# Predicting recovery from surgery

## The influence of preoperative stress and mental preparation on postoperative state

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# Predicting recovery from surgery

## The influence of preoperative stress and mental preparation on postoperative state

Het voorspellen van herstel na een operatie

De invloed van preoperatieve stress en mentale voorbereiding op postoperatief herstel

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Voor mijn vader en moeder

en voor Aart

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# Chapter 1

## Introduction

What influence do preoperative psychological factors have on postoperative emotional and physical state? This question has been studied intensively since Janis (1958) wrote his book on psychological stress and reactions to surgery. Janis (1958) proposed that preparatory worry, termed the "work of worrying", is beneficial to recovery. This worry would provide the patient with accurate expectations of pain and discomfort, thus preventing postoperative distress and disappointment. He assumed that moderate anxiety would lead to this preparatory worry. Patients who experience little preoperative anxiety would not be motivated to worry, whereas patients with high anxiety would be engaged in too many worries unrelated to surgery. Janis (1958) found that patients with high and low anxiety fared less well postoperatively. However, subsequent research has not been able to confirm this finding (Johnston, 1986; Johnston & Carpenter, 1980; Johnson, Leventhal & Dabbs, 1971; Wallace, 1986). Many recent studies have found that high preoperative anxiety predicted high levels of postoperative anxiety, but there was no evidence that low anxiety was associated with high postoperative anxiety. Although it has been difficult to prove the assumptions of Janis (1958), his work has stimulated many studies on anxiety and other psychological factors that may influence postoperative recovery.

Psychological factors that are amenable to change have received special interest in the development of intervention techniques that may help patients to cope with surgery. Also, the ability of a physician to take into account a patient's psychological reactions to illness and surgery may optimize pre- and postoperative medical treatment. Furthermore, knowledge of the influence of psychological factors also has theoretical implications on our understanding of emotions, the study of environmental stress and on how individuals develop methods of coping with stress and dangerous situations (Johnston, 1986).

Many studies have shown that postoperative state is influenced by diverse biographic, medical and psychological variables (Johnston, 1986; Kincey & Saltmore, 1990; Mathews & Ridgeway, 1981; Salmon, 1992; Taenzer, Melzack & Jeans, 1986). With respect to the psychological variables, personality or trait variables as well as state variables have been investigated. Personality variables such as trait anxiety and neuroticism are associated with more distress, pain and slower recovery from surgery (Mathews & Ridgeway, 1981).

Preoperative anxiety as a state variable was also found to be associated with a poor postoperative emotional state and pain (Boeke, Duivenvoorden, Verhage & Zwaveling, 1991a; George, Scott, Turner & Gregg, 1980; Johnston, 1986; Manyande & Salmon, 1992; Scott, Clum & Peoples, 1983; Taenzer et al., 1986). Coping strategies were also found to be related to aspects of postoperative state (Cohen & Lazarus, 1973; George et al., 1980; Ho, Hashish, Salmon, Freeman & Harvey, 1988).

However, discrepancies between research findings and theoretical assumptions have made it difficult to draw any conclusions about the influence of psychological variables on recovery. For example, despite extensive evidence that high levels of anxiety are associated with higher postoperative anxiety and pain, some researchers (Janis, 1958, 1983; Salmon, 1992) are still of the opinion that moderate feelings of anxiety may have an adaptive function in overcoming the threat of surgery. Furthermore, research into the relation between coping behaviour and postoperative state has not yielded any unequivocal conclusions (Kincey & Saltmore, 1990; Mathews & Ridgeway, 1981). These discrepancies emphasize the need for further studies on the influence of psychological variables on postoperative state with a refined design. The aim of this thesis was to investigate the influence of preoperative psychological state variables on postoperative state.

This chapter describes the choice of the psychological variables, the postoperative measures and other variables used, the study subjects and the aims of the study.

**Search for preoperative psychological variables that influence postoperative state**

As previously mentioned, personality or trait variables and state variables are known to be related to postoperative recovery. A problem with personality variables, however, is that these variables cannot easily be changed to improve a patient's recovery. Therefore, although personality is an important predictor, this research was confined to psychological state variables that are more amenable to change. The search for state variables that may influence postoperative state was guided by theories on psychological stress.

*Psychological stress*

In 1958 Janis was already aware that although the term psychological stress is frequently used, there is no generally accepted definition. The concept of stress has been criticised for its wide applicability and too generic meaning and also for the lack of consensus on the definition of stress (Cox, 1980; Elliott & Eisdorfer, 1982; Selye, 1978). For example, stress has been used to indicate stimuli that are likely to arouse affective responses (Basowitz, 1955), or as events impinging on a person (Lazarus & Folkman, 1984), and also to indicate the reactions to such stimuli. Selye (1978) gave several definitions of stress and stated the essence of the concept in the following way: "Stress is a nonspecific response of the body to any demand, whether it is caused by, or results in, pleasant or unpleasant conditions" (Selye, 1978, p. 74). This definition implies that stress does not necessarily have a negative effect. Selye even suggested that stress can have a positive effect on well-being. Rather than the stress itself, the way a person "takes" the stressful event will ultimately determine whether he or she can adapt successfully to the event. Later, this relation between person and event was added to the definition of psychological stress. Lazarus and Folkman (1984, p. 19) defined psychological stress as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his well-being".

Cox (1980) summarized these different attempts to define stress in three main approaches: 1) the approach that treats stress as a dependent study variable and describes it in terms of a person's response to disturbing environments; 2) the approach that describes stress in terms of stimuli or stressors and treats it as an independent variable; 3) the approach that views stress as the reflection of a lack of harmony between the person and his environment. Contrary to the first two approaches, the third approach takes into account the mechanisms that determine the stressfulness of the event for a particular person: the amount of stress depends not only on external demands, but also on the way a person copes with the demands or mentally prepares for a threatening event.

In this thesis the third approach was followed. We investigated how preoperative stress as well as indications of mental preparation before surgery, such as coping behaviours, influence postoperative state.

*Preoperative stress*

Stress includes subjective responses such as anxiety and other emotions and changes in overt behaviours and physiological responses. This thesis only addressed subjective responses. The investigation of changes in overt behaviours and physiological responses was beyond the scope of the study. Selye (1978) described a number of subjective responses that patients can observe within themselves, such as general irritability, pounding of the heart, feelings of dizziness, queasiness of the stomach, inability to concentrate, emotional tension or alertness, general anxiety, fatigue, pain in the neck and lower back region. Some of these stress reactions, such as general irritability, inability to concentrate and emotional tension, have been investigated in previous studies as part of the broader concept of anxiety. Other stress reactions such as fatigue, pain and feelings of dizziness, seem to be physical rather than emotional indications of stress. Very few studies investigated these physical indications of stress in relation to surgery. Studying several types of stress reaction at the same time may provide a

better understanding of the influence of stress on postoperative state. Therefore, different aspects of anxiety as well as physical indications of stress were studied.

*Anxiety.* Anxiety has been described as a state of passive stress which merely constitutes an undesirable and unhelpful response to threat, and also as a mental process with an important function in preparing the person to face threat (Salmon, 1993). In empirical studies on anxiety, several different measures of anxiety have been used, such as state anxiety (Boeke et al., 1991a; Scott et al., 1983; Taenzer et al., 1986), anxiety specifically related to surgery (Boeke et al., 1991a; Janis, 1958; Scott et al., 1983), worries (Johnston & Carpenter, 1980), anxiety about recovery (George et al., 1980) and stress (Ray & Fitzgibbon, 1981). It is possible that these measures may not have measured the same underlying construct of anxiety, but different aspects of anxiety with different effects on postoperative state. Few studies investigated these different aspects of anxiety simultaneously.

*Physical indications of stress.* Two physical indications of stress were studied, preoperative fatigue and preoperative pain. These were selected because preliminary observations at the hospital revealed that several patients had clearly observable signs of these particular symptoms on the day before surgery, but not of other physical indications of stress, such as dizziness, a queasy stomach or headaches.

Fatigue is a mood state of physical or mental exhaustion due to exertion or stress. Patients who are greatly fatigued report that they feel "dead tired", "exhausted" or "worn out".

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage (IASP, 1979). On the one hand, pain may be indicative of the severity of a disorder and thus may be related to a poor physical state. However, it is also becoming steadily more clear that reported pain is only tenuously related to pathophysiological processes (Wall, 1979), while on the other hand, reports of pain are associated with the emotional state of a patient (Gaskin, Greene, Robinson & Geisser, 1992; de Groot, 1993; Wade, Price, Hamer, Schwartz & Hart, 1990). For example, patients who report a great deal of pain have

higher reports of a variety of disturbing emotions, especially anxiety and frustration, than patients with fewer reports of pain (Wade et al., 1990). Furthermore, the personality trait inadequacy, which is associated with state anxiety, was found to be a more powerful determinant of neck pain than radiological abnormalities (van der Donk, Schouten, Passchier, van Romunde & Valkenburg, 1991). Moreover, some types of pain, such as pain in the neck and lower back region are assumed to be stress reactions (Selye, 1978). Thus, although pain is often due to actual pathophysiology, the amount of pain may also be a physical indication of stress.

*Indications of mental preparation before surgery*

Early theorists have proposed that mental preparation for surgery may help patients to cope with the surgical event. However, it has been difficult to establish how patients prepare themselves before surgery. As mentioned above, there is little evidence that preparatory worry is beneficial to postoperative state.

A more recent approach to assess which patients are poorly prepared for surgery has been to investigate coping behaviour before surgery. It has long been assumed that an avoidant coping style is detrimental for recovery, because patients with this attitude are believed to be poorly prepared for the upcoming stressful event (Cohen & Lazarus, 1973; Janis, 1958). An alert, vigilant style has been thought to be more adaptive, because it would stimulate information seeking behaviour and working through the threat of surgery (Cohen & Lazarus, 1973). However, it has also been difficult to prove these assumptions. Several studies have indicated contrary to expectations that avoidance is more adaptive than vigilance (Cohen & Lazarus, 1973; George et al., 1980; Mathews & Ridgeway, 1981). Avoidance may be adaptive in some circumstances because it prevents patients from becoming overwhelmed by their emotions (Janis, 1958; Lazarus & Folkman, 1984). However, owing to the fact that avoidance is associated with low preoperative anxiety and vigilance with high preoperative anxiety, some researchers have cast doubt on the differences between vigilance, avoidance and anxiety measures (Kincey & Saltmore, 1990; Mathews & Ridgeway, 1981). Some new

approaches to measure mental preparation before surgery may identify patients with less adaptive coping behaviour or poor mental preparation for surgery.

*Monitoring and blunting.* Recently, two related behavioural measures of coping, monitoring and blunting of information, have been developed to measure coping independent of anxiety (Miller, 1987) and they seem to be promising variables to predict postoperative distress (Salmon, 1992). Monitoring refers to "...the extent to which people seek out and monitor for information about threat..." and blunting to "...the extent to which people can cognitively distract from and psychologically blunt threat-relevant information..." (Miller, Brody & Summerton, 1988, p. 142).

*Expectations before surgery.* A second approach to identify patients who are poorly prepared may be to investigate the expectations of pain and recovery. Janis (1958) assumed that worry and information seeking behaviour would provide the patient with accurate expectations of pain and discomfort, and thus help to prevent postoperative distress and disappointment. Patients who expect little or no postoperative pain may report more postoperative disappointment than patients who expect a great deal of pain after surgery when confronted with normal postoperative pain. Possibly, a patient's expectation of pain and discomfort is a more direct indication of his or her mental preparation than worries or coping behaviour.

In summary, the following preoperative variables that reflect psychological stress and indications of mental preparation before surgery were investigated:

Preoperative stress:

- different aspects of anxiety
- fatigue
- pain.

Indications of mental preparation before surgery:

- monitoring and blunting
- expectations of pain and recovery.

## The choice of postoperative state measures

Previous research has suggested that discrepancies between empirical findings and theoretical assumptions may be due to measurement problems of postoperative state. A major problem in studying recovery from surgery is that recovery is not a unidimensional concept, but consists of several aspects, which are often independent of each other (Johnston, 1984; Salmon, 1992; Wilson, 1980). Johnston (1986) reported several outcome measures such as length of hospitalization, ambulation on the ward, emotional distress, pain, medication, postoperative complications, blood pressure, return to work, etc.. Johnston (1984) also investigated the interrelations between a wide range of postoperative variables that were used in many studies on the outcome of surgical patient care. Four independent factors emerged two days after surgery: well-being, attitudes towards the hospital staff, distress and passivity. One week after surgery five independent factors were identified: well-being, attitudes towards the hospital staff, distress, effort and pain. Other studies have also shown that postoperative measures are often uncorrelated and that preoperative variables have different effects on different measures (Kincey & Saltmore, 1990). Furthermore, Johnston (1984) and Salmon (1992) both concluded that the choice of outcome measures is crucial for finding a relation between certain preoperative psychological factors and postoperative state.

The question, therefore, arose as to which postoperative measures should be chosen. One possibility would be to investigate the relation of preoperative state variables with many aspects of postoperative state. An advantage of this approach is that it will yield information about which variables are important for all these different aspects and thus for general recovery of the patient. Another possibility would be to investigate the influence of psychological state variables on one or two theoretically relevant aspects of postoperative state. The advantage of this approach is that it may produce results that are more easy to interpret theoretically. For example, research into mental preparation for and coping with surgery has primarily been concerned with reducing the level of stress before and after surgery. In this case, postoperative distress is one

of the most relevant dimensions of postoperative state. When investigating expectations of pain and recovery, a theoretically relevant measure is disappointment, which is defined as failure to meet expectations, hopes or desires of a person. We chose to follow both approaches and to study, on the one hand, several different postoperative measures, which together reflect postoperative state and, on the other hand, a few postoperative measures based on theoretical relevance.

A related question concerns the time at which postoperative state should be measured. Most studies measured postoperative state two or three days after surgery because at that time the postoperative state is more stable than it is immediately after surgery. Very few studies investigated the influence of preoperative variables on postoperative state in the long-term. Knowledge of this influence may help to assess which patients are at risk of poor recovery in the long run.

On the basis of these considerations, it was decided to study six different aspects of short and long-term postoperative state to assess general recovery from lumbar surgery. These aspects were one measure of postoperative emotional distress, postoperative tension, and one measure of postoperative physical distress, fatigue; two measures of postoperative physical state related to the disorder, i.e., back pain and pain during daily activities; and two measures of postoperative physical state that are the most clear indicators of a poor or good outcome of surgery, i.e., leg pain and observed recovery assessed by the neurosurgeon (these two measures were called disorder-specific recovery measures).

In addition, three postoperative aspects that are theoretically relevant to the preoperative variables were studied in-depth. Two other short-term measures of postoperative distress were studied, i.e., postoperative state anxiety and postoperative physical complaints related to distress. State anxiety is the most commonly used measure to assess postoperative distress. Further we chose stress-induced physical complaints, such as headaches, dizziness and nausea, because these may be affected more by preoperative variables than other physical recovery indices, such as appetite, stomach condition, bowel condition, and urination used in previous studies (Johnston

& Carpenter, 1980; Wolfer & Davis, 1970). Finally, postoperative disappointment was chosen as the outcome measure for studying the preoperative expectations of pain and recovery.

## Other variables that influence the relation between psychological variables and postoperative outcome measures

Not only psychological variables, but also biographic and medical variables may influence the level of stress before surgery experienced by the patient and they may have separate effects on postoperative state. Previous research (Boeke et al., 1991a; George et al., 1980) has indicated that the medical history, age and sex of a patient may represent serious confounders of the relation between pre- and postoperative anxiety. For example, various medical variables have been found to be associated with aspects of poor recovery: the duration of surgery (George et al., 1980; Wolfer & Davis, 1970), the amount of pain medication administered (Scott et al., 1983), the severity of the disorder (Taenzer et al., 1986), prior surgery (Boeke et al., 1991a; Scott et al., 1983) and overweight (Kardaun, 1990). The biographic variables older age and female sex were found to be associated with poorer postoperative state (Taenzer et al., 1986). Therefore, biographic and medical variables should be taken into account.

## Study subjects

For the sake of sufficiency and patient burden, it was decided to study one sample in-depth rather than to investigate new samples for each different objective in the research project. Four studies were based on one sample of 126 patients who were undergoing lumbar surgery. This type of surgery is performed on patients with severe leg pain due to a back disorder whose pathophysiological abnormalities can be ident-

ified radiologically. Many, but not all of the patients were also suffering from back pain. This patient group was chosen because they were generally in good health except for the lumbar disorder and they provided a good model for the influence of surgical stress with minimal confounding by differences in health status.

After analyzing the results of this sample, a new sample was studied in an attempt to replicate the results of one of the four studies, which investigated the influence of preoperative anxiety aspects on postoperative anxiety and physical complaints, in several different patient groups. This new sample consisted of 60 patients who were undergoing different types of surgery such as lumbar surgery, abdominal surgery and others.

**Methodological considerations**

Ideally, to study the influence of one variable on another an experimental design should be used in which manipulation of one variable changes the value of another variable. However, a major difficulty in research into surgical stress is that undergoing surgery is a very complex event. Many variables have many effects at different points in time. Kincey and Saltmore (1990, p.121) described surgery "as a process within which different stages of the event may be more or less stressful for a particular individual and within which different interventions may be more or less effective at different points in time, with differential effects on different outcome measures". This suggests that many different variables should be taken into account when studying the influence of particular variables on postoperative state. However, Stevens (1992) warned that the inclusion of several independent and dependent variables in one analysis without any empirical or theoretical rationale may obscure any real differences between independent and dependent variables. He recommended to carefully select a relatively small set of independent variables to obtain results that will have generalizability. Therefore, small groups of related preoperative variables were studied

rather than lumping all the preoperative variables into one overall study. The delineation of the empirical studies was based on the previous considerations and is described below.

**Delineation of the studies**

The data from the sample of 126 lumbar surgery patients were divided into four coherent (partly overlapping) subsets of data to investigate any influences of preoperative variables on postoperative state on the basis of relatively small groups of related variables. The sample of 60 other patients was used to investigate whether results from the study that investigated the influence of preoperative anxiety aspects on postoperative anxiety and physical complaints could be generalized to patients undergoing several different types of surgery. Table 1-1 shows the pre- and postoperative variables investigated in each study. The empirical studies were delineated in the following way.

The aim of the study in chapter 2 was to make a general assessment of the biographic, medical and psychological variables that were associated with six aspects of postoperative state in lumbar surgery patients. From the preoperative psychological variables the three different indices of stress (anxiety, fatigue and pain) and the coping behaviours monitoring and blunting were studied. The data on expectations are reported separately because relatively little is known about this new variable and the expectations were not measured with validated questionnaires, but with a semi-structured interview. The six postoperative aspects were postoperative tension, fatigue, leg pain, back pain, pain during daily activities and recovery assessed by the neurosurgeon (i.e., observed recovery). The biographic, medical and psychological variables were treated as being equally relevant variables in the assessment of recovery. Furthermore, because recovery from lumbar surgery takes some time, and ultimate recovery from this type of surgery can be determined more accurately at three months after surgery, both short

and long-term postoperative state were investigated. In view of the many dependent variables in this study, a canonical correlation technique was used that takes into account the intercorrelations among the pre- and postoperative variables.

The studies in chapters 3, 4 and 5 focused on the relation between preoperative variables and two short-term outcome measures of distress, i.e., postoperative anxiety and physical complaints. To study the influence of preoperative variables on postoperative distress beyond the effects of other variables, multiple regression analysis was used in these three studies.

The study in chapter 3 examined the influence of the same preoperative variables as those used in the study in chapter 2 on postoperative distress, beyond the influence of sex, age and medical variables.

The study in chapter 4 concentrated on preoperative anxiety and aimed to investigate the influence of different aspects of preoperative anxiety, i.e., state anxiety, specific anxiety, tension, amount of thinking about surgery and observed anxiety on postoperative distress, beyond the influence of age, sex and medical variables.

In a new sample of patients who were undergoing several different types of surgery, the study in chapter 5 attempted to reproduce the findings of the study in chapter 4 into the influence of different preoperative aspects of anxiety on postoperative distress.

The study in chapter 6 investigated the expectations of pain and recovery and their relations with postoperative disappointment. On the basis of interview material, groups of patients with different expectations were formed. Short- and long-term measures of disappointment were studied, because the expectations of pain and recovery not only concerned the immediate period after surgery, but they also extended to a longer period. With analyses of variance, differences in postoperative disappointment were calculated between the patient groups with different expectations. Results were controlled for biographic and medical variables.

In addition to these empirical studies, a theoretical analysis of the adaptive function of coping behaviour on postoperative adjustment was undertaken in an attempt to resolve the inconsistency between theoretical assumptions and empirical findings

regarding the adaptiveness of coping (chapter 7). Finally, a discussion of the results, limitations of the studies and implications for future research and clinical practice are presented in chapter 8. Table 8-2 (page 128) presents an overview of the general results of this thesis that may be helpful in reading the separate chapters.

The chapters 2 to 7 were written as manuscripts for publication into a journal. Therefore, some overlap will occur, in particular among the method sections of chapters 2, 3, 4 and 6, which described the data of the 126 lumbar surgery patients.

## Summary of the aims of each study

The general aim of this thesis was to investigate the influence of preoperative stress and mental preparation before surgery on postoperative state. The specific aims of the studies were as follows:

- To assess short- and long-term recovery from lumbar surgery with medical, biographic and psychological variables (chapter 2).
- To investigate the influence of preoperative anxiety, fatigue, pain and coping behaviour on postoperative anxiety and physical complaints in patients undergoing lumbar surgery (chapter 3).
- To investigate the influence of different aspects of preoperative anxiety on postoperative anxiety and physical complaints in patients undergoing lumbar surgery (chapter 4).
- To investigate the influence of different aspects of preoperative anxiety on postoperative anxiety and physical complaints in patients undergoing different types of surgery (chapter 5).
- To investigate the influence of different expectations of pain and recovery on postoperative disappointment in patients undergoing lumbar surgery (chapter 6).
- To revaluate the adaptiveness of avoidant and vigilant coping with surgery (chapter 7).

*Table 1-1. Overview of the pre- and postoperative variables investigated in each study*

| Preoperatively | Postoperatively at 3 days | Postoperatively at 3 months |
|---|---|---|
| *Study in chapter 2. N = 126* | | |
| Biographic variables | Tension | Tension |
| Medical variables | Fatigue | Fatigue |
| Psychological variables | Leg pain | Leg pain |
| State anxiety | Back pain | Back pain |
| Fatigue | Observed recovery | Pain during activities |
| Pain (in leg, back, with activities) | | Observed recovery |
| Monitoring | | |
| Blunting | | |
| *Study in chapter 3. N = 126* | | |
| Control variables | State anxiety | |
| Psychological variables | Physical complaints | |
| State anxiety | | |
| Fatigue | | |
| Pain (in leg and back) | | |
| Monitoring | | |
| Blunting | | |
| *Study in chapter 4. N = 126* | | |
| Control variables | State anxiety | |
| Psychological variables | Physical complaints | |
| State anxiety | | |
| Specific anxiety | | |
| Tension | | |
| Amount of thinking | | |
| Observed anxiety | | |
| *Study in chapter 5. N = 60* | | |
| Control variables | State anxiety | |
| Psychological variables | Physical complaints | |
| State anxiety | | |
| Specific anxiety | | |
| Tension | | |
| Amount of thinking | | |
| *Study in chapter 6. N = 120* | | |
| Control variables | Disappointment | Disappointment |
| Psychological variables | | |
| Expectations of pain and recovery | | |

# Chapter 2

## Assessing short- and long-term recovery from lumbar surgery with preoperative biographic, medical and psychological variables

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*(submitted)*

**Summary**

Using bivariate and canonical correlations, we investigated the value of biographic, medical and psychological variables for the assessment of short- and long-term recovery in 126 patients undergoing lumbar surgery. On the day before surgery, information was obtained regarding age, sex, medical status variables, anxiety, fatigue, indices of pain, and coping. Three days and three months postoperatively, several aspects of recovery were measured. Female sex, amount of analgesics, expected poorer recovery according to the neurosurgeon, and preoperative anxiety were associated with poorer short term recovery. A reoperation, preoperative anxiety, fatigue and pain during daily activities were associated with poorer long-term recovery. The results suggest that the assessment of progression of recovery after lumbar surgery might be improved by taking psychological variables into account, apart from biographic and medical variables. Recovery of patients undergoing lumbar surgery might be improved by interventions aimed at the reduction of anxiety, fatigue and pain during daily activities.

## Introduction

The rate of recovery and postoperative emotional and physical state have been found to be highly variable among patients (Cohen & Lazarus, 1973; Taenzer, Melzack & Jeans, 1986). Knowledge of preoperative variables that can explain this variability in postoperative state may be of value when assessing the progression after surgery and when designing interventions aimed at improving recovery. Diverse preoperative medical, biographic and psychological variables have been found to be associated with aspects of postoperative state.

Among medical variables, the duration of surgery (George, Scott, Turner & Gregg, 1980; Wolfer & Davis, 1970), the amount of pain medication (Scott, Clum & Peoples, 1983), the severity of the disorder (Taenzer et al., 1986), prior surgery (Boeke, Stronks, Verhage & Zwaveling, 1991b; Scott et al., 1983), and overweight (Kardaun, 1990) have been found to be associated with aspects of poorer recovery, such as postoperative pain intensity and postoperative hospital stay.

Of biographic variables, age and sex were associated with number of postoperative narcotics, but not with postoperative anxiety or pain (Taenzer et al., 1986). Age was also associated with postoperative hospital stay (Boeke, Duivenvoorden, Verhage & Zwaveling, 1991a).

Psychological factors related to postoperative emotional and physical state have been studied intensively. Preoperative anxiety has been shown to be associated with poor postoperative emotional state and pain (George et al., 1980; Johnston, 1986; Manyande & Salmon, 1992; Scott et al., 1983; Taenzer et al., 1986). Recently, fatigue was found to predict cardiac symptoms six months after heart surgery (Jenkins, Stanton & Jono, 1994). Also, preoperative pain has been found to be associated with more postoperative pain (Scott et al., 1983). Furthermore, coping styles have been found to be related to aspects of postoperative state (Cohen & Lazarus, 1973; George et al., 1980; Ho, Hashish, Salmon, Freeman & Harvy, 1988). Some studies, however, reported a lack of association between psychological variables such as anxiety (Johnston & Carpenter,

1980; Wallace, 1986; Wolfer & Davis, 1970), coping (Kincey & Saltmore, 1990; Sime, 1976) and aspects of recovery such as postoperative physical symptoms and medication.

