%, n = 8), Catholic (18%, n = 4), Jewish (14%, n = 3), and non-denominational (22%, n = 5). More than half (55% n=12) were married and additional 5 patients were living with a significant other. Fifty-five percent (n=12) were employed; 27% (n = 6) were retired; 14% (n=3) were unemployed, and one was a homemaker. A sizeable majority (68% n=15) had incomes higher than $30,000 per year. Eight-two percent (n = 18) had a history of smoking, and 40 percent (n = 8) still smoked.

Clinical characteristics of the sample are presented in Table 4.2 Most (95% n = 21) of the subjects suffered with Q-wave MIs, half (50% n = 11) were diagnosed with an anterior MI, and a majority (60% n = 13) had more than two vessels involved. Thirty-three percent (n = 7) had a history of previous MI. Fifty

Table 4.1

Demographic Characteristics (N = 22)

Variables	**Number**	**Percent (%)**
Gender		
Female	5	22
Male	17	78
Ethnicity		
White	20	90
Asian	1	5
Other	1	5
Religion		
Buddhist	1	5
Catholic	4	18
Jewish	3	13
Protestant	8	36
Other	6	27
Marital Status		
Single	5	23
Married	12	55
Divorced	4	18
Widowed	1	5
Living Status		
Alone	5	23
With Spouse/Partner	11	50
With Parent	2	9
With Family	2	9
With Others	2	9
Type of Residence		
House	13	59
Apartment	9	41
Education		
High school	6	31
College	11	50
Graduate	4	18

Continued Table 4.1

Demographic Characteristics

Variables	Number	Percent(%)	Mean (SD)
Gross Income in 1991 ($)			
< 20,000	4	19	
> 20,000 to < 30,000	3	14	
> 30,001 to < 40,000	2	9	
> 40,001	13	59	
Working Status			
Employed	12	55	
Unemployed	3	14	
Retired	6	27	
Homemaker	1	5	
Hours Working per Week before MI			
> 20 to < 40	7	58	
> 41 to < 60	5	42	
Level of Activity			
Sedentary	2	17	
Minimum Activity	4	33	
Moderate Activity	2	17	
Heavy Activity	4	33	
Age			54(12.8)

Table 4.2

Disease Characteristics (N = 22)

Variables	Number	Percent(%)	Mean(SD)	Range
Diagnosis				
Non-Q MI	1	5		
Inferior MI	8	36		
Anterior MI	11	50		
Lateral MI	1	5		
Right Ventricle MI	1	5		
Involved Vessels				
One	6	40		
More than Two Vessels	9	60		
History of				
MI	7	33		
Hypertension	11	50		
Diabetics	5	24		
Smoking (Past)	18	82		
Smoking (Current)	8	38		
CAD (in Family)	8	38		
Discharge Medications				
B-Blocker	11	50		
Diuretics	8	38		
Thrombolytic	8	38		
Post-Angina	9	45		
Length of stay in Hospital (days)			6.7(1.5)	5-9
CPK (mU/ml)			1213(14)	70-4700
Cholesterol (mg/dl)			232(45)	151-346
WBC			11690(4761)	4300-21700
HB (g/100ml)			14(1.4)	11.1-16.7
Hct (%)			41(4)	32-48

CPK: Creatine PhosphoKinase HB: Hemoglobin
Hct: Hematocrit

percent (n = 11) had a history of hypertension, and 24 percent (n = 5) had a history of diabetes. Three patients had a positive family history of coronary artery disease. The mean peak CPK was 1213 (range 70 to 4700); cholesterol was 232 (range 151 to 346) and WBC was 11690 (range: 4761 to 21700) at admission. Hemoglobin, hematocrit, and temperature were within normal range. The mean length of stay in the hospital was 6.7 days (range 5 to 9 days). At discharge, 11 patients (50%) were given Beta-blockers, and eight patients (38%) were given thrombolytic and diuretics. Between three weeks and six months after the MI, 45 percent (n=9) had developed angina, and two had undergone coronary artery bypass surgery.

CHANGES IN FATIGUE AND FATIGUE-RELATED VARIABLES OVER TIME

PATTERNS OF FATIGUE AFTER MI FOR THE TOTAL SAMPLE

The means of fatigue from day 5 to day 21 after the MI (17 days) ranged from 33 to 44 out of 100 using the VAS-F Fatigue subscale and from 7.7 to 10.5 out of 28 using the POMS Fatigue subscale (Table 4.3; Figure 4.1, 4.2). The weekly mean of fatigue on the VAS-F Fatigue subscale was 37.9 ± 19.3 for Week 1, 32.7 ± 19.7 for Week 2, and 31.1 ± 22.9 for Week 3. The POMS Fatigue subscale was 8.8 ± 5.0, 7.4 ± 5.9, and 7.3 ± 7.6 on Week 1, 2, and 3 respectively (Table 4.4).

There were no significant changes in fatigue over time for

Figure 4.1 Patterns of the VAS-F Fatigue and Energy Subscales for Total Subjects (n = 22)

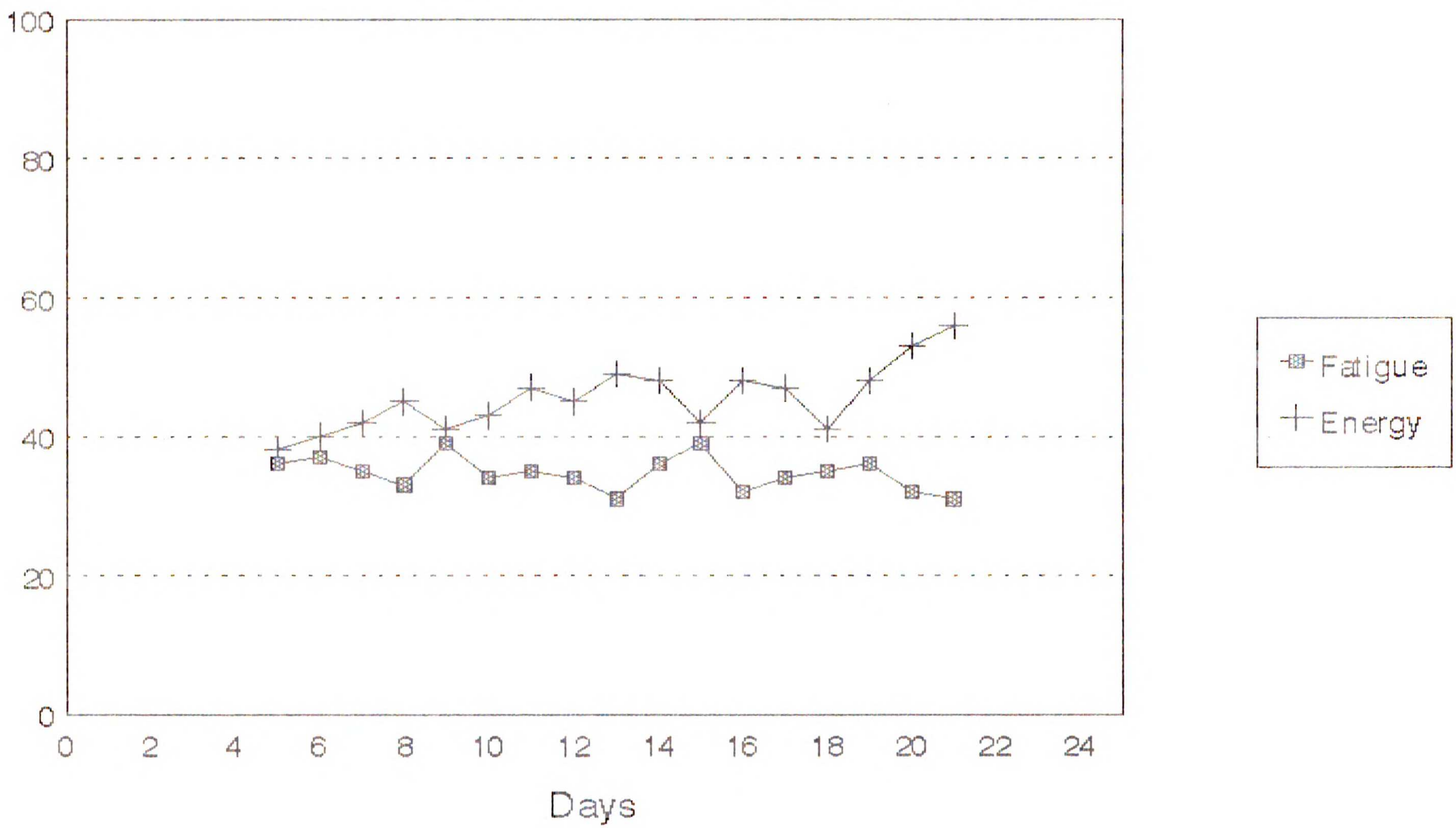


Figure 4.2 Patterns of the POMS Fatigue, Vigor, Anxiety, Depression, and Global subscales for Total Subjects (n=22)

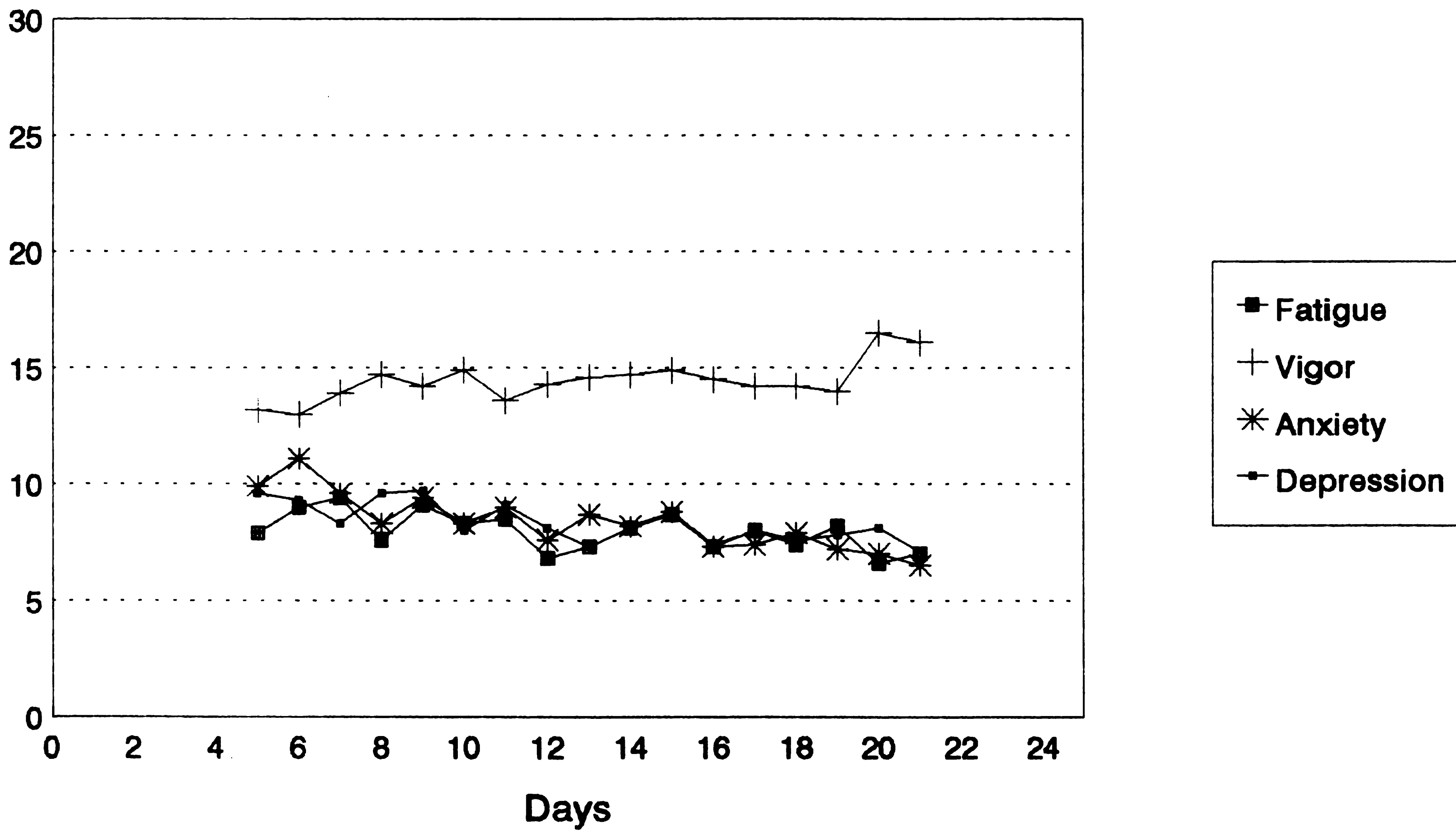


Table 4.3

Means and Standard Deviations, F-Values for the VAS-F and The POMS Fatigue, Energy, and Vigor Subscales Summary of ANOVA

Variables	VAS-F Fatigue(n=18)	VAS-F Energy(n=17)	POMS Fatigue(n=15)	POMS Vigor(n=16)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Days				
Day 5	41(20)	39(19)	9.1(4.7)	13.5(6.2)
Day 6	40(20)	39(17)	10.5(5.6)	13.3(5.5)
Day 7	39(18)	39(15)	10.5(6.5)	13.3(7.0)
Day 8	37(23)	43(22)	9.0(7.2)	13.5(8.3)
Day 9	43(20)	40(20)	10.5(8.0)	13.1(7.2)
Day 10	38(21)	40(20)	9.7(7.2)	14.8(6.4)
Day 11	36(23)	47(22)	9.6(8.1)	13.0(7.0)
Day 12	37(19)	42(16)	7.5(5.3)	14.1(6.1)
Day 13	36(20)	49(19)	9.4(7.8)	14.5(6.7)
Day 14	38(23)	47(20)	9.9(8.1)	14.5(6.9)
Day 15	44(21)	42(21)	10.5(7.4)	14.1(7.4)
Day 16	37(19)	46(21)	8.3(7.2)	14.5(8.4)
Day 17	39(22)	41(21)	9.3(8.2)	14.1(7.8)
Day 18	38(24)	46(23)	7.9(8.1)	13.6(8.1)
Day 19	38(22)	42(20)	8.4(7.8)	13.7(6.4)
Day 20	35(23)	48(22)	7.5(7.9)	15.0(7.3)
Day 21	33(25)	50(24)	7.7(8.8)	15.5(9.1)
F	.76	1.32	.97	.45
DF	16/272	16/256	16/224	16/240
P	.73	.18	.49	.97

the total sample in fatigue subscales in the VAS-F or the POMS by daily or weekly analysis (VAS-F Daily: F (16,272) = .76, p = .73, Weekly: F (2,34) = .80, p = .43; POMS (Daily: F (16,224) = .97, p = .49; Weekly: F (2,30) = .19, p = .83)(Table 4.3, 4.4; Figure 4.1, 4.2).

THE PATTERNS OF ENERGY, VIGOR, ANXIETY, AND DEPRESSION AFTER MYOCARDIAL INFARCTION FOR THE TOTAL SAMPLE

The weekly total group mean of energy on the VAS-F Energy subscale was 39.7 ± 19.3 for Week 1, 46.3 ± 19.7 for Week 2, and 52.6 ± 23.8 for Week 3, and the POMS Vigor subscale was 13.7 ± 6.0, 14.9 ± 6.8, and 15.1 ± 7.3 on Week 1, 2, and 3 respectively. The VAS-F Energy subscale showed that there were no daily energy changes over time (F(16,256) = 1.32, p = .18) (Table 4.3; Figure 4.1), but there was a trend for weekly changes over time (F(2,34) = 4.3, p =.02) (Table 4.4). However, there were no changes in both daily and weekly analyses on the POMS Vigor subscale (Daily: F(16,240) = .45, p = .97; Weekly: F(2,30) = .38, p =.69) like analyses in fatigue (Table 4.3, 4.4: Figure 4.1, 4.2).