As the above findings show, recovery has been measured in several different ways and this has made it difficult to establish which variables are important for explaining differences in recovery. This points to one of the major problems in studying recovery from surgery that recovery is not an unidimensional concept, but consists of several aspects, which are often independent of each other (Johnston, 1984; Salmon, 1992; Wilson, 1980). In this respect, Wolfer and Davis (1970) recommended to measure at least three general aspects of recovery, i.e., emotional state, pain and physical aspects. To assess whether the symptoms for which surgery is performed diminish, disorder-specific symptoms should be measured.

In this study, we investigated the relation of preoperative variables with two measures of postoperative psychological state and four disorder-specific outcome measures. Postoperative tension and fatigue were chosen as measures of postoperative psychological state. Leg pain was chosen as a disorder-specific measure because the patients studied underwent lumbar surgery to diminish pain in their leg. Furthermore, back pain and pain during daily activities may also diminish after lumbar surgery and were used as disorder-specific outcome measures. Lastly, the neurosurgeon assessed recovery.

Some of these aspects of recovery are presumably interrelated and may even measure the same underlying dimension of recovery. Therefore, apart from investigating which preoperative variables are related with any outcome measure, we chose to investigate the relations with canonical correlation technique to determine which groups of preoperative variables were related with groups of outcome measures.

Most studies have investigated the relation between preoperative variables and short-term recovery in the first week after surgery. In that period, a placebo-effect of the treatment may interfere with the real effect of the treatment. Furthermore, recovery from lumbar surgery takes time, and the eventual outcome of surgery can be more

accurately determined at three months after surgery. Therefore, both short- and long-term recovery were studied.

## Methods

### *Patients*

Participants were 126 patients undergoing lumbar surgery in St. Clara Hospital Rotterdam with ages ranging from 20 to 77 (*M* age = 44 years). There were 68 men and 58 women. Diagnoses of patients were lumbar disc herniation (*N* = 104; *M* age = 41 years; range 20 to 74), lumbar canal stenosis, (*N* = 19; *M* age = 59 years; range 37 to 77), extraforaminal disc herniation (*N* = 2) and familial narrow spinal canal (*N* = 1). Patients with a lumbar disc herniation underwent lumbar disc surgery (*N* = 106). The other patients underwent surgery for lumbar canal stenosis (*N* = 20). Fifteen patients underwent lumbar surgery for the second time. Patients who had other severe diseases, were above 80 years of age, or were not fluent in Dutch were left out. Permission for inclusion into the study was asked to 135 patients, five of whom refused. One hundred and fifteen (88%) patients returned the questionnaires at three months. Four patients were excluded from the analyses because they filled out too few questionnaires. This resulted in the present sample of 126 patients at the first and second assessment and 112 patients at the third assessment.

### *Procedure*

Patients admitted in the hospital to undergo lumbar surgery on a particular day of the week were studied during an 18-month period. All surgeries were performed by the same neurosurgeon (third author). The hospital staff informed patients about the study on the day before surgery. After having obtained informed consent, the investigator (first author) carried out the first assessment. Next, biographic and medical variables were collected from the medical files. On the same day, the neurosurgeon

independently rated the severity of the disorder. The next day, immediately after surgery, the neurosurgeon rated his expectation of recovery based on his findings during surgery. On the third day after surgery, the first postoperative assessment was carried out. The neurosurgeon independently assessed general recovery of the patient on the day before discharge, usually the fifth day after surgery. After three months, a booklet of questionnaires was sent to the patients for the second assessment. The neurosurgeon assessed general recovery of each patient on the first checkup which was standard at six weeks after surgery. Recovery was reassessed at a later point in time if a patient returned to the surgeon for a second checkup. The study was approved by the medical ethics committee of St. Clara's Hospital Rotterdam.

*Preoperative measures*

The choice of preoperative variables was guided by the literature and clinical relevance.

*Biographic and medical variables.* Information was obtained regarding sex, age, severity of the disorder, type of surgery, duration of surgery, prior lumbar surgery (reoperation), amount of analgesics used by the patient, amount of types of pain medication used, and overweight[1]. The neurosurgeon rated the severity of the disorder on a 4-point scale ranging from *not severe* (1) to *very severe* (4). His rating was an overall judgement of the patients' state on basis of clinical data such as the duration of the disorder, reported pain, muscular paralysis and loss of sensory sensitivity. The neurosurgeon also rated his expectation of recovery on basis of the findings during surgery on a three-point scale: poor, moderate or good recovery. Poor or moderate recovery was expected in case of the following findings: a. no or disappointing findings, b. a very narrow vertebra-canal, c. other causes of pain than a herniated disc,

[1]The Quetelet index (weight/hight$^2$) was used to calculate overweight (Passmore & Eastwood, 1986). We used a cut-off value of 27 (Coelho, 1983).

i.e., an arterial disorder, a stenosis or the presence of a second herniated disc, or d. poor sight on the surgical location because of blood loss.

*Anxiety*. Patients completed the State version of the State-Trait Anxiety Inventory (STAI; Dutch translation by van der Ploeg, Defares & Spielberger, 1980).

*Fatigue*. Patients also filled in a validated shortened Dutch version of the Profile of Mood States (POMS; McNair, Lorr & Droppleman, 1971; Dutch shortened version, Wald & Mellenbergh, 1990) of which two subscales, fatigue and vigour, were used together as indicator of fatigue. Internal consistency of the combined 11-item scale was good ($\alpha$ = .84).

*Pain*. Patients rated frequency and intensity of back pain and leg pain on two Visual Analogue Scales (VAS) of 100 mm long. One scale ranged from *never* to *continuously*, the other from *no pain* to *unbearable pain*. Reports of reliability and validity are satisfactory (Chapman, Casey, Dubner, Foley, Gracely & Reading, 1985; Price, McGrath, Rafii & Buckingham, 1983). The intensity score was multiplied by the frequency score and divided by hundred yielding a severity score of pain. Because severity of back pain and leg pain were not highly correlated ($r$ = .29), they were treated as separate variables.

*Pain during daily activities*. A 20-item questionnaire on pain during daily activities of Oostdam (1982) was used. Internal consistency was good ($\alpha$ = .88).

*Coping*. Coping behaviour was assessed with the Threatening Medical Situation Inventory (TMSI; van Zuuren & Hanewald, 1993). This questionnaire was developed analogous to the Miller Behavioral Style Scale (Miller, 1987) and specifically designed for the use in medical situations. Two independent styles were measured, monitoring and blunting. The former refers to "the extent to which people seek out and monitor for information about threat" and the latter to "the extent to which people can cognitively distract from and psychologically blunt threat-relevant information" (Miller, Brody & Summerton, 1988). The list consists of four situations, each with three items on monitoring and three items on blunting. The two scales had an internal consistency of .84 and .74, respectively. Psychometric properties of this questionnaire were

adequate (van Zuuren & Hanewald, 1993; van Zuuren & Wolfs, 1991). A fifth situation was added, designed for the forthcoming operation to assess the situation-specific monitoring and blunting style ($\alpha$ = .69, and .60, respectively).

*Outcome measures at three days after surgery*

*Tension and fatigue.* Postoperatively, the POMS was again administered. The subscale tension was used to assess postoperative emotional anxiety. The sumscore of the subscales vigour and fatigue was again used as indicator of fatigue.

*Pain.* The visual analogue scales of intensity of leg pain and back pain were administered. Frequency of pain was not registered at this measurement point, because the period after surgery was too short to compare the frequency of pain before and after surgery. Also, the pain during daily activities questionnaire was not administered because daily activities three days after surgery were hampered by the surgical wound and therefore not comparable with activities before surgery.

*Observed outcome.* The neurosurgeon rated general recovery of the patient on a three-point scale: good (1), moderate (2) or poor (3) recovery.

*Outcome measures at three months after surgery*

*Tension and fatigue.* Three months after surgery, patients completed the POMS for the third time.

*Pain.* The Visual Analogue Scales of frequency and intensity of back pain and leg pain, and the 20-item questionnaire of pain during daily activities were again administered.

*Observed outcome.* The neurosurgeon again rated recovery on a three-point scale six weeks to three months after discharge. Recovery was rated good when the patient no longer showed signs of leg pain. Recovery was rated moderate when the patient was able to do his or her previous job or adjusted work, but no complete recovery of leg pain, sensory sensitivity or motor dysfunction was obtained. It was rated poor when

the patient still reported leg pain, was not able to return to work or when deep muscular paralysis remained.

*Data analysis*

We used predicted mean matching (Little, 1988) for substituting missing data points of seven patients who skipped one or two questionnaires. Frequencies of medical variables and means and standard deviations of psychological variables and outcome measures were calculated. Repeated measures analysis was used to test differences among occasions. Product moment correlations were calculated to assess the associations between preoperative variables and each outcome measure. Furthermore, to take into account the interrelations among independent measures and among outcome measures, the technique of canonical correlations was used. This technique finds linear combinations of sets of preoperative variables and sets of outcome measures that are maximally associated. Successive independent linear combinations are extracted yielding two canonical variates for each linear combination. The relation between pairs of canonical variates is the canonical correlation. Canonical correlations were interpreted by using the loadings of the variables on the canonical variates that were largest in absolute magnitude (.40 or higher) (Stevens, 1992).

## Results

*Descriptive data of medical and psychological variables and outcome measures*

In Table 2-1 the frequency distributions of the medical variables are shown. Means and standard deviations of preoperative psychological variables and outcome measures are reported in Table 2-2. As expected, surgery was successful in relieving pain: The intensity of postoperative leg pain and back pain at three days and at three months were significantly decreased compared to the presurgical level. Also, pain during daily activities fell significantly from presurgery to the three months follow-up. Fatigue diminished

from presurgery to three days postoperatively, but was increased again at three months.

*Table 2-1. Frequency distributions of medical variables*

| Variable | Category | *N* | % |
|---|---|---|---|
| Type of surgery | lumbar disc surgery | 106 | 84.1 |
| | surgery for canal stenosis | 20 | 15.9 |
| Reoperation | no | 111 | 88.0 |
| | yes | 15 | 12.0 |
| Duration of surgery | < 1/2 hour | 20 | 15.9 |
| | < 3/4 hour | 59 | 46.8 |
| | < 1 hour | 26 | 20.6 |
| | > 1 hour | 21 | 16.7 |
| Overweight | no | 88 | 69.8 |
| | yes | 38 | 30.2 |
| Severity of disorder | not severe | 42 | 33.3 |
| according to the neurosurgeon | moderate | 34 | 27.0 |
| | severe | 37 | 29.4 |
| | very severe | 13 | 10.3 |
| Expected of recovery | good | 64 | 50.8 |
| according to the neurosurgeon | moderate | 27 | 21.4 |
| | poor | 35 | 27.8 |

At three days, observed outcome of 82 (65.1%) patients was rated as good, of 25 (19.8%) patients as moderate and of 19 (15.1%) patients as poor. At three months recovery of 90 (78.3%) patients was rated as good, of 16 (13.9%) patients as moderate and of 9 (7.8%) as poor. The means of observed outcome in Table 2-2 show that recovery was rated better at three months than at three days.

Patients who did not return the questionnaires at three months ($N$ = 13) did not differ from the other patients on preoperative medical and biographic variables, nor on most psychological variables. The only difference found was that drop-outs had significantly lower scores on monitoring than the other patients ($M$ of drop-outs = 26.9, ± 3.01; $M$ other patients = 33.5 ± 0.95; $F$ (1, 125) = 5.3; $p < .03$).

*Table 2-2. Means (and standard deviations in parentheses) of preoperative psychological variables and outcome measures with F-value for differences among occasions*

| Variables | Presurgery ($N$ = 126) | Three days postsurgery ($N$ = 126) | Three months postsurgery ($N$ = 112) | $F$-value for difference among occasions |
|---|---|---|---|---|
| Anxiety | 43.9 (12.3) | | | |
| Tension | | 8.65 (3.18) | 10.2 (4.97) | 12.90[b] |
| Fatigue | 28.0 (8.99) | 23.8 (7.89) | 26.4 (9.79) | 11.39[b] |
| Intensity Leg pain | 69.8 (18.9) | 28.2 (29.1) | 28.9 (28.5) | 129.0[b] |
| Severity Leg pain[a] | 61.2 (21.9) | | 18.6 (26.0) | 197.9[b] |
| Intensity Back pain | 55.7 (27.0) | 39.5 (22.8) | 34.5 (23.1) | 29.37[b] |
| Severity Back pain[a] | 45.8 (28.6) | | 24.0 (23.6) | 58.10[b] |
| Pain during activities | 51.9 (10.5) | | 40.3 (11.8) | 80.42[b] |
| Observed outcome | | 1.49 (0.73) | 1.29 (0.59) | 5.05[c] |
| Monitoring | 32.7 (10.4) | | | |
| Specific Monitoring | 9.51 (3.32) | | | |
| Blunting | 39.5 (8.17) | | | |
| Specific Blunting | 10.9 (2.86) | | | |

[a]Formula for calculation of severity leg pain and back pain: frequency x intensity / 100.
[b]$p < .001$.
[c]$p < .05$.

*Correlations between preoperative variables and outcome measures three days postoperatively*

The correlations between preoperative variables and outcome measures were quite low (Table 2-3). Only six correlations had a *p*-value of .01 or less. Of the medical

*Table 2-3. Correlations between preoperative variables and outcome measures three days postoperatively*

| Variables | Fatigue | Tension | Leg pain | Back pain | Obs. outc.[a] |
|---|---|---|---|---|---|
| *Biographic variables* | | | | | |
| Sex | .02 | .18* | .18* | .01 | .16 |
| Age | .13 | .13 | .11 | .02 | .22* |
| *Medical variables* | | | | | |
| Type of surgery | .04 | -.02 | -.06 | .07 | -.05 |
| Reoperation | .19* | .06 | .16 | .13 | .15 |
| Duration of surgery | .12 | .20* | .14 | .12 | .14 |
| Overweight | .05 | .17 | -.08 | .00 | .03 |
| Amount of analgesics | .17 | .28** | -.03 | .05 | .14 |
| Types of pain medication | .13 | .20* | -.03 | .17 | .06 |
| Severity of disorder | .12 | .26** | -.11 | .02 | .05 |
| Expected recovery | -.12 | .13 | -.22* | -.01 | .16 |
| *Psychological variables* | | | | | |
| Anxiety | .16 | .30** | .23* | .21* | .24** |
| Fatigue | .33** | .12 | .16 | .32** | .15 |
| Leg pain | .09 | .14 | .22* | .10 | .03 |
| Back pain | .08 | .02 | .18* | .10 | .15 |
| Pain during activities | -.03 | .15 | .11 | .04 | -.05 |
| Monitoring | -.05 | .04 | -.06 | .05 | -.11 |
| Specific Monitoring | .00 | .00 | -.04 | .06 | -.05 |
| Blunting | -.14 | -.06 | -.06 | -.15 | -.07 |
| Specific Blunting | -.17 | -.05 | -.19* | -.17 | -.15 |

[a]Observed outcome.

Two-tailed significance, * $p < .05$, ** $p < .01$.

variables, amount of analgesics and the severity of the disorder were moderately related to postoperative tension. Of the psychological variables, anxiety was associated with more postoperative tension, leg pain, back pain and poorer observed recovery. Fatigue was associated with more postoperative fatigue and back pain.

*Correlations between preoperative variables and outcome measures three months postoperatively*

At three months, the correlations were somewhat higher than at three days (Table 2-4). Fifteen correlations now had a $p$-value of .01 or less. The medical variable reoperation was now associated with several outcome measures, especially with the disorder specific-outcome measures leg pain and poor observed outcome. Female sex was associated with higher levels of postoperative leg pain. Of psychological variables, preoperative anxiety and fatigue were associated with the two measures of emotional state, back pain and pain during daily activities, but not with leg pain and observed outcome at three months. Preoperative back pain correlated with all six outcome measures. Pain during daily activities correlated with postoperative leg and back pain.

*Canonical correlations*

For the relation between preoperative variables and outcome measures at three days, only the first canonical correlation was significant with a correlation of 0.58 ($\chi^2 = 128.06$, $p < .02$), accounting for 34% of the variance in the set of outcome measures.

Of the preoperative variables, sex, amount of analgesics, expected recovery and anxiety showed the highest loadings on the canonical variate of the first canonical correlation (Table 2-5). These variables were the same that showed significant bivariate correlations, except that now sex showed a relatively high loading. All outcome measures loaded on the canonical variate with loadings from .32 to .77 (Table 2-6). These results indicate that higher levels of anxiety, higher amount of analgesics, poorer

expected recovery, and female sex were associated with poorer recovery in terms of emotional state as well as the disorder-specific postoperative state.

*Table 2-4. Correlations between preoperative variables and outcome measures three months postoperatively*

| Variable | Fatigue | Tension | Leg pain | Back pain | Pain act.[a] | Obs. outc.[b] |
|---|---|---|---|---|---|---|
| *Biographic variables* | | | | | | |
| Sex | .11 | .05 | .21* | .05 | .11 | .11 |
| Age | -.01 | .02 | .18* | .00 | .07 | .01 |
| *Medical variables* | | | | | | |
| Type of surgery | .05 | .02 | .22* | -.05 | .09 | .07 |
| Reoperation | .21* | .17 | .34** | .19* | .14 | .36** |
| Duration of surgery | .06 | .16 | .06 | .07 | .02 | .15 |
| Overweight | .00 | .09 | -.03 | .06 | .02 | .03 |
| Amount of analgesics | .17 | .15 | .04 | .15 | .17 | .02 |
| Types of pain medication | .15 | .06 | .02 | .05 | .15 | -.07 |
| Severity of the disorder | .10 | -.04 | .09 | -.02 | .08 | .09 |
| Expected recovery | .04 | .15 | .04 | .00 | .00 | .17 |
| *Psychological variables* | | | | | | |
| Anxiety | .36** | .50** | .05 | .35** | .38** | .14 |
| Fatigue | .30** | .27** | .00 | .10 | .28** | .12 |
| Leg pain | .09 | .08 | .08 | .05 | .07 | .06 |
| Back pain | .26** | .27** | .21* | .38** | .36** | .24* |
| Pain during activities | .12 | .17 | .04 | .36** | .31** | -.08 |
| Monitoring | .12 | .07 | -.04 | .16 | .10 | .00 |
| Specific monitoring | .18* | .14 | .03 | .05 | .10 | .05 |
| Blunting | .19* | .04 | .22* | .05 | .15 | .02 |
| Specific blunting | -.08 | -.09 | .05 | -.01 | -.17 | -.14 |

[a]Pain during daily activities.

[b]Observed outcome.

Two-tailed significance, * $p < .05$, ** $p < .01$.

*Table 2-5. Loadings of preoperative variables for the significant canonical correlations*

| Variables | Three days | Three months | |
|---|---|---|---|
| | First pair of canonical variates | First pair of canonical variates | Second pair of canonical variates |
| | loading | loading | loading |
| *Biographic variables* | | | |
| Sex | .41 | .35 | -.16 |
| Age | .39 | .10 | -.06 |
| *Medical variables* | | | |
| Type of surgery | -.09 | .22 | -.07 |
| Reoperation | .29 | .49 | -.20 |
| Duration of surgery | .37 | .15 | .07 |
| Overweight | .18 | -.01 | .14 |
| Amount of analgesics | .43 | .13 | .24 |
| Types of pain medication | .23 | .08 | .16 |
| Severity of disorder | .30 | .20 | -.14 |
| Expected recovery | .42 | .19 | .03 |
| *Psychological variables* | | | |
| Anxiety | .56 | .35 | .70 |
| Fatigue | .34 | .31 | .42 |
| Leg pain | .27 | .16 | .02 |
| Back pain | .21 | .38 | .30 |
| Pain during activities | .14 | .04 | .50 |
| Monitoring | -.11 | .07 | .15 |
| Specific monitoring | -.08 | .23 | .09 |
| Blunting | -.14 | .32 | -.14 |
| Specific blunting | -.26 | -.14 | -.24 |

*Note.* Loadings $\geq .40$ are underlined.

For the relation between preoperative variables and outcome measures at three months, the first and the second canonical correlation were significant with a correlation of .71 ($\chi^2 = 202.2, p < .001$), and .67 ($\chi^2 = 132.88, p < .002$), respec-

tively. Together, they accounted for 47.5% of the variance in the sets of outcome measures[2].

The preoperative variables that showed significant bivariate correlations also showed high loadings, except back pain that showed a relatively low loading while it was correlated with all outcome measures. Reoperation had the highest loading on the canonical variate of the first significant canonical correlation. All recovery measures loaded again on the variate of this canonical correlation, with loadings from .46 to .79 (Table 2-6).

*Table 2-6. Loadings of postoperative variables for the significant canonical correlations*

| Variables | Three days | Three months | |
|---|---|---|---|
| | First pair of canonical variates | First pair of canonical variates | Second pair of canonical variates |
| | loading | loading | loading |
| *Outcome measures* | | | |
| Fatigue | .62 | .79 | .33 |
| Tension | .76 | .56 | .68 |
| Leg pain | .55 | .70 | -.20 |
| Back pain | .32 | .46 | .49 |
| Pain during activities | - | .67 | .55 |
| Observed outcome | .77 | .73 | -.13 |

For the second significant canonical correlation, the preoperative variables anxiety, fatigue and pain during daily activities had the highest loadings (Table 2-5). Of the recovery measures, tension, pain during daily activities and back pain had the

[2]The average squared canonical correlation of the two significant canonical correlations was used as measure of variance accounted for as recommended by Cramer and Nicewander in Stevens (1992).

highest loadings (Table 2-6). The results of the canonical analysis confirms the pattern seen in the correlations: Reoperation was positively associated with measures of emotional state as well as leg pain and observed outcome; Anxiety and fatigue were positively associated with postoperative emotional state and back pain, but not with leg pain and observed outcome.

## Discussion

The correlations and loadings show that different biographic, medical and psychological variables may be relevant for the assessment of short- and long-term recovery after lumbar surgery. Sex, amount of analgesics, expected recovery and preoperative anxiety appeared to be relevant to short-term recovery in terms of emotional state as well as measures of pain and observed outcome. Reoperation appeared to be relevant to long-term recovery in terms of emotional state, measures of pain and observed outcome. Anxiety, fatigue, and pain during daily activities appeared to be relevant to long-term recovery in terms of emotional state and pain during daily activities.

From the results, it also may be concluded that preoperative psychological variables are more important to assessing long-term recovery than to assessing short-term recovery. More variance could be explained after three months than after three days and more psychological variables were associated with the outcome measures after three months. The relatively little variance explained and the low to moderate correlations with the outcome measures at three days indicate that a large part of the variance might be due to other variables not measured in this study.

Regarding the dimensions of recovery, only one recovery dimension was found at three days and two after three months, while previous studies reported several different dimensions of recovery (Johnston, 1984; Wolfer & Davis, 1970). This study, however, heavily depended on subjective outcome measures which may be the reason for finding only a few dimensions. We should, therefore, confine our conclusions of the relevance

of the preoperative variables to these types of outcome measures. For other outcome measures such as length of hospital stay or physiological measures results may be different. The two dimensions found at three months show that reoperation affected all dimensions of recovery, whereas preoperative anxiety, fatigue and pain during daily activities can explain differences in general pain complaints and emotional state that accompany the disorder, but not the differences in the specific outcome of surgery, i.e., postoperative leg pain and observed recovery.

The finding that preoperative pain during daily activities was associated with postoperative emotional state and back pain at three months and that preoperative back pain was associated with poorer outcome on all measures at that time may indicate that some patients suffered from a low back pain disorder, apart from the leg pain, that was not diminished by surgery and also was not treated in the meantime. These patients may be in need of pain treatment apart from surgery.

Surprisingly, the expectation of the neurosurgeon on basis of findings during surgery such as the absence of a hernia, other causes of pain or difficult identification of the cause of pain, was not related to any measure of long-term recovery. It accords, however, with a previous study that reported no differences in postoperative recovery between patients with and without a lumbar disk herniation (Kardaun, 1990). On the other hand, Rosenstiel Gross (1986) reported differences in postoperative pain and intake of analgesics due to different types of disc problems found during surgery. Possibly, with a more precise categorisation of the findings, differences in recovery might have been found. It will be interesting to investigate detailed findings during surgery and their relation with recovery from lumbar surgery in a future study.

Clinicians often emphasize the importance of patient selection on the basis of variables that predict which patients are at risk of poor recovery. The results of this study indicate that the decision to perform lumbar surgery may be taken extra carefully if patients had prior lumbar surgery, because this variable predicted outcomes that are an indication of less successful surgery, i.e., leg pain and observed poor recovery at three months. Clinicians may use the knowledge that higher levels of preoperative

anxiety, fatigue and pain during daily activities are associated with poorer recovery at three months in two ways. Firstly, they may take into consideration these signs of a patient's state to adjust their expectation of recovery of a patient. Secondly, they may be more able to understand and advise patients who return to their practice a few months after surgery with general pain complaints. Long-term postoperative state of patients undergoing lumbar surgery might be improved by interventions aimed at the reduction of anxiety, fatigue and pain during daily activities.

# Chapter 3

## The influence of psychological variables on postoperative anxiety and physical complaints in patients undergoing lumbar surgery

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*(Pain: in press)*

**Summary**

Previous research has indicated that postoperative distress is influenced by diverse biographic, medical and psychological variables, such as personality, coping behaviours and anxiety. The influence of state variables, apart from anxiety and coping behaviour, has received scant attention. Furthermore, the influence of coping behaviour has remained unclear. The present study investigated coping behaviour and indications of physical distress, i.e., preoperative fatigue, leg pain and back pain, besides preoperative anxiety, as predictors of postoperative anxiety and physical complaints in 126 patients undergoing lumbar surgery. Preoperative anxiety and leg pain independently predicted more postoperative anxiety beyond the influence of age, sex and medical variables. Preoperative anxiety and fatigue independently predicted more postoperative physical complaints. No associations were found between the coping behaviours and the postoperative variables. The implications of these results are discussed in relation to intervention strategies aimed at diminishing the stress of surgery.