The weekly total group mean of anxiety on the POMS subscale was 11.4 ± 5.9, 7.8 ± 7.0, and 6.2 ± 5.9 on Week 1, 2, and 3 respectively. The weekly changes in the level of anxiety were significant over time (F (2,30) = 12.4, p < .001), but there was a trend for daily changes over time (F(16, 224) = 2.09, p = .009)

Table 4.4

Means and Standard Deviations, and F-Values
for the Subscales of the VAS-F and POMS
Summary of Weekly Repeated ANOVA for Total Sample

	WeeK 1	Week 2	Week 3	DF	F	P
Variables	Mean (SD)	Mean (SD)	Mean (SD)			
VAS-F(n=22)						
Fatigue	37.9(19.3)	32.7(19.7)	31.1(22.9)	2,38	1.2	.43
Energy	39.7(14.2)	46.3(19.7)	52.6(23.8)	2,34	4.3	.02
POMS(n=20)						
Fatigue	8.8(5.0)	7.4(5.9)	7.3(7.6)	2,30	.19	.83
Vigor	13.7(6.0)	14.9(6.8)	15.1(7.3)	2,30	.38	.69
Anxiety	11.4(5.9)	7.8(7.0)	6.2(5.9)	2,30	12.4	.001
Depression	10.1(11.9)	7.5(11.1)	6.6(9.8)	2,30	1.4	.26

Table 4.5

Means and Standard Deviations, and F-Values for the POMS subscales
Summary of ANOVA

Variables	Anxiety(n=15)	Depression(n=15)
	Mean (SD)	Mean (SD)
Days		
Day 5	11.0(4.4)	12.1(8.4)
Day 6	12.5(7.1)	12.8(13.7)
Day 7	10.6(7.5)	12.0(14.5)
Day 8	9.5(6.6)	10.9(10.4)
Day 9	11.6(8.4)	12.8(16.7)
Day 10	10.2(7.3)	10.6(11.7)
Day 11	10.4(9.0)	11.6(15.1)
Day 12	8.9(8.3)	9.7(12.2)
Day 13	11.2(8.1)	10.2(11.2)
Day 14	10.9(8.2)	12.3(14.4)
Day 15	10.6(7.7)	12.0(15.0)
Day 16	8.3(5.5)	9.9(12.9)
Day 17	8.6(6.0)	10.6(14.0)
Day 18	8.9(6.6)	8.9(10.7)
Day 19	7.1(6.6)	8.2(10.8)
Day 20	8.0(5.7)	8.3(10.9)
Day 21	7.3(7.1)	7.9(12.1)
F	2.09	1.03
DF	16/224	16/224
P	.0095	.43

(Table, 4.4, 4.5; Figure 4.2).

The weekly total group mean of depression on the POMS Depression subscale was 10.1 ± 11.8, 7.5 ± 11.1, and 6.6 ± 9.8 on Week 1, 2, and 3. There was no changes in both daily and weekly analyses on the POMS Depression subscale (Daily: $F(16,224) = 1.03$, $p = .43$, Weekly; $F(2,30) = 1.4$, $p = .26$) (Table 4.4, 4,5; Figure 4.2). Overall, these MI patients rated themselves less anxious and less depressed with the passage of time. These improvements were accompanied by increasing energy over time.

PATTERN OF HEMODYNAMIC CHANGES AFTER MI FOR TOTAL SAMPLE

Table 4.6 presents Doppler-Echocardiography measurements at four observation points: Within 48 hours after admission, Week 1, Week 2, and Week 3 post admission. Repeated measures to test within-groups differences across time were based on pairwise deleting of missing data. Although the completed sample size was 22, three patients' first echocardiogram did not allow quantification. Therefore, the sample size for the repeated measures of ANOVA, based on pairwise deletion for missing data, was 17 for testing hemodynamic changes over time.

Table 4.6

Mean Differences in Repeated Measure ANOVA for 4 Time Observations of the Echocardiography Variables (n = 17)

	48 Hours	Week 1	Week 2	Week 3	DF	F	P
Variables	Mean(SD)	MEAN (SD)	Mean (SD)	Mean (SD)			Scheffe
2-Dimensional Echocardiography							
EF (%)	45(11)	50(8)	53(9)	52(11)	3,48	7.6	.001 1<3,4
CO (L/Min)	3.0(1.2)	3.9(1.3)	3.7(1.0)	3.6(.8)	3,48	3.8	.04
SV (ml)	40(13)	54(17)	58(13)	55(12)	3,48	8.4	.001 1<2,3,4
HR/min	75(15)	72(13)	63(7)	65(9)	3,48	7.3	.001 1<3,4; 2>3
Doppler Echocardiography							
PWVTI (cm)		18.2(.3)	18.7(3.2)	18.8(3.0)	2,32	.9	.40
CWVTI (cm)		19.7(3.7)	22.0(4.0)	20.9(3.1)	2,32	3.5	.04

EF: Ejection Fraction
SV: Stroke volume
VTI: Velocity Total Integrity
CW: Continuous Wave
CO: Cardiac Output
HR: Heart Rate
PW: Pulsed Wave

CARDIAC OUTPUT

There was a trend for Cardiac Output (CO) change over time $F(3,48) = 3.8$, $p = .04$). Scheffe' post-hoc comparison indicated that CO on Week 1 was somewhat higher than baseline (baseline = 3.0 L/min vs Week 1 = 3.9 L/min, $p <.04$).

EJECTION FRACTION

Ejection fraction (EF) within 48 hours (baseline) was 45 ± 11.2 % (range: 30 to 68 %, n = 19) and increased to 51 ± 8 % (range: 33 to 66 % n = 21) on Week 1 then 53 % and 52 % followed Week 2, 3 after MI. Overall, the EF change over the four time observations was significant ($F(3.48) = 7.6$, $p<.001$). The Scheffe' post-hoc comparison indicated that EF on Week 2 (52.9%) and 3 (51.9 %) was significantly higher ($p<.01$) than the baseline value (44.5 %).

Six of 19 patients (33%) showed lower than 42 % of EF at 48 hours. However, four of these patients improved their EF over 42%, while still two of these patients showed lower than 42 % of EF on Week 3. Intercorrelation among EF variables at these four time measurements were significant (range from .52 to .80, $p<.01$) except between EF within 48 hours and two weeks after admission ($r = .38$).

LEFT VENTRICUALR VOLUMRE

Mean end diastolic volume (EDV) was 93.7 ± 31.3ml at 48 hours (Baseline), 110 ± 38.5 ml at week 1, 112 ± 33ml at week 2, and 106.8 ± 29.9ml at week 3. There was a trend for change across the four time observations ($F(3, 48) = 3.5$, $p < .02$). However, there was no difference of end systolic volume (ESV) change over three weeks after MI. Since stroke volume (SV) is obtained from the formulation "end diastolic volume (EDV) - end systolic volume (ESV) = stroke volume (SV)" and since EDV changed, while ESV did not change over time, the change of SV was expected. A significant change ($F(3, 48) = 8.4$, $p < .001$) occurred across the observations. The Scheffe' post-hoc comparison indicted that the SV at Week 1, 2, and 3 was bigger than that baseline at 48 hours (baseline = 40.0 ml vs Week 1 = 54.1 ml, Week 2 = 57.8 ml, and Week 3 = 54.6 ml, $p < .01$).

HEART RATE AND BLOOD PRESSURE

There were significant heart rate (HR) change observed over time ($F(3,48) = 7.3$, $p<.001$). The Scheffe' post-hoc comparison indicated that HR per minute on Week 2 (63/min) and 3 (65/min) was slower than within 48 hours (75/min)($p<.01$). Fifty-seven percent of the subjects (n = 12) were prescribed beta-blocker for their discharge medication. However, there was no difference in

HT, EF, and CO between the groups with and without beta-blockers administered for discharge medication.

The mean systolic blood pressure (BP) was 130 ± 12 mmHg at 48 hours (baseline), 112 ± 12 mmHg at week 1 and week 2, 116 ± 12 mmHg at week 3. The mean diastolic BP was 84 ± 7 mmHg at baseline, 70 ± 9 mmHg, 66 ± 10 mmHg, and 69 ± 10 mmHg for week 1, 2, and 3 respectively. There was a trend for in both diastolic and systolic BP changes over time.

DOPPLER ECHOCARDIOGRAPHY

The majority of Doppler-Echocardiography studies within 48 hours post admission did not include doppler image acquisition. Therefore, statistical analysis of pulsed wave velocity total integrity (PWVTI) and continuous wave VTI (CWVTI) were based on three time observation data which is Week 1, 2, and 3 respectively.

Mean PWVTI was 18.2 ± .3 cm, 18.7 ± 3.2 cm, and 18.8 ± .9 cm while mean CWVTI was 19.7 ± 3.7 cm, 22.0 ± 4.0 cm, and 20.9 ± 3.1 cm on Week 1, 2, and 3. Doppler echocardiography showed that there was no PWVTI change over three weeks after MI ($F(2,32) = .9$, $p =.80$), but there was a trend for CWVTI change over time ($F(2, 32) = 3.5$, $p = .04$) (Table 4.6). The Scheffe' post-hoc comparison indicated that the CWVTI at Week 2 was somewhat greater than Week 1 ($p = .04$).

DIFFERENT FATIGUE PATTERNS AND FATIGUE-RELATED VARIABLES

Figure 4.3 is a data-based, visual presentation of the fatigue patterns among the 22 MI patients from Day 5 to Day 21 after admission based on the VAS-F fatigue subscale. Five patterns of fatigue profiles were derived from the visual analysis of scatter plots in the following steps: a) A scatter plot was made for each subject's fatigue graphed from Day 5 to Day 21 post-admission (x axis was day and y axis was fatigue). b) The investigator visually analyzed different patterns of fatigue among 22 subjects. c) To increase reliability, step b was repeated by two nurses and one lay person. d) For confirmation, slopes were calculated using Pearson correlation between days of post admission and the level of fatigue scores were compared for each group. Finally, five distinctive patterns of fatigue were derived (Figure 4.3): Group 1 (decreasing fatigue over time); Group 2 (increasing fatigue over time); Group 3 (unchanged pattern with low fatigue over time); Group 4 (unchanged pattern with high fatigue over time); and Group 5 (curve-linear shape pattern with low fatigue during week 1 and high fatigue during week 2 and then low fatigue during week 3).

There were no significant differences between the five groups on demographic variables including gender, age, and

Figure 4.3 Five Fatigue Patterns for Total subjects (n = 22)

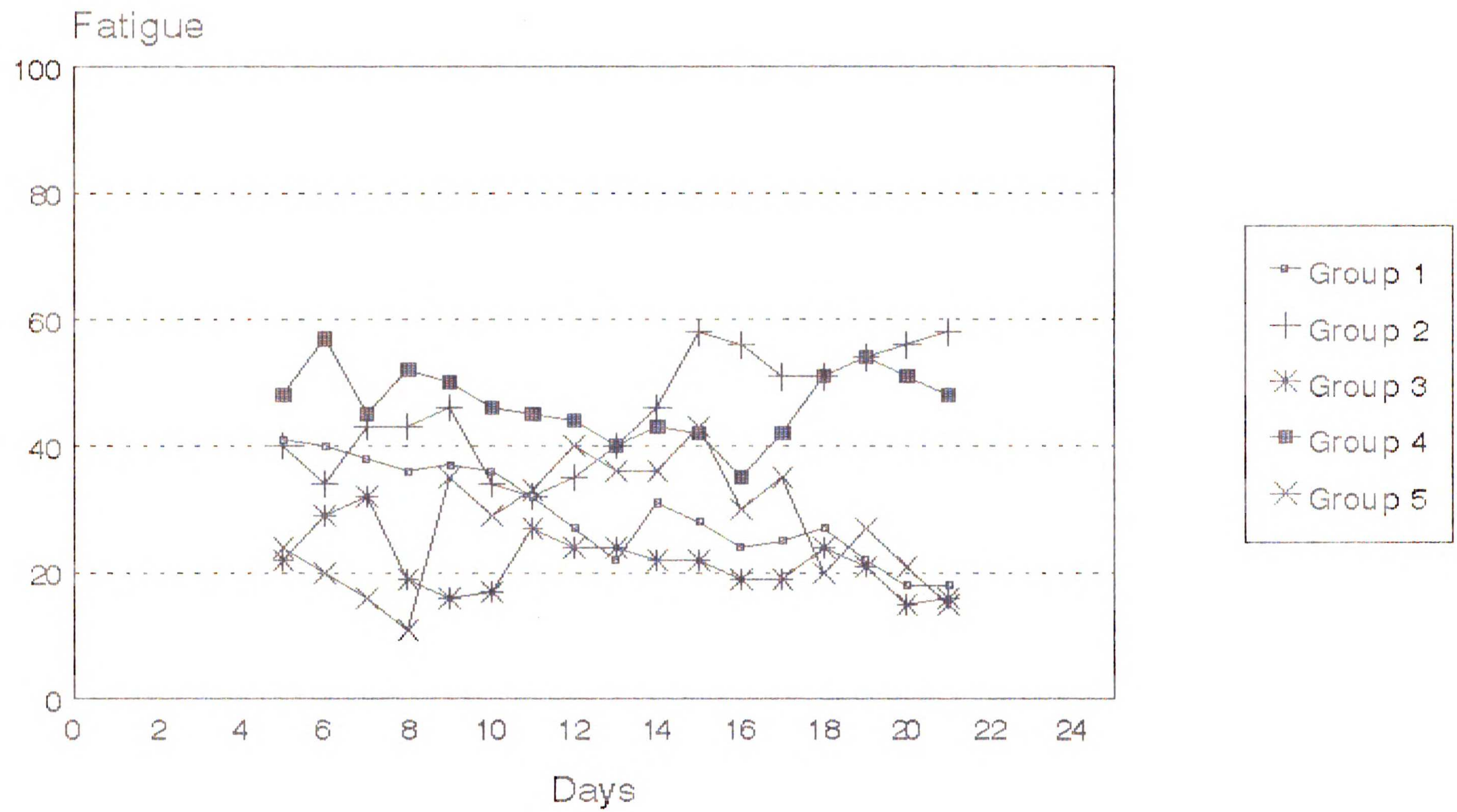


Table 4.7

The Demographic and Clinical Characteristics Among 5 Groups with Different Fatigue Patterns (N = 22)

Groups Subjects	Sex	Age	DX	CPK	EF(48H)	EF(Wk3)	Week 1 Fatigue VAS-F	Week 1 Fatigue POMS
Group 1								
101	M	54	RV	70	50	55	20.1	7
108	F	62	Inf	1876	57		53.9	12
122	M	55	Ant	460	47	54	50.0	13
147	M	62	Ant	2110	32	31	44.9	10
149	M	61	Ant	750	47	51	50.2	11
152	M	30	Ant	78	43	57	26.9	8
153	M	51	Lat	249	54	67	41.5	7
Group 2								
103	F	58	Inf	465	47	40	42.3	9
104	F	38	Ant	3561	31	30	73.4	11
123	M	77	Non-Q	463	56*	59	28.3	3
124	M	53	Ant	4700	49*	45	15.1	1
Group 3								
142	M	47	Inf	451	49	45	12.2	0
144	M	62	Inf	183	63	52	7.1	8
146	M	54	Inf	222	36	46	19.3	4
148	M	61	Ant	750	47	54	35.6	3
Group 4								
102	F	53	Ant	3388	68	62	54.6	
141	F	38	Ant	318	35	55	62.7	9
107	M	74	Inf	943	30	55	68.6	21
Group 5								
105	M	73	Ant	401	62*	51	10.1	7
106	M	28	Ant	3560	30	48	28.9	9
143	M	57	Ant	131	46	69	3.1	0
145	M	57	Inf	338	48	50	54.9	5

EF* from Week 1 Echocardiogaraphy

H: hours
Wk: Week
RV: Right Ventricle MI
Ant: Anterior MI
Inf: Inferior MI
Lat: Lateral MI
CPK: Creatine PhosphoKinase mU/ml

income. Clinical variables, the severity of infarction based on CPK level, or site of infarction based on anterior infarction versus non-anterior infarction did not show significant group differences (Table 4.7).