## Introduction

What is the impact of psychological factors on postoperative emotional and physical state? This question has been studied intensively, since Janis (1958) wrote his book on psychological stress and reactions to surgery. Many studies have shown that postoperative state is influenced by diverse biographic, medical and psychological variables, such as personality, anxiety and coping behaviours (Johnston, 1986; Kincey & Saltmore, 1990; Mathews & Ridgeway, 1981; Salmon, 1992; Taenzer, Melzack & Jeans, 1986). Psychological factors that are amenable to change have been of special interest for the development of intervention techniques that may help patients to cope with surgery. However, research on the relation between coping behaviour and postoperative state has not yielded any unequivocal conclusions (Kincey & Saltmore, 1990; Mathews & Ridgeway, 1981). Furthermore, apart from anxiety and coping behaviour, other preoperative variables amenable to change, such as physical indications of distress, have received only scant attention. Therefore, the present study investigated the influence of coping behaviour and of two indications of physical distress, i.e., preoperative fatigue and pain, on postoperative state, apart from anxiety.

The most consistent finding of research on coping behaviour has been that avoidant coping or not thinking about surgery is associated with less preoperative anxiety (Ho, Hashish, Salmon, Freeman & Harvey, 1988; Krohne, 1989) and faster postoperative physical recovery (Cohen & Lazarus, 1973; George, Scott, Turner & Gregg, 1980) than vigilant coping (i.e., an alertness and an active search for information). However, because report of avoidance is associated with low preoperative anxiety and report of vigilance with high preoperative anxiety, some researchers have casted doubt on the difference between vigilance and avoidance on the one hand and anxiety measures on the other (Kincey & Saltmore 1990; Mathews & Ridgeway, 1981). Recently, two behavioral measures of coping, monitoring and blunting of information, were developed (Miller, 1987) that seem promising variables to predict postoperative distress (Salmon, 1992). High monitoring was positively associated with factual knowledge in women

admitted for gynaecological surgery (Steptoe & O'Sullivan, 1986). Also, high monitoring patients, visiting a primary care facility, demanded more information, tests and counselling from their doctors (Miller, Brody & Summerton, 1988). These patients, however, did not like to play an active role in their own care and were slower to report improvement or to recover than low monitoring patients. Furthermore, high monitoring has been associated with higher levels of medical fear and higher anxiety during anticipation of a film concerning a medical procedure of brain surgery (Muris, van Zuuren & de Vries, 1994). Blunting was associated with lower anxiety during anticipation of the film. These studies suggest that, although high monitors will engage in more health related information seeking behaviour, they are, nevertheless, more anxious for a medical threatening event and report less improvement than low monitors and high blunting patients. Whether monitoring and blunting are associated with postoperative state has to our knowledge not yet been investigated. Therefore, we studied the influence of monitoring and blunting of information on postoperative distress.

The relation between preoperative fatigue and postoperative state has received scant attention. Fatigue is a mood state of physical or mental exhaustion due to exertion or stress. Patients with excess fatigue report that they are "dead tired", "exhausted" or "worn out". Recently, fatigue was found to predict cardiac symptoms six months after heart surgery (Jenkins, Stanton & Jono, 1994). Feelings of excess fatigue also predicted new cardiac problems after coronary angioplasty (Kop, Appels, Mendes de Leon, de Swart & Bär, 1994). Presumably, excess fatigue may also predict difficulties in short-term recovery from surgery.

Furthermore, the relation between preoperative pain and postoperative state has seldom been investigated. Pain may be indicative for the severity of the disorder and thus may be related to poorer postoperative physical state. However, it becomes more and more clear that reported pain is only tenuously related to pathophysiological processes. The relation between pain and emotional state is now well established (Dworkin, 1991; Gaskin, Greene, Robinson & Geisser, 1992; Wade, Price, Hamer, Schwartz & Hart, 1990). Patients reporting a lot of pain show higher reports of a variety of

disturbing emotions, especially anxiety and frustration (Wade et al., 1990). This suggests that patients with a lot of preoperative pain have higher anxiety levels and are at risk of poor postoperative state.

Establishing a relation between psychological variables and postoperative state has not always been successful. In this respect, researchers have emphasized that the choice of outcome measures is crucial for finding a relationship between preoperative psychological factors and postoperative state (Johnston, 1984; Salmon, 1992). For example, preoperative state anxiety has been found to be related with higher levels of postoperative anxiety (Johnston, 1986; Johnston & Carpenter, 1980; Manyande & Salmon, 1992; Taenzer et al., 1986; Wallace, 1986; Wolfer & Davis, 1970), and pain (Boeke, Duivenvoorden, Verhage & Zwaveling, 1991a; George et al., 1980; Martelli, Auerbach, Alexander & Mercuri, 1987; Scott, Clum & Peoples, 1983), whereas no association was found with indices of postoperative physical state such as energy, appetite, stomach condition, bowel condition, and urination (Johnston & Carpenter, 1980; Wallace, 1986; Wolfer & Davis, 1970). These general physical recovery-indices, however, may be less influenced by anxiety than physical complaints that are more often found to be related to distress. In the present study, two outcome measures were studied, i.e., postoperative state anxiety, and postoperative physical complaints related to distress such as headache, dizziness and nausea.

The present study investigated patients undergoing lumbar surgery. Lumbar surgery is performed if a patient suffers from severe leg pain due to a back disorder of which pathophysiological abnormalities were identified with roentgenographs. Many, but not all patients, also suffer from back pain. This patient group was chosen because these patients are in good health except for the lumbar disorder, providing a model for the influence of surgical stress minimally confounded by the differences in health status. For the severity of the lumbar disorder, other medical status variables, sex and age was statistically controlled.

In summary, the aim of the study was to investigate the influence of preoperative coping behaviour, fatigue and pain, besides anxiety, on postoperative anxiety and

physical complaints beyond age, sex and medical variables in patients undergoing lumbar surgery.

## Methods

### *Patients*

Participants were 126 consenting patients (*M* age = 44 years; range 20 to 77) undergoing lumbar surgery on the neurosurgical department of a local hospital. This sample comprised 68 men and 58 women. Diagnoses of patients were lumbar disc herniation (*N* = 104; *M* age = 41 years; range 20 to 74), lumbar canal stenosis, (*N* = 19; *M* age = 59 years; range 37 to 77), extraforaminal disc herniation (*N* = 2) and familial narrow spinal canal (*N* = 1). In patients with lumbar disc herniation a removal of the disc prolaps and intervertrabal disc was performed. In patients with extraforaminal herniation the extraforaminal disc prolaps and the contents of the disc were removed. In the other patients, bone of the vertebrae was removed to widen the spinal canal. Fifteen patients underwent lumbar surgery for the second time. Patients who had other severe diseases, were above 80 years of age, or were not fluent in Dutch were left out. Permission for inclusion into the study was asked of 135 patients, five of whom refused. Four other patients were excluded from the analyses, because they filled out too few questionnaires.

### *Procedure*

During an 18-month period, patients admitted to the hospital for lumbar surgery at a particular day of the week were studied. All surgeries were performed by the same neurosurgeon (third author). The hospital staff informed patients about the study on the day before surgery. After having obtained consent, the investigator (first author) carried out the first assessment. Next, biographic and medical variables were collected from the medical files. On the same day, the neurosurgeon independently rated the

severity of the disorder. On the third day after surgery, the postoperative assessment was carried out. The study was approved by the medical ethics committee of St. Clara's Hospital Rotterdam.

*Preoperative assessment*

*Biographic and medical variables.* Information was obtained regarding sex, age, severity of disorder, type of surgery, duration of surgery, prior lumbar surgery, and overweight (Quetelet-index: weight/length$^2$, Passmore & Eastwood, 1986). The neurosurgeon rated the severity of the disorder on a 4-point scale ranging from *not severe* (1) to *very severe* (4). His rating was an overall judgement of the patients' state on the basis of clinical data such as the duration of the disorder, observed pain, muscular paralysis and loss of sensory sensitivity. A longer duration of the disorder, more pain during the Lasegue test (i.e., flexion of the hip is painful when the knee is extended, but painless when the knee is flexed), and loss of locomotor or sensory functions were judged as signs of a more severe disorder. Patients high on all these symptoms were judged as having the most severe disorder. Furthermore, number of analgesics and number of types of pain relieving medication (analgesics and muscle relaxants) were taken into account. During the first assessment patients were asked to fill in the number of analgesic pills they took on the day before surgery. This measure is presumably more subjective than recording analgesic intake from the medical files. However, it appeared that some patients did take pain medication whereas the medical files showed no intake of medication. Therefore, we decided to use patients' records of analgesics. The number of types of pain relieving medication was recorded from the medical files. Unfortunately, we have no data concerning the reliability or validity of the variables severity of the disorder and pain medication intake.

*Anxiety.* Patients completed the State version of the State-Trait Anxiety Inventory (STAI; Dutch translation by van der Ploeg, Defares & Spielberger, 1980). This 20-item scale is widely used in research, and psychometric properties are satisfactory (Evers, van Vliet-Mulder & ter Laak, 1992).

*Fatigue.* Patients also filled in a shortened Dutch version of the Profile of Mood States (POMS; Wald & Mellenbergh, 1990) of which two factors, fatigue and vigour were used together as indicator of fatigue. Psychometric properties are good (Wald & Mellenbergh, 1990), internal consistency of the combined 11-item scale high ($\alpha$ = .84).

*Pain.* Patients rated current intensity of back pain and leg pain on two 100 mm Visual Analogue Scales (VAS). The scale ranged from *no pain* to *unbearable pain.* This is a frequently used method for measuring pain and reports of reliability and validity are satisfactory (Chapman, Casey, Dubner, Foley, Gracely & Reading, 1985; Price, McGrath, Rafii & Buckingham, 1983). Because current intensity of back pain and leg pain were not highly correlated ($r$ = .29), they were treated as separate variables.

*Coping.* Coping behaviour was assessed with the Threatening Medical Situation Inventory (TMSI; van Zuuren & Hanewald, 1993). This questionnaire is developed analogous to the Miller Behavioral Style Scale (Miller, 1987) and specifically designed for the use in medical situations. Two independent coping behaviours were measured, monitoring and blunting. The former refers to "...the extent to which people seek out and monitor for information about threat..." and the latter to "...the extent to which people can cognitively distract from and psychologically blunt threat-relevant information..." (Miller et al., 1988, p.142). Monitoring can be classified as a vigilant coping behaviour and blunting as an avoidant coping behaviour. The questionnaire consist of four situations, each having three monitoring and three blunting items. Psychometric properties are adequate (van Zuuren & Hanewald, 1993; van Zuuren & Wolfs, 1991). Internal consistency for monitoring and blunting was .84 and .74, respectively. A fifth situation was added, relevant to the forthcoming operation, to assess the situation specific monitoring and blunting behaviour ($\alpha$ = .69, and .60, respectively).

*Postoperative Assessment*

Two measures were used as indicators of postoperative distress, i.e., state anxiety and physical complaints. State anxiety (STAI) was again assessed on day three. Furthermore, two scales of the Symptom Checklist-90 (SCL-90; Dutch translation, Arrindell & Ettema, 1986), i.e., physical complaints (e.g., headache, dizziness, nausea) and sleep, consisting of 12 and 3 items, respectively, were used to assess physical distress during the days after surgery. This 15-item scale had an internal consistency of .81. These scales were chosen because the items measure physical reactions to anxiety.

*Data Analysis*

We used predicted mean matching (Little, 1988) for substituting missing data of seven patients who had skipped one or two questionnaires. To control for the medical variables, we first estimated the extent to which seven medical variables were related to the two outcome measures, postoperative anxiety and physical complaints. Number of analgesics ($r = .24$, $p < .01$), number of types of pain relieving medication ($r = .22$, $p < .05$), duration of surgery ($r = .20$, $p < .05$) and having had prior lumbar surgery ($r = .21$, $p < .05$) significantly correlated with postoperative anxiety. Number of analgesics ($r = .21$, $p < .05$) and number of types of pain relieving medication ($r = .28$, $p < .01$) significantly correlated with postoperative physical complaints. Next, for each of the eight preoperative psychological variables a regression equation was build to determine the relation to the outcome measure after control for age, sex and the significant medical variables.

A difficulty in determining the impact of a specific preoperative psychological variable on postoperative state has been that preoperative psychological variables are often highly related to each other (Mathews & Ridgeway, 1981). The influence of preoperative fatigue, pain or coping behaviours may overlap with anxiety, yielding no new variable for explaining postoperative state. To demonstrate relations between specific psychological variables and outcome measures, Watson and Clark (1992)

advised to tease out the independent contribution of each psychological variable to a specific outcome measure. Therefore, age, sex, significantly related medical variables and all preoperative psychological variables were entered in a multiple regression equation to determine the independent contribution to predicting postoperative anxiety and physical complaints. Using backward elimination, the preoperative psychological variables that showed no independent contribution were excluded from the model ($p$ for removal $>$ .05).

## Results

*Prevalence of preoperative and postoperative variables*

Table 3-1 displays means and standard deviations for the pre- and postoperative variables. Patients reported more leg pain than back pain, $t(125) = 5.74$, $p < .001$.

*Table 3-1. Means, standard deviations and possible range of scores of preoperative and postoperative variables (N = 126)*

| Variable | *M* | *SD* | Possible range of scores |
|---|---|---|---|
| *Before surgery* | | | |
| Anxiety | 43.9 | 12.3 | 20 - 80 |
| Fatigue | 28.0 | 9.0 | 11 - 55 |
| Leg pain | 69.8 | 18.9 | 0 - 10 |
| Back pain | 55.7 | 27.0 | 0 - 100 |
| Monitoring | 32.7 | 10.4 | 12 - 60 |
| Specific Monitoring | 9.5 | 3.3 | 3 - 15 |
| Blunting | 39.5 | 8.2 | 12 - 60 |
| Specific Blunting | 10.9 | 2.9 | 3 - 15 |
| *After surgery* | | | |
| Anxiety | 33.6 | 9.6 | 20 - 80 |
| Physical complaints | 35.9 | 9.6 | 15 - 75 |

Scores on blunting and specific blunting were significantly higher than scores on monitoring, $t(125) = 5.79$, $p < .001$, and specific monitoring, $t(125) = 3.68$, $p < .001$, respectively. Anxiety diminished significantly from pre- to postsurgery, $t(125) = 9.63$, $p < .001$.

*Intercorrelations among preoperative anxiety, fatigue, pain, and coping behaviours and among postoperative measures*

Preoperative anxiety, fatigue, back pain and leg pain were significantly interrelated (Table 3-2). Of the coping variables, specific blunting was negatively associated with preoperative anxiety. Postoperative anxiety and physical complaints were significantly interrelated ($r = .49$, $p < .001$; not shown in Table 3-2).

*Table 3-2. Correlations among preoperative variables*

| Variable | Anxiety | Fatigue | Leg pain | Back pain | Monitor-ing | Specific Monitoring | Blunting |
|---|---|---|---|---|---|---|---|
| Anxiety | - | | | | | | |
| Fatigue | .36** | - | | | | | |
| Leg pain | .20* | .22* | - | | | | |
| Back pain | .28** | .27* | .30** | - | | | |
| Monitoring | .15 | .17 | .16 | .08 | - | | |
| Specific Monitoring | .07 | .08 | .05 | -.02 | .56** | - | |
| Blunting | -.14 | -.11 | .03 | .00 | .09 | .06 | - |
| Specific Blunting | -.21* | -.10 | .17 | .01 | .28** | .02 | .45** |

Two-tailed significance, *$p < .05$, **$p < .01$.

*Associations between preoperative psychological and postoperative variables controlled for age, sex and medical variables*

Preoperative anxiety, fatigue and leg pain were positively associated with postope-

rative anxiety after control for biographic variables and the medical variables (Table 3-3). Preoperative anxiety and fatigue were positively associated with postoperative physical complaints after control. However, none of the coping variables were associated with the postoperative variables.

*Table 3-3. Associations (βs) between preoperative psychological and postoperative variables controlled for sex, age and medical variables*

| Preoperative variable | Postoperative anxiety | Postoperative physical complaints |
|---|---|---|
| | β | β |
| Anxiety | .40** | .28** |
| Fatigue | .24** | .32** |
| Leg pain | .28** | .09 |
| Back pain | .15 | .13 |
| Monitoring | -.07 | .04 |
| Specific Monitoring | -.11 | -.01 |
| Blunting | -.08 | -.15 |
| Specific blunting | -.16 | -.14 |

*$p < .05$, **$p < .01$.

*Independent contribution of psychological variables in predicting postoperative anxiety and physical complaints*

To tease out which psychological variables had a nonoverlapping association with a particular outcome measure, the independent contribution of the psychological variables was calculated. Although the preoperative psychological variables were interrelated, no problem of multicollinearity arose (Variance Inflation Factor was less than 2, while a VIF exceeding 10 is believed to be of concern (Stevens, 1992)).

Of the three psychological preoperative variables associated with postoperative anxiety, preoperative anxiety ($\beta = .38$, $p < .001$) and leg pain ($\beta = .24$, $p < .004$)

were independently contributing to the prediction (Multiple $R = .58$, $F = 7.52$, $p < .0001$). Preoperative anxiety ($\beta = .22, p < .02$) and fatigue ($\beta = .27, p < .005$) both independently predicted physical complaints (Multiple $R = .50$, $F = 6.77$, $p < .0001$).

Figures 3-1 and 3-2 summarize the directional pattern of significant intercorrelations among preoperative psychological variables and the significant nonoverlapping associations with postoperative anxiety and physical complaints, respectively.

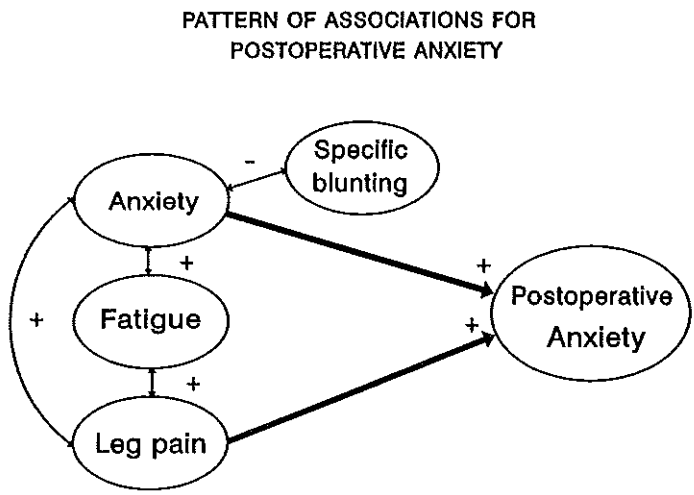


*Figure 3-1.* The symbol "+" indicates a positive significant association, the symbol "-" a negative significant association. The thin arrows represent simple correlations, the thick arrows represent independent associations.

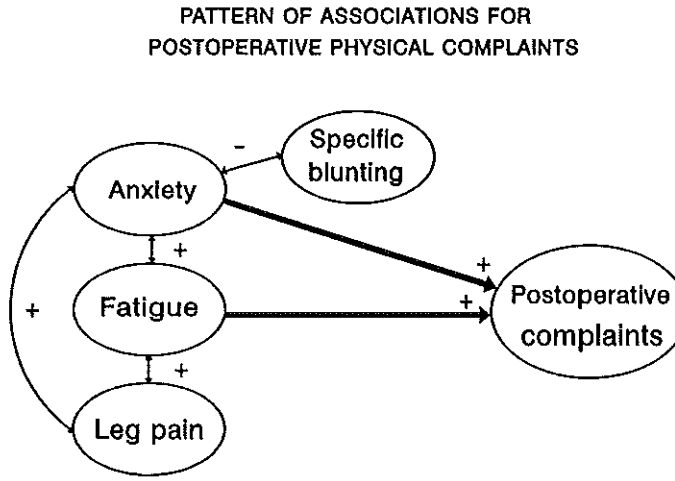


*Figure 3-2.* The symbol "+" indicates a positive significant association, the symbol "-" a negative significant association. The thin arrows represent simple correlations, the thick arrows represent independent associations.

## Discussion

The main finding of our study was that, besides preoperative anxiety, leg pain was an independent predictor of postoperative anxiety, and preoperative fatigue was an independent predictor of postoperative physical complaints. The coping variables were not associated with postoperative anxiety, nor with physical complaints.

Preoperative anxiety was not only related to postoperative anxiety, but also to physical complaints associated with distress. This suggests that the influence of

preoperative anxiety may be extended to particular physical complaints such as dizziness, nausea and headache.

Apart from anxiety, fatigue seems to be a promising variable to explain postoperative physical complaints. A shortcoming of our study was, however, that physical complaints were not measured before surgery. We thought this to be less relevant, because in the pilot study of the project, we observed that patients were anxious and tired, but heard very few patients complaining about headache, dizziness and nausea before surgery. After surgery, many patients reported such complaints.

The finding that preoperative pain is associated with postoperative anxiety confirms findings that intensity of pain has an emotional component (Gaskin et al., 1992; Wade et al., 1990). Moreover, leg pain showed an independent contribution to predicting postoperative anxiety. Clinical observation during the assessments suggested that patients reporting a lot of pain before surgery were distrusting their relatively pain free postoperative state and were afraid that the disorder would return. This may account for the higher level of postoperative anxiety. These patients may also be somatizing patients, expressing their preoperative emotional distress in terms of pain rather than as anxiety (Dworkin, 1991). Because the leg pain clearly diminishes after surgery, they then express their emotional distress as anxiety rather than pain. These patients may be in need of reassurance before surgery and extra care postsurgery in order to diminishing anxiety.

The finding that specific blunting was negatively related with preoperative anxiety corresponds with previous findings on avoidant coping (Ho et al., 1988; Krohne, 1989). This finding may suggest that patients should develop a blunting strategy to cope with anxiety before surgery. However, Martelli et al. (1987) have shown that better adjustment to surgery, satisfaction and lower self-reported pain were obtained when interventions matched with the patient's preferred coping style. In our opinion, monitoring patients might benefit from developing a blunting strategy, but only after their need for information is fulfilled. The lack of association between monitoring, blunting and postoperative distress suggests that although monitoring may influence

the factual knowledge of patients (Steptoe & O'Sullivan, 1986) and blunting may reduce specific fear before surgery, these coping behaviours do not actually help to diminish postoperative distress. A reason for this lack of association may be that the coping behaviours measured were based on self reports and, therefore, possibly did not measure the patients' actual coping behaviours.

Regarding the adaptation to lumbar surgery, the results of our study suggest that patients with high levels of preoperative anxiety, fatigue or leg pain, may be at risk of a poorer postoperative state. Janis (1983) has pointed out that any preparatory communication that enables a person to increase the tolerance for subsequent threatening events may inoculate a person for the stress of surgery and facilitate recovery. Our study suggests that this preparation is not only relevant to patients with high levels of anxiety, but also to patients with excess fatigue and patients with a lot of pain. Besides reassurance, information and training procedures for reducing anxiety, recommendations for diminishing fatigue and pain may be offered to the patient. However, for the development of such preoperative preparation more knowledge should be gathered about the nature of the relation of preoperative pain and fatigue to postoperative distress. In future studies, it will be interesting to further explore the nature of the relation between preoperative pain and postoperative anxiety in patients undergoing lumbar surgery. Investigating the relation between fatigue and physical complaints both, before and after surgery, may show whether fatigue is an independent predictor beyond such complaints. Studying fatigue as predictor of postoperative distress in patients undergoing other types of surgery may show whether the findings can be generalized to other types of surgical stress. Which coping behaviours influence postoperative anxiety and physical recovery remains an intriguing, but complicated question.

# Chapter 4

## Different aspects of anxiety as predictors of postoperative anxiety and physical complaints

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*(Personality and Individual Differences: in press)*

**Summary**

Previous studies have suggested that preoperative anxiety consists of different aspects each with its own specific influence on postoperative state. This study investigated the influence of different aspects of transient anxiety, i.e., state anxiety, specific anxiety, tension, observed anxiety and the amount of thinking about surgery, on postoperative anxiety and physical complaints in 126 patients undergoing lumbar surgery. Results showed that preoperative state anxiety, specific anxiety, tension and observed anxiety each contributed uniquely to the prediction of postoperative anxiety after control for age, sex and medical variables. Tension showed a negative contribution, indicating that, when the effects of other anxiety aspects were removed, patients with high tension showed less postoperative anxiety than patients with low tension. The three other anxiety variables showed a positive contribution. Regarding postoperative physical complaints, only specific anxiety showed a positive significant contribution to the prediction. Results will be discussed in relation to the adaptation to surgery and to Janis' theory that experiencing moderate levels of anxiety is beneficial for recovery.

## Introduction

Many individuals will experience surgery as a stressful life event. Patients often show a range of emotions such as anxiety, fear, anger, and sadness in the period before surgery, and they worry about anaesthesia and the effectiveness of surgery. Studies on surgical stress have shown that the experience of high levels of such emotions may not be harmless.

Spielberger, Gorsuch and Lushene (1970) distinguished state anxiety and trait anxiety. Trait anxiety is a personality disposition that remains relatively stable over time, whereas state anxiety is a transitory emotional state that varies in intensity and fluctuates over time (Spielberger et al., 1970). Temporary perioperative increases in anxiety have been the subject of many investigations, because of the relevance to preoperative interventions such as providing information and reassurance (Mathews & Ridgeway, 1981).

Preoperative transient anxiety is associated with higher levels of postoperative anxiety (Johnston, 1986; Johnston & Carpenter, 1980; Manyande & Salmon, 1992; Taenzer, Melzack & Jeans, 1986; Wallace, 1986; Wolfer & Davis, 1970) and with postoperative pain (Boeke, Duivenvoorden, Verhage & Zwaveling, 1991a; George, Scott, Turner & Gregg, 1980; Martelli, Auerbach, Alexander & Mercuri, 1987; Scott, Clum & Peoples, 1983; Ray & Fitzgibbon, 1981). In these studies, different aspects of anxiety were measured, such as state anxiety (Boeke et al., 1991a; Scott et al., 1983; Teanzer et al., 1986), anxiety specifically related to surgery (Boeke et al., 1991a; Janis, 1958; Scott et al., 1983), worries (Johnston & Carpenter, 1980), anxiety about recovery (George et al., 1980) and stress (Ray & Fitzgibbon, 1981).

Evidence suggests that these aspects may not represent the same underlying construct of transient anxiety, but rather different aspects with each its own particular effect on postoperative state. Boeke et al. (1991a) found, after controlling for medical and biographic variables and the level of anxiety three days after surgery, that preoperative state anxiety was associated with shorter hospital stay, but preoperative specific anxiety

with a longer stay. Davey, Hampton, Farrell and Davidson (1992) showed that worrying differed from general anxiety in students. Worrying was associated with adaptive problem-focused coping strategies, general anxiety with less adaptive outcomes such as poor problem-solving confidence. Salmon (1992) also separates worry and anxiety, and suggests that worry could have an adaptive function in preparing a person to face the threat of surgery, thereby reducing the stressfulness of the event. Thus, some aspects such as general or specific anxiety may be detrimental for recovery, whereas worrying or concern about surgery appear to be adaptive or at least do not hamper recovery. No study, so far, has investigated several different aspects of transient anxiety at the same time.

Differences in aspects of transient anxiety may be relevant in the light of Janis' (1958) theory on surgical stress, which proposed that preparatory worry, the "work of worrying", is beneficial for recovery. Such worrying would provide the patient with accurate expectations of pain and discomfort, so preventing postoperative distress and disappointment. Janis assumed that moderate anxiety would lead to this preparatory worry. Patients experiencing little preoperative anxiety would not be motivated to worry, whereas those with high anxiety would be engaged in too many worries unrelated to surgery. The assumption that moderate levels of anxiety are adaptive for recovery, and low and high levels of anxiety detrimental, is known as the curvilinear association. However, subsequent research has not been able to confirm this (Johnson, Leventhal & Dabbs, 1971; Johnston, 1986; Johnston & Carpenter, 1980; Wallace, 1986). Possibly, a particular aspect of transient anxiety is adaptive rather than a particular level of anxiety.

Knowledge about the aspects of transient anxiety that are associated with postoperative state is also important for the implementation of interventions aimed at reducing preoperative anxiety and its effects on recovery. Intervention should be aimed only at those aspects of transient anxiety that are clearly associated with poorer postoperative state.

Examination of the methodologies of previous studies on preoperative anxiety suggests that at least two issues should be taken into account. Firstly, previous research (Boeke et al., 1991a; George et al., 1980) has indicated that variables like the medical history, age and sex may represent serious confounders of the relation between pre- and postoperative anxiety. Our results were, therefore, controlled for several medical variables, age and sex. Secondly, Johnston (1986) and Salmon (1992) have emphasized that postoperative recovery is multidimensional and that the choice of outcome measure is crucial for establishing a relation between pre- and postoperative state. In the present study, two measures of postoperative distress were studied, i.e., postoperative state anxiety and stress-related physical complaints.

The aim of the present study was to investigate which preoperative aspects of transient anxiety are associated with postoperative anxiety and physical complaints with and without control for medical variables, age and sex. In addition, we investigated which preoperative aspects also have a unique contribution to the prediction of postoperative state after controlling for medical variables, age, sex and the other preoperative anxiety aspects.

## Method

### *Patients*

Participants were 126 consenting patients (*M* age = 44 years; *SD* = 12.5; range 20 to 77) undergoing lumbar surgery at the neurosurgical department of St. Clara's Hospital Rotterdam. There were 68 men and 58 women. Diagnoses of patients were lumbar disc herniation (*N* = 104; *M* age = 41 years; *SD* = 10.6; range 20 to 74), lumbar canal stenosis, (*N* = 19; *M* age = 59 years; *SD* = 11.8; range 37 to 77), extraforaminal disc herniation (*N* = 2) and familial narrow spinal canal (*N* = 1). Patients with a lumbar disc herniation underwent lumbar disc surgery (*N* = 106). The other patients underwent surgery for lumbar canal stenosis (*N* = 20). Fifteen patients

underwent lumbar surgery for a second time. Patients who had other serious disorders, were above 80 years, or were not fluent in Dutch were left out. Permission for inclusion into the study was asked of 135 patients, five of whom refused. Four more patients were excluded, because they filled out too few questionnaires.

*Procedure*

Patients admitted to the hospital for lumbar surgery on a particular day of the week were studied during an 18-month period. All surgeries were performed by the same neurosurgeon. The hospital staff informed patients about the study on the day before surgery. After having obtained consent, the investigator (first author) carried out the first assessment. Next, biographic and medical variables were collected from the medical files. On the same day, the hospital staff independently rated the patients' anxiety. On the third day after surgery, the postoperative assessment was carried out. The study was approved by the medical ethics committee of St. Clara's Hospital Rotterdam.

*Preoperative assessment*

*Biographic and medical variables*. Information was obtained regarding age, sex, severity of disorder, type and duration of surgery, prior lumbar surgery, number of analgesics used, number of types of pain medication used, and overweight (Quetelet-index: weight/squared length, Passmore & Eastwood, 1986). The neurosurgeon rated the severity of the disorder on a 4-point rating scale ranging from "not severe" (1) to "very severe" (4).

*Aspects of transient anxiety*. Because we were interested in anxiety that could be changed by intervention, only state measures of anxiety were studied. These measures may in part overlap with each other, but may, nevertheless, have their own specific effect on postoperative state.

*State Anxiety*. Patients completed the State version of the State-Trait Anxiety Inventory (STAI; Dutch translation by van der Ploeg, Defares & Spielberger, 1980), which is the most common measure of the general transitory emotional state that varies

in intensity and fluctuates over time (Spielberger et al., 1970). This 20-item scale is widely used in research, and reliability and validity are satisfactory. It consists of 10 negative items that directly assess anxiety and 10 positive items that assess comfort or well-being. More agreement with the negative items and more disagreement with the positive items indicates higher levels of anxiety (Bonke, Smorenburg, van der Ent & Spielberger, 1987).

*Specific anxiety*. A 9-item measure of specific anxiety with a 5-point rating scale was developed, based on Janis (1958), Johnson et al. (1971) and Boeke (1988). It consists of questions concerning worries about surgery and anaesthesia, and about difficulties in concentrating (Appendix 4-1). These items may be regarded as cognitive indications of anxiety. Internal consistency of this scale was .78.

*Tension*. Patients filled in a validated, shortened, Dutch version of the Profile of Mood States (POMS; Wald & Mellenbergh, 1990), measuring five mood states, i.e., depression, tension, anger, fatigue and vigour. Only the subscale tension was used because its items resembled the stress-items reported in Ray and Fitzgibbon (1981). It measures an emotional response to threat, i.e., nervousness, but no cognitive indications of anxiety.

*Amount of thinking about surgery*. In an interview the patient was asked whether he or she had been thinking a great deal about surgery in the week before admission. The interviewer rated the answer on a 3-point rating scale: "no, not much";"yes, but not very much"; "yes, a great deal". We assumed this to be a more neutral question than questions about worries, which might yield information about adaptive concerns and preparation before surgery.

*Observed anxiety*. The hospital staff answered the question: "how anxious do you think this patient is regarding surgery"? The answer was given on a 3-point rating scale: "low", "moderate", or "high". The patient's state was assessed by one person, usually the nurse who had informed the patient about the study.

*Postoperative Assessment*

*State anxiety.* The STAI was again administered three days after surgery.

*Physical complaints.* Two scales of the Symptom Checklist-90 (SCL-90; Dutch translation, Arrindell & Ettema, 1986), i.e., bodily complaints (e.g., headache, dizziness, or nausea) and sleep, consisting of 12 and 3 items, respectively, were used to assess physical complaints during the days after surgery. This 15-item scale had an internal consistency of .81. This list was chosen because the items measure physical reactions to anxiety that could be expected to be aggravated most, if anxiety plays a role in physical recovery.

*Data Analysis*

Seven patients had skipped one or two questionnaires. The judgement of anxiety by the hospital staff was lacking in 11 cases. Eight patients were not interviewed. We used predicted mean matching (Little, 1988) for substituting these missing data.

Firstly, correlations were calculated among the preoperative aspects of anxiety. Secondly, regression coefficients ($\beta$s) were used to determine simple associations and associations between pre- and postoperative variables controlled for medical variables, age and sex. To control for medical variables, we first estimated with regression analysis the extent to which seven medical variables were related to the two outcome measures. These were severity of disorder, type of surgery, first or second operation, duration of surgery, overweight, amount of pain medication, and number of types of pain medication. Using backward elimination, variables with $p > .30$ were excluded. A critical $p$-value of .30 was chosen because small but nonsignificant differences might nevertheless confound a relation. This procedure yielded a prediction score for each outcome measure, which was used as medical confounder score in subsequent analyses (Miettinen, 1985).

Lastly, to determine which aspects of anxiety had a unique contribution to predicting postoperative anxiety and physical complaints beyond the medical confounder score, sex and age, the control variables and anxiety variables were entered into a multiple

regression equation. Anxiety variables with regression coefficients showing a $p < .05$ were regarded as significantly contributing to the prediction.

## Results

*Descriptives and associations among preoperative anxiety variables and postoperative variables*

Table 4-1 shows means and standard deviations of the preoperative anxiety aspects and the postoperative variables. State anxiety diminished significantly from pre- to postsurgery ($t(125) = 9.36, p < .001$). Table 4-2 shows the intercorrelations among the preoperative anxiety aspects. State anxiety, specific anxiety and tension were highly intercorrelated. The correlations with observed anxiety and amount of thinking were somewhat lower, but still significant.

*Table 4-1. Means and standard deviations of preoperative anxiety aspects and postoperative variables*

| Variable | *M* | *SD* |
|---|---|---|
| *Preoperatively* | | |
| State anxiety | 43.9 | 12.3 |
| Specific anxiety | 23.8 | 7.3 |
| Tension | 13.3 | 5.5 |
| Amount of thinking | 2.0 | 0.9 |
| Observed anxiety | 1.4 | 0.6 |
| *Postoperatively* | | |
| State anxiety | 33.6 | 9.6 |
| Physical complaints | 35.9 | 9.6 |

*Table 4-2. Correlations among preoperative anxiety aspects*

| Preoperative Variable | State anxiety | Specific anxiety | Tension | Amount of thinking |
|---|---|---|---|---|
| State anxiety | - | | | |
| Specific anxiety | .74 | - | | |
| Tension | .78 | .74 | - | |
| Amount of thinking | .43 | .43 | .50 | - |
| Observed anxiety | .45 | .44 | .53 | .21 |

*Note.* All correlations were significant at $p < .05$ (two-tailed).

Table 4-3 displays the associations between the aspects of preoperative anxiety, postoperative anxiety and postoperative physical complaints with and without control for age, sex, and the medical confounder score. The simple associations show that all aspects were positively related to postoperative anxiety and physical complaints. After control for age, sex, and the medical confounder score, most anxiety aspects were still significantly associated.

*Table 4-3. Standardized regression coefficients for associations between preoperative anxiety aspects and postoperative variables with and without control for age, sex and medical confounder score*

| Preoperative variable | Postoperative anxiety | | Physical complaints | |
|---|---|---|---|---|
| | $\beta^a$ | $\beta^b$ | $\beta^a$ | $\beta^b$ |
| State anxiety | .42** | .37** | .37** | .27** |
| Specific anxiety | .43** | .39** | .41** | .32** |
| Tension | .28** | .22* | .28** | .17 |
| Amount of thinking | .20* | .10 | .22* | .15 |
| Observed anxiety | .49** | .28** | .27** | .18* |

[a]uncontrolled. [b]controlled for age, sex and medical confounder score.
*$p < .05$, **$p < .01$.

*Unique contributions of anxiety aspects in predicting postoperative variables*

To investigate whether different aspects of anxiety were independent in explaining variance in postoperative variables, unique contributions were calculated. Although the anxiety aspects were interrelated, no problem of multicollinearity arose (the Variance Inflation Factors (VIF) in all analyses were < 3.2 while a VIF exceeding 10 is believed to be of concern (Stevens, 1992)).

Preoperative state anxiety, specific anxiety, tension, and observed anxiety each contributed uniquely to the prediction of postoperative anxiety after control (Table 4-4). Tension showed a negative contribution, whereas the other three aspects contributed positively. This indicates, for example, that patients with high state anxiety, specific anxiety and observed anxiety had more postoperative anxiety than those with high state anxiety, but lower specific or observed anxiety. Furthermore, patients scoring high on these three aspects of anxiety, but low on tension reported higher postoperative anxiety than patients with high scores on all four anxiety aspects.

*Table 4-4. Unique contributions of preoperative anxiety aspects to predicting postoperative anxiety and physical complaints*

| | Postoperative anxiety[a] | | Physical complaints[b] | |
|---|---|---|---|---|
| Preoperative variable | $\beta$ | $p$-value | $\beta$ | $p$-value |
| State anxiety | .31 | .02 | .16 | .26 |
| Specific anxiety | .35 | .003 | .33 | .01 |
| Tension | -.36 | .01 | -.26 | .08 |
| Amount of thinking | -.02 | .80 | -.05 | .60 |
| Observed anxiety | .20 | .03 | .11 | .27 |

*Note.* Age, sex, the medical confounder score and all preoperative anxiety variables were entered as independent variables in the equation.

[a]Multiple $R = 0.61$, $R^2 = 0.37$, $F = 8.89$, $p < .0001$.

[b]Multiple $R = 0.51$, $R^2 = 0.26$, $F = 5.27$, $p < .0001$.

Regarding physical complaints, only specific anxiety showed a significant unique contribution to the prediction (Table 4-4). There was a trend for a negative contribution of tension to predicting physical complaints.

## Discussion

Our study shows that, after controlling for sex, age, and medical variables, state anxiety, specific anxiety, and observed anxiety were all positively associated with postoperative anxiety and physical complaints. This is in line with previous findings concerning the relation between pre- and postoperative anxiety and pain. Three aspects of preoperative anxiety were also related to physical complaints, which does not correspond with previous studies that found no associations with postoperative indices of recovery such as energy, appetite, stomach condition, bowel condition and urination (Johnston & Carpenter, 1980; Wallace, 1986; Wolfer & Davis, 1970). Presumably, preoperative anxiety is associated with those postoperative physical complaints that are related to distress, such as dizziness, nausea and headache, but not with the more general physical indices of recovery.

Our study showed that four aspects of anxiety each had a unique effect on postoperative anxiety. One of these, specific anxiety, predicted physical complaints beyond the other anxiety aspects. Watson and Clark (1992) suggested that the component that is common in different emotion variables, explaining the same variance in emotional state or somatic complaints, is a nonspecific factor called Negative Affect, reflecting the strong influence of hedonic tone, i.e., whether the experience is negative or positive. However, they also stated that "... this nonspecificity coexists with specific variance that represents the unique contributions of different types of item content" (Watson & Clark, 1992, p. 499). The unique contributions in our study show that some anxiety aspects differ indeed, having a specific effect on postoperative state beyond the nonspecific effect common in all anxiety aspects. Specific anxiety had a specific

effect on both measures of postoperative distress. This variable seems, therefore, the best predictor of postoperative distress.

Amount of thinking about surgery (assumed to be an indication of adaptive worry or preparation before surgery) was the only variable that showed no unique contribution. Our expectation that this variable would be negatively associated with poor postoperative state was not confirmed. Furthermore, it showed a positive association with all other preoperative aspects of anxiety. Thus, the amount of thinking is higher in anxious patients, but this has no separate predictive value for postoperative state.

Regarding observed anxiety, previous studies have reported a similar moderate correlation ($r = .45$) with subjective measures of preoperative anxiety as in our study (Badner, Nielson, Munk, Kwiatkowska & Gelb, 1990; Cohen & Lazarus, 1973). The present study shows that this assessment of the patient's anxiety is also associated with postoperative anxiety and physical complaints, even after controlling for differences in sex, age, and medical variables. This suggests that a clinical judgement of anxiety is of value when assessing patients at risk of poor recovery.

The finding that tension showed a low positive simple association with postoperative anxiety and also a negative unique contribution to postoperative anxiety has been described under the phenomenon of suppression. Some researchers in other research areas have reported similar findings. For example, Watson and Clark (1992) found in a study on the relations between several affects and somatic complaints that hostility had a simple positive correlation with somatic complaints, but a negative partial correlation. A classic explanation for the phenomenon has been that the suppression variable correlates with a component of another independent variable that is irrelevant for the prediction (Wiggins, 1973). This irrelevant component is subtracted out of the prediction equation by the suppressor variable, providing a more accurate prediction. Cohen and Cohen (1983) suggested that the component that is subtracted out need not be irrelevant, but one of two counteractive forces. According to them, suppression is a plausible model for many biological or social homeostatic mechanisms, in which

force and counterforce tend to occur together and have counteractive effects. Applied to our results, this suggests that anxiety consists of aspects that are counteractive: There may be a strong negative influence of anxiety on postoperative anxiety because of the stress that is involved; at the same time, however, there may be a beneficial influence because cognitively anxious patients who also feel nervous or tense may better prepare themselves for surgery than cognitively anxious patients who experience low tension. It is also possible that patients who are cognitively anxious and tense experience more relief after surgery than anxious patients who are less tense.

The suggestion that experiencing tension is beneficial partly supports Janis' (1958) theory that moderate anxiety has an adaptive function in preparing the patient to overcome surgical stress. A suppression model of the influence of anxiety on postoperative emotional state may be a better model to describe this influence than a curvilinear association. The model may bring together two different views of anxiety: 1) anxiety as a state of passive distress that constitutes merely an undesirable and unhelpful response to threat; and 2) anxiety as a mental process with an important function in preparing the person to face threat (Salmon, 1993). However, the model should be replicated before any conclusion can be drawn on the adaptiveness of particular aspects of anxiety. Furthermore, whether tension increased the motivation to anticipate future events with subsequent lower levels of anxiety or whether tense patients just experienced more relief after surgery, which in turn lowered the level of postoperative anxiety, remained unclear.

We were surprised that even state anxiety showed a unique contribution to the prediction of postoperative anxiety, because some of the STAI-items correspond with items of specific anxiety and others with items of tension. Possibly, the 10 items of the STAI assessing comfort rather than anxiety accounted for the uniquely explained variance.

Regarding the adaptation to surgery, our results suggest that interventions should be aimed at a reduction of preoperative state anxiety, worries, concentration difficulties, and observed anxiety while at the same time providing opportunity for

experiencing tension. Presumably, emotional support as suggested by Salmon (1993) that enables patients to disclose their fears and to experience concomitant tension may reduce unproductive worries as well as encourage patients to face the threat of surgery.

Our study focused on transient anxiety and not on trait anxiety. Nevertheless, measuring trait anxiety may be of value in assessing the origin of raised levels of transient anxiety. Patients with high trait anxiety may respond to stressful situations with stronger emotional reactions than those with little trait anxiety. Also, trait anxiety may be a predictor of high transient anxiety on the day before surgery (Mathews & Ridgeway, 1981) and may thus identify patients who need extra care. Boeke, Duivenvoorden and Bonke (1984) have shown that the measurement of trait anxiety on the day before surgery may not be valid because scores on trait-measures are affected by surgical stress and thus may measure state rather than trait anxiety at that time. Thus, to minimize confounding between state and trait anxiety, trait anxiety should be measured at a less stressful point in time, for instance some weeks before surgery.

In future studies, the role of different aspects of transient anxiety needs to be further explored. The structure of each anxiety aspect may be further established using questionnaires that make separate assessments of worries, concentration problems, comfort and tension, instead of questionnaires with mixed items. Future research may also investigate other indications of the adaptiveness of anxiety and preparatory worry. Investigating the relation between aspects of anxiety and coping behaviour may establish whether differences in coping exist between patients with high state and specific anxiety, but different levels of tension.

*Appendix 4-1. Questionnaire assessing specific anxiety for surgery*

Please read each statement carefully. Circle one of the five numbers next to each statement to indicate what best applies to you *today*.

| | No definitely not | | | | Yes definitely |
|---|---|---|---|---|---|
| 1. Are you concerned about your disorder? | 1 | 2 | 3 | 4 | 5 |
| 2. Do you worry about the operation? | 1 | 2 | 3 | 4 | 5 |
| 3. Do you worry about the anaesthesia? | 1 | 2 | 3 | 4 | 5 |
| 4. The hours creep by | 1 | 2 | 3 | 4 | 5 |
| 5. Are you easily distracted? | 1 | 2 | 3 | 4 | 5 |
| 6. Are you able to concentrate (when reading for instance)? | 1 | 2 | 3 | 4 | 5 |
| 7. I face the prospect of surgery with confidence | 1 | 2 | 3 | 4 | 5 |
| 8. I dread the prospect of surgery | 1 | 2 | 3 | 4 | 5 |
| 9. I have difficulty to collect my thoughts | 1 | 2 | 3 | 4 | 5 |

# Chapter 5

## Anxiety aspects as predictors of postoperative anxiety and physical complaints in patients undergoing different types of surgery

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*(submitted)*

**Summary**

Previous studies have suggested that preoperative transient anxiety consists of different aspects, each with its own specific influence on postoperative state. This study investigated the influence of four aspects of transient anxiety, i.e., state anxiety, specific anxiety, tension, and the amount of thinking about surgery, on postoperative anxiety and physical complaints in 60 patients undergoing different types of surgery. Results showed that each preoperative anxiety aspect was associated with more postoperative anxiety after controlling for age and sex. Two aspects, tension and amount of thinking about surgery, were also associated with more physical complaints after controlling for age and sex. However, none of the anxiety aspects showed a unique contribution to predicting the postoperative variables beyond the other anxiety aspects. The results suggest that preoperative anxiety generally affects postoperative state unfavourably in patients undergoing different types of surgery, but that different aspects of preoperative anxiety have no specific effects in such a mixed patient group.

## Introduction

Many individuals experience surgery as a stressful and anxious event. Patients often feel tense, uneasy and sometimes even confused, and they worry about anaesthesia and the effectiveness of surgery. Studies on surgical stress have shown that the experience of high levels of state anxiety before surgery may not be harmless. Preoperative transient anxiety is associated with higher levels of postoperative anxiety (Johnston, 1986; Johnston & Carpenter, 1980; Manyande & Salmon, 1992; Taenzer, Melzack & Jeans, 1986; Wallace, 1986; Wolfer & Davis, 1970) and with postoperative pain (Boeke, Duivenvoorden, Verhage & Zwaveling, 1991a; George, Scott, Turner & Gregg, 1980; Martelli, Auerbach, Alexander & Mercuri, 1987; Ray & Fitzgibbon, 1981; Scott, Clum & Peoples, 1983).

In these studies, different aspects of transient anxiety were measured, such as state anxiety (Boeke et al., 1991a; Scott et al., 1983; Taenzer et al., 1986), specific anxiety for surgery (Boeke et al., 1991a; Janis, 1958; Scott et al., 1983), worries (Johnston & Carpenter, 1980), anxiety about recovery (George et al., 1980) and stress (Ray & Fitzgibbon, 1981). Conceptually, these aspects differ from each other slightly. State anxiety is an unpleasant emotional state characterized by subjective feelings of tension, apprehension, and worry, and by activation or arousal of the autonomic nervous system (Spielberger, 1972). Specific anxiety and worries concern the anxiety associated with hospitalization and surgery (Johnston & Carpenter, 1980). Worries captures a more specific and more cognitive process than does the relatively broad construct of anxiety (Mathews, 1990). Finally, stress is the individual's emotional rather than cognitive response to the perception of threat (Ray & Fitzgibbon, 1981).

Evidence suggests that these aspects may not represent the same underlying construct of transient anxiety, but rather different aspects each with its own particular effect on postoperative state. Boeke et al. (1991a) found that, after controlling for medical and biographic variables and anxiety three days after surgery, preoperative state anxiety was associated with a shorter hospital stay than average, but preoperative specific

stay than average. Davey, Hampton, Farrell and Davidson (1992) showed that worrying differed from general anxiety in students. Worrying was associated with adaptive problem-focused coping strategies, and general anxiety with less adaptive outcomes such as poor problem-solving confidence. Furthermore, a study that investigated the influence of different aspects of anxiety on postoperative state (de Groot, Boeke, Duivenvoorden, Bonke & Passchier, chapter 4) found that state anxiety and specific anxiety were positively and tension (or stress, the emotional response to surgery) was negatively associated with postoperative anxiety after control for biographic, medical variables, and other preoperative anxiety aspects. This suggested that experiencing tension might have a beneficial rather than a detrimental effect on postoperative state. The finding supports Janis' theory (1958) that moderate anxiety has an adaptive function in preparing the patient to overcome surgical stress.

Knowledge about the aspects of anxiety that are associated with poorer postoperative state is important to the implementation of interventions reducing anxiety before surgery aimed at improving recovery. Intervention should be aimed only at those aspects of transient anxiety that are clearly associated with poorer postoperative state.

In the study of de Groot et al. (chapter 4) differential effects of anxiety aspects on postoperative anxiety and stress-related physical complaints were found in a sample of patients undergoing lumbar surgery. The aim of the present study was to investigate whether these findings could be extrapolated to patients undergoing diverse types of operations.

## Method

### *Patients*

Participants were 60 consenting patients (*M* age = 44 years; *SD* = 12.6; range 20 to 66) undergoing elective surgery at different departments of a local hospital. There were 30 men and 30 women. They underwent neurosurgery (lumbar disc surgery,

$N$ = 31; lumbar surgery for canal stenosis, $N$ = 2); abdominal surgery (gynaecological surgery, $N$ = 8; cholecystectomy, $N$ = 3); operations for laying open of anal fistulae, $N$ = 3; or other surgical procedures such as plastic surgery, scar correction, surgery because of hernia inguinalis or umbilical hernia, $N$ = 13. Seventy-seven percent of the patients ($N$ = 46) had had previous surgery. Patients who also had other serious disorders, who were over 70 years old, or who were not fluent in Dutch were not included. In total, 69 patients were asked whether they would participate; seven of them refused. Two more patients were excluded from the analyses because they were discharged from hospital too early and did not fill out the postoperative questionnaires.

*Procedure*

During a 5-month period, patients admitted to the hospital for surgery on two particular days of the week were asked to participate. After obtaining consent, the investigator (second author) carried out the first assessment. On the third day after surgery, the postoperative assessment was carried out and the medical variables were collected from the medical files. The study was approved by the medical ethics committee of St. Clara's Hospital Rotterdam.

*Preoperative assessment*

*Biographic and medical variables.* Information was obtained regarding age, sex, type of surgery, prior surgery, and number of analgesics used as had been recorded on the patient's chart by the nurse.

*Anxiety aspects.* Four subjective preoperative aspects of transient anxiety, i.e., state anxiety, specific anxiety, tension, and amount of thinking about surgery, were studied. We did not measure trait anxiety in our study because scores on trait anxiety may be confounded by state anxiety when measured on the day before surgery (Boeke, Duivenvoorden & Bonke, 1984). The measurement of trait anxiety weeks before or after surgery was beyond the scope of the present study.