Two-way ANOVA was conducted on VAS-F Fatigue and Energy subscales and on the POMS subscales of Fatigue, Vigor, Anxiety, and Depression to determine the differences between the five groups over time. Weekly means and standard deviations of these subscales are reported in Table 4.8 to 4.12.

GROUP 1 (DECREASING FATIGUE PATTERN)

Although there was some variation, in general, visual analysis revealed that fatigue scores declined with the passage of time in seven of 22 patients (32%). (Figure 4.4). For these seven patients, negative associations were found between the fatigue scores on the VAS-F Fatigue subscale and days since admission, and ranged from -0.59 to -0.79. Mean age was 51 ± 11 years, and only one of these seven subjects was female. Four were diagnosed as anterior MIs, and the mean CPK at diagnosis for this group was 974 ± 959.

Figure 4.5 reflects fatigue, vigor, anxiety, and depression patterns of Group 1. Similar to fatigue, anxiety and depression scores declined with the passage of time in these seven patients. Significant changes over time were found in the VAS-F fatigue subscales (VAS-F Tired: $F(2,34) = 11.3$ $p < .001$), but POMS

Figure 4.4 Scatter Plots of Individual Subjects in Group 1 (Decreasing Fatigue Pattern)

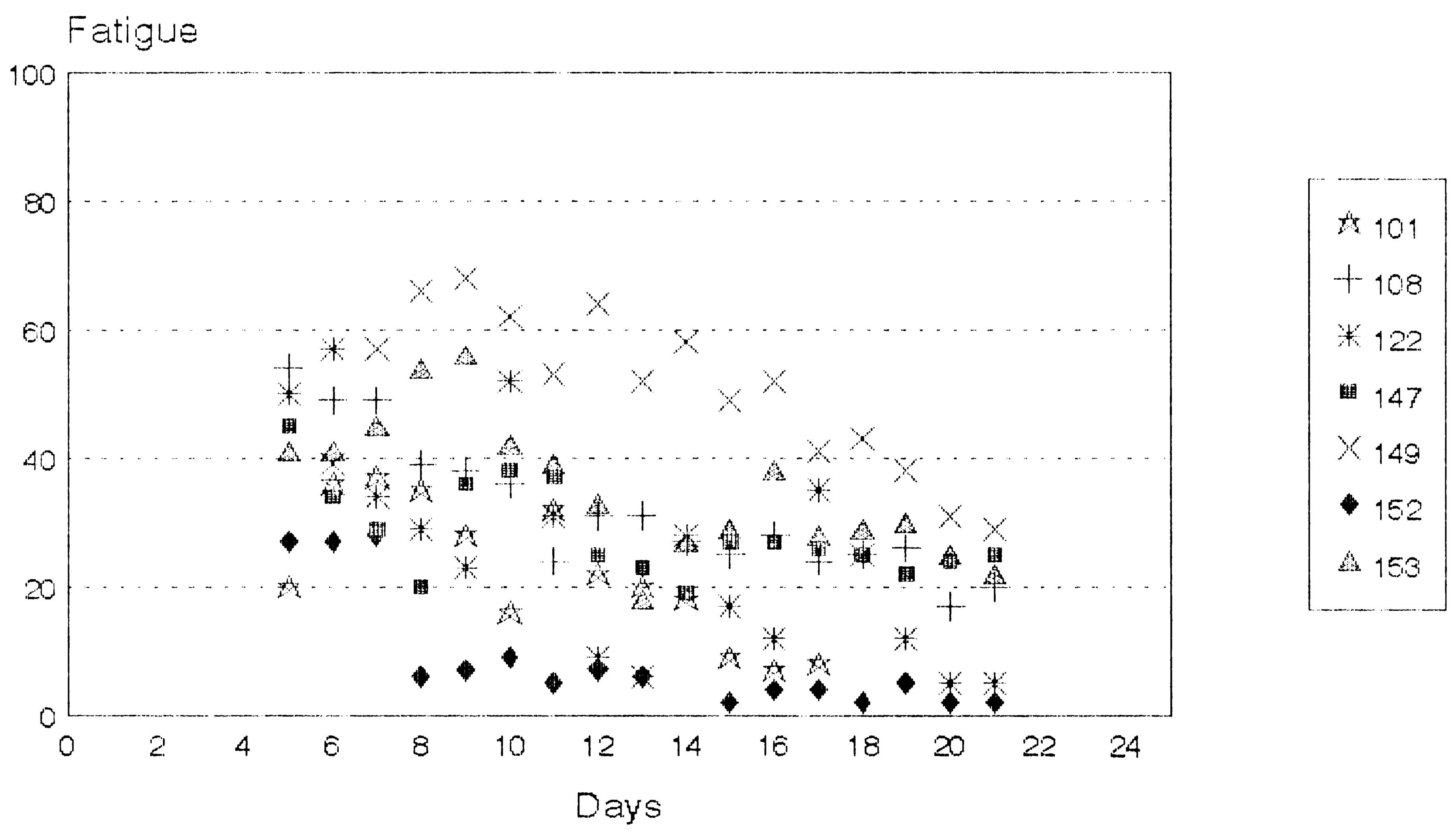


Figure 4.5 Fatigue, Vigor, Anxiety, and Depression Patterns in Group 1 (n = 7)

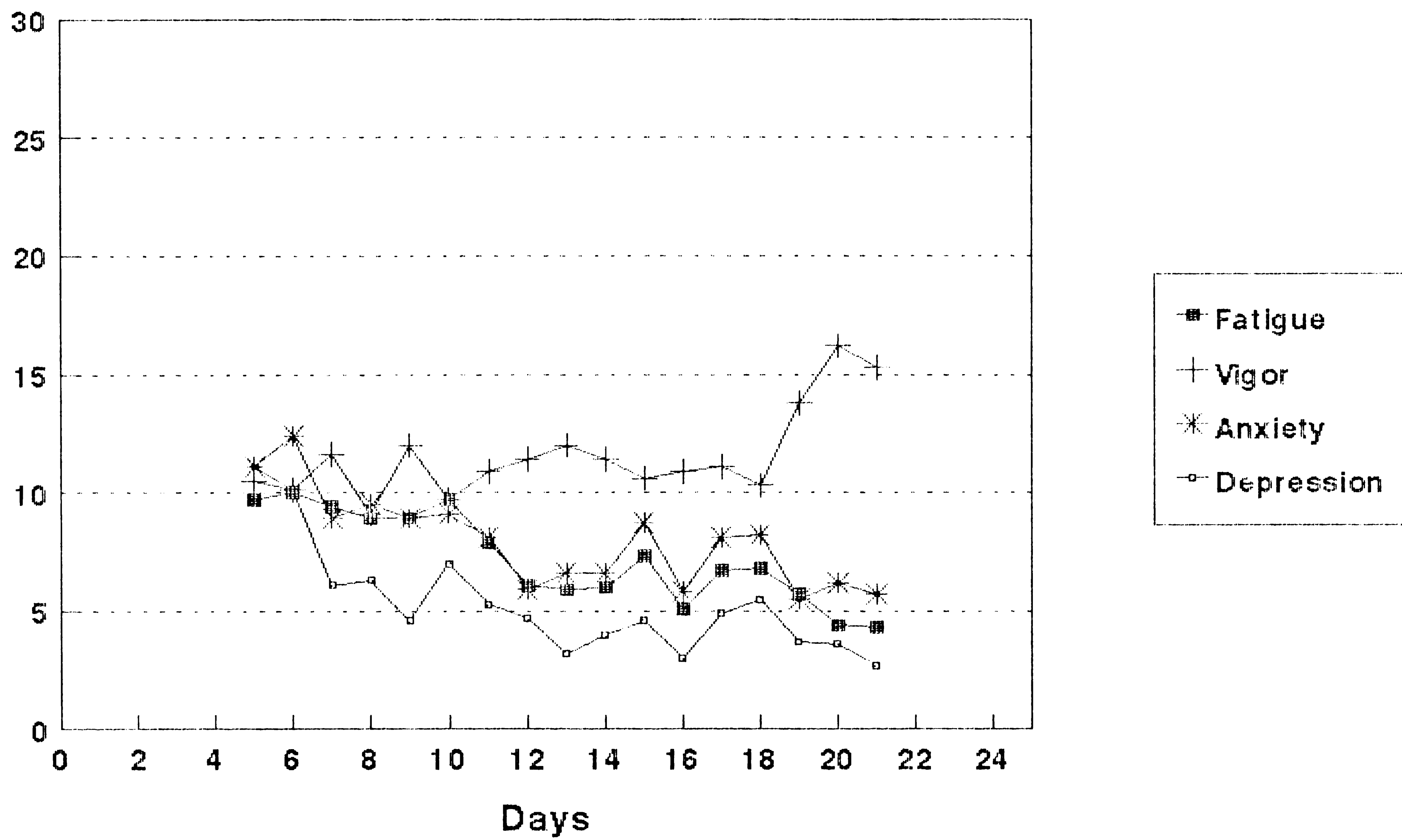


Table 4.8

Means and Standard Deviations, and F-Values for Subscales of the VAS-F and POMS in Group 1 (N = 7) Summary of Weekly Repeated ANOVA

Variables	Week 1 Mean (SD)	Week 2 Mean (SD)	Week 3 Mean (SD)	DF	F	P
VAS-F						
Fatigue	42.7(10.3)	24.3(17.1)	17.6(11.4)	2,34	11.3	.001
Energy	31.3(11.8)	39.2(22.1)	52.4(26.0)	2,34	4.9	.01
POMS						
Fatigue	10.1(2.7)	6.2(1.6)	4.6(3.5)	2,34	6.6	.004
Vigor	10.7(5.5)	11.8(6.8)	14.7(8.5)	2,34	3.1	.06
Anxiety	12.0(3.0)	6.3(1.7)	5.2(2.9)	2,34	12.7	.001
Depression	10.0(7.3)	3.2(1.0)	3.3(2.8)	2,34	4.1	.03

Fatigue subscale showed a trend for weekly change over time ($F_{(2,34)} = 6.6$, $p < .01$). The mean of Group 1 on the VAS-F subscale Fatigue was 42.7 ± 10.3 Week 1, 24.3 ± 17.1 Week 2, and 17.6 ± 11.4 Week 3. This group also rated themselves significantly less anxious ($F_{(2, 43)} = 12.7$, $p < .001$), and somewhat less depressed ($F_{(2, 43)} = 4.1$ $p = .03$) and more energetic over time (VAS-F Energy: $F_{(2, 34)} = 4.9$, $p = .01$) (Table 4.8).

GROUP 2 (INCREASING FATIGUE PATTERN)

Fatigue appeared to increase with the passage of time in four of the 22 patients as seen in Figure 4.6. The correlation between fatigue and day since MI was positive and ranged from 0.36 to 0.81. The patients' mean age was 57 ± 16 years, and two of these subjects were female. Two had anterior MIs, and two had non-anterior MIs. The group mean peak CPK at diagnosis was 2297 ± 2167.

Figure 4.7 shows POMS subscales scores for fatigue, vigor, anxiety, and depression patterns of Group 2. In contrast to the increasing pattern of fatigue scores, anxiety, depression and global scores declined as time passed.

The group mean on the VAS-F subscale Fatigue increased from Week 1 (38.5 ± 22.6) and Week 2 (38.5 ± 25.7) to Week 3 (55.9 ± 26.6). Fatigue scores were somewhat different over time (VAS-F: $F(2, 34) = 3.9$, $p = .03$; POMS: $F(2, 34) = 4.9$,

Figure 4.6 Scatter Plots of Individual Subjects in Group 2 (Increasing Fatigue Pattern)

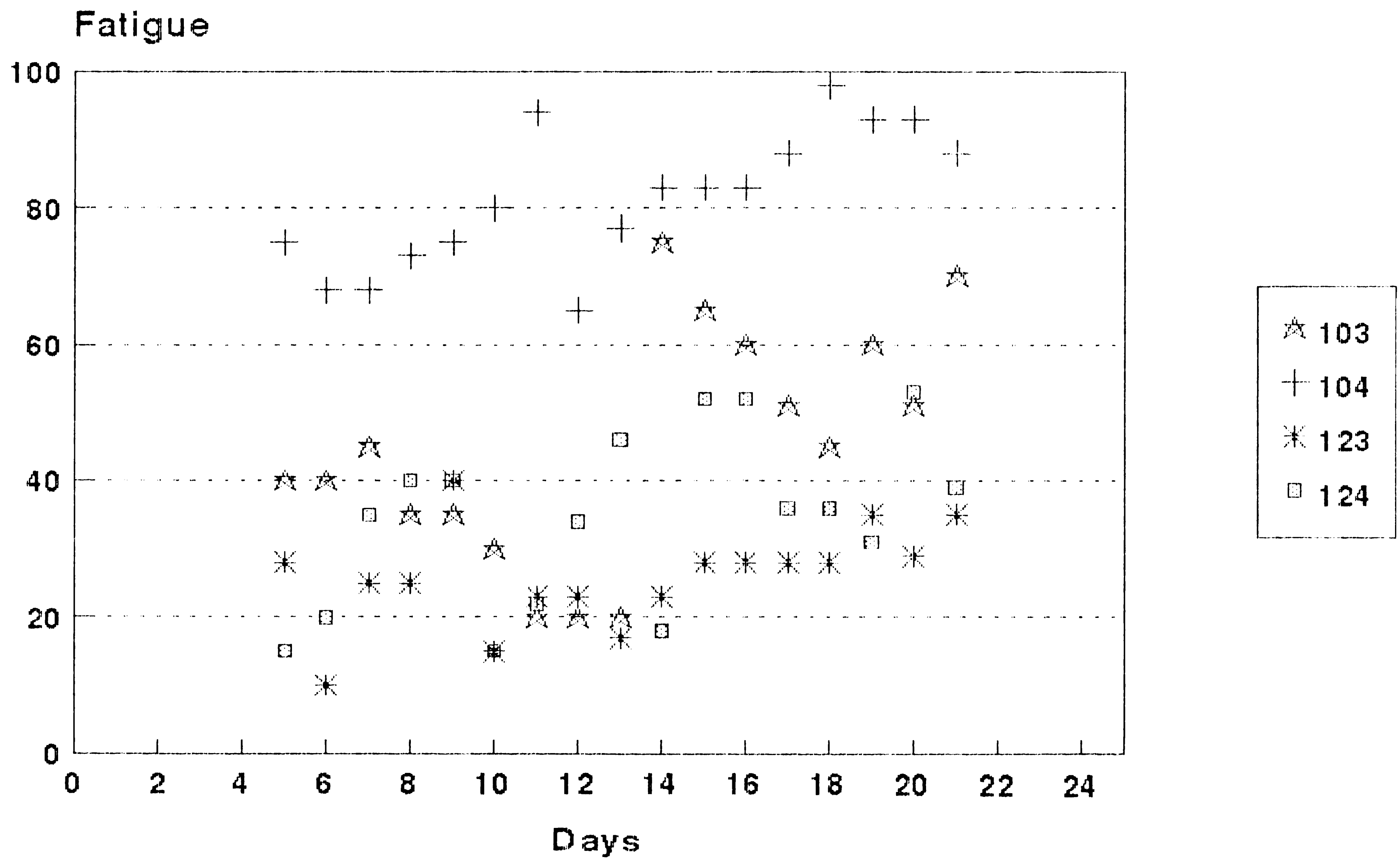


Figure 4.7 Fatigue, Vigor, Anxiety, and Depression Patterns in Group 2 (n = 4)

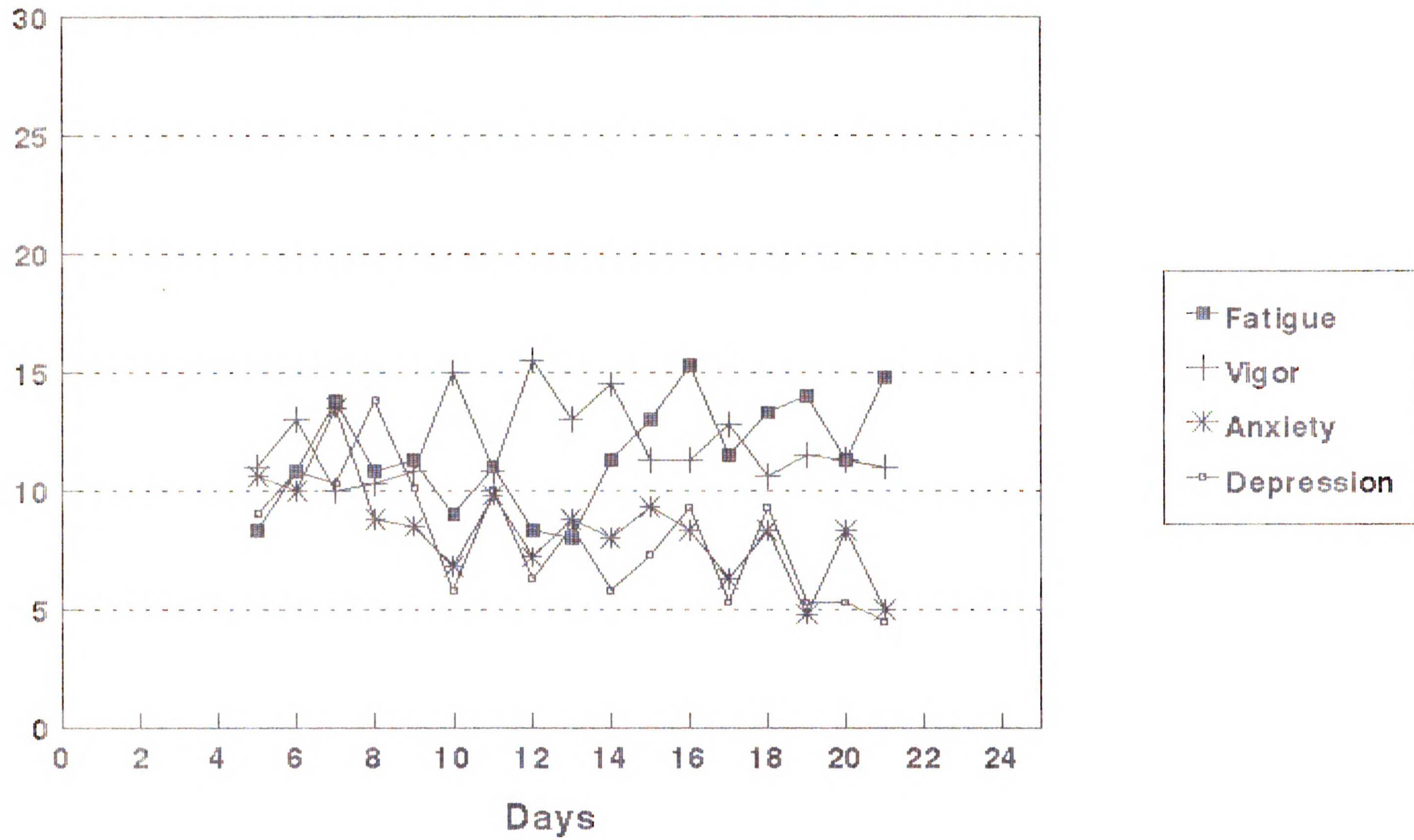


Table 4.9

Means and Standard Deviations, and F-Values for the Subscales of the VAS-F and POMS in Group 2 (N = 4) Summary of Weekly Repeated ANOVA

Variables	Week 1 Mean (SD)	Week 2 Mean (SD)	Week 3 Mean (SD)	DF	F	P
VAS-F						
Fatigue	38.5(23.2)	38.5(25.7)	55.9(26.6)	2,34	7.0	.03
Energy	40.2(9.5)	43.9(8.6)	34.3(14.1)	2,34	.5	.57
POMS						
Fatigue	9.4(4.8)	8.5(5.6)	14.5(10.9)	2,34	4.9	.01
Vigor	12.2(3.4)	14.3(1.9)	11.3(3.0)	2,34	1.0	.37
Anxiety	11.4(2.7)	8.0(3.9)	4.7(2.5)	2,34	7.2	.003
Depression	7.5(7.9)	5.7(6.1)	5.0(5.4)	2,34	.2	.75

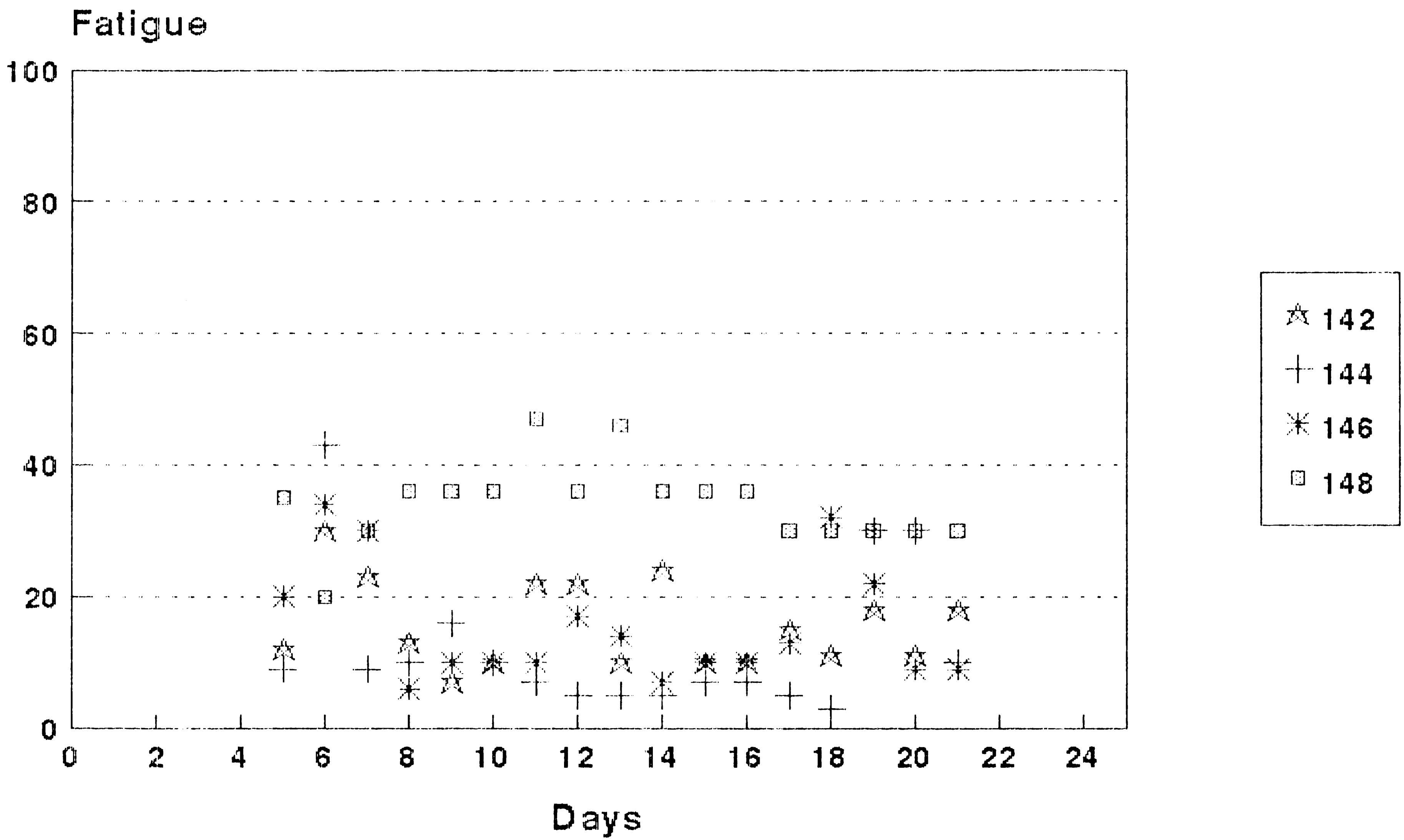
$p = .01$). This group was somewhat more fatigued during Week 3 than during Week 1, while there was no difference between the means of Week 1 and Week 2. The mean score for VAS-F was higher than the total group mean for all observations. While this group's mean on Week 1 was slightly lower than Group 1, the mean of Week 2 and 3 were noticeably higher than Group 1. Anxiety showed significant differences over time ($F_{(2,34)} = 7.2$, $p < .003$); this group rated themselves less anxious with the passage of time (Week 1 = 11.4 ± 2.7, Week 2 = 8.0 ± 3.9, and Week 3 = 5.0 ± 5.4) (Table 4.9). No significant changes were found over time in POMS subscales for Vigor and Depression.

GROUP 3 (UNCHANGED PATTERN WITH LOW FATIGUE)

There was an unchanged fatigue pattern for four of 22 patients, and only minor variations were noticed (Figure 4.8). Pearson correlation between the VAS-F fatigue score and day post admission ranged from 0.27 to -0.29. The patients' mean age was 56 ± 7 years. All four subjects were male. Only one patient was diagnosed as anterior MI and the mean peak CPK at the diagnosis for the groups was 402 ± 260. For these subjects, fatigue was lower across the 17 time observations (range 16 to 31). As illustrated in Figure 4.9, the group was less anxious, depressed, and globally mood disturbed than other groups, and had higher energy and vigor across the 17 time observations.

No significant changes in fatigue severity over time were

Figure 4.8 Scatter Plots of Individual Subjects in Group 3 (Unchanged Pattern with Low Fatigue)



Figuaro 4.9 Fatigue, vigor, Anxiety, and Depression Patterns in Group 3 (n = 4)

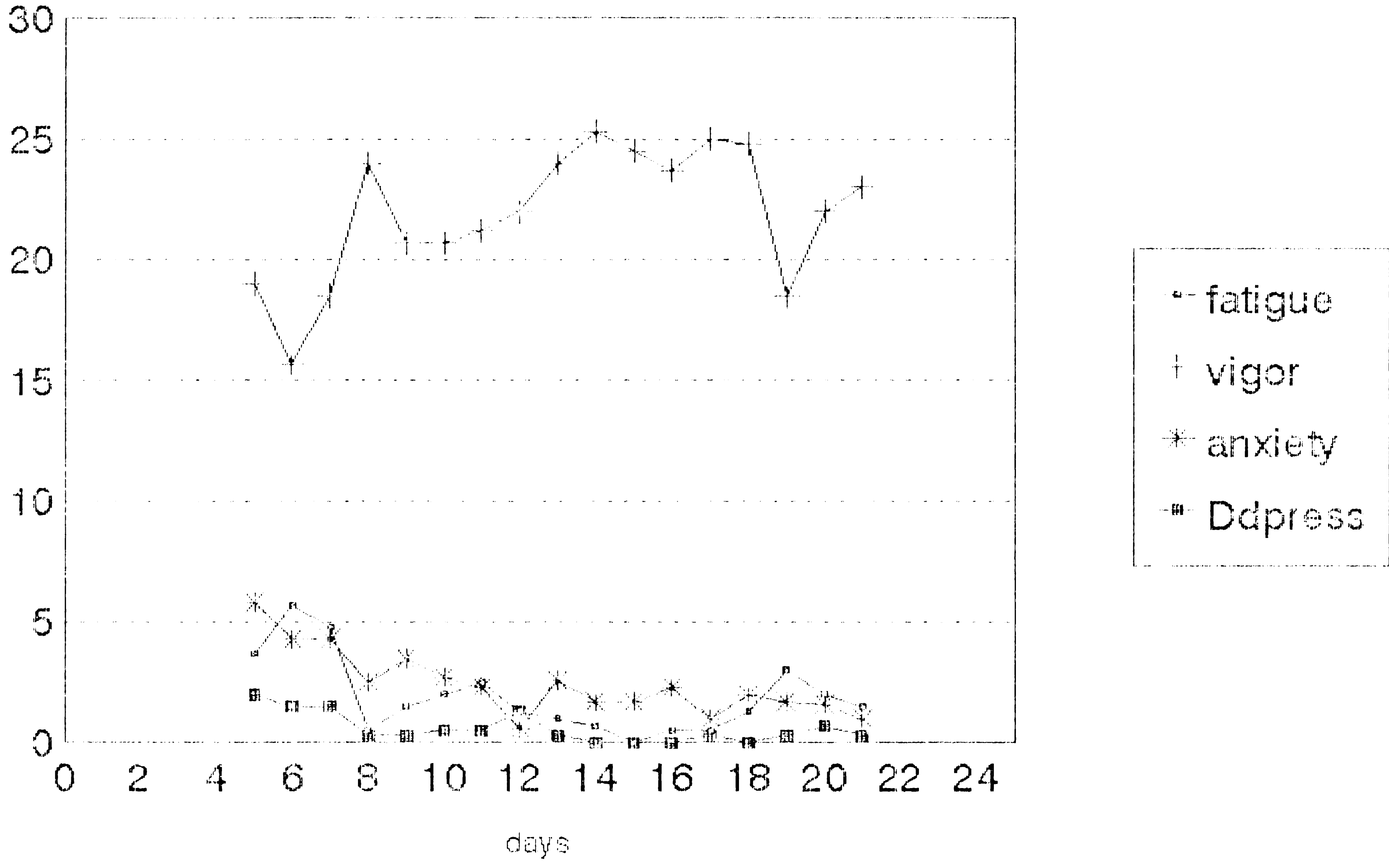


Table 4.10

Means and Standard Deviations, and F-Values for the Subscales of the VAS-F and POMS in Group 3 (N = 4) Summary of Weekly Repeated ANOVA

	Week 1	Week 2	Week 3	DF	F	P
Variables	Mean (SD)	Mean (SD)	Mean (SD)			
VAS-F						
Fatigue	25.7(14.4)	18.9(12.9)	19.6(10.0)	2,34	.5	.59
Energy	48.8(9.8)	63.0(11.8)	67.2(17.8)	2,34	2.3	.11
POMS						
Fatigue	4.8(3.2)	.7(.9)	2.1(3.6)	2,34	2.0	.15
Vigor	17.8(3.8)	23.2(2.9)	20.8(3.9)	2,34	3.1	.06
Anxiety	5.8(1.6)	.8(.5)	1.4(.4)	2,34	4.3	.02
Depression	1.7(1.9)	.4(.8)	.4(.8)	2,34	.1	.92

found in the VAS-F fatigue subscale and the POMS fatigue subscale. The weekly group mean scores of fatigue for these four patients on the VAS-F was 25.7 ± 14.4, 18.9 ± 12.9, and 19.6 ± 10.0 on Week 1, 2, and 3 respectively. The group means for VAS-F and POMS subscale Fatigue scores were lower than those of other groups for most observations.