*State Anxiety.* Patients completed the State version of the State-Trait Anxiety Inventory (STAI; Dutch translation by van der Ploeg, Defares & Spielberger, 1980), which measures a general transitory emotional state that varies in intensity and fluctuates over time (Spielberger, Gorsuch & Lushene, 1970). This 20-item scale is widely used in research, and reliability and validity are satisfactory. It consists of 10 negative items that directly assess anxiety and 10 positive items that assess comfort or well-being. More agreement with the negative items and more disagreement with the positive items indicate higher levels of anxiety (Bonke, Smorenburg, van der Ent & Spielberger, 1987).

*Specific anxiety.* A 9-item measure of specific anxiety with a 5-point rating scale (de Groot et al., chapter 4), which was based on questions selected by Janis (1958), Johnson, Leventhal and Dabbs (1971) and Boeke (1988) was used. It consists of questions concerning worries about surgery and anaesthesia, and about difficulties in concentrating. These items may be regarded as cognitive indications of anxiety. Internal consistency of this scale was .85.

*Tension.* Patients filled in a validated, shortened, Dutch version of the Profile of Mood States (POMS; Wald & Mellenbergh, 1990). The subscale tension was used because its items resemble the stress-items used by Ray and Fitzgibbon (1981). It measures an emotional response to threat such as nervousness, but no cognitive indications of anxiety.

*Amount of thinking about surgery.* In an interview the patient was asked whether he or she had been thinking a great deal about surgery in the week before admission. The interviewer rated the answer on a 3-point rating scale: "no, not much" (1); "yes, but not very much" (2); "yes, a great deal" (3).

*Postoperative Assessment*

*State anxiety.* The state version of the STAI was again administered three days after surgery.

*Physical complaints.* One scale of the Symptom Checklist-90 (SCL-90; Dutch translation, Arrindell & Ettema, 1986), i.e., bodily complaints (e.g., headache, dizziness, or nausea), which consists of 12 items, was used to assess physical complaints during the days after surgery. This scale had an internal consistency of .75.

*Data Analysis*

To control for biographic and medical variables, we assessed the extent to which five variables were related to the postoperative variables. These were sex, age, type of surgery (scored dichotomously as neurosurgery or other surgical procedure), reoperation (scored dichotomously as had a previous operation or not), and amount of pain medication intake. Sex showed associations with postoperative anxiety ($r$ = .27, $p < .05$) and physical complaints ($r$ = .22, $p < .10$). Age was associated with postoperative anxiety ($r$ = -.22, $p < .10$). The medical variables were not associated with the outcome variables. Associations were, therefore, controlled for sex and age only.

Correlations were calculated among the preoperative aspects of anxiety. Next, regression coefficients ($\beta$s) were used to determine simple associations between pre- and postoperative variables and associations controlled for age and sex. Lastly, to determine which aspects of anxiety had a unique contribution to predicting postoperative anxiety and physical complaints beyond sex, age, and the other anxiety aspects, the control variables and anxiety variables were entered into a multiple regression equation. Anxiety variables with regression coefficients showing a $p < .05$ were regarded as significantly contributing to the prediction.

## Results

*Descriptives and associations among preoperative anxiety variables and postoperative variables*

Table 5-1 shows means and standard deviations of the preoperative anxiety aspects and the postoperative variables. State anxiety diminished significantly from pre- to postsurgery ($t(59) = 7.89, p < .001$).

*Table 5-1. Means and standard deviations of preoperative anxiety aspects and postoperative variables (N = 60)*

| Variable | *M* | *SD* |
|---|---|---|
| *Preoperatively* | | |
| State anxiety | 44.7 | 12.6 |
| Specific anxiety | 22.6 | 9.0 |
| Tension | 13.1 | 6.0 |
| Amount of thinking | 2.2 | .8 |
| *Postoperatively* | | |
| State anxiety | 33.5 | 9.6 |
| Physical complaints | 27.7 | 8.3 |

Table 5-2 shows the intercorrelations among the preoperative anxiety aspects. State anxiety, specific anxiety, tension and amount of thinking were highly intercorrelated.

Table 5-3 displays the associations between the aspects of preoperative anxiety, postoperative anxiety and postoperative physical complaints with and without control for age and sex. All anxiety aspects were positively related to postoperative anxiety before and after control. Three of the four anxiety aspects showed a modest, but significant association with postoperative physical complaints. After control for age and sex, the association between preoperative state anxiety and postoperative physical complaints appeared to be nonsignificant, but still showed a trend with $p < .10$.

*Table 5-2. Correlations among preoperative anxiety aspects (N = 60)*

| Preoperative Variable | State anxiety | Specific anxiety | Tension |
|---|---|---|---|
| State anxiety | - | | |
| Specific anxiety | .77 | - | |
| Tension | .75 | .81 | - |
| Amount of thinking | .62 | .57 | .60 |

*Note.* All correlations were significant at $p < .05$ (two-tailed).

*Table 5-3. Standardized regression coefficients for associations between preoperative anxiety aspects and postoperative variables with and without control for age and sex (N = 60)*

| Preoperative Variable | Postoperative anxiety | | Physical complaints | |
|---|---|---|---|---|
| | $\beta^a$ | $\beta^b$ | $\beta^a$ | $\beta^b$ |
| State anxiety | .62** | .57** | .28* | .25 |
| Specific anxiety | .63** | .59** | .25 | .24 |
| Tension | .59** | .55** | .27* | .27* |
| Amount of thinking | .43** | .36** | .29* | .28* |

[a]uncontrolled.

[b]controlled for age and sex.

*$p < .05$, **$p < .01$.

*Unique contributions of anxiety aspects in predicting postoperative variables*

To investigate whether different aspects of anxiety were independent in explaining variance in postoperative variables, unique contributions were calculated. Although the anxiety aspects were interrelated, no problem of multicollinearity arose. The Variance Inflation Factors (VIF) in all analyses were < 3.2 while a VIF exceeding 10 is believed to be of concern (Stevens, 1992).

None of the anxiety aspects uniquely predicted postoperative anxiety or physical complaints, beyond age, sex, and the other anxiety aspects (Table 5-4).

*Table 5-4. Unique contributions of preoperative anxiety aspects to predicting postoperative anxiety and physical complaints (N = 60)*

| | Postoperative anxiety[a] | | Physical complaints[b] | |
|---|---|---|---|---|
| Preoperative Variable | $\beta$ | $p$-value | $\beta$ | $p$-value |
| State anxiety | .19 | .29 | .06 | .79 |
| Specific anxiety | .33 | .08 | .00 | .99 |
| Tension | .16 | .39 | .12 | .56 |
| Amount of thinking | -.01 | .95 | .16 | .35 |

*Note.* Age, sex and all preoperative anxiety variables were entered as independent variables in the equation.
[a]Multiple $R = 0.69$, $R^2 = 0.48$, $F = 8.22$, $p < .0001$.
[b]Multiple $R = 0.37$, $R^2 = 0.14$, $F = 1.38$, $p = 0.24$.

## Discussion

The results show that, after control for sex and age, all anxiety aspects were positively associated with postoperative anxiety in patients undergoing different types of surgery. This is in line with previous findings concerning the relation between pre- and postoperative anxiety. Only two aspects of preoperative anxiety, tension and amount of thinking, were also related to physical complaints, but these associations were rather low. These findings are in line with previous findings of low, nonsignificant associations with postoperative indices of recovery such as energy, appetite, stomach condition, bowel condition, and urination (Johnston & Carpenter, 1980; Wallace, 1986; Wolfer & Davis, 1970). However, de Groot et al. (chapter 4) found a significant relation between state anxiety and postoperative physical complaints in

patients undergoing lumbar surgery. We conclude on basis of the present results that preoperative aspects of anxiety are related to postoperative physical complaints, but that these correlations are probably too low to be of value for predicting patients at risk of poor recovery.

Differences in place and severity of the physical injury due to different surgical procedures may have influenced the physical complaints after surgery, confounding the relation between preoperative anxiety and postoperative complaints. For example, patients who underwent gynaecological surgery may have had other postoperative physical complaints, related to the postoperative injury in their abdomen, than patients who underwent lumbar surgery with severe postoperative wound pain in the back or than patients who underwent a scar correction with only an external injury to the skin. Although we investigated postoperative physical complaints that are related to psychological and physiological stress and occur after several types of surgery, these nevertheless may have been influenced by the type of injury due to the surgical procedure.

Although the present study was designed to investigate patients undergoing diverse types of surgery, a relatively large group underwent lumbar surgery ($N = 33$). We, therefore, made a post-hoc analysis of the associations between preoperative anxiety aspects and postoperative variables in this subgroup. In line with the previous findings in lumbar surgery patients, all preoperative anxiety aspects were correlated with postoperative anxiety (with correlations ranging from $r = .45$ to $r = .69$, with $p < .01$), whereas preoperative specific anxiety was marginally related to physical complaints ($r = .31$, $p < .10$). However, the associations with physical complaints were smaller than the correlations found in the previous sample of patients undergoing lumbar surgery of de Groot et al. (chapter 4). In that study, 26% of the variance in postoperative complaints could be explained by the preoperative biographic, medical and anxiety variables, whereas in the present study, the percentage of explained variance of physical complaints in the sample of patients undergoing lumbar surgery was nonsignificant. These different results may be due to differences in the

circumstances under which the two studies took place. Due to a reorganization in the hospital, patients undergoing lumbar surgery were admitted to another surgical department and treated by another surgeon in the present study.

Also contrary to the study of de Groot et al. (chapter 4), none of the aspects of anxiety had a unique effect on postoperative anxiety, indicating that anxiety aspects that were associated with postoperative variables explained the same variance. Thus, the findings of de Groot et al. on specific effects of different anxiety effects could not be extrapolated to patients undergoing any type other of surgery. We also found no support for the assumption that any aspect of transient anxiety has a favourable influence on postoperative anxiety. Watson and Clark (1992) suggested that the component that is common in different emotion variables, explaining the same variance in emotional state or somatic complaints, is a nonspecific factor called Negative Affect. This factor reflects the strong influence of hedonic tone, i.e., whether the experience is negative or positive. It is also possible that the shared relation between preoperative anxiety aspects and postoperative anxiety was due to differences in trait anxiety between patients. However, results regarding trait anxiety are inconsistent (Kincey & Saltmore, 1990; Wallace, 1987). There is evidence that trait anxiety measured several weeks before surgery predicts levels of preoperative state anxiety, but trait anxiety had no associations with postoperative state anxiety or other outcome measures (Ho, Hashish, Salmon, Freeman & Harvey, 1988; Scott et al., 1983; Wallace, 1987; Wolfer & Davis, 1970). Taenzer et al. (1986), however, found that trait anxiety measured two weeks prior to surgery predicted postoperative anxiety, pain and analgesic intake. Future studies that measure aspects of transient anxiety the day before surgery as well as trait anxiety some weeks before or after surgery may show whether trait anxiety is important to explain the relation between pre- and postoperative transient anxiety.

Two reasons may account for the lack of specific effects of the transient anxiety aspects. Firstly, the great variety in medical status characteristics, such as the type and severity among the disorders, and medical history, may have confounded the results in this sample of patients. It was not possible to control for the severity of the disorder

as was done in our previous study (chapter 4), because there were no criteria to decide, for example, whether a gynaecological disorder is a more severe disorder than a lumbar disorder. We were also unable to adjust the results for the differential influence of the diverse types of surgery, because the groups of patients undergoing specific, similar operations were too small. Wacholder, McLauhglin, Silverman and Mandel (1992) warned that unmeasured or unknown confounders should have as little variability as possible in case-control studies because of the possible distortion of the estimation of an effect between patients groups. This may also be the case when searching for differential effects among subgroups of patients in a before-after design. Thus, specific effects may be more easily detected when the variability in medical status characteristics is relatively small.

A second reason may be that patients have made less distinction between the different questions about anxiety aspects than in the previous study on anxiety aspects (chapter 4). In that study, the questionnaires about anxiety were alternated with other types of questionnaires concerning pain and coping, whereas the present study consisted of anxiety questionnaires only. Possibly, the patients remembered their answers to similar questions more easily in the present study than in the former and filled in their previous answer rather than giving a fresh response to each question.

As regards the adaptation to surgery, the results suggest that interventions aimed at a reduction of the nonspecific factor common in the anxiety aspects may result in a better postoperative emotional state and, to a lesser extent, a better postoperative physical state. Furthermore, the association between amount of thinking about surgery in the week before the event and higher postoperative physical complaints suggests that such interventions should be carried out earlier than one day before surgery.

In future studies, the influence of different anxiety aspects may be established in more homogeneous patient groups, for example, in patients with comparable severe disorders and postoperative complaints undergoing abdominal surgery or orthopaedic surgery. Another possibility is to study the influence of anxiety aspects in a large heterogeneous sample consisting of homogeneous subsamples of around 60 patients

undergoing the same surgical procedure. In such a study, the nonspecific as well as specific effects of anxiety aspects may become apparent.

# Chapter 6

## Preoperative expectations of pain and recovery in relation to postoperative disappointment in patients undergoing lumbar surgery

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*(submitted)*

**Summary**

This study investigated the level of postoperative disappointment at three days and three months after surgery among groups of patients with different expectations of postoperative pain, rate of recovery, and return to work. One hundred and twenty patients undergoing lumbar surgery who suffered from pain in the leg and back were studied. Lumbar surgery is performed to reduce or even remove pain in the leg. However, patients often still experience pain in the leg in the week after surgery. The results showed that patients who expected to have no postoperative pain in the leg and back reported significantly less postoperative disappointment at three days and three months after surgery than patients with the expectation of having postoperative pain in the leg and back. No significant differences in postoperative disappointment were found among groups with different expectations of rate of recovery or of return to work. Implications of the results for the theory of mental preparation and for preoperative intervention strategies aimed at diminishing the stress of surgery are discussed.

## Introduction

It has been assumed that mental preparation and worry before surgery, through which patients get an accurate perception of future events, diminishes postoperative anxiety and disappointment. According to Janis (1958, p. 374), for being well prepared, "a patient needs relatively little of the informational and theoretical background of the scientific expert. Rather, the type of information that makes for successful inoculation is likely to be much more superficial descriptive material which conveys a concrete, personalized picture of the outstanding danger events as the person will actually perceive them". In an early investigation, Janis (1958) found that patients with low anxiety, which was assumed to be an indication of little preparation for surgery, showed more anger after surgery. However, this finding has been difficult to replicate. Several studies have found that low levels of preoperative anxiety are associated with low levels of postoperative anxiety (Johnston & Carpenter, 1980; Johnston, 1986; Manyande & Salmon, 1992; Taenzer, Melzack & Jeans, 1986; Wallace, 1986; Wolfer & Davis, 1970). In trying to find a group of patients with a lack of mental preparation, Johnston and Carpenter (1980) compared the preoperative level of anxiety and worries of patients who postoperatively showed high anger and moderate anger. They assumed that patients who were angry after surgery were not well prepared. However, they found no differences in preoperative anxiety or worries between these two groups. Another approach to establish that preparation is healthy has been to investigate coping behaviour prior to surgery. In this approach it was assumed that patients with avoidant behaviour would be less prepared and, therefore, would recover less well than patients with vigilant behaviour, because the latter would stimulate the working through of the threat of surgery (Cohen & Lazarus, 1973). However, avoidance was associated with good recovery (Cohen & Lazarus, 1973; George, Scott, Turner & Gregg, 1980; Kincey & Saltmore, 1990; Mathews & Ridgeway, 1981; Salmon, 1992). These results also contradict the idea that worry and mental preparation are beneficial for recovery.

A few studies have investigated a cognitive aspect of patients' preoperative state, i.e., expectations of surgery (Flood, Lorence, Ding, McPherson & Black, 1993; George et al., 1980; Johnston, 1981; Wallace, 1985). Expectations are beliefs about an event that will happen in the future. Patients who are mentally well prepared and seek information about surgery may develop more accurate expectations than patients who avoid thinking about surgery. Presumably, such expectations are a better indication of mental preparation than anxiety, worries or coping behaviour.

Janis (1958) assumed that if a stressful event produces more suffering than had been expected, the mood will tend to be dysphoric; If suffering is less than had been expected, the mood will tend to be euphoric. Especially a person's overoptimistic expectations and fantasies which remain uncorrected and hence increase the chance that they are not in line with the number of complaints that are actually experienced, increase the probability of disappointment or anger reactions. Johnson (1973) proposed that merely the accuracy of pain expectations about impending threat determines the intensity of the patients' emotional response. In this respect, patients who expect pain to be more or less intense than actually experienced would fare better if led to expect a more realistic level of pain. Wallace (1985) investigated how far patients' expectations regarding pain and symptoms influence subsequent reporting of pain and symptoms immediately after surgery. She investigated three different hypotheses concerning the relation between expectations and postoperative pain. Although the hypotheses seem to conflict, she, nevertheless, found support for all three of them. First, patients who expected pain to occur reported greater pain intensity and postoperative fear immediately after surgery than patients who did not hold such expectancies. This hypothesis was derived from studies of suggestions for the management of pain and 'clinical wisdom' that suggest that warning patients that they may experience pain may result in greater pain and distress. Secondly, in line with Johnson (1973), she found that the greater the discrepancy between expected and actual pain, the greater the experience of distress immediately after surgery. Thirdly, in accordance with Janis (1958), she found that patients who expected pain to be more

intense than it actually was reported being least distressed immediately after surgery. This is in line with the findings of Johnston (1981) that patients who experienced less pain than they had expected had the lowest surgical stress. A critical test between the second and the third hypotheses did not provide support for either hypothesis. In line with the first hypothesis of Wallace, George et al. (1980) found, in oral surgery patients, that expectations of a greater amount of pain were associated with higher levels of pain and slower healing in the week after surgery. Furthermore, Flood et al. (1993) found that more positive expectations of improvement were associated with higher reports of improvement of health after urological surgery at three, six and twelve months.

Most research into the influence of expectations on postoperative state have investigated postoperative distress, symptoms or actual pain. Relatively little attention has been paid to the relationship between preoperative expectations and postoperative disappointment. Disappointment is defined as failure to meet expectations, hopes or desires of a person. Thus, a possibility to check whether expectations are in accordance with postoperative experiences, is to ask patients about the fulfilment of their expectations in terms of disappointment.

The present study investigated the relation between preoperative expectations and postoperative disappointment at three days and three months after surgery in patients undergoing lumbar surgery. These patients suffer from pain in the leg and often from backache. Surgery is performed to reduce and even remove pain in the leg. Pain in the back is often also diminished but is less influenced by surgery. On the basis of the information patients read and hear from the medical staff, these patients may have formed expectations about the level of postoperative pain in the leg and back, about the rate of recovery and about returning to work. Such expectations may be an indication of how patients differ in preparing themselves for the upcoming event and resulting pain, and of the level of postoperative disappointment.

## Method

*Patients*

Participants were 120 consenting patients undergoing lumbar surgery in the neurosurgical department of a local hospital. All patients participated in a larger investigation on the influence of biographic, medical and psychological variables on postoperative recovery that will be reported elsewhere. The sample comprised 66 men and 54 women. Ages ranged from 20 to 77 ($M$ = 43.8). Surgeries performed were lumbar disc surgery ($N$ = 101) and surgery for lumbar canal stenosis ($N$ = 19). Fourteen patients underwent lumbar surgery for the second time. Patients who had other severe diseases, were above 80 years, or were not fluent in Dutch were not included. Permission for inclusion in the study was asked of 135 patients, five of whom refused. Ten participants were excluded from the analyses because they filled out too few questionnaires or were not interviewed. Thirteen of the 120 patients did not return the questionnaires after three months.

*Procedure*

Patients admitted to the hospital for lumbar surgery on a particular day of the week were studied during an 18-month period. All surgeries were performed by the same neurosurgeon. At the outpatient clinic, when the decision to operate was taken, patients were informed about the procedure in the hospital, the surgical procedure, and the mobilisation programme after surgery. All patients received a booklet which described what they were able to do and when and what they would feel after surgery. The booklet informed patients when they could walk, sit and dress. Regarding pain, it was described that pain in the back would remain the same or get even worse because of wound pain. The pain in the leg would be gone, but some spasm or radiating pain in the leg could remain until some weeks after surgery. Furthermore, the neurosurgeon also explicitly told each patient that surgery was performed to diminish pain in the leg, but it would be likely that the pain in the back would remain even in the long run. The

neurosurgeon expected that, on average, patients would be able to return to work six weeks after surgery in the case of office work, and three months after surgery in case of heavy labour. This information was, however, not explicitly stated. The hospital staff informed patients about the study on the day before surgery. After having obtained consent, the investigator (first author) carried out the preoperative assessment. The patients filled in a booklet of questionnaires and were then interviewed about their expectations of postoperative pain and recovery from surgery. On the third day after surgery, the first postoperative assessment was carried out. After three months, a booklet of questionnaires was sent to the patients for the second postoperative assessment. The study was approved by the medical ethics committee of St. Clara's Hospital Rotterdam.

*Medical and biographic information obtained*

Information was obtained regarding age, sex, severity of disorder, type and duration of surgery, prior lumbar surgery, number of analgesics used, number of types of pain medication used, and overweight (Quetelet-index: weight/squared height, Passmore & Eastwood, 1986). The neurosurgeon rated the severity of the disorder on a 4-point rating scale ranging from *not severe* (1) to *very severe* (4). Furthermore, information was obtained regarding postoperative pain in the leg and back at three days and at three months after surgery. Patients rated intensity of postoperative pain in the leg and back on two 100 mm Visual Analogue Scales (VAS). The scale ranged from *no pain* to *unbearable pain*. This method is frequently used for measuring pain and reports of reliability and validity are satisfactory (Chapman, Casey, Dubner, Foley, Gracely & Reading, 1985; Price, McGrath, Rafii & Buckingham, 1983).

*Preoperative variables*

*Expectations of pain and recovery*. The expectations of patients about the period after surgery were assessed with a semi-structured interview. Three open questions were asked. 1. "Do you expect, knowing yourself, to recover faster, according to or slower

than is described in the booklet?" 2. "What do you think will happen with the pain in your leg and back after surgery?" 3. "When do you think that you will be able to work again?"

The answers were categorized into meaningful categories by the first author. This yielded five categories for expectations of rate of recovery and return to work, and four categories for expectations of pain. The categories for rate of recovery expectation were: 1. "expected recovery faster than the booklet described"; 2. "expected recovery at the same rate as the booklet described"; 3. "expected recovery slower than the booklet". 4. "will wait and see"; 5. "has no expectations". Three patients explicitly stated that they had not read the booklet. These patients were classified into group 5, because they also stated to have no expectations about recovery. The categories for expectations of postoperative pain were: 1. "expects to have no pain in the leg and back after surgery"; 2. "expects to have no pain in the leg after surgery, had no backache[3] before surgery"; 3. "expects to have no pain in the leg, while pain in the back will remain"; 4. "expects to still have some pain in the leg or spasm and backache after surgery". The categories for expectations of return to work were: 1. "return to work within two months"; 2. "return to work after 2 to 3 months"; 3. "return to work after three months or more"; 4. "will wait and see"; 5. "has no expectations about returning to work".

To assess reliability, three psychologists independently categorized the answers of 25% of the interviews into the formed categories. Cohen's kappa for agreement among the three raters ranged from .73 to .75 for expectations of rate of recovery; from .65 to .91 for expectations of pain; and from .66 to .75 for expectations of work. A kappa of .61 to .80 is regarded as substantial agreement, a kappa of .81 to 1.00 as almost perfect agreement (Landis & Koch, 1977).

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[3]This patient group is very much like patient group 1, except that they had no backache before surgery and, therefore, did not expect to get pain in the back after surgery. We distinguished this group from the others because results of lumbar surgery are known to be most successful in patients with no preoperative backache.

*Postoperative variable*

*Disappointment.* A questionnaire was developed to assess whether patients were disappointed after surgery. It consisted of 10 self-descriptive items with 4-point rating scales. Examples of items are presented in Appendix 6-1. Disappointment scores were computed by summing the scores for each item. Scores of six items referring to positive feelings were converted. Range of the scores was 10 to 40, with higher scores indicating more disappointment. Expectations of pain and recovery not only related to the immediate period after surgery, but extended to a longer period. Therefore, patients' disappointment was investigated three days after surgery as well as three months after surgery when most patients were able to return to work. The time reference of some items was adjusted ("days after surgery" was changed into "weeks after surgery"). Cronbach's $\alpha$ of the list ranged from 0.81 to 0.92.

*Data analysis*

Analyses of variance (ANOVAs) were performed to detect differences in postoperative pain among the groups with different expectations. Analyses of covariance (ANCOVAs) were performed to assess differences in postoperative disappointment at three days and at three months postoperatively beyond the influence of biographic and medical variables. Sex, age and medical variables were included in the analyses as covariates. With respect to the medical variables, we assessed the extent to which seven medical status variables were related to disappointment three days and three months after surgery. These were severity of disorder, type of surgery, reoperation, duration of surgery, overweight, amount of pain medication and number of types of pain medication. Only the medical variable reoperation showed a correlation ($r = .17, p < .10$) with postoperative disappointment at three months, indicating the need for control. To control for the possibility that patients differed in disappointment because of differences in postoperative pain in the leg or back, new ANCOVAs were performed in which the postoperative pain in the leg and back were added as covariates. When an overall significant effect was found, Scheffé's multiple comparison

tests were performed to detect which groups significantly differed from each other on postoperative disappointment.

## Results

*Postoperative pain and disappointment*

Means of postoperative pain in the leg and back, and disappointment in the total patient group are shown in Table 6-1. Patients reported significantly more disappointment after three months than after three days ($F(1, 106) = 16.5, p < .001$).

*Table 6-1. Means (and standard deviations in parentheses) of postoperative leg pain, back pain and disappointment*

| Postoperative Variable | Possible range of scores | Three days postsurgery ($N$ = 120) | Three months postsurgery ($N$ = 107) |
|---|---|---|---|
| Leg pain | 0 - 100 | 28.2 (29.0) | 29.4 (28.6) |
| Back pain | 0 - 100 | 39.1 (22.8) | 35.2 (23.3) |
| Disappointment | 10 - 40 | 17.6 (6.2) | 20.3 (7.0) |

To the specific item "I feel disappointed after the operation" 106 (88%) patients answered "no" at three days and 14 (12%) "yes". At three months, 77 (72%) patients answered "no", and 30 (28%) said "yes" to this item. To the item "I experienced more complaints after surgery than I had expected" 81 (68%) patient answered "no" and 39 (32%) "yes" at three days; and 62 (59%) "no" and 45 (41%) "yes" at three months. There were no significant differences in pain scores between the two postoperative occasions. As was shown in chapter 2, Table 2-2, postoperative leg pain and back pain at three days and at three months were significantly decreased compared to the presurgical level.