Like fatigue changes over time, there were no changes over time in POMS subscales Vigor and Depression. In contrast, there was a trend for anxiety to improve with the passage of time ($F_{(2,34)} = 4.3$, $p = .05$)(Table 4.10).

GROUP 4 (UNCHANGED PATTERN WITH HIGH FATIGUE)

Like Group 3, the fatigue pattern based on VAS-F in this group of three patients also was unchanged (Figure 4.10). However, there was a noticeable difference between Group 3 and 4; while Group 3 had the lowest VAS-F fatigue scores (range 16 to 31 mm), Group 4 had the highest VAS-F fatigue scores (range 34 to 58 mm) among the observations across the five groups. Pearson correlations between "fatigue" and "day since MI" ranged from 0.04 to 0.40. The subjects' mean age was 55 ± 18 years for this group; two were female. Two patients were diagnosed as an anterior MI, and the mean peak CPK at diagnosis for the group was 1549 ± 1622.

As illustrated in Figure 4.11, there were unchanged patterns of anxiety and depression. However, similar to fatigue patterns,

Figure 4.10 Scatter Plots of Individual Subjects in Group 4 (Unchanged Pattern with High Fatigue)

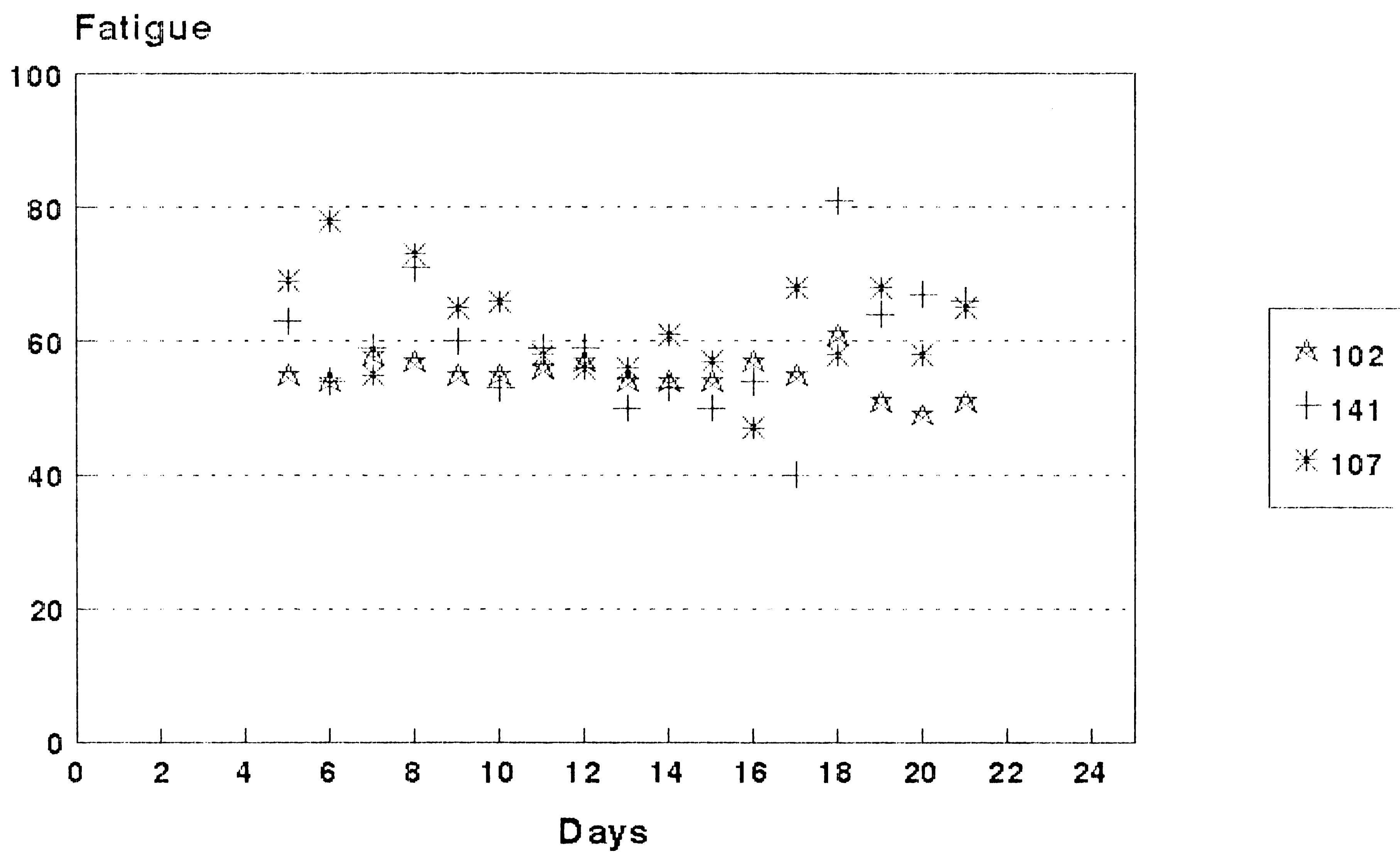


Figure 4.11 Fatigue, Vigor, Anxiety, and Depression Patterns in Group 4 (n = 3)

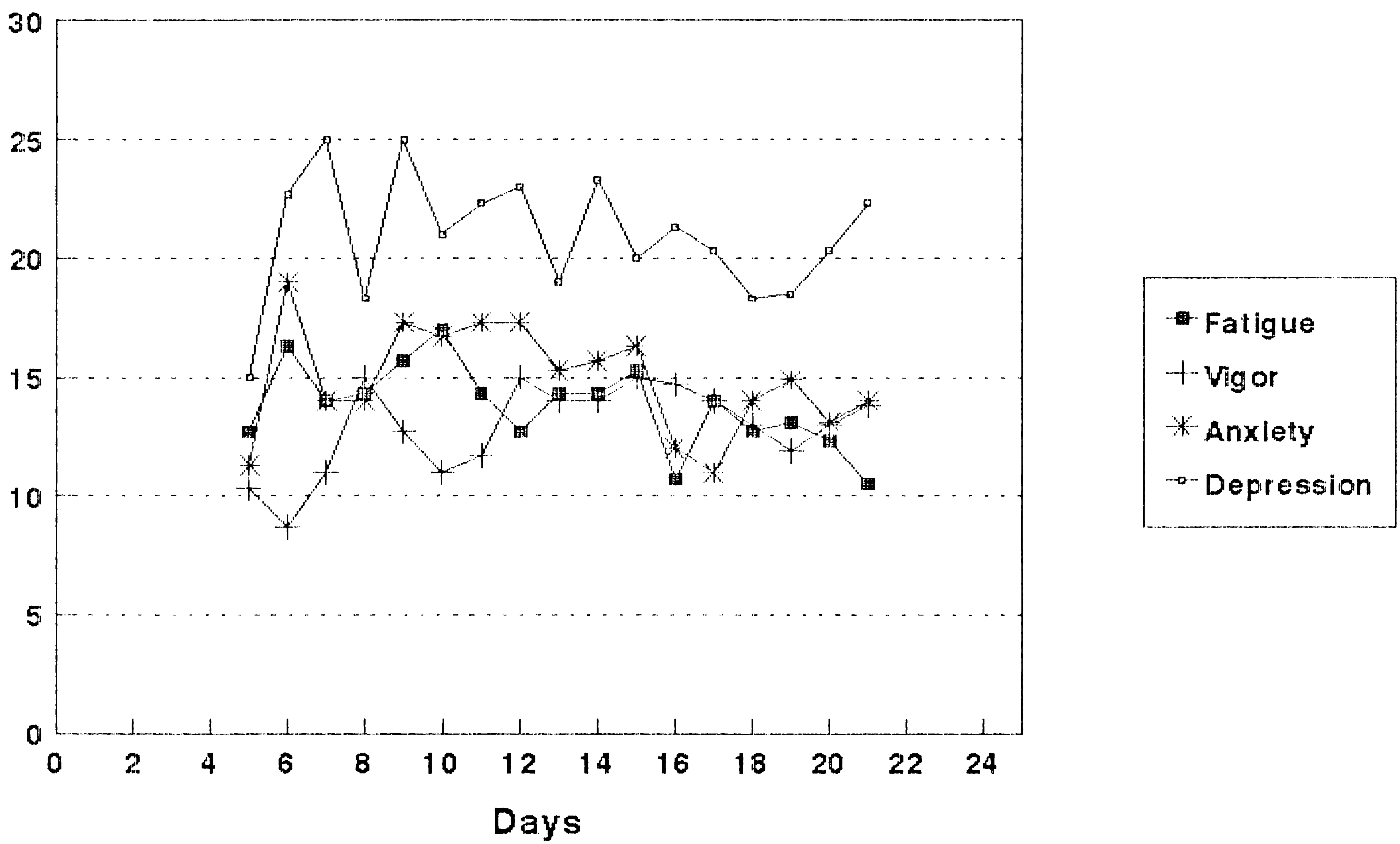


Table 4.11

Means and Standard Deviations, and F-Values for the Subscales of the VAS-F and POMS in Group 4 (N = 3) Summary of Weekly Repeated ANOVA

	Week 1	Week 2	Week 3	DF	F	P
Variables	Mean (SD)	Mean (SD)	Mean (SD)			
VAS-F						
Fatigue	62.4(9.3)	55.4(2.2)	59.8(7.9)	2,34	.4	.70
Energy	36.4(24.0)	51.5(35.4)	49.9(35.2)	2,34	1.3	.29
POMS						
Fatigue	17.0(6.6)	20.3(.4)	18.3(3.7)	2,34	.7	.52
Vigor	7.5(5.4)	8.0(9.9)	5.9(5.1)	2,34	.2	.78
Anxiety	22.8(11.5)	24.2(6.4)	20.5(1.7)	2,34	1.0	.39
Depression	34.7(21.7)	34.8(.4)	30.5(7.4)	2,34	.5	.63

this group's mean scores for anxiety and depression were noticeably higher than those of the other groups. Fatigue did not different over time, nor did other psychological variables on the POMS subscales vary. The mean of VAS-F fatigue scores was 62.4 ± 9.3 Week 1, 55.4 ± 2.2 Week 2, and 59.8 ± 7.9 Week 3 (Table 4.11).

GROUP 5 (CURVE-LINEAR SHAPED PATTERN)

As shown in Figure 4.12, this group of 4 patients had a high level of variability with a curve-linear shaped pattern of low fatigue early in their recovery, high fatigue during the second week and low fatigue during the third week. All four patients were male with a mean age of 54 ± 19 years. Three were diagnosed as having anterior MI. The mean peak CPK at diagnosis for the group was 1108 ± 1639.

Although the subgroups are small and have a large degree of variance in all variables, the means of individuals in this group were not higher than those of the total group in general. This group rated themselves as feeling more vigorous than other groups except Group 3.

There was a trend of changes over time for ratings of fatigue on the VAS-F subscale ($F(2,34) = 3.8$, $p = .03$). However, as the curve-linear shaped figure indicates, this group rated more severe fatigue in the second week rather than at the beginning or the end of week (Figure 4.13)(VAS-F Fatigue:

Figure 4.12 Scatter Plots of Individual Subjects in Group 5 (Bell Shape Fatigue Pattern)

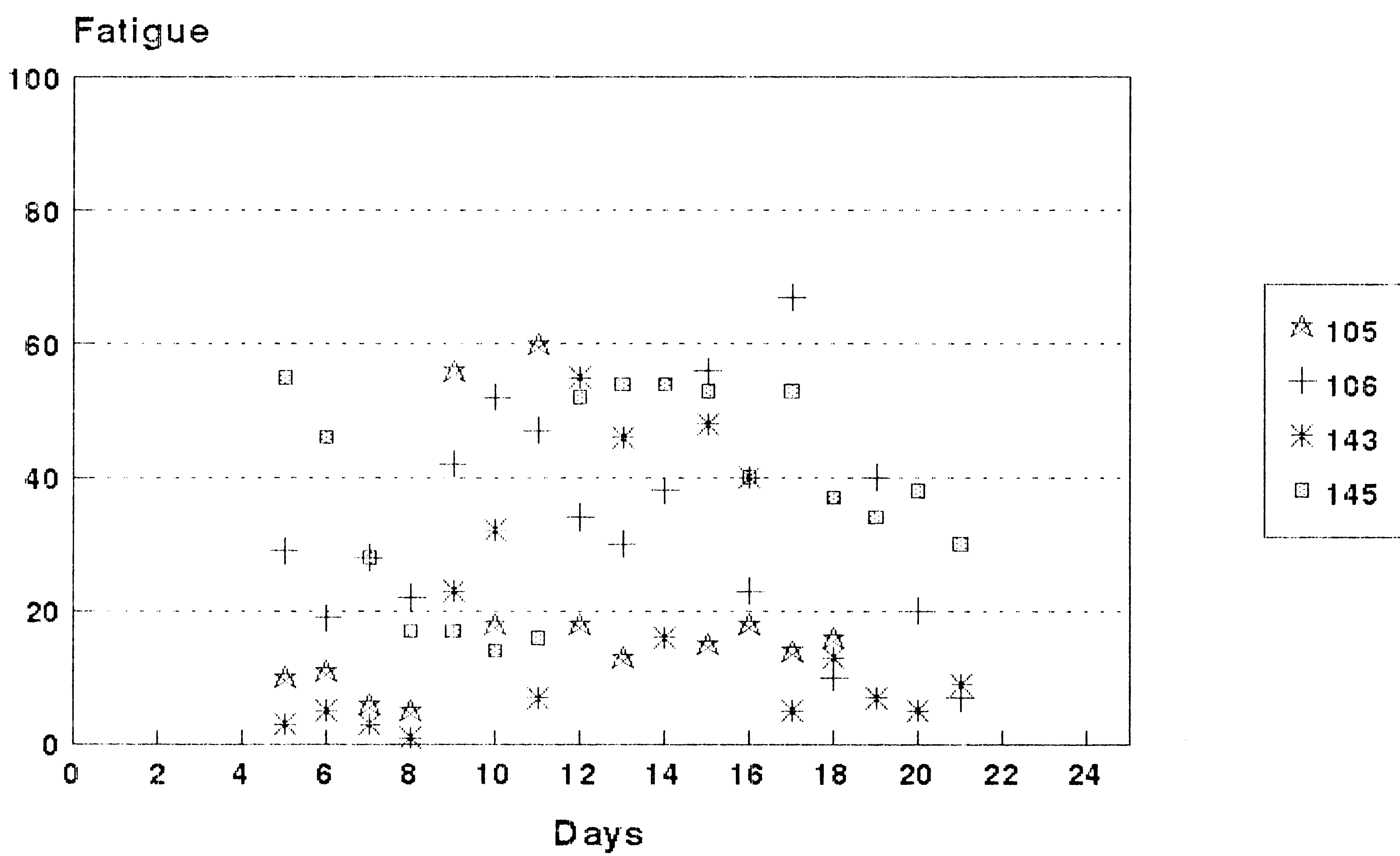


Figure 4.13 Fatigue, Vigor, Anxiety, and Depression Patterns in Group 5 (n = 4)

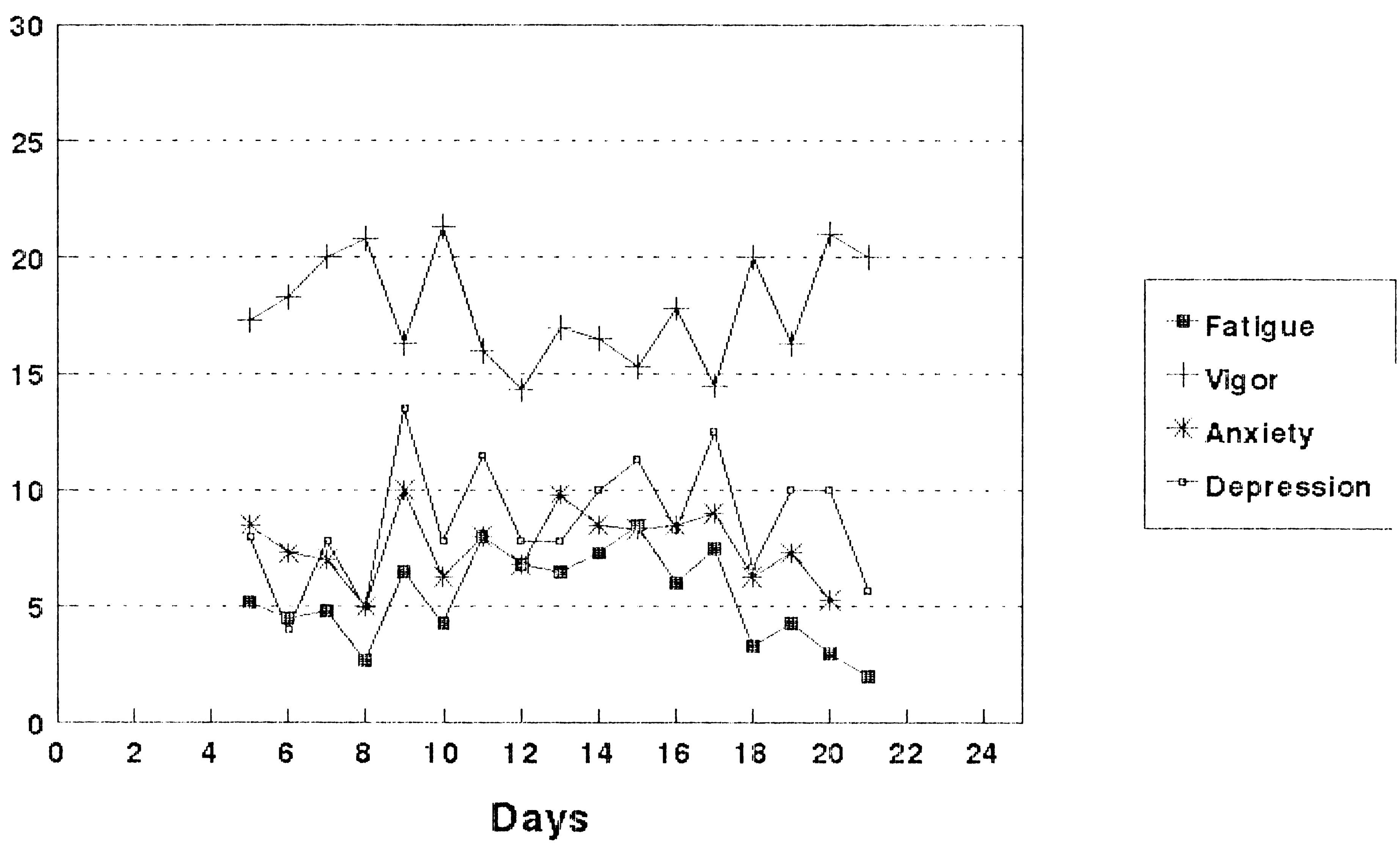


Table 4.12

Means and Standard Deviations, and F-Values for the Subscales of The VAS-F and POMS in Group 5 (N = 4) Summary of Weekly Repeated ANOVA

	Week 1	Week 2	Week 3	DF	F	P
Variables	Mean (SD)	Mean (SD)	Mean (SD)			
VAS-F						
Fatigue	22.9(21.2)	38.3(17.4)	19.7(11.5)	2,34	3.8	.03
Energy	47.5(11.3)	40.3(11.3)	58.3(22.5)	2,34	2.0	.14
POMS						
Fatigue	5.1(4.5)	8.8(2.9)	3.8(3.4)	2,34	2.4	.11
Vigor	21.1(2.0)	16.6(3.3)	19.3(5.7)	2,34	1.6	.21
Anxiety	9.3(4.3)	9.2(4.7)	6.9(5.7)	2,34	.7	.51
Depression	8.3(9.8)	11.3(14.2)	8.6(11.4)	2,34	.3	.72

Week 1 ;22.9 ± 21.2, Week 2 ; 38.3 ± 17.4, and Week 3; 19.7 ± 11.5, POMS Fatigue: Week 1; 5.1 ± 4.5, Week 2;= 8.8 ± 2.9, Week 3; 3.8 ± 3.4) (Table 4.12).

GROUP DIFFERENCES

Two-way ANOVA was conducted on the two VAS-F subscales Fatigue and Energy, and on the POMS subscales for Fatigue, Vigor, Anxiety, Depression, and Global Mood to determine the differences between the five groups over time. For post hoc analyses, the Scheff'e procedure with an alpha = 0.05 was used. There were significant differences between the five groups on ratings of fatigue on VAS-F subscales and Fatigue, Vigor, Anxiety, Depression, and Global on the POMS subscales (Table 4.13).

A significant group difference between the five groups on the rating of fatigue severity on the VAS-F subscale was found during week 3 (Week 3 ($F(4,21) = 6.9$, $p < .001$) and similar trend was noted for Week 1 and 2. A Scheffe' post hoc analysis of VAS-F subscale Fatigue showed that Group 4 was more fatigued than Group 1, 3, and 5 on Week 3 ($p <.01$). Individuals in Group 2 also rated themselves as more tired (66 ± 27) than those in Group 1 (18 ± 11) ($p <.01$).

The POMS Fatigue subscale score validated the VAS-F fatigue scores and also showed significant differences between groups during week 2 and 3(Week 2:$F(4, 22) = 7.3$, $p <.001$; Week 3: $F(4, 22) = 8.9$, $p <.001$) and similar trend was noted for Week 2.

Table 4.13

Summary of Fatigue and Psychological variables between Five different Groups

Source	G 1	G 2	G 3	G 4	G 5	DF	F	P
VAS-F								
Fati Wk1	43(10)	38(23)	26(14)	62(9)	23(21)	4,26	3.3	.025
Fati Wk2	24(17)	39(26)	19(13)	66(9)	38(17)	4,26	2.9	.04
Fati WK3	18(11)	66(27)	20(11)	60(8)	20(12)	4,26	6.9	.001
Ener WK1	31(12)	40(9)	49(10)	36(24)	48(14)	4,27	.6	.58
Ener WK2	39(22)	44(8)	63(12)	62(35)	42(11)	4,27	.4	.35
Ener WK3	52(26)	43(14)	67(8)	60(35)	68(22)	4,27	.2	.22
POMS								
Fati WK1	10.1(3)	9.4(6)	4.8(3)	17.0(7)	6.2(4)	4,22	3.5	.024
Fati WK2	6.2(2)	8.5(6)	.8(1)	20.3(3)	7.2(4)	4,22	7.3	.001
Fati WK3	4.6(4)	14.6(10)	2.1(4)	14.3(8)	3.8(3)	4,22	8.9	.001
Vigo WK1	10.7(5)	12.2(3)	17.8(4)	7.6(5)	21.1(2)	4,18	3.2	.037
Vigo WK2	11.8(7)	14.3(2)	23.2(3)	8.0(9)	16.5(3)	4,18	3.8	.020
Vigo WK3	14.8(8)	11.2(3)	20.8(4)	5.9(5)	19.3(6)	4,18	3.6	.027
Anxi Wk1	12.0(6)	11.9(3)	6.8(2)	22.3(11)	6.6(4)	4,26	8.3	.001
Anxi WK2	6.3(2)	8.0(4)	.8(1)	24.2(6)	7.6(6)	4,26	15.6	.001
Anxi WK3	6.3(3)	4.7(3)	1.4(0)	18.1(4)	6.9(6)	4,26	10.7	.001
Depr WK1	10.0(7)	7.6(8)	1.7(2)	34.7(22)	8.3(9)	4,24	8.0	.001
Depr WK2	3.2(1)	6.7(6)	.4(1)	34.8(0)	11.3(14)	4,24	9.8	.001
Depr WK3	3.4(4)	5.0(5)	.4(1)	30.5(7)	8.5(11)	4,24	7.3	.001

Fati: Fatigue
Vigo: Vigor
Depr: Depression
G: Group
Ener: Energy
Anxi: Anxiety
WK: Week

Scheffe' post-hoc comparison procedure indicated that patients in Group 4 again rated themselves more fatigued than all other groups ($p < .05$). For the POMS vigor subscale, there was a trend of vigor changes among the groups (Week 1; $F(4,18) = 3.2$, $p = .04$) , Week 2; $F(4,18) = 3.8$, $p = .02$, and Week 3; $F(4, 18) = 3.5$, $p = .03$).

The groups were also compared on the level of anxiety and depression. Anxiety showed significant differences over time for the five groups on Week 1 ($F(4,26) = 8.3$, $p < .001$), on Week 2 ($F (4,26) = 15.6$, $p < .001$), and on Week 3 ($F(4,26) = 10.7$, $p <.001$). Scheffe' post hoc procedure indicated that Group 4 was more anxious than Group 3 and 5 on the Week 1 ($p<0.05$). Also, Group 4 perceived themselves to be more anxious than all the other groups on Week 2 and 3 ($p<0.05$)

There were significant differences in the Depression subscale between the five groups in Week 1 ($F(4,24) = 8.0$, $p <.001$), Week 2 ($F(4,24) = 9.8$, $p <.001$), and Week 3 ($F(4,24) = 7.3$, $p<.001$). Scheffe' Post hoc procedure indicated that patients in Group 4 perceived themselves to be more depressed than all other groups over the three week observation period ($p <.05$).

RELATIONSHIP BETWEEN FATIGUE AND RELATED VARIABLES

This section describes the direction, strength, and statistical significance between fatigue and fatigue-related variables as discussed in the conceptual framework (Figure 2.1).

Of the demographic variables, only gender showed that women (n = 6) were rated somewhat more fatigued than men (n = 16) (Table 4.14). As shown in Table 4.15, fatigue severity on the VAS-F during Week 2 was somewhat positively and moderately related to the level of CPK at dignosis ($r = .46$, $p < .07$). There was a trend that patients who were taking beta blockers rated somewhat more fatigue on Week 3 on the VAS-F subscale ($r = .46$, $p < .04$). Although there was a positive relationship between fatigue and history post-angina, this relationship was not statistically significant (Table 4.15). For hemodynamic variables, there was a somewhat negative and moderate relationship between fatigue and EF on Week 1 on both the VAS-F and POMS Fatigue subscale (VAS-F: -.55, $p = .01$; POMS: -.49, $p = .03$).

Table 4.16 shows the relationship between Fatigue measured by the VAS-F subscales and POMS subscales and Anxiety, Depression, and Vigor as measured by POMS subscales and Energy measured by the VAS-F subscale. During Week 1, fatigue measured with the POMS subscale was significantly and negatively related to energy and vigor ($p < .001$). During Week 2, fatigue measured by the POMS Fatigue subscale was significantly related to anxiety and depression ($p < .001$). During Week 3, fatigue measured by both in the VAS-F and POMS Fatigue subscales was significantly and negatively related to energy and vigor. Also, fatigue measured by POMS Fatigue subscale was significantly related to

Table 4.14

Spearmans Correlation between Fatigue and Demographic and Clinical Variables for Week 1 (n = 19)

Variables	Sex	Diagnosis	B-Blocker	Post-Angina
VAS-F				
Fatigue (r)	-.44	.04	.39	.16
(p)	.03	.63	.09	.52
POMS				
Fatigue (r)	-.38	.07	.26	.32
	.02	.82	.31	.31

Spearmans Correlation between Fatigue and Demographic and Clinical Variables for Week 2 (n = 19)

Variables	Sex	Diagnosis	B-Blocker	Post-Angina
VAS-F				
Fatigue (r)	-.28	-.16	.19	.13
(p)	.23	.49	.41	.63
POMS				
Fatigue (r)	-.50	-.06	.35	.25
(p)	.03	.83	.12	.30

Spearmans Correlations between Fatigue and Demographic and Clinical Variables for Week 3 (n = 20)

Variables	Sex	Diagnosis	B-Blocker	Post-Angina
VAS-F				
Fatigue (r)	-.52	-.00	.46	.40
(p)	.02	1.00	.04	.08
POMS				
Fatigue (r)	-.49	-.03	.36	.38
(p)	.024	.86	.11	.10

Table 4.15

Pearson Correlation between Fatigue and Demographic and Physiological Variables for Week 1 (n = 20)

Variables	Age	CPK	HB	EF	CO
VAS-F					
Fatigue (r)	-.11	.10	-.04	-.55	-.06
(p)	.66	.68	.87	.01	.79
POMS					
Fatigue (r)	.01	.39	-.12	-.49	-.11
(p)	.96	.09	.59	. 03	.64

Pearson Correlation between Fatigue and Demographic and Physiological Variables for Week 2 (n = 17)

Variables	Age	CPK	HB	EF	CO
VAS-F					
Fatigue (r)	-.36	.46	-.39	-.25	.25
(p)	.16	.07	.12	.32	.33
POMS					
Fatigue (r)	-.25	.34	-.37	-.09	.00
(p)	.33	.18	.14	.72	.99

Pearson Correlation between Fatigue and Demographic and Physiological Variables for Week 3 (n = 19)

Variables	Age	CPK	HB	EF	CO
VAS-F					
Fatigue (r)	.01	.38	-.23	-.19	.03
(p)	.96	.10	.34	.43	.89
POMS					
Fatigue (r)	.04	.32	-.21	-.19	.13
(p)	.87	.18	.38	.43	.57

HB: Hemoglobin
WBC: White blood count
CO: Cardiac output
Hct: Hematocrit
EF: Ejection fraction

Table 4.16

Pearson Correlation between Fatigue and Energy, Vigor Anxiety, and Depression Variables for Week 1 (n = 20)

Variables	Energy	Vigor	Anxiety	Depression	Fatigue (POMS)
VAS-F Fatigue	-.44	-.53	.46	.46	.69**
POMS Fatigue	-.75*	-.72*	.53	.47	

Pearson Correlation between Fatigue and Energy, Vigor Anxiety, and Depression Variables for Week 2 (n = 17)

Variables	Energy	Vigor	Anxiety	Depression	Fatigue (POMS)
VAS-F Fatigue	-.23	-.40	.61*	.43	.66*
POMS Fatigue	-.41	-.62*	.94*	.87*	

Pearson Correlation between Fatigue and Energy, Vigor Anxiety, and Depression Variables for Week 3 (n = 19)

Variables	Energy	Vigor	Anxiety	Depression	Fatigue (POMS)
VAS-F Fatigue	-.68*	-.69*	.56	.48	.91*
POMS Fatigue	-.72*	-.69*	.63	.60	

* P <.003

anxiety ($p < .001$). The VAS-F Fatigue subscale score related to fatigue scores as measured withe POMS Fatigue subscale (r;.66 to .91, $p < .004$ to $p < .001$) which showed the evidence of concurrent validity of this fatigue tool.