*Expectations of pain and recovery and postoperative pain*

Analysis of variance of the groups with different expectations of pain indicated a significant effect for postoperative pain in the leg at three days ($F(3, 116) = 3.262$, $p = .024$), and a trend at three months ($F(3,103) = 2.11$, $p = .10$). Patient groups also differed significantly in postoperative backache at three months ($F(3, 103) = 11.5$, $p < .001$), but there was no significant effect at three days ($F(3, 116) = .97$, $p = .41$). Patient group 2, that had no backache, did not expect to get pain in the back and expected pain in the leg to have disappeared, showed the lowest postoperative pain in the leg at three days ($N = 29$) and at three months ($N = 26$; Table 6-2). This is in accordance with the notion that lumbar surgery is most successful in patients with no preoperative backache. Patient group 4, that expected some pain in the leg or cramp would still be present after surgery, had the highest postoperative pain in the leg at three days ($N = 37$) and three months ($N = 35$; Table 6-2).

*Table 6-2. Means (and number of patients in parentheses) of postoperative leg pain, back pain and disappointment in patient groups with different expectations of pain*

| Postoperative variable | Expectations of postoperative pain | | | |
|---|---|---|---|---|
| | 1. No leg and back pain | 2. No leg pain, had no back pain | 3. Back pain, no leg pain | 4. Leg and back pain |
| *Leg pain* | | | | |
| Three days | 23.6 (20) | 18.7 (29) | 26.7 (34) | 39.4 (37) |
| Three months | 23.4 (16) | 21.9 (26) | 28.3 (30) | 38.6 (35) |
| *Back pain* | | | | |
| Three days | 42.3 (20) | 33.7 (29) | 38.3 (34) | 42.5 (37) |
| Three months | 28.7 (16) | 17.0 (26) | 44.5 (30) | 43.8 (35) |
| *Disappointment* | | | | |
| Three days | 14.4 (20) | 15.8 (29) | 17.2 (34) | 21.2 (37) |
| Three months | 17.5 (16) | 16.4 (26) | 21.8 (30) | 23.6 (35) |

There were no overall significant differences in postoperative pain among the groups with different expectations of rate of recovery, nor among groups with different expectations of return to work. With respect to the period in the week after surgery, patients in group 3, that described themselves as recovering more slowly than the booklet, showed the highest pain in the leg and back at three days postoperatively ($N$ = 21; Table 6-3). Those who expected to recover faster than the booklet (group 1, $N$ = 21) had lower pain scores at three days than patients in group 3.

With respect to return to work, group 3 that expected to return to work after three months or more had the highest pain scores at three days ($N$ = 21), a high level of backache at three months but relatively little pain in the leg at three months ($N$ = 20; Table 6-4).

*Table 6-3. Means (and number of patients in parentheses) of postoperative leg pain, back pain and disappointment in patients groups with different expectations of recovery*

| Postoperative variable | Expectations of recovery | | | | |
|---|---|---|---|---|---|
| | 1. Fast recovery | 2. Recovery as in the booklet | 3. Slow recovery | 4. Wait and see | 5. No expectations |
| *Leg pain* | | | | | |
| Three days | 27.5 (21) | 25.7 (23) | 33.2 (21) | 29.7 (29) | 25.0 (26) |
| Three months | 28.5 (19) | 31.2 (21) | 27.2 (20) | 31.4 (27) | 27.9 (20) |
| *Back pain* | | | | | |
| Three days | 32.5 (21) | 38.2 (23) | 49.9 (21) | 37.6 (29) | 38.8 (26) |
| Three months | 37.3 (19) | 32.8 (21) | 34.3 (20) | 38.5 (27) | 32.5 (20) |
| *Disappointment* | | | | | |
| Three days | 17.2 (21) | 18.6 (23) | 19.2 (21) | 16.7 (29) | 17.0 (26) |
| Three months | 20.0 (19) | 18.7 (21) | 21.5 (20) | 21.6 (27) | 20.2 (20) |

*Table 6-4. Means (and number of patients in parentheses) of postoperative leg pain, back pain and disappointment in patients with different expectations of return to work*

| Postoperative variable | Expectations of return to work | | | | |
|---|---|---|---|---|---|
| | 1. Within 2 months | 2. In 2 to 3 months | 3. After 3 months or more | 4. Wait and see | 5. No expectations |
| *Leg pain* | | | | | |
| Three days | 28.7 (43) | 20.7 (13) | 36.8 (21) | 24.2 (27) | 28.2 (16) |
| Three months | 33.9 (39) | 29.6 (11) | 24.8 (20) | 28.6 (27) | 23.2 (10) |
| *Back pain* | | | | | |
| Three days | 38.9 (43) | 36.2 (13) | 44.8 (21) | 36.7 (27) | 38.9 (16) |
| Three months | 35.0 (39) | 38.2 (11) | 38.4 (20) | 32.2 (27) | 34.9 (10) |
| *Disappointment* | | | | | |
| Three days | 17.6 (43) | 18.2 (13) | 17.6 (21) | 16.5 (27) | 19.3 (16) |
| Three months | 19.3 (39) | 21.8 (11) | 22.3 (20) | 20.4 (27) | 19.8 (10) |

*Differences in postoperative disappointment among expectation groups beyond the influence of biographic and medical variables*

Analysis of covariance among the four groups with different expectations of pain indicated a significant effect for postoperative disappointment at three days ($F(6, 113) = 7.80$, $p < .001$) and at three months ($F(6, 100) = 5.36$, $p < .005$) beyond the influence of sex, age and reoperation. The lowest scores for disappointment at three days and at three months were found in group 1 "expecting no pain in the leg and back" and group 2, "expecting no pain in the leg and had no backache" (Table 6-2). The highest scores for disappointment at three days and at three months were found in group 4, that expected pain in the leg and back. When postoperative pain in the leg and back were added as covariates, the effect of expectations on disappointment at three days remained significant ($F(8, 111) = 6.5$, $p < .001$). Adjusted means were still lower in the groups that expected no pain than in the groups expecting pain in the leg and/or back. The effect on disappointment at three months was no longer significant

($F(8, 98) = 1.06$, $p = .37$), indicating that differences in disappointment at three months may be due to the differences in postoperative pain at that time. Scheffé's multiple comparison tests for differences between groups with different pain expectations revealed that patient groups 1, 2 and 3 (all expecting no pain in the leg after surgery) reported significantly less disappointment at three days than group 4 that had expected still some pain in the leg or cramp as described in the booklet. At three months, patient group 1 and 2 were significantly less disappointed than groups 3 and 4 (but the first two groups also showed the lowest pain scores).

Regarding the expectations of rate of recovery, scores for disappointment at three days were highest in patients who expected to recover more slowly than described in the booklet (group 3, Table 6-3). However, these differences were not significant. There were also no significant differences in postoperative disappointment at three months among the groups with different expectations of rate of recovery. Results remained nonsignificant after controlling for sex, age, reoperation and postoperative pain. There were also no significant differences among groups of patients with different expectations of return to work (Table 6-4).

## Discussion

The aim of the study was to investigate the level of postoperative disappointment among groups of patients with different expectations of postoperative pain, rate of recovery, and work. The results show that patients who expected postoperative pain in the leg and back reported more disappointment at three days and at three months than patients expecting no postoperative pain. Moreover, patients who expected pain in the leg and back also reported more postoperative pain in the leg at three days and at three months than those who expected no pain. These results are in line with the findings of George et al. (1980), Wallace (1985), Flood et al. (1993) and the 'clinical wisdom' that patients who expected pain to occur report more pain than patients who

do not hold such expectancies. No evidence was found that patients with the optimistic expectation that they would experience no pain in the leg and back or to have a fast rate of recovery became more disappointed than other patients as was suggested by Janis (1958) and Johnston (1981).

The results are also in accordance with findings in the research area of optimism. Scheier and colleagues (1989) proposed optimism, i.e., the expectancy that good outcomes generally occur when confronted with problems across important life domains, to have beneficial effects on recovery after surgery. Accordingly, optimistic beliefs were found to be positively related to physical rate of recovery (Scheier et al., 1989) and well-being after surgery (Carver et al., 1993; Chamberlain, Petrie & Azariah, 1992). The expectations of patients in our study may have measured such optimistic or pessimistic beliefs rather than current expectations based on the information.

Our assumption that expectations may be a better indication of mental preparation than worries or coping behaviour does not seem appropriate. If the expectations measured were an indication of mental preparation we presumably would have found results more in line with Janis' (1958) assumptions, i.e., that patients who expected more suffering than in actuality would tend to have a low level of disappointment, and patients who expected less pain than in actuality would tend to be more disappointed. Possibly, expectations refer to more global or personal characteristics and beliefs of a person, whereas mental preparation refers to a more specific process.

No significant differences in postoperative disappointment were found among groups with different expectations of rate of recovery or of return to work. These types of expectations seem to be less clear than expectations of pain. In this respect, the answers of patients' expectations of recovery and return to work were less precise, which resulted in the two categories "wait and see" and "has no expectations". The difficulty several patients had in describing their expectancies in these areas may indicate the realistic difficulty in predicting one's own recovery. The patients' descriptions of what to expect also gave us the impression that many patients did not mentally prepare

themselves in the way that they had a concrete personalized picture of future discomfort. Fifty-five patients (46%) in our study said that they would "wait and see" or that they had "no expectations at all" regarding their recovery; and even after prompting by the interviewer, they were unable or reluctant to give more precise expectations. This suggests that precise expectations are hard to verbalize and, therefore, may be difficult to measure. Possibly, in-depth interviews in which patients describe why they have particular expectations or no expectations and what they did with the information provided, may give a better view on mental preparation before surgery. However, considering that several investigators were unable to establish a beneficial influence of mental preparation before surgery, it is arguable that the construct of mental preparation is far less important as a determinant of postoperative state than other patient characteristics, such as the anxiety level, global expectations and coping behaviour.

Regarding intervention before surgery, several studies have shown that giving information about pain and complaints has benefits in terms of reducing negative affect and pain reports (e.g., Devine, 1992; Suls & Wan, 1989). However, our results suggest that it is not necessary and may even be harmful to change optimistic expectations or beliefs some patients have that they will experience no or little postoperative pain. Rather, checking patients' expectations of pain would help the medical staff to detect patients who are pessimistic about their recovery and subsequently may experience disappointment after surgery. Such pessimistic patients may also be at a considerable risk of a difficult and extended recovery (Scheier et al., 1989), and may need extra care pre- and postoperatively. The reframing of preoperative pessimistic expectations as described by Teasdale (1993) seems a promising intervention technique to prevent disappointment in such patients. However, it is arguable that, clinically, the results may be more relevant to the early detection of problems in convalescence than to preventing disappointment through preoperative psychological interventions.

*Appendix 6-1. Examples of items translated from the Dutch questionnaire measuring disappointment*

"The days after surgery were worse than I had expected"

"I feel disappointed after the operation"

"The operation turned out badly"

"I experienced more complaints than I had expected"

"I feel satisfied with the operation"

"The operation went well beyond expectations"

Answer categories were: 1. no!; 2. no; 3. yes; 4. yes!

# Chapter 7

## A revaluation of the adaptiveness of avoidant and vigilant coping with surgery

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Summary

It has been assumed that an avoidant coping style is less adaptive in patients coping with surgery than a vigilant coping style. Empirical evidence, however, has indicated the contrary. This article, therefore, revaluated the adaptiveness of these coping styles. A review of the literature yielded three conditions of the situation that determine the adaptiveness of coping: controllability of the situation, time-reference and interpretational set. Problem-focused coping, vigilance, active coping and monitoring seem to be more adaptive in controllable situations; emotion-focused coping, avoidance, blunting and passive coping more adaptive when little control is possible. For short-term adaptation, avoidance seems the more adaptive strategy, whereas in the long run vigilance is a better strategy. Regarding interpretational set, avoidance seems more adaptive when patients have to cope with the emotional value of the event; vigilance seems more adaptive when coping with sensory elements of the event. Implications of the situational conditions for the adaptiveness of coping with surgical stress and consequences for future research are discussed.

## Introduction

Before and after surgery, patients have to cope with negative events as a consequence of their illness and of surgery itself, such as staying in the hospital and suffering pain. They also have to face anaesthesia, which can be life-threatening, and the risk of a negative outcome from surgery. Which coping strategies will be adaptive in this complex situation has not yet been established.

It has long been assumed that an avoidant coping style is detrimental for recovery, because surgical patients with this attitude were believed to be poorly prepared for the upcoming stressful event (Cohen & Lazarus, 1973; Janis, 1958). An alert, vigilant style was considered more adaptive, because it would stimulate information-seeking behaviour and the working-through of the threat of surgery (Cohen & Lazarus, 1973). These assumptions were based on Janis' (1958) theory that mentally prepared patients are better able to overcome harm than those who are unprepared.

It has been difficult, however, to find conclusive evidence for these assumptions. Several studies have indicated, contrary to expectations, that avoidance is more adaptive than vigilance. Cohen and Lazarus (1973) demonstrated that avoidant patients showed fewer minor complications after surgery and had a shorter hospital stay than vigilant patients. Also, patients with vigilant coping behaviours had more overall pain and disability, and slower healing after oral surgery than those with avoidant coping strategies (George, Scott, Turner & Gregg, 1980). Furthermore, in reviewing the relation between coping and recovery, Mathews and Ridgeway (1981) concluded that avoidant patients tend to fare better as surgical patients than vigilant patients.

Nonetheless, the assumption that mental preparation and information seeking is beneficial for recovery has not been abandoned (Salmon, 1992). Also, several types of preparation and the teaching of coping skills have been found to be beneficial for recovery (Anderson, 1987; Devine, 1992). The question remains, therefore, which coping strategies are more adaptive to cope with surgery, vigilant or avoidant strategies.

Previous reviews on coping with stress (Kincey & Saltmore, 1990; Mathews & Ridgeway, 1981; Salmon, 1992) have assumed that discrepant findings on the adaptiveness of coping might be due to a lack of validity and the wide variety of coping measures used. However, Suls and Fletcher (1985) proposed that a resolution to the contradictory findings might be that avoidant and vigilant coping can both be adaptive, but under different conditions. Also, according to Lazarus and Folkman (1984) judgements as to the adaptiveness of a coping strategy should be made contextually rather than assuming that a strategy in itself should be considered as inherently better or worse than any other. This accords with the view of Thompson (1981) that "...the utility of an avoidant and nonavoidant strategy depends on the situation" (p. 94).

The aim of this article was to review the conditions determining the adaptiveness of coping such as avoidance and vigilance. Knowledge of such conditions may reconcile the contradiction between theoretical assumptions and empirical findings on the adaptiveness of coping. Before we review the conditions determining the adaptiveness of coping, we will discuss two key issues, the adaptiveness and the classification of coping.

## What is the adaptiveness of coping?

The popular meaning of coping with something is to manage successfully or be able to deal with something difficult. In redefining the concept of coping, Lazarus and Folkman (1984) proposed to distinguish between the behaviour that manages or deals with a situation and the outcome of such behaviour, its successfulness. Many coping behaviours may be attempts at managing a situation successfully, but do not necessarily lead to a favourable effect. Therefore, the concept of coping has been restricted to the managing behaviours, independent of success or failure of those behaviours.

The question remained, however, which ways of coping are successful. Therefore, the efficacy, or adaptiveness, of coping came into focus, with adaptive coping referring to successfully and nonadaptive coping to less successfully managing a situation.

Regarding the adaptiveness of coping, trait-centered and situation-centered approaches are distinguished. The traditional view of coping adaptiveness is trait-centered and involves an individual's competence to adapt, usually without reference to particular circumstances (Lazarus & Folkman, 1984). In such a view, personality, traits or styles, and personal experience are important determinants of adaptation. The alternative view is the situational approach that views the situation as providing a set of constraints and demands or conditions, that determine the adaptiveness of coping. Those coping strategies that accord with the demands of the situation are adaptive. In this approach, coping strategies are studied rather than coping traits.

In the present review, the situational approach was followed because the trait-centered approach that reviewed findings irrespective of the situational demands has yielded few unequivocal conclusions on the adaptiveness of coping (Kincey & Saltmore, 1990; Mathews & Ridgeway, 1981; Salmon, 1992).

## Classification of coping

Regarding coping with surgery, the most prevalent classification is between the two broad categories of avoidant and vigilant coping (Mathews & Ridgeway, 1981). These categories has been used for coping styles as well as strategies. We confined our review to avoidance and vigilance as coping strategies, because of our situational approach. Vigilance refers to an alertness and an active search for information; avoidance to withdrawal from information, distraction or unwillingness to discuss thoughts about the operation (see also Roth & Cohen, 1986).

Other concepts have been used to describe the major dimension of coping. Lazarus (1975) divided coping processes into two main types, namely, direct action on the

person-environment relationship, and intrapsychic processes. Later, these became known as problem-focused and emotion-focused coping, respectively. Problem-focused strategies are similar to strategies used for problem solving such as defining a problem, generating alternative solutions, choosing among alternative solutions and direct action (Lazarus & Folkman, 1984). Examples of emotion-focused strategies are avoidance, denial, distancing and wishful thinking.

Recently, Salmon (1992) distinguished between active and passive coping responses to stress. Furthermore, Miller (1987) developed two concepts related to avoidance and vigilance, monitoring and blunting, with monitoring referring to the extent to which patients seek information about the threat, and blunting referring to distraction from the threat.

We reviewed studies that presented evidence for conditions that determine the adaptiveness of each of these categorizations of coping.

## Conditions determining the adaptiveness of coping

*Avoidant and vigilant coping.* Roth and Cohen (1986) reported two conditions relevant to the adaptiveness of vigilant and avoidant coping strategies: the controllability of the situation and the point in time at which effectiveness is evaluated. They concluded that avoidance is better than vigilance if a situation is uncontrollable, whereas vigilance is better if there is potential control. This accords with findings that avoidance is more adaptive than vigilance in low control situations such as the procedure of blood donation (Kaloupek, White & Wong, 1984) and surgical procedures (Johnston, 1986). Regarding the time reference, Roth and Cohen (1986) concluded that avoidance strategies were effective when outcome measures were short-term, whereas vigilance strategies were more effective when outcome measures were long-term. Thompson (1981) also reported evidence that avoidant strategies had positive effects during the initial part of the process of coping with a major traumatic event, but

nonavoidant strategies were more useful later on in the process. Suls and Fletcher (1985) studied the relative efficacy of avoidant and nonavoidant strategies in experimental studies in which patients were confronted with a stressor such as electric shock, cold pressor and radiant heat. Their meta-analysis showed that, on the whole, avoidance was more adaptive in the short run, whereas vigilance was better in the long run. Furthermore, they found that the interpretational set was important. The interpretational set refers to the way a threatening stimulus is appraised or processed as suggested by the parallel processing model of emotion (Leventhal & Everhart, 1980). Threatening stimuli can be processed in terms of emotional value, or alternatively, in a nonemotional way in terms of sensory elements. Suls and Fletcher found that avoidance was more adaptive when patients had to cope with the threat, or emotional value, of the event. Vigilance was more adaptive for coping with nonemotional sensory elements of the event, such as the coldness of water, and numbness of the hand.

*Emotion- and problem-focused coping*. Lazarus (1975, 1993) assumed that problem-focused behaviour is generally more effective than emotion-focused coping. Taking actions against problems, rather than changing their relational meaning, is widely recognized as more desirable (Lazarus, 1993; Terry, 1991). However, under certain circumstances, particularly when nothing can be done, emotion-focused coping can be beneficial (Lazarus, 1993). Auerbach (1989) also concluded on the basis of laboratory studies and studies with blood donors, that emotion-focused coping is effective in short-term, low control situations.

Consistent with these findings is the evidence that active coping is, in general, better than passive coping (Ho, Hashish, Salmon, Freeman & Harvey, 1988; Manyande & Salmon, 1992), but that it can also be counterproductive when there is little opportunity to be active as in low-control situations (Salmon, 1992).

*Monitoring and blunting*. The theoretical framework of monitoring and blunting proposes an explicit interaction between control contingencies and these coping strategies (Miller, Combs & Stoddard, 1989). The assumption is that when an aversive

event is controllable, high monitoring and low blunting are the main coping responses and information is preferred. When an aversive event is uncontrollable, however, the main responses are high blunting and low monitoring.

In accordance with this assumption, patients reported higher monitoring and lower blunting scores when they were asked to imagine coping with a more controllable medical threat, being diagnosed for hypertension which can be easily treated, than when imagining coping with less controllable medical threats, such as vague headache complaints, and the decision to have cardiac surgery with an uncertain outcome (van Zuuren, de Groot, Mulder & Muris, 1996).

**Conclusions on conditions for adaptive coping**

Although several categorizations of coping were reviewed, we only found three conditions that may determine the adaptiveness of coping: controllability of a situation, time-reference and interpretational set.

Controllability of a situation was a major determinant of the adaptiveness of several coping strategies. Problem-focused coping, vigilance, active coping and monitoring seem to be more adaptive in controllable situations, emotion-focused coping, avoidance, blunting and passive coping in low control situations.

Time reference was found to determine the adaptiveness of some ways of coping. For short-term adaptation avoidance seems the more adaptive strategy, whereas in the long run vigilance is a better strategy. Time reference may be relevant to the adaptiveness of other ways of coping as well. However, we found no studies that investigated these relations.

Regarding interpretational set, avoidance was more adaptive when patients had to cope with the emotional value of the event. Vigilance was more adaptive when coping with nonemotional, sensory elements of the event. This latter result was based on experimental studies on coping, therefore, generalizing these results to the clinical

medical setting may be more difficult. However, the results on emotional value are consistent with the notion that avoidance and emotion-focused strategies are used to cope with emotions before surgery. It also accords with the view of Contrada, Leventhal and Anderson (1994) who proposed that problem-focused coping is appropriate when coping with objective facets of the surgical event and emotion-focused coping when coping with emotional and other subjective responses to surgery.

These conditions are not entirely new. Lazarus and Folkman (1984) already proposed that controllability, timing and certain facets of the situation were important for specifying the conditions under which denial and denial-like processes might have favourable or unfavourable outcomes. The presented evidence establishes their assumptions.

With these conditions in mind, we may resolve the inconsistency between theoretical assumptions and empirical findings regarding the adaptiveness of coping. Reviewers of the empirical evidence of coping with surgery have concluded that patients with an avoidant coping strategy tend to fare better as surgical patients than patients using a vigilant strategy. Because low-control aspects, such as awaiting anaesthesia and the surgical procedure, predominate before surgery, and because outcome measures primarily consisted of outcomes having an emotional value such as postoperative anxiety, pain and disability, it is not surprising that an avoidant strategy was regularly found to be more adaptive before surgery than a vigilant strategy. However, this does not imply that other coping behaviours such as vigilance are necessarily nonadaptive. Patients also have to cope with several other things, such as getting used to the regimen, adherence to medication, and preparing for exercises, which do not immediately give rise to strong emotions and are more under the control of the patient. Thus, although avoidance coping is important to cope with threat and emotions, vigilance may still be relevant when coping with other, more controllable, less emotional aspects. These latter aspects are probably important to recovery in the long run.

## Future directions

The conditions determining the adaptiveness of coping have some consequences for future research. First, researchers investigating coping behaviours should always bear in mind in what kind of control situation coping is investigated. For this purpose, the degree of controllability of particular situations should be listed. This may seem difficult because asking people to assess controllability might yield answers about perceived control rather than real control. On the other hand, researchers had no difficulty distinguishing controllable from uncontrollable situations, considering the studies that investigated low- and high-control situations (e.g., Davey, 1994; Helgeson, 1992; Kaloupek et al., 1984). Objective controllability is the degree of control an average individual might have over an event (Davey, 1994). Controllability is higher when an average person is able to affect the course of an illness or symptoms; controllability is lower when the course of the illness depends on others, or on fate. Thus, the objective degree of control can be listed by comparing the average possible control among different situations, rather than investigating subjective feelings of personal control in a particular situation.

Secondly, within a particular situation with a particular degree of controllability, the time reference and the interpretational set should be taken into account when studying the adaptiveness of coping. It is remarkable that only a few studies directly compared the adaptiveness of ways of coping within the same stressful situation (e.g., Suls & Fletcher, 1985). More research needs to be done to establish the importance of situational conditions for the adaptiveness of different ways of coping in relation to a particular stressful event. For research on coping with surgery, this implies that short-term as well as long-term outcomes should be investigated. Furthermore, not only outcome measures related to emotional value and threat of the situation, such as pain, emotions, and rate of recovery, should be investigated, but also outcome measures related to the less emotional aspects of surgery such as adherence to the regimen, exercise programme, or medication intake, and particular actions that should be

undertaken by the patients after surgery such as returning to the physician for a postoperative check up.

A final step in the understanding of the adaptiveness of coping behaviour is to combine a situational approach and a trait-centered approach. This may yield a model in which the conditions that determine the adaptiveness of coping and the ability of a person to use such ways of coping together determine the adjustment of a particular person in a particular situation. For example, an individual with a preference for vigilant, information-seeking behaviour because of a personality characteristic, such as high trait anxiety, may have difficulty in using an avoidant coping strategy when confronted with a low control situation. An individual with a preference for avoidant coping may surrender easily to a low control situation, but may be less informed and less active, and does not learn how to exert possible control. Such a model suggests that interventions aimed at improving recovery should be directed at patients with difficulty in using avoidant and/or vigilant behaviour in accordance with the situational demands, i.e., avoidance for uncontrollable, emotional and short-term aspects, and vigilance for more controllable, less emotional and long-term aspects. Many patients, however, seem very well able to cope with surgery, and presumably use both vigilant and avoidant coping strategies in accordance with the demands of the situation.

# Chapter 8

## Discussion

### Introduction

The aim of this thesis was to investigate the influence of preoperative stress and mental preparation before surgery on postoperative state. Researchers such as Janis (1958), Selye (1978) and Salmon (1992) proposed that anxiety or stress not only have detrimental effects on well-being and recovery from surgery but might also have beneficial effects. Until now, there has been little evidence that such beneficial effects indeed exist. One of the most intriguing questions during the research project was, therefore, whether we were able to detect such a beneficial effect of anxiety or stress on the postoperative state. For this purpose, we investigated several aspects of preoperative stress, namely different aspects of preoperative anxiety as well as physical indicators of stress that received little attention in previous studies. Furthermore, modern approaches of research into stress have emphasized that the stressfulness of an event not only depends on the external demands of the threatening event, but also on the way a person copes with the demands or prepares for the threatening event. Therefore, we also investigated two indications of mental preparation before surgery, information-seeking behaviour and expectations that patients have formed about postoperative pain and recovery. These variables were investigated in a sample of 126 patients undergoing lumbar surgery. A second sample of 60 patients undergoing different types of surgery was studied in an attempt to replicate the findings concerning different aspects of anxiety. In the following sections the influence of preoperative stress, of indications of mental preparation before surgery and of biographic and medical variables will be discussed. Next, general conclusions regarding the influence of preoperative variables on postoperative state are presented. Furthermore, limitations of the design and methods, and implications for future research and clinical practice

are discussed. An overview of the general concepts, the variables investigated and measures used is presented in Table 8-1. The general results are summarized in Table 8-2 (page 128).

## Preoperative stress

We distinguished preoperative emotional and physical indicators of stress. As regards the emotional indicators of stress, five aspects of preoperative anxiety were investigated: state anxiety, specific anxiety, tension, amount of thinking about surgery and observed anxiety. Two physical indicators of stress were studied: preoperative fatigue and preoperative pain.

*Preoperative anxiety*

In chapters 2 to 5 we showed that preoperative state anxiety predicts postoperative emotional and physical state, including disorder-specific recovery. That is, higher preoperative state anxiety was associated with higher levels of a range of postoperative emotional and physical outcome measures at three days in lumbar surgery patients, i.e., postoperative state anxiety, physical complaints (chapter 3), tension, pain in the leg and back and also with poorer observed recovery (chapter 2). The variance in these outcome measures explained by preoperative anxiety ranged from 5.3% to 17.6%[4]. These are small to moderate effect sizes according to the criteria of Cohen (1988; small effect 2% up to 9% explained variance; moderate effect 9% up to 25%; large effect ≥ 25%). Furthermore, in patients who underwent different types of surgery, preoperative state anxiety was also positively associated with postoperative state anxiety

[4]The effect sizes ($r^2$) reported in this chapter were calculated on the basis of the Pearson correlation coefficient $r$. We did not calculate the effect sizes of the unique contributions of psychological variables.

*Table 8-1. Overview of general concepts, variables and measures*

| Concept | Variable | Measure |
|---|---|---|
| *Preoperatively* | | |
| Stress | | |
| Emotional indications | State anxiety | State Trait Anxiety Inventory |
| | Specific anxiety | Specific anxiety questionnaire |
| | Tension | Profile of Mood States |
| | Amount of thinking | Interview question |
| | Observed anxiety | Ratings by the nursing staff |
| Physical indications | Fatigue | Profile of Mood States |
| | Pain (leg and back) | Visual Analogue Scale |
| | Pain during activities | Questionnaire of Oostdam |
| Mental preparation | Monitoring and blunting | Threatening Medical Situations Inventory |
| | Expectations | Interview questions |
| *Postoperatively* | | |
| Emotional state | State anxiety | State Trait Anxiety Inventory |
| | Tension | Profile of Mood States |
| | Disappointment | Disappointment questionnaire |
| Physical state | Physical complaints | Symptom Checklist - 90 |
| | Fatigue | Profile of Mood States |
| | Back pain | Visual Analogue Scale |
| | Pain during activities | Questionnaire of Oostdam |
| Disorder-specific recovery | Leg pain | Visual Analogue Scale |
| | Observed recovery | Ratings by the neurosurgeon |

*Note.* Indices of pain may be physical indications of stress as well as of the severity of the disorder. In this thesis, we focused on the stress component of pain. Nevertheless, leg pain seems to be an appropriate measure to determine whether patients recovered well from lumbar surgery. Therefore, after surgery, it was classified as a measure of disorder-specific recovery.

and physical complaints (chapter 5). In that study preoperative state anxiety explained 38.4% of the variance in postoperative anxiety and 7.8% of the variance in postoperative physical complaints, indicating a large effect size for postoperative emotional state and a small effect size for postoperative physical state.

Previous studies already showed that preoperative state anxiety predicts postoperative anxiety and pain. However, several studies found no association between preoperative state anxiety and indices of physical recovery other than pain (Johnston & Carpenter, 1980; Wallace, 1986; Wolfer & Davis, 1970). In these studies postoperative indices of recovery such as energy, appetite, stomach condition, bowel condition, and urination were used. Possibly, preoperative state anxiety is associated with those postoperative physical complaints that are related to distress, such as dizziness, nausea, headache and pain but not with the more specific physical indices of recovery. Besides, the validity of the recovery indices used in the previous studies could also be questioned because the studies reported no data concerning the internal consistency or other measures of validity of the recovery indices.

Preoperative state anxiety also predicted long-term aspects of postoperative emotional and physical state. It was positively associated with anxiety, fatigue and pain during daily activities. The variance explained ranged from 12.3% to 25%, indicating a moderate to large effect for long-term postoperative state. This finding was unexpected because we had assumed that the effects of temporary increases in state anxiety would subside shortly after a threatening event. Presumably, scores on state anxiety were partly attributable to underlying trait anxiety that did not change during the surgical event.

In chapters 4 and 5 we took a closer look at anxiety. We investigated the possibility that, although high preoperative state anxiety is clearly unfavourable for the postoperative state, other aspects of anxiety might be beneficial. We found that, apart from preoperative state anxiety, specific anxiety (worries and difficulties in concentrating) and observed anxiety each had a unique, unfavourable effect on postoperative anxiety. However, we also found that preoperative tension, an emotional

aspect of anxiety, was associated with less postoperative anxiety after controlling for other anxiety aspects. This suggested that patients who showed high specific anxiety and reported high tension, adjusted better than patients with high specific anxiety and low tension. This would be in line with the suggestions of Janis (1958) and Selye (1978) that stress is not always detrimental. According to Selye feelings of tension may be beneficial because a certain amount of stress is needed to tune a person up for action and keep him or her 'on his toes'. He named this feeling "emotional alertness" or the feeling of being "keyed up". An explanation in line with Janis (1958) is that the patients who report worries and difficulties in concentrating but show little tension may isolate their affect from affect-arousing thoughts, resulting in an admittance of worries about external danger, but a denial of the emotional impact of the event. Rationalization of feelings may involve such isolation of affect: By giving oneself reasons as to why one is anxious, a person can avoid the most disturbing inner feelings. After surgery, when actual suffering occurs, patients who denied the emotional impact before surgery may become more disturbed by the accumulating pain, discomfort and frustrations during convalescence than patients who already acknowledged disturbing affects before surgery. Nevertheless, patients who reported little preoperative anxiety and little tension were still better off than patients with high preoperative anxiety and much or little tension.

The finding of chapter 4 that tension may be beneficial was not replicated in the 60 patients who underwent different types of surgery (chapter 5). In this sample, each of the different aspects of anxiety had an unfavourable effect on postoperative anxiety. Several reasons may account for the failure to replicate the beneficial effect of tension. First, it is possible that the effect was not found because we studied patients with many different disorders. The sample may have been too heterogeneous to find specific effects. Secondly, the findings may only apply to patients undergoing lumbar surgery and do not generalize to other patients. As for this possibility, we found a similar, but nonsignificant pattern of associations (a positive contribution of specific anxiety and a negative contribution of tension and state anxiety to predicting postoperative anxiety)

in the 33 patients who underwent lumbar surgery in the replication study. However, the finding in chapter 4 may also have been a chance finding. Our main conclusion is, therefore, that, in general, preoperative anxiety and its different aspects are unfavourable for postoperative state.

*Physical indicators of stress*

*Preoperative fatigue.* In chapter 2 and 3 it was shown that fatigue may be relevant for the adjustment to surgery. Preoperative fatigue was associated with aspects of postoperative emotional and physical state, i.e., postoperative anxiety, physical complaints (chapter 3), fatigue and backache at three days postoperatively (chapter 2). The variance explained in these outcome measures ranged from 10% to 16%, indicating a moderate effect. Fatigue was not associated with the disorder-specific measures leg pain and observed recovery. Part of the variance explained by preoperative fatigue overlapped with the variance explained by preoperative anxiety. However, preoperative fatigue appeared to have a unique effect on postoperative physical complaints independent of anxiety (chapter 3).

Preoperative fatigue was also associated with long-term aspects of postoperative emotional and physical state, such as postoperative tension, fatigue and pain during daily activities at three months, but not with the disorder-specific measures, leg pain and observed recovery (chapter 2). Variances explained ranged from 7.3% to 9%. We concluded that preoperative fatigue predicts a poor emotional state and a poor physical condition in the long run, but does not predict disorder-specific recovery.

The relation between stress responses such as fatigue and illness or recovery can be very complex, since it is influenced by a number of preexisting and intervening factors (Taylor, 1986). We will now consider some explanations for the predictive value of fatigue. It has generally been assumed that the origin of fatigue may be found in a prolonged state of stress resulting from mental or physical overload (Wessely, 1990). It has also been suggested that fatigue may result from a particular work ethic, the drive to succeed, because fatigue is seen in professions demanding "unflagging

devotion to the task or a high degree of emotional pressure" (Wessely, 1990). Mental or physical overload may also be due to preexisting or concurrent life stressors such as prolonged conflict in the family, prolonged financial problems or prolonged overwork (Appels, Kop, Meesters, Markusse, Golombeck & Falger, 1994). Surgery itself is also a major life event which may further evoke fatigue. The accumulation of stressful events may result in a poor emotional and physical condition shortly after surgery and even in the long run. Furthermore, fatigue may also affect recovery by altering a person's behaviour patterns. Reduced activity and decreased motivation to perform exercises due to fatigue may hamper postoperative recovery.

*Preoperative pain.* Pain may be indicative of the severity of a disorder. However, reported pain is only tenuously related to pathophysiological processes (Wall, 1979) and it was, therefore, argued that the amount of pain may also be a physical indication of stress.

Preoperative leg pain appeared to have a unique effect on postoperative anxiety (chapter 3). The variance explained by preoperative pain was 8.4%, indicating a small effect. Clinical observation during the assessments suggested that patients who reported much pain before surgery were distrusting their relatively pain-free postoperative state and were afraid that the disorder would return. This may account for the higher level of postoperative anxiety. These patients may also be somatizing patients, expressing their preoperative emotional distress in terms of pain rather than as anxiety (Dworkin, 1991). After surgery, patients may express their emotional distress as anxiety rather than pain, because the leg pain clearly has diminished or disappeared due to the surgery performed.

The levels of preoperative back pain and pain during daily activities were predictive of long-term recovery (chapter 2). Preoperative back pain was predictive of poorer emotional state, physical state and disorder-specific recovery at three months postoperatively. The variance explained in outcome measures ranged from 4.4% to 14.4%. Pain during daily activities was predictive of emotional and physical state at three months (variance explained 9.6% to 13%), but not of disorder-specific recovery.

This suggests that the level of preoperative back pain especially is an important predictor of poor recovery from lumbar surgery in the long run. It accords with the clinical notion that lumbar surgery is most successful in patients with little or no preoperative back pain.

In chapter 6, further evidence confirmed that the level of preoperative back pain is important for long-term recovery. In chapter 2 the level of back pain was measured with a Visual Analogue Scale. In chapter 6, however, we classified patients into four groups on the basis of their expectation of postoperative pain. It turned out that a subgroup of patients spontaneously stated that they had no preoperative back pain at all. These patients were categorized as patients who expected no postoperative back pain, and also had no back pain before surgery (group 2 in chapter 6). This group reported the lowest level of postoperative pain in the leg and back and the lowest level of disappointment at three days and at three months postoperatively.

**Indications of mental preparation before surgery**

Two approaches to measure mental preparation before surgery were used that might identify patients with poor preparation for surgery. First, two related behavioural measures of information-seeking behaviour, monitoring and blunting of information, were developed (Miller, 1987), which seemed to be promising variables to predict postoperative distress (Salmon, 1992). We assessed monitoring and blunting behaviours that were specifically related to medical situations (van Zuuren & Hanewald, 1993). The second approach was to investigate patients' expectations of pain and recovery. We assumed that patients who are mentally well prepared and seek information about surgery may develop more accurate expectations than patients who avoid thinking about surgery.

*Information-seeking behaviour: monitoring and blunting*

All associations between the coping behaviours monitoring and blunting and outcome measures turned out to be very low and showed no effect that was independent of other variables taken into account (chapters 2 and 3). We concluded that the information-seeking behaviours had little effect on postoperative state.

In the theoretical chapter 7, we assumed that vigilant and avoidant behaviour can both be adaptive. Vigilance seems to be more adaptive in controllable situations; avoidance more adaptive when little control is possible. For short-term adaptation, avoidance seems the more adaptive strategy, whereas in the long run vigilance is a better strategy. Furthermore, avoidance seems more adaptive when patients have to cope with the emotional value of the event; vigilance more adaptive when coping with less emotional elements of the event. We found that specific blunting (i.e., blunting related to the specific situation of surgery) was negatively associated with preoperative anxiety and postoperative pain (chapter 2), which is in line with other studies that found a favourable effect of avoidant strategies (Cohen & Lazarus, 1973; George, Scott, Turner & Gregg, 1980; Mathews & Ridgeway, 1981). Also, higher scores on general blunting (i.e., blunting of threatening information in several situations) were positively associated with fatigue and pain in the leg at three months which accords with the assumption that avoidance is nonadaptive in the long run (Suls & Fletcher, 1985; Thompson, 1981). As mentioned above, these associations were rather low. We found no evidence that monitoring was associated with better recovery.

*Expectations of pain and recovery*

The patients who expected no pain reported less postoperative pain and disappointment than patients who expected pain to occur (chapter 6). These results were in accordance with Wallace (1985) who demonstrated that patients who expected pain to occur showed higher reports of pain when pain actually occurred than other patients. The results are also in line with other studies that showed that patients with optimistic expectations or beliefs regarding postoperative pain or recovery showed better

postoperative adjustment than other patients (Carver et al., 1993; Chamberlain, Petrie & Azariah, 1992; Flood, Lorence, Ding, McPherson & Black, 1993; George et al., 1980; Scheier et al., 1989). Other researchers (Janis, 1958; Johnston, 1981) assumed that if a stressful event produces more suffering than had been expected, patients may become more anxious and disappointed. Especially a person's overoptimistic expectations that remain uncorrected before surgery would increase the probability of disappointment or other emotional responses. We found no evidence that supported these assumptions. Taken together, these results suggested that the expectations measured were general optimistic and pessimistic beliefs rather than current expectations based on the information provided. We doubted, therefore, whether the expectations measured were an indication of mental preparation before surgery. Several investigators, including our research group, were unable to find evidence for the influence of mental preparation before surgery on postoperative state, which seems to justify the conclusion that the construct of mental preparation is far less important as a determinant of postoperative state than other patient characteristics such as the preoperative anxiety level, fatigue, pain, and global expectations.

## Influence of biographic and medical variables

Previous researchers (Boeke, Duivenvoorden, Verhage & Zwaveling, 1991a; George et al., 1980) emphasized the need to control for biographic and medical variables because variables like medical history, age and sex may seriously confound the relation between pre- and postoperative state. These variables were systematically taken into account in our studies. We will now summarize the effects of these variables.

### *Biographic variables*

Women reported higher levels of postoperative tension, more pain in the leg, and more physical complaints in the sample of lumbar surgery patients, and higher

postoperative state anxiety and physical complaints in the sample of patients undergoing several different types of surgery (chapters 2 to 5) than men. These differences between men and women have been explained in terms of differences in social roles, gender-based expectancies about one's own or others' behaviour and the higher social status of being male rather than female (Eagly, 1995). In particular, it has been assumed that the differential social roles allow women to experience more emotions than men and also to express their emotions more easily (Fabes & Martin, 1991). We concluded that it remains necessary to take the variable sex into account when studying adjustment to surgery.

Results regarding age were inconsistent. Older lumbar surgery patients showed poorer observed recovery (chapter 2) and more postoperative state anxiety (chapter 3) at three days postoperatively than younger patients. However, in the 60 patients who underwent different types of surgery, older patients showed less postoperative state anxiety than younger patients. Taenzer, Melzack and Jeans (1986) found that age was associated with postoperative analgesic intake, but not with postoperative anxiety and pain. Parbrook, Steel and Dalrympe (1973) found no association between age and postoperative pain. Other studies showed a significant positive association between age and length of hospital stay (Boeke et al. 1991a; Boeke et al., 1991b; Boeke, Jelicic & Bonke, 1992). Regarding long-term recovery, a low positive association was found between age and level of pain in the leg at three months, in patients undergoing lumbar surgery (chapter 2). However, this relation was presumably due to the type of disorder. Patients with lumbar canal stenosis were, on average, older than those with a lumbar disc herniation. Further analysis showed that the relation between age and pain in the leg at three months disappeared when the type of disorder was taken into account. Taken together, these results suggest that age has no pervasive influence on recovery from lumbar surgery.

Other biographic variables, such as education and marital status, have, in general, not shown to be relevant for research into surgical stress. In the study of Taenzer et al. (1986) higher education was related to lower levels of pain, but education showed

no association with other outcome measures. Other studies showed no significant associations between education or marital state and postoperative variables (Jenkins, Stanton, Jono, 1994; Scott, Clum & Peoples, 1983; Voulgari, Lykouras, Papanikolaou, Tzonou, Danou-Roussaki & Christodoulou, 1991). Also, in our study of 60 patients who underwent different types of surgery (chapter 5), no associations were found between education or marital status and the outcome measures.

*Medical variables*

Regarding the medical variables, lumbar surgery patients who had a reoperation showed more fatigue at three days (variance explained 3.6%) than those who underwent lumbar surgery for the first time. Furthermore, having had a reoperation was positively associated with fatigue, pain in the leg and back, and poor observed recovery at three months postoperatively (variance explained ranged from 3.6% to 13%, a small to moderate effect). No associations were found between reoperation and outcome measures in the patients undergoing several different types of surgery. In some previous studies, prior experience with surgery was positively associated with postoperative outcome measures such as length of hospital stay and pain (Boeke et al., 1991b; Scott et al., 1983), whereas in other studies no such relation was found (Boeke et al., 1991a).

Type of disorder was not related to any short-term outcome in lumbar surgery patients. Regarding the long-term aspects, patients who underwent surgery because of lumbar canal stenosis showed significantly more pain in the leg after three months than patients who underwent lumbar disc surgery. In the sample of patients undergoing different types of surgery, patients who underwent lumbar disc surgery reported more postoperative complaints, but less disappointment than those who underwent other types of surgery. This suggests that type of disorder or surgery is most relevant to take into account when studying the postoperative state in a group of patients who have different disorders.

The preoperative amount of pain medication intake and number of types of pain medication in lumbar surgery patients were positively associated with postoperative tension, state anxiety and physical complaints, but not with pain in the leg or back, nor with aspects of long-term recovery. No relation was found between medication intake and outcome measures in the 60 patients-sample. Duration of surgery was positively associated with postoperative state anxiety and tension in lumbar surgery patients.

In conclusion, reoperation turned out to be an important medical variable to the prediction of long-term recovery. The type of disorder or surgery is relevant when studying surgical stress in heterogeneous groups of patients. The influence of other medical variables seems to be confined to one or two particular aspects of postoperative state, but not to postoperative state on the whole.

**Conclusions regarding the influence of preoperative variables on postoperative state**

We conclude that patients with high levels of preoperative anxiety, high levels of fatigue and expectations of postoperative pain will, on average, show a poorer emotional and physical state shortly after surgery than other patients. Patients with high levels of preoperative pain in the leg will, on average, show a poorer postoperative emotional state than patients with low levels of leg pain.

Furthermore, patients with high levels of preoperative anxiety, fatigue, pain during daily activities, and those who expect postoperative pain will, on average, show a poorer postoperative emotional and physical state in the long run than other patients. Patients with high levels of preoperative backache and those who had a reoperation are at not only risk of poor long-term emotional and physical state, but also of poor disorder-specific recovery.

*Table 8-2. Summary of general results concerning the relation between preoperative variables and poor postoperative state*

| Preoperative variable | Prediction of poor postoperative state at three days | Prediction of poor postoperative state at three months |
|---|---|---|
| Anxiety | emotional state: +<br>physical state: +<br>disorder specific recovery: + | emotional state: +<br>physical state: +<br>disorder specific recovery: 0 |
| Fatigue | emotional state: +<br>physical state: +<br>disorder specific recovery: 0 | emotional state: +<br>physical state: +<br>disorder specific recovery: 0 |
| Leg pain | emotional state: +<br>physical state: 0<br>disorder specific recovery: 0 | emotional state: 0<br>physical state: 0<br>disorder specific recovery: 0 |
| Back pain | emotional state: 0<br>physical state: 0<br>disorder specific recovery: 0 | emotional state: +<br>physical state: +<br>disorder specific recovery: + |
| Coping behaviour | emotional state: 0<br>physical state: 0<br>disorder specific recovery: 0 | emotional state: 0<br>physical state:0<br>disorder specific recovery: 0 |
| Expected postoperative pain | disappointment: +<br>pain: + | disappointment: +<br>pain: + |

*Note 1.* The symbol "+" indicates that a high level of the preoperative variable predicts *poor* postoperative state. The symbol "0" indicates no predictive value.

*Note 2.* For all preoperative variables, except for expected postoperative pain, the outcome measures were categorized into three categories, emotional state, physical state and disorder specific recovery. For expected postoperative pain outcome measures were categorized into two categories, disappointment and pain.

We found little evidence that stress or anxiety has a beneficial influence on postoperative state. There was some evidence that feelings of tension are beneficial in cognitive anxious patients. However, we were unable to reproduce this finding in the sample of patients undergoing different types of surgery. Furthermore, we found no evidence that patients who seek a lot of information or have expectations of postoperative pain are better prepared to overcome postoperative pain and discomfort (as was suggested by Janis' theory of mental preparation) than other patients.

**Limitations of the design and methods**

The results described in this thesis are primarily based on self-report measures. Results should, therefore, be confined to conclusions about subjective postoperative state and recovery. This limitation may explain the lack of finding an effect of some variables such as coping behaviour. For example, actual coping behaviour measured by observational methods instead of self-reports may be a predictor of postoperative state.

Another problem with self-report measures is that associations between pre- and postoperative variables may exist because of a person's tendency to respond in a certain way to a particular questionnaire, regardless of content. Two types of such tendencies that often affect self-report measures are acquiescence (the tendency to agree with a statement regardless of its content) and individual interpretations of indefinite qualifiers such as "some" and "often" (Crocker & Algina, 1986). We cannot exclude the possibility that results were biased by such response tendencies. However, we used questionnaires that reduced the likelihood that response tendencies occurred. For example, in agreement with the suggestions of Crocker and Algina (1986), we used questionnaires that consisted of short statements expressing both positive and negative feelings. Furthermore, we avoided questionnaires that used statements containing

universals such as "all", "always", "never" and the use of indefinite qualifiers such as "just", "many", "often" and "seldom".

The methods of analyses used (correlational methods and analyses of variance) also have some limitations. Results generated by our methods apply to average reactions of groups of patients rather than to individual reactions. Some variables that are not very important to the majority of patients may still be relevant to particular individuals. During the interviews, many patients stated that they had not prepared themselves in a special way before surgery. These observations cast doubt on the assumption that mental preparation is necessary to overcome harm in the majority of patients. However, some patients gave clear descriptions of how they prepared themselves. For example, one patient answered that she had prepared for the worst, with the explicit purpose that the postoperative experience would be less bad than expected. In other words, she manipulated her own feelings to prevent disappointment. Another patient stated that he had been in such pain during an accident a few years earlier that he could bear anything now. The diversity of patients' answers gave the impression that it is difficult to compare patients regarding their preparatory behaviour. This may be a reason why the influence of mental preparation or coping behaviours is difficult to establish: There are few universal methods to cope with stress.

Another limitation of the study is that the personality of patients was not taken into account. It is very well possible that part of the influence of state variables is due to underlying personality factors. The finding that preoperative state anxiety, fatigue and pain in the back predicted long-term recovery suggests that these variables may have measured an attitude with a long-term influence rather than a state that had disappeared after surgery. Results of previous studies regarding the influence of personality variables were, however, mixed. For example, some studies found that trait anxiety predicted pre- but not postoperative state anxiety (Ho, Hashish, Salmon, Freeman & Harvey, 1988; Wallace, 1987). Also, in the study of Scott et al. (1983) preoperative state anxiety predicted postoperative pain, whereas trait anxiety did not. However, in another study both trait and state anxiety appeared to be predictive of postoperative

state anxiety and postoperative indices of pain (Taenzer et al., 1986). Cohen, Doyle, Skoner, Gwaltny and Newsom (1995) investigated state and trait anxiety as predictors of symptoms of respiratory viral infections. They suggested that high state anxiety is associated with greater symptom reporting related to the actual underlying illness than low anxiety, whereas trait anxiety is associated with cognitive biases that influence symptom reporting, thus with increased complaining. Taken together these studies suggest that state anxiety rather than trait anxiety is the most relevant predictor of postoperative physical state. Nevertheless, taking into account trait anxiety and other personality factors may show to what extent state variables are affected by underlying personality dispositions.

**Future research**

Our results have some implications for future research into the area of stress and mental preparation before surgery.

*Preoperative anxiety*. It will be interesting to continue to explore the role of different aspects of transient anxiety. Possibly, the beneficial effect of the emotional aspect of anxiety, i.e., tension, can be established in homogeneous patient groups, for example, in patients undergoing abdominal surgery or orthopaedic surgery with comparable, severe disorders. As regards the different aspects of transient anxiety, it seems especially relevant to distinguish the emotional responses to an event from the more cognitive responses such as worries and concentration difficulties.

*Preoperative fatigue*. Studying fatigue as a predictor of postoperative distress in patients undergoing different types of surgery may show whether the findings can be generalized to other types of surgery. Dimsdale et al. (1981, in Appels et al., 1994) found that fatigue predicted substantial cardiac morbidity in the year after catheterization, such as hospitalization, myocardial infarction or death. This suggests

that fatigue is also an important predictor of physical state after other invasive medical procedures.

*Preoperative pain.* Furthermore, the nature of the relation between preoperative pain and postoperative anxiety in patients undergoing lumbar surgery deserves further exploration. As argued on page 121, distrust in a relatively pain-free postoperative state or the tendency to somatize may explain this relation, and may be investigated in relation to preoperative pain and postoperative state.

*Personality characteristics.* Investigating personality and state variables as shared determinants for adjustment to surgery may result in greater predictability of postoperative state. Previous studies already took several personality variables and state variables into account (e.g., Jenkins et al. 1994; Scheier et al., 1989; Taenzer et al., 1986). Our results suggest that, in particular, the measurement of trait variables related to state anxiety, fatigue, pain and expectations such as trait anxiety, depression, dispositional optimism, somatization (or hypochondria) and inadequacy, may be of value to determine the extent to which the influence of state variables can be explained by underlying personality variables. Boeke, Duivenvoorden and Bonke (1984) have shown that the measurement of trait anxiety on the day before surgery may not be valid because scores on trait-measures are affected by the surgical stress situation and thus may measure state rather than trait anxiety at that time. Other personality variables may also be influenced by the patient's present state. We emphasize the importance of measuring personality variables at a less stressful point in time, for example some weeks before or after surgery.

*Differences between men and women.* Exploring differences in anxiety and coping behaviour between men and women may yield further insight into the ways in which subgroups of patients react to surgical stress. For example, it has been assumed that men deny feelings of anxiety. This denial of feelings could be detrimental, because patients who deny feelings might be less prepared than other patients to the upcoming negative experiences of surgery. In line with this assumption, it was found that women show higher anxiety levels before surgery than men, whereas men more often show

an increase in anxiety from pre- to postsurgery than women (Boeke, Duivenvoorden, Verhage & Zwaveling, 1990; Johnston, 1980). As part of our research project (not reported in this thesis) differences between men and women in the sample of 60 surgery patients were studied (Reijerse, de Groot & Passchier, in preparation). Contrary to previous findings, we found no differences in the course of perioperative anxiety between men and women. Men and women differed in state anxiety, but not in specific anxiety and tension before surgery. Possibly, the social roles of men and women have changed as compared with a decade ago, which might allow men to show emotions more easily nowadays than in former years. However, the results of Johnston (1980) and Boeke et al. (1990) may also be explained by a regression-to-the mean effect that occurs when the initial levels between two groups are different. Nevertheless, there are some indications that men and women differ in their way to cope with surgical stress. A post hoc analysis of the short-term influence of coping in lumbar surgery patients revealed a significant difference in the relation between coping and outcome measures in men and women. In men, a significant negative association between monitoring and postoperative anxiety was found, whereas a positive trend between monitoring and postoperative anxiety was found in women. This interaction between sex and a monitoring coping style was significant. Other studies also suggest that effects of coping differ in men and women (Krohne, Slangen & Kleemann, 1996; Schmidt, 1988). Studying interaction effects of sex and coping in future studies may reveal differences in the way men and women cope with surgery.

*Mental preparation.* Other ways to measure mental preparation may show whether this type of preparation is important to particular patients. Possibly, in-depth interviews in which patients describe why they have particular expectations, what they like and dislike about the information provided, and what they actually do to handle the stress of surgery, may give a better view on mental preparation before surgery. The study of unusual cases such as cases with extremely high scores on pre- and postoperative measures and those with unexpected values beyond the levels predicted by the applied

multiple linear regression equation (outliers), may show whether mental preparation is required in such patients and, if so, what kind of preparation is needed.

*Coping behaviours*. Which coping behaviours influence postoperative state remains an intriguing, but complicated question. One suggestion is to investigate actual coping behaviours rather than self-report measures of coping. Furthermore, effects of coping behaviours seem most likely to be detected in subgroups of patients that are as comparable as possible in other variables. In our study of the long-term influence of monitoring and blunting, a blunting style was positively associated with postoperative pain at three months. Post-hoc analysis revealed that this effect was much greater when control variables such as anxiety, age and reoperation were taken into account. Differences in effects of coping on postoperative state between men and women also suggest that coping varies widely among patients and that only particular subgroups of patients are comparable regarding their way of coping.

Besides, the monitoring- and blunting-related distinction between vigilant and avoidant coping behaviours yielded some consistent findings throughout the past thirty years as described in chapter 7. On the basis of the theoretical considerations of chapter 7 the following future directions are suggested. Differences in coping behaviour may be investigated in relation to the controllability of the situation, time reference and interpretational set of the situation (i.e., whether a situation is interpreted in terms of emotional value, or alternatively, in a nonemotional way). We proposed that although blunting or avoidance is most often found to be the more adaptive strategy in low-control situations, monitoring may still have beneficial effects when coping with more controllable aspects of a stressful situation. As regards the interpretational set, we suggest that not only outcome measures related to emotional value and threat of the situation, such as pain and anxiety deserve to be studied, but also outcome measures related to the less emotional aspects of surgery. Examples of these are: adherence to the regimen, the exercise programme, medication intake, and particular actions that should be undertaken by patients after surgery such as returning to the physician for a postoperative check up. Furthermore, future research may establish whether

avoidance is the more adaptive strategy for short-term adaptation, and vigilance a better strategy in the long run, since coping demands may change over time (Auerbach, 1989). This emphasizes the need for systematic longitudinal research of the adaptiveness of coping strategies.

## Implications for clinical practice

The results of this project are based on the study of two patient samples. Implications for clinical practice are therefore preliminary. However, on the basis of the present and other studies and of observations during the interviews, we will present some suggestions.

*Recognizing patients at risk of poor postoperative state*

Our results may be used to indicate which patients are at risk of recovering less well. Checking patients' levels of preoperative anxiety, fatigue, pain and expectations of postoperative pain might help the hospital staff to detect patients who may be at risk of poorer recovery or may experience more anxiety or disappointment after surgery. As was shown in chapter 4, anxiety judged by the nurses on the ward predicted poor postoperative state. This suggests that nurses are able to recognize preoperative anxiety related to postoperative adjustment. For the further recognition of preoperative stress responses a short and easily applicable questionnaire may be developed, for example in the format of three Visual Analogue Scales, giving a global impression of the levels of preoperative anxiety, fatigue and pain. However, before such a questionnaire could be applied, it should first be validated and evaluated regarding its ability to predict postoperative state in individual patients. Besides, we believe that good clinicians have the sensitivity to recognize patients with preoperative anxiety, fatigue or pessimistic expectations without the use of questionnaires. When clinicians take the preoperative levels of stress into account they may refine their expectations about the progress of

recovery and may be able to predict which patients will come back after a few months with less than optimal recovery from lumbar surgery. In such patients clinicians may more easily consider psychological causes, such as prolonged stress, apart from physical causes such as an unsuccessful operation.

*Intervention techniques*

Preoperative intervention techniques may be applied to facilitate recovery. Several studies showed that interventions designed to treat preoperative anxiety and fear may result in a better postoperative emotional and physical state (Anderson, 1987; Edelman, 1992; O'Halloran & Altmaier, 1995; Pickett & Clum, 1982; Salmon, 1993; Teasdale, 1993). Beneficial results have been obtained from video-taped presentation of information that included interviews with recovered patients (Anderson, 1987). Cognitive restructuring (referring to interventions in which one tries to learn patients to evaluate events as less threatening than they originally believed or feared) and modelling approaches (such as exposure to a model, demonstrating initial fear followed by successful coping) have also yielded positive effects (Edelman, 1992; O'Halloran & Altmaier, 1995). Furthermore, emotional support provided by the hospital staff as suggested by Salmon (1993) which enables patients to disclose their fears, may reduce unproductive worries. This kind of emotional support may also facilitate the experience of tension or nervousness. Also, the reframing of preoperative pessimistic expectations as described by Teasdale (1993) seems a promising intervention technique to prevent disappointment in patients who are pessimistic about their postoperative pain and recovery. Our results indicate that it is not necessary and may even be harmful to change the optimistic expectations or beliefs some patients have, e.g., that they will experience little or no postoperative pain. Providing written information only seems to be less effective in reducing preoperative anxiety than the interventions just mentioned, but has been shown to affect behavioural ratings of adjustment and discomfort (Edelman, 1992). Furthermore, relaxation techniques seem to be less effective in patients undergoing surgery than in patients undergoing uncomfortable

medical procedures other than surgery such as gastrointestinal endoscopy, sigmoidoscopy and dental extraction.

*Other clinical implications*

The finding that patients with little anxiety and those who expected no postoperative pain showed better adjustment to surgery than other patients may seem at odds with the notion that giving accurate, but sometimes threatening information about risks of surgery and postoperative pain and complaints is necessary. Clinicians even have the obligation to provide information about risks. As regards the provision of information, the way such information is provided seems to be very important. In our opinion, it is the way information is provided rather than the amount of information that influences patients' attitudes towards surgery and recovery. A nonconfronting, nonthreatening attitude seems most appropriate when providing information about risks. For example, clinicians may tell patients in a nonthreatening way that "in case of lumbar surgery, there is small a risk of becoming disabled". However, if information is provided in a confronting way that compels a patient to realize that "it is indeed me who may be the victim of unsuccessful surgery", anxiety may easily arise. Part of an empathic attitude towards patients' anxiety is that risks are discussed without going into detail regarding the further scenarios that may result from unsuccessful surgery. It also seems inappropriate to change positive attitudes towards surgery or to warn patients of pain in such a way that they become anxious or pessimistic about the outcome of surgery. Future research may show whether differences in the way information is provided, especially between information given with a nonconfronting versus a confronting attitude are important to the adjustment to surgery.

# Summary

This thesis describes an investigation into the influence of preoperative stress and mental preparation before surgery on postoperative state. Three indications of stress were investigated, preoperative anxiety, fatigue and pain, and two indications of mental preparation before surgery, information seeking behaviour and patients' expectations of postoperative pain and recovery.

Chapter 1 describes the choice of preoperative variables, the postoperative measures and the study subjects of the thesis. In the chapters 2 and 3 the investigations on influence of preoperative state anxiety, fatigue, pain and information-seeking behaviour on postoperative state were reported.

In chapter 2 the association between preoperative biographic, medical and psychological variables on the one hand and six different postoperative outcome measures on the other was investigated in 126 patients undergoing lumbar surgery. To assess the association between the many pre- and postoperative variables canonical correlations were calculated. Postoperative state was assessed at three days as well as at three months postoperatively. Results showed that female sex, greater amount of preoperative analgesic intake, expected poor recovery according to the neurosurgeon and higher levels of preoperative anxiety were associated with poorer short-term postoperative emotional and physical state. Furthermore, higher levels of preoperative anxiety, fatigue and pain during daily activities were associated with poorer long-term postoperative emotional and physical state. A reoperation and higher levels of preoperative back pain were associated with poorer long-term postoperative emotional and physical state and disorder-specific recovery.

In chapter 3 the same variables as in chapter 2 were investigated in the lumbar surgery patients, but now as predictors of two specific outcome measures, i.e., postoperative anxiety and physical complaints. Results were controlled for the influence of medical and biographic variables. The outcome measures were measured at three days postoperatively. Results showed that higher levels of preoperative anxiety and fatigue

predicted higher levels of postoperative anxiety and physical complaints. Preoperative pain in the leg predicted higher levels of postoperative anxiety. No evidence was found that the information seeking behaviours monitoring and blunting are important to the prediction of postoperative state.

In chapters 4 and 5 we took a closer look at anxiety. We investigated the possibility that, although preoperative state anxiety is clearly unfavourable for postoperative state, some aspects of anxiety might be beneficial. The outcome measures were measured at three days postoperatively. We found that, apart from preoperative state anxiety, specific anxiety and observed anxiety each had a unique, unfavourable effect on postoperative anxiety. However, we also found that preoperative tension, an emotional aspect of anxiety, was associated with less postoperative anxiety after controlling for the other anxiety aspects. This suggested that patients who reported high specific anxiety (i.e., cognitive anxious patients) and high tension adjusted better than cognitive anxious patients with low tension. This would be in line with the assumption that anxiety or stress is not always detrimental and may have an adaptive function in overcoming surgical stress.

In chapter 5 we investigated whether the findings of chapter 4 could be extrapolated to patients undergoing diverse types of operations. We studied the influence of four aspects of anxiety, i.e., state anxiety, specific anxiety, tension, and the amount of thinking about surgery, on postoperative anxiety and physical complaints (at three days postoperatively) in 60 patients undergoing different types of surgery. Results showed that each preoperative anxiety aspect was positively associated with postoperative anxiety. Furthermore, tension and amount of thinking about surgery were also positively associated with physical complaints. None of the different aspects of preoperative anxiety showed a beneficial effect in this mixed patient group. These results suggested that preoperative anxiety generally affects postoperative state unfavourably in patients undergoing different types of surgery.

In chapter 6 we investigated patients' expectations of pain and recovery and their relation with postoperative pain and disappointment in the sample of patients who

underwent lumbar surgery. The results showed that patients who expected to have little or no postoperative pain in the leg and back reported significantly less postoperative pain and disappointment at three days and at three months after surgery than patients with the expectation of having postoperative pain in the leg and back. These results were in line with previous findings that patients with optimistic expectations having little postoperative pain will show better postoperative adjustment than patients with pessimistic expectations or beliefs about postoperative pain and recovery. The results were contrary to the assumption that patients who expected pain to occur were better prepared to overcome discomfort and would, therefore, tend to have a lower level of disappointment than patients who expected little or no pain. Taken together, the findings suggested that the expectations measured were indications of optimistic and pessimistic beliefs about recovery rather than an indication of mental preparation before surgery.

In chapter 7 a theoretical analysis of the adaptive function of coping behaviour related to postsurgical adjustment was undertaken. It was assumed that the characteristics of a situation rather than person characteristics determine which coping behaviours will be adaptive when coping with a particular event. A review of the literature yielded three conditions of the situation that determine the adaptiveness of coping: controllability of the situation, time-reference (short-term or long-term) and interpretational set (i.e., whether a situation is interpreted in terms of emotional value, or alternatively, in a nonemotional way). Problem-focused coping, vigilance, active coping and monitoring seem to be more adaptive in controllable situations, emotion-focused coping, avoidance, blunting and passive coping when little control is possible as in the case of surgery. For short-term adaptation, avoidance seems the more adaptive strategy, whereas in the long run vigilance is a better strategy. Regarding interpretational set, avoidance seems more adaptive when patients had to cope with the emotional value of the event, such as coping with anxiety and pain. Vigilance seems more adaptive when coping with less emotional elements of the event, such as

preparing for exercises that should be performed in the postoperative period and adherence to the treatment regimen.

In chapter 8 a discussion of the results was presented. It was concluded that patients with high levels of preoperative anxiety, high levels of fatigue and expectations of pain to occur will on average show poorer emotional and physical state shortly after surgery than other patients. Patients with high levels of pain in the leg will on average show a poorer emotional state than patients with low levels of leg pain. Furthermore, patients with high levels of preoperative anxiety, fatigue, pain during daily activities, and those who expect postoperative pain will, on average, show a poorer postoperative emotional and physical state in the long run than other patients. Patients with high levels of preoperative backache and those who had a reoperation are at risk of poor long-term emotional and physical state, and poor disorder-specific recovery.

We found no evidence that patients who seek a lot of information or have expectations of pain to occur are better prepared to overcome postoperative pain and discomfort than other patients. Considering that several investigators were unable to establish a beneficial influence of mental preparation before surgery, it is arguable that the construct of mental preparation is far less important as a determinant of postoperative state than other patient characteristics such as the anxiety level, fatigue, pain and global expectations or beliefs about postoperative state.

Finally, implications of the results in relation to intervention strategies aimed at diminishing the stress of surgery and consequences for future research were discussed.

# Samenvatting

Dit proefschrift beschrijft een onderzoek naar de invloed van preoperatieve stress en mentale voorbereiding voor een operatie op de toestand van patiënten na een operatie. Er werden drie verschillende indicaties van stress onderzocht, namelijk preoperatieve angst, vermoeidheid en pijn, en twee indicaties van mentale voorbereiding op de operatie, namelijk informatie-zoekend gedrag en verwachtingen die patiënten hebben van pijn en herstel na de operatie.

In hoofdstuk 1 werd de keuze van de preoperatieve variabelen, de postoperatieve uitkomstmaten, en de onderzochte patiëntengroepen besproken. In de hoofdstukken 2 en 3 werd het onderzoek naar de invloed van preoperatieve angst, vermoeidheid, pijn en informatie-zoekend gedrag op de postoperatieve toestand beschreven.

In hoofdstuk 2 werd bij 126 patiënten die een rugoperatie ondergingen het verband tussen enerzijds preoperatieve biografische, medische en psychologische variabelen en anderzijds zes verschillende uitkomstmaten geschat met behulp van een canonische correlatietechniek. Met deze techniek werd gekeken naar de algemene samenhang tussen groepen pre- en postoperatieve variabelen. De postoperatieve toestand werd zowel drie dagen als drie maanden na de operatie gemeten. Uit dit onderzoek bleek dat vrouwelijke patiënten, patiënten waarbij een minder gunstig herstel verwacht werd door de neurochirurg, patiënten die relatief veel pijnmedicatie voor de operatie gebruikten en patiënten met een hoger angstniveau drie dagen na de operatie een gemiddeld slechtere postoperatieve emotionele en fysieke toestand lieten zien dan andere patiënten. Daarnaast bleek dat een hogere mate van preoperatieve angst, vermoeidheid en pijn bij dagelijkse activiteiten samenhingen met een minder gunstige emotionele en algemene fysieke toestand op de lange termijn, maar niet met operatie-specifiek herstel. Het voor de tweede keer ondergaan van de operatie en een hogere mate van preoperatieve rugpijn hingen samen met een minder goede postoperatieve emotionele en fysieke toestand en slechter operatie-specifiek herstel.

In hoofdstuk 3 werden dezelfde variabelen onderzocht als in hoofdstuk 2 bij de patiënten die een rugoperatie ondergingen, maar nu als voorspellers van twee specifieke uitkomstmaten, namelijk postoperatieve angst en lichamelijke klachten. Hierbij werd gecontroleerd voor de invloed van biografische en medische variabelen. De uitkomstmaten werden drie dagen na de operatie gemeten. De resultaten lieten zien dat een hoger niveau van preoperatieve angst en vermoeidheid zowel meer postoperatieve angst als meer lichamelijke klachten voorspelde. Een hoger niveau van preoperatieve pijn in het been voorspelde meer angst na de operatie. Er waren geen aanwijzingen dat informatie-zoekend gedrag van belang is voor het voorspellen van de postoperatieve toestand.

In de hoofdstukken 4 en 5 werd de invloed van preoperatieve angst nader bekeken. Verschillende onderzoekers veronderstellen dat angst of stress niet alleen een ongunstige invloed heeft op herstel maar soms ook een gunstige invloed kan hebben omdat mensen die zich wat angstig voelen zich beter zouden voorbereiden op een operatie dan patiënten met weinig angst. Wij onderzochten daarom de mogelijkheid dat sommige aspecten van angst een ongunstige en andere angstaspecten een gunstige invloed hebben op de postoperatieve toestand. Er werden vijf aspecten van preoperatieve angst onderzocht, toestandsangst, specifieke angst voor de operatie (cognitieve angst), emotionele spanning, de mate van denken aan de operatie in de week voor de operatie en angstig gedrag geobserveerd door de verpleging. Er werd gevonden dat toestandsangst, specifieke angst en geobserveerde angst ieder een unieke ongunstige invloed hadden op postoperatieve angst. Daarnaast werd echter gevonden dat een hogere emotionele spanning gerelateerd was aan minder postoperatieve angst na controle voor de invloed van de andere angstaspecten. Dit suggereerde dat patiënten die zich zorgen maken (cognitief angstig zijn) en tevens emotionele spanning voelen beter herstellen dan cognitief angstige patiënten die geen emotionele spanning voelen. Deze bevinding ondersteunt de veronderstelling dat angst of stress niet altijd ongunstig is en een adaptieve functie kan hebben bij het zich aanpassen aan een stressvolle gebeurtenis.

In hoofdstuk 5 werd onderzocht of de bevindingen van hoofdstuk 4 gegeneraliseerd konden worden naar patiënten die verschillende soorten operaties ondergaan. De invloed van vier angstaspecten, toestandsangst, specifieke angst, emotionele spanning en de mate van denken aan de operatie in de week voor de operatie, werd onderzocht in een nieuwe groep van 60 patiënten die verschillende soorten operatie ondergingen. In dit onderzoek bleek dat elk angstaspect een ongunstige invloed had op de postoperatieve toestand. We vonden dus geen aanwijzing dat emotionele spanning een gunstige invloed had in deze heterogene patiëntengroep.

In hoofdstuk 6 onderzochten we het verband tussen de verwachtingen over postoperatieve pijn en herstel en de mate van pijn en teleurstelling na de operatie in de groep patiënten die een rugoperatie onderging. Uit de resultaten bleek dat patiënten die geen postoperatieve pijn in het been en de rug verwachtten, drie dagen en drie maanden na de operatie minder postoperatieve pijn en teleurstelling rapporteerden dan patiënten die wel pijn verwachtten. Deze resultaten kwamen overeen met eerder bevindingen dat patiënten met een optimistisch geloof over het algemeen beter herstellen dan patiënten met pessimistisch geloof wat betreft pijn en herstel. De resultaten waren in tegenstelling met de aanname dat patiënten die pijn verwachten beter voorbereid zouden zijn en daardoor minder teleurstelling zouden rapporteren dan patiënten die geen pijn verwachten. Samengenomen suggereerde de bevindingen dat de gemeten verwachtingen eerder indicaties waren van een optimistisch of pessimistisch geloof van patiënten dan een indicatie van mentale voorbereiding op een operatie.

In hoofdstuk 7 werd vanuit een theoretisch kader de invloed van verschillende manieren van omgaan met de operatie op het herstel beschreven. Er werd vanuit gegaan dat niet zozeer persoonsgebonden karakteristieken als wel bepaalde karakteristieken van de situatie bepalen welke manier van omgaan met de operatie adaptief is voor het herstel na de operatie. Een analyse van eerder onderzoek naar de invloed van de manier van omgaan met situatie op postoperatief herstel leverde drie condities van de situatie op die de adaptieve waarde van de manier van omgaan met de situatie bepalen: de mogelijkheid van controle in de situatie, het moment na de operatie waarop het herstel

gemeten is (kort of lang na de operatie) en de manier van interpretatie van de situatie (interpretatie van emotionele aspecten van de situatie of interpretatie van een meer technische, niet-emotionele aspecten). Op basis van de literatuur werd geconcludeerd dat een probleemgerichte manier van omgaan met de situatie, een alerte oplettende houding, een actieve houding en informatiezoekend gedrag meer adaptief zijn in meer controleerbare situaties. Een emotiegerichte manier van omgaan, afleidingzoekend gedrag, informatie-vermijdend gedrag en een passieve houding lijken meer adaptief in situaties waar weinig controle mogelijk is zoals bij het ondergaan van een operatie. Voor adaptatie in een korte periode, lijkt afleidingzoekend, vermijdend gedrag een betere strategie, terwijl op langere termijn alert informatie-zoekend gedrag een betere strategie is. Wat betreft de interpretatie van de situatie lijkt vermijdend, afleidingzoekend gedrag beter wanneer een patiënt omgaat met aspecten van een situatie die emoties oproepen zoals het moeten ondergaan van anesthesie en de te verwachten pijn en ongemakken na de operatie. Een alerte informatie-zoekende houding is beter wanneer men omgaat met minder emotioneel beladen aspecten zoals het zich voorbereiden op een oefenprogramma, en het zich houden aan de medicatie en andere voorschriften van de behandeling.

In hoofdstuk 8 werden de resultaten besproken. Er werd geconcludeerd dat patiënten met een hoog niveau van preoperatieve angst en vermoeidheid, en met de verwachting postoperatief pijn in het been en/of de rug te hebben, na de operatie gemiddeld een minder goede emotionele en fysieke toestand zullen laten zien dan andere patiënten. Patiënten die veel pijn in het been rapporteren zullen een minder goede postoperatieve emotionele toestand laten zien. Verder zullen patiënten met hoge niveaus van preoperatieve angst, vermoeidheid, pijn gedurende dagelijkse activiteiten en diegene die postoperatieve pijn verwachten op de langere termijn een minder goede postoperatieve emotionele en fysieke toestand laten zien. Patiënten die voor de tweede keer geopereerd worden en patiënten die preoperatief veel rugpijn rapporteren zullen op de langere termijn een minder goede postoperatieve emotionele en fysieke toestand laten zien en een minder gunstig operatie-specifiek herstel.

We vonden in het onderzoek geen aanwijzingen dat patiënten die veel informatie hadden gezocht of patiënten die hun verwachtingen laag hadden gesteld, en dus pijn verwachtten na de operatie, beter voorbereid waren op de postoperatieve pijn en ongemakken dan andere patiënten. Het feit dat vele onderzoekers niet in staat zijn geweest om bewijs te vinden voor een gunstige invloed van mentale voorbereiding op de operatie, lijkt de conclusie te rechtvaardigen dat het construct van mentale voorbereiding veel minder belangrijk is als een determinant van de postoperatieve toestand dan andere karakteristieken van patiënten zoals het niveau van preoperatieve angst, vermoeidheid en pijn, en de globale verwachtingen of geloof over het postoperatieve herstel.

Tot slot werden de implicaties van de resultaten besproken voor interventie-strategieën gericht op het verminderen van stress voor de operatie en voor toekomstig onderzoek.

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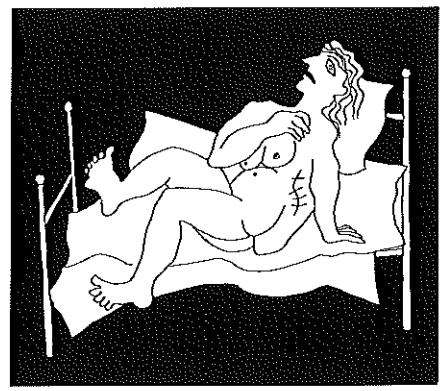

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# Curriculum vitae

Karen Irene (Karina) de Groot werd geboren op 28 maart 1964 te Naarden. Na het doorlopen van het VWO aan het Stedelijk Gymnasium te Arnhem begon zij in 1982 aan de studie fysiotherapie aan de Hoge School Interstudie te Nijmegen. Van 1985 tot 1986 studeerde ze filosofie aan de Katholieke Universiteit te Nijmegen. In 1987 studeerde ze af als fysiotherapeute. Aansluitend begon zij de studie psychologie aan de Universiteit van Amsterdam. In 1992 legde zij het doctoraal-examen af met als afstudeerrichtingen psychologische functieleer en klinische psychologie. Van 1992 tot en met 1996 werkte zij als Assistent In Opleiding bij het Instituut Medische Psychologie en Psychotherapie van de Erasmus