SUMMARY OF THE RESULTS

The study had nine significant findings, which are as follows:

1. The presence of fatigue severity in MI patients was mild to moderate (Week 1: 38, Week 2: 33, and Week 3: 31), occurred every day, and was consistently present during the 3 week observation period.

2. There were no significant fatigue changes over time among the total number of MI patients.

3. However, there were significant changes in anxiety over time among the total number of MI patients and there was a trend for energy change over time.

4. There also were significant changes in hemodynamic changes, such as ejection fraction, stroke volume, and heart rate.

5. There were five fatigue groups among the total number of MI patients: Group 1 (decreasing fatigue pattern over time), Group 2 (increasing fatigue pattern over time), Group 3 (unchanged pattern with low fatigue over time), Group 4 (unchanged pattern with high fatigue over time), and

Group 5 (curve-linear shaped pattern of low fatigue during the first week, high fatigue during the second week, then low fatigue during the last week.

6. There were no group differences in demographic variables or clinical variables such as gender, age, or the severity of MI (peak CPK, anterior MI, and EF).

7. Anxiety and depression were significantly and positively related to fatigue during Week 2, while energy and vigor were negatively related to fatigue during Week 1 and 3.

8. Ejection fraction was somewhat negatively related to fatigue(The VAS-F Fatigue subscale; -.55 and The POMS Fatigue subscale; -.49) during Week 1 and the peak CPK was somewhat positively related to fatigue measured with the VAS-F Fatigue subscale during Week 2 ($r = .46$). Also, the 11 patients who were taking beta blockers rated higher fatigue severity (40.2 ± 18 mm) than the 11 patients who were not (35.5 ± 21.6 mm) during Week 1. There were no significant relationship between fatigue scores and presence of post-angina after discharge hospital, the site of MI, cardiac output, or hemoglobin level at diagnosis.

9. Higher fatigue was somewhat associated with gender(female), but no significant relationship was found between fatigue and age, education, marital status, the history of smoking, or annual income.

Chapter Five

Discussion

Introduction

This chapter includes three sections. In the first section, the major findings of the study and the significance of these findings are discussed. Second, the strengths and the limitations of the study are presented. Finally, there will be discussion of clinical implications and future directions for research.

Discussion and Interpretation of the Findings

This sample of 22 MI patients, predominantly white middle-age males, reflects the higher prevalence of MI in this segment of the population. The ethnicity, education level, annual income, and occupation of this sample seems to be representative of middle class America. The average length of hospitalization was 5.7 days which is somewhat lower than other large MI data sets which ranged from 9 to 14 days (Clearly, et al., 1991; Feinleib, et al., 1989; Heller, et al., 1990; Hopkins, et al., 1989). This may indicate that patients in this study consisted of uncomplicated MI patients. The peak CPK at diagnosis, the frequency of anterior MI, and baseline EF were not lower than studies publishing other large MI data sets (Goldberg, 1989; Hori, et al., 1979; Van Der Laarse, 1988; Magnani, et al., 1989).

The most important finding of this study is that the level of fatigue across 17 days ranged from 32 to 45 on the 100 mm VAS-F scale. This result suggests that fatigue in MI patients was mild to moderate during the three week observation period of the study. There was no mean change in fatigue over time. Since no prior reports offer findings with which to compare these results, no direct comparisons with MI patients can be made. However, the mean scores of fatigue in this study were higher than the mean scores of evening fatigue on the VAS-F Fatigue tool in sleep disorder patients (24.5 ± 45.9), but interestingly lower than healthy control subjects (55.6 ± 18.7) (Lee, et al., 1991).

There are two studies measuring fatigue with the POMS Fatigue subscale one month after MI. The means of the POMS Fatigue subscale with total range 0 to 28 in this study were Week 1, 9.4 ± 4.9; Week 2, 7.6 ±+ 6.0; Week 3, 7.9 ± 7.3. McCorkel and Quint-Benoliel (1983) compared the level of fatigue by the POMS in MI patients (n = 40) one month after infarction with that of newly diagnosed lung cancer patients (n = 56). The mean score for the MI patients was 7.2 and 13.4 for the cancer patients respectively. Their fatigue mean score at one month after MI is slightly higher than in the present study, but their observation was one week later than this study. Riegel and her colleagues (1992) reported that the means of fatigue measured by the POMS were 7.7 in overprotected MI patients (n = 81) and 9.5 in inadequately supported MI patients (n = 28) one month after MI. They classified these groups with Social Support Scale developed by UCLA. The results in this study were similar to the "overprotected" MI patients at three weeks in this study.

Sole focus on the mean value of fatigue for the total group does not consider the interindividual differences in fatigue after MI. For example, there were individuals within the group whose fatigue level was high or whose fatigue level did not improve over time. The five different patterns of fatigue over time represent quite divergent patterns of fatigue after MI. There were no differences between these groups in gender, age, marital status, or the peak CPK, baseline EF, or the history of post-angina after discharge from the hospital. Although there are consistent reports that prepsychological history is related to the severity and duration of emotional distress after MI, this study did not include this information. Also, it is clear that the sample size in this study is too small to make any inferential statements. Further research with large samples are needed to confirm or reject this finding.

Time is assumed to be an important factor in recovery after MI, both physically and psychologically. Thus, it was theoretically expected that fatigue would decrease over time. However, the patterns of fatigue change observed in individuals in Group 2 (n = 4) were not consistent with these assumptions. Rather, the level of fatigue increased as time passed. There is a need to examine individual differences in fatigue and the fact that the passage of time does not produce a uniform response in the improvement of fatigue severity.

Although there was no significant change in fatigue over time, patients did report that feelings of being less anxious over time. Anxiety was significantly greater during the first week than during the third week. Individuals in Group 4 (n = 3) whose fatigue was not changed but who experienced higher fatigue over time were the most anxious and depressed and the least energetic across the observation period.

Cassem and Hackett (1971) found that patients felt heightened anxiety during the first two days after their MI. Then, anxiety decreased and shortly thereafter the patients became depressed for a few more days. Several studies (Havic & Maeland 1990, Gentry, 1972, Mayou, 1979) have supported the finding that anxiety initially is at a high level and declines within five or six days following an MI, but there is no report regarding depression. However, in the present study, symptoms of anxiety did not decrease significantly within one week following an MI. During the first week, patients rated themselves more anxious and then gradually less anxious during the second and the third week. Previous studies in patients with MI have also reported that anxiety was more pronounced than depression, and depression was resolved more quickly than anxiety (Stern, et al., 1976; Trelawny-Ross & Russel, 1987). Although the level of anxiety and depression was similar in this study, the severity of anxiety decreased significantly over observation period but depression did not.

Left ventricle (LV) function for the total group improved significantly over time. The baseline ejection fraction (EF) measured by echocardiography at 48 hours after admission (baseline) was 45%; statistically significant improvements occurred during the first and second week (50% and 53% respectively). Ejection fraction was less than 45% at the baseline in 7 of 19 patients (47%) and, at the third week in 3 of 21 patients (15%). The EF improved in 17 of 22 patients (63%). The improvement in EF is like that found by others (Bhatnagar, et al., 1987; Marzoll, et al., 1991). During a similar interval of observation, Marzoll and colleagues (1991) reported that in a sample of 137 MI patients, EF within 24 hours was 45.7% and at predischarge (no report about the length of hospitalization) was 49.6% by radionuclide. Bhatnagar and colleagues (1987) reported that the mean echocardiogarphic EF prior to discharge was 51.9% in patients with uncomplicated infarction (n = 17), 45.3% in patients with post-infarction angina (n = 16), and 35.1% patients with left ventricular failure (n = 14). These figures are similar to those found during the first week with this sample. This is the first report of EF three weeks after MI, and there is no study with which to compare it.

Although there was significant improvement in EF and stroke volume when compared with healthy volunteers normative data, the cardiac function for this sample at week 3 was still lower than that on the healthy population (UCSF Echocardiography Laboratory Normative data; Wahr, et al., 1983)

In this sample, the level of fatigue was somewhat higher in women than in men at all measurement times. This finding is consistent with observations in clinical practice (David, 1990; Morrison, 1980; Reich, 1991). Using epidemiology data from the first National Health and Nutrition Examination Survey, Chen (1985) reported that healthy women were 1.5 times more fatigued than men. However, contrasted with the findings of this study, Rankin (1990) reported that female patients are significantly less anxious and depressed than their male counterparts as measured by POMS at one and three months after cardiac surgery.

In this study. there was no correlation between age and fatigue (ranged .01 to -.36), which is consistent with the findings of David and colleagues (1990) who reported that the severity of fatigue was not related to age ($N = 611$). They did find a relationship between duration of fatigue and age ($r = .28$, $p<.001$). this relationship was weak and only statistically significant because of their large sample size. Gortner and colleagues (1988) reported that older patients (> 70 years old) were less fatigued than their younger counterparts (<50 years old) as measured by the POMS, but that fatigue lasted longer in older patients after cardiac surgery.

Peak CPK was positively related to fatigue ($r = .46$, $p = .07$) only during the second week. The presence of an Anterior MI, hemoglobin level at admission, a history of hypertension, and post-angina after discharge from hospital were not related to fatigue.

Fatigue is frequently reported as a side-effect of Beta-blocker medication and was a major reason for discontinuing use of this medication (Fletcher, et al., 1992; Medical Research Council Working Part on Hypertension, 1981). Fifty percent of patients were given beta-blocker medications in the present study. However, there was no relationship between fatigue and use of Beta-blocker medications (Spearman's rho = .19 to .39, p = .035 to .41) across the observation periods.

Decreased cardiac function and lower EF are characteristic symptoms in MI patients and have been proposed as factors associated with fatigue. In the present study, there was a trend of negative and moderate relationship between fatigue as measured by both the VAS-F and POMS subscales and EF on Week 1. However, EF measured during Week 2 and 3 were not related to fatigue. Schaefer (1990) found that the severity of fatigue in congestive heart failure (CHF) patients was significantly related to EF. However, in another study by Schaefer and Potylycki (1993)there was no relationship between fatigue and EF in CHF patients. These authors did not report the methods used to measure EF or when it was measured. In addition, the EF of these samples was below normal for CHF patients (1990; 13%, 1993; 12%).

The findings from the present study indicated that fatigue and anxiety and depression were positively and significantly related during Week 2. As theoretically expected, there was a negative association between fatigue and energy or vigor. This finding is in agreement with other authors who have found that fatigue, depression and anxiety occurred concurrently and are related in both clinical and healthy populations (Blesh, et al., 1991; Chen, 1983; Cardenas & Kutner, 1982; Gardner, 1991; McCorkle, 1978; Montgomery, 1983; Piper, et al., 1991). Cardenas and Kutner (1982) reported that hemodialysis patients (N = 137) who rated high fatigue in the morning had significantly higher depression scores than their counterparts who reported no fatigue. In cancer patients, Knoff (1990), McCorkle (1978) and Piper (1991) found a significant positive relationship between fatigue and depression. Nerenz and colleagues (1982) indicated that fatigue was related more to psychological distress than physiological symptoms such as nausea and vomiting in cancer patients.

On the other hand, there are several reports that indicate that neither depression nor anxiety were related to fatigue severity (McCarkel, 1981, Garden, 1991). In McCarkle's (1981) study, fatigue and depression were more common in the multiple sclerosis patients than in their counterparts in the healthy control group, but there was no relationship between fatigue and depression in either group.

For Group 2, the relationship between "fatigue, anxiety, depression" and "days since post-admission(DPA)", the relationship between fatigue and DPA and the relationship between anxiety and DPA produced unexpected findings. While the mean scores of fatigue increased with the passage of time, the mean anxiety scores declined over time. One possible interpretation of these results might be that increasing fatigue over time may inhibit the perception of anxiety. It may be, too, that there is denial of reality and the seriousness of one's illness and, therefore, these patients were not anxious.

In conclusion, although the severity of fatigue remained the same for the total group over time, patients experienced more energetic and were less anxious at the third week following a MI with improved cardiac function. This occurred without any known interventions directed toward improving mood. These findings indicate that MI patients should be monitored for at least three weeks or more after an MI to identify those at risk for chronic fatigue and chronic emotional distress during the recovery period. Nearly two thirds of the patients, those belonging to Group 1, 3, and 5 experienced mild fatigue and emotional readjustment after MI. Only a moderate increase in fatigue and emotional upset was found in Group 5 at Week 2 after admission. However, there are subgroups of patients who seem to be more in need of emotional assessment and appropriate interventions. For example, patients in Group 2 showed increased fatigue with the passage of time in spite of better emotional readjustment, and patients in Group 5 showed the highest fatigue and emotional distress across the observation period. There were no group differences in terms of the demographic and/or clinical characteristics, such as peak CPK, the severity of MI, EF, gender, and age.

Aa expected, fatigue was statistically significant and positively related to anxiety and depression and negatively related to energy and vigor. In addition, there was a trend of relationship between fatigue and EF, peak CPK, and being female. These associations support the theoretical proposition of this study that fatigue experienced by MI patients is multifactorial in etiology.

STRENGTHS AND LIMITATIONS

This study is the first attempt to describe daily fatigue patterns over three weeks after MI, rather than cross sectional observations and to correlate the subjective measure of fatigue with physiological measures. Patients were identified at an early and uniform day after MI, so that the fatigue pattern and clinical course was measured at the same time for all individuals.

Fatigue may depend upon the time of day. Typically, fatigue is lower in the morning and increases as the day progresses. In this study, patients were asked to rate their feelings of fatigue and mood between 4 pm and 7 pm for all 17 times observations. The measures used to evaluate fatigue and emotional distress were multi-dimensional tools with reliability and validity established.

This study involved not only collecting data on self-rated fatigue and mood but also objective physiological data such as blood tests, blood pressure, and heart rate. In addition to the data from the medical records, echocardiography was performed four times and simultaneously measured with fatigue and emotional variables. Therefore, the triangulation of these methods provide a rich data base.

Because this study involved a convenience sample rather than a randomly selected sample, generalization of the findings is limited. Also, the characteristics of the study sample (mostly white, male, middle class) pose limitations to generalizability of the findings. However, the severity of MI, measured by peak CPK, frequency of anterior MI, and level of EF were not different from those of other MI studies.

This was a descriptive study and there was no age and gender-matched healthy control group. Consequently, there is no control healthy group to determine whether fatigue is more severe in MI patients at the same time of day. than healthy individuals. Because the primary aim of this study is to describe patterns of fatigue and psychological variables over time with a time series design, power analysis was not performed. However, for secondary purposes, cross-sectional analyses were performed to define fatigue-related variables. The small sample size, which affects power threatens the statistical conclusion validity.

The verbal descriptive nature of the questionnaires required patients to read English, and the use of VAS-F requires motor and visual ability of the patients. Obesity, a large chest, or chronic obstructive pulmonary disease may interfere with a good echocardiograph acquisition for quantitation. This problem limited the characteristics of the population selection and resulted in some missing data.

Another question arises regarding the time frame selected for the analysis of the relationship between fatigue and biochemistry variables, since biochemistry parameters were not always measured concurrently with other variables, only baseline blood test results were available for all patients. Blood tests on Week 1, 2, and 3 were done for less than 50% of patients; therefore, only baseline blood test results were used for correlational analysis.

The repeated use of the same fatigue measuring tools over time might be expected to influence rating the symptom of fatigue. Patients might provide responses that are expected by the investigator. Another concern of this repeated observation is that the development of a therapeutic relationship between the investigator and the subject may have influenced the symptoms of fatigue and emotional distress. Many subjects told the investigator that they were looking forward to the weekly echocardiography tests, because this test reassured them about their prognosis; simply seeing their cardiac image on the screen of the echocardiographic machine made them feel more secure and relieved.

Finally, a major limitation of this study was the lack of control for activity such as whether patients returned to previous work, or determining the level of activity of subjects whether the level of activity was related to their fatigue. Although, sleep is one of the important fatigue correlates, sleep variables or characteristics were not measured in this study .

CLINICAL IMPLICATIONS AND FURTHER RESEARCH

CLINICAL IMPLICATIONS

This research represents a beginning effort to define the severity, duration, and patterns of fatigue in patients with MI. Since fatigue in post-MI patients may interfere with optimal recovery and rehabilitation, the finding of this study (i.e., that fatigue is mild to moderate over a three week period after MI), suggests that nurses in clinical practice should assess MI patients for fatigue daily throughout the recovery period for at least three weeks after MI.

The study finding of five different fatigue patterns after an MI suggests that patients after MI should not be treated as a uniform group who are assumed to have decreasing fatigue with the passage of time. Of particular importance is that patients in Group 2 and 4 experienced more fatigue over time or were highly fatigued at all measurement points. Therefore, nurses should identify these groups (Group 2 and 4) of patients and give them detailed information for their fatigue and emotional course after MI.

It has also been found in this study that fatigue is a multidimensional phenomenon with physical, psychological, and social etiologies and thus, nursing assessment and intervention to facilitate recovery from fatigue should include potential correlates variables such as, gender, peak CPK, EF, depression, anxiety, energy, and vigor.

Finally, the study results can be used in preparing patients and family for the transition to home by giving them specific information about fatigue, mood, and EF changes after discharge.

FUTURE RESEARCH

Replication of this study with a larger sample is needed to confirm or reject the results. Future research should be conducted with a large sample with multiple observation points over time, at least more than three weeks, to determine the fatigue patterns. Future research should include additional physiological factors that may precipitate fatigue such as, hemoglobin, lactic acid, PH, WBC, EF, CO, and the level of activity. Psychological variables such as anxiety, depression, anger, and daniel should also be included. Sleep problems should also be ascertained. Factors such as race, gender, age, educational level, and social support should be investigated to determine their impact on fatigue with post-MI patients.

Also, replication of this study is needed in a variety of settings such as a comparison between a medically-treated MI patient group and a surgically treated MI patient group or an intravenous thrombolytic therapy group or a coronary artery thrombolytic therapy group with healthy control groups.

The link with duration of illness should be further explored, as this study suggests that there may be differences in patterns of fatigue in MI patients with differing recovery periods. Studies with time series or repeated observational design are needed to better understand the relationship between time and fatigue or fatigue-related variables during the recovery period after MI. In addition, studies of interventions with qualitative approaches based on the multi-dimensional nature of this phenomenon are needed.

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UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
CONSENT TO BE A RESEARCH SUBJECT

PURPOSE AND BACKGROUND

Hae-ok Lee, R.N., M.S.N., a nursing doctoral student in the Department of Physiological Nursing is doing a study to learn more about the mood and level of fatigue of patients after a heart attack. This study is under the direction of Virginia Carrieri, R.N., D.N.Sc.(sponsor), Kathryn Lee, R.N. Ph.D., Susie, Kim R.N., D.N.S. and Kanu Chatterjee, M.D. I am being asked to participate in this study because I have had a heart attack.

PROCEDURE

If I agree to be in this study, the following will occur:

1) I will complete the questionnaires about my mood and how tired I am once a day from Days 5 to 21 of hospitalization. These will take approximately 7 minutes to complete.
2) I will be asked to participate in a walking activity of up to five minutes. This activity will take place around the hallways near my hospital room or in or near my home if discharged before completion of this study. It will continue at my own pace. The maximum time will be five minutes three times between Days 5 and 7, 12 and 14, and 19 and 21 of my hospitalization. After intervals of 2 minutes, I will be asked whether I want to continue walking.
3) I will have a picture of my heart taken three times in the Doppler-Echocardiography laboratory. I will lie down on a hospital bed. My heart rhythm will be monitored. Blood pressure will be checked. I will then turn on my left side. An echo transducer which is about 2.5cm by 1.5cm will be gently moved around on the left side of my chest. The other end of the transducer is connected to an echo machine through which pictures of my heart will be recorded on videotape for 15 to 20 minutes. This procedure will be taken three times in the course of the study. All study procedures will be at the Medical Center at the University of California, San Francisco, Alameda Hospital, and Marine General Hospital.

RISKS AND DISCOMFORTS

There are some possible risks or discomforts from being in this study:

1) Completing the checklists may make me tired. Filling out the questionnaires may produce unpleasant feelings.
2) During the procedure of Doppler-Echocardiography scanning, I may be uncomfortable.
3) The walking activity may cause fatigue or discomfort.

Confidentiality: My study records will be kept confidential. No individual identities will be used in any reports or publications resulting from the study. Study information will be coded and kept in locked files at all times. Only the study investigator will have access to my records.

TREATMENT AND COMPENSATION FOR INJURY

If I am injured as a result of being in this study, treatment will be available. The costs of such treatment may be covered by the University of California, depending on a number of factors. The University does not normally provide any other form of compensation for injury. For further information about this, I may call the office of the Committee on Human Research at (415) 476-1814.

BENEFITS

1) I will not benefit directly from participation in this study.
2) The information gained from 3 Doppler-Echocardiography studies may help my physician in assessing my response to therapy.
3) As a participant in this study, I will receive the cumulative results of all subjects who participate.
4) The information learned from this study may help in the understanding and possible treatment of patients with conditions similar to mine.

ALTERNATIVES

If I choose not to participate in this study, I will continue to receive the same standard of care given to all patients with my condition.

COSTS

I will not be charged for any of the study procedures or measurements. All costs will be paid by the investigator.

REIMBURSEMENT

I will not be reimbursed for participating in this study.

QUESTIONS

This study has been explained to me by Hae-ok Lee, RN., MSN. and my questions were answered. If I have any other questions about this study, I may call Hae-ok Lee, RN. at (415) 666-3522, or her sponsor, Dr. Ginger Carrieri at (415) 476-4131.

CONSENT

I have been given copies of this consent form and the Experimental Subject's bill of rights to keep. PARTICIPATION IN RESEARCH IS VOLUNTARY. I have the right to decline to participate or to withdraw at any point in this study without jeopardy to my medical care/employment/student status.

If I wish to participate, I should sign below.

Subject's signature	Date
Person Obtaining Consent	Telephone Number

DEMOGRAPHIC PROFILE

Subject Number:

Date of Entry:______/_____/______
Month/ Day / Year

DIRECTIONS: Circle the appropriate answer or fill in the bland with the requested information.

1) Gender: 1_____Female, 2_____Male

2) Birth date:______/______/______
Month/ Day / Year

3) Age:________(Years)

4) Ethnicity:
1 Caucasian
2 Mexican-American
3 Oriental-American
4 Black-African-American
5 Other (Name)

5) Religion:
1 Buddhist
2 Catholic
3 Jewish
4 Protestant
5 Other: (Name)
6 No declared religion

6) Marital status:

1 Single, Never Married
2 Married
3 Separated
4 Divorced
5 Widowed

7) With whom do you presently live?

1 Live alone
2 Live with spouse/partner
3 Live with Parent
4 With family member other than spouse or parent
5 other: (describe)

8) What type of housing do you live in?

1 Private home
2 Apartment or condominium
3 Retirement center
4 Hotel
5 Other: (Describe)____________________

9) Highest educational level achieved:

1 Less than 9th grade
2 Completed part of high school
3 Completed high school
4 Partial college
5 Completed college or university
6 Completed graduate school

11) Annual income level:

1 Less than $10,000
2 More than $10,000 but less than $20,000
3 More than $20,000 but less than $30,000
4 More than $30,000 but less than $40,000
5 More than $40,000

12) Current occupational status:

1 Employed
2 Unemployed
3 Retired
4 Homemaker

13) If employed, how many hours a week do you work?

1 Less than 20 hrs./week
2 More than 20 but less than 40 hrs./week
3 More than 40 hrs./week but less than 60 hrs./week
4 More than 60 hrs./week

14) If employed, what is the level of activity?

1 Sedentary
2 Small amount of physical activity
3 Moderate amount of physical activity
4 heavy physical activity

15) Before this infarction, did you ever experience any of the following?

		YES	NO
1	Chest pain	______	______
2	Fainting	______	______
3	Dizziness	______	______
4	Fatigue	______	______
5	Dyspnea	______	______
6	Palpitation	______	______
7	Difficulty getting to sleep	______	______
8	Awakenings during sleep	______	______
9	Waking up too early	______	______
10	Day time sleepiness	______	______

16) Have you ever smoke?

1 Yes
2 No

17) If yes, do you presently smoke?

1 Yes
2 No

18) IF YES, How much do you presently smoke?

_________ Packs/Day

19) IF YES, How many years have you smoked?

__________ Years

20) IF NO, How did you ever smoke?

1 Yes
2 No

21) IF YES, For how long did you smoke?

____________ Years

22) IF YES, For how much did you smoke?

____________ Packs/Day

Time: __________ p.m.

ID # __________

Date __________

I am trying to find out how your heart attack affects your level of energy.
There are 18 items I would like you to respond to.
This should only take about 1 minute of your time. Thank you.

DIRECTIONS: You are asked to place an "X" through these lines to indicate how you are feeling RIGHT NOW.

For example, suppose you have not eaten since yesterday. Where would you put the "X" on the line below?

not at all hungry ____ extremely hungry

You would probably put the "X" closer to the "extremely hungry" end of the line. This is where I put it:

not at all hungry ________________________________X_______ extremely hungry

NOW PLEASE COMPLETE THE FOLLOWING ITEMS:

not at all tired ____ extremely tired

not at all sleepy ____ extremely sleepy

not at all drowsy ____ extremely drowsy

not at all fatigued ____ extremely fatigued

not at all worn out ____ extremely worn out

not at all energetic ____ extremely energetic

not at all active ____ extremely active

not at all vigorous	______________________	extremely vigorous
not at all efficient	______________________	extremely efficient
not at all lively	______________________	extremely lively
not at all bushed	______________________	totally bushed
not at all exhausted	______________________	totally exhausted
keeping my eyes open is no effort at all	______________________	keeping my eyes open is a tremendous chore
moving my body is no effort at all	______________________	moving my body is a tremendous chore
concentrating is no effort at all	______________________	concentrating is a tremendous chore
carrying on a conversation is no effort at all	______________________	carrying on a conversation is a tremendous chore
I have absolutely no desire to close me eyes	______________________	I have a tremendous desire to close my eyes
I have absolutely no desire to lie down	______________________	I have a tremendous desire to lie down

NCS Trans-Optic M08-70416-3

NAME ______________________ DATE ______________

SEX: Male (M) Female (F)

IDENTIFICATION

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

Below is a list of words that describe feelings people have. Please read each one carefully. Then fill in ONE circle under the answer to the right which best describes HOW YOU ~~HAVE BEEN FEELING DURING THE PAST WEEK INCLUDING TODAY.~~

Feel Right Now

The numbers refer to these phrases.

0 = Not at all
1 = A little
2 = Moderately
3 = Quite a bit
4 = Extremely

Col (C) O.P. (O)

		NOT AT ALL	A LITTLE	MODERATELY	QUITE A BIT	EXTREMELY
T	1. Friendly	0	1	2	3	4
	2. Tense	0	1	2	3	4
D	3. Angry	0	1	2	3	4
	4. Worn out	0	1	2	3	4
	5. Unhappy	0	1	2	3	4
A	6. Clear-headed	0	1	2	3	4
	7. Lively	0	1	2	3	4
	8. Confused	0	1	2	3	4
V	9. Sorry for things done	0	1	2	3	4
	10. Shaky	0	1	2	3	4
	11. Listless	0	1	2	3	4
F	12. Peeved	0	1	2	3	4
	13. Considerate	0	1	2	3	4
	14. Sad	0	1	2	3	4
C	15. Active	0	1	2	3	4
	16. On edge	0	1	2	3	4
	17. Grouchy	0	1	2	3	4
	18. Blue	0	1	2	3	4
	19. Energetic	0	1	2	3	4

	NOT AT ALL	A LITTLE	MODERATELY	QUITE A BIT	EXTREMELY
21. Hopeless	0	1	2	3	4
22. Relaxed	0	1	2	3	4
23. Unworthy	0	1	2	3	4
24. Spiteful	0	1	2	3	4
25. Sympathetic	0	1	2	3	4
26. Uneasy	0	1	2	3	4
27. Restless	0	1	2	3	4
28. Unable to concentrate	0	1	2	3	4
29. Fatigued	0	1	2	3	4
30. Helpful	0	1	2	3	4
31. Annoyed	0	1	2	3	4
32. Discouraged	0	1	2	3	4
33. Resentful	0	1	2	3	4
34. Nervous	0	1	2	3	4
35. Lonely	0	1	2	3	4
36. Miserable	0	1	2	3	4
37. Muddled	0	1	2	3	4
38. Cheerful	0	1	2	3	4
39. Bitter	0	1	2	3	4
40. Exhausted	0	1	2	3	4
41. Anxious	0	1	2	3	4
42. Ready to fight	0	1	2	3	4
43. Good natured	0	1	2	3	4

	NOT AT ALL	A LITTLE	MODERATELY	QUITE A BIT	EXTREMELY
45. Desperate	0	1	2	3	4
46. Sluggish	0	1	2	3	4
47. Rebellious	0	1	2	3	4
48. Helpless	0	1	2	3	4
49. Weary	0	1	2	3	4
50. Bewildered	0	1	2	3	4
51. Alert	0	1	2	3	4
52. Deceived	0	1	2	3	4
53. Furious	0	1	2	3	4
54. Efficient	0	1	2	3	4
55. Trusting	0	1	2	3	4
56. Full of pep	0	1	2	3	4
57. Bad-tempered	0	1	2	3	4
58. Worthless	0	1	2	3	4
59. Forgetful	0	1	2	3	4
60. Carefree	0	1	2	3	4
61. Terrified	0	1	2	3	4
62. Guilty	0	1	2	3	4
63. Vigorous	0	1	2	3	4
64. Uncertain about things	0	1	2	3	4
65. Bushed	0	1	2	3	4

MAKE SURE YOU HAVE ANSWERED EVERY ITEM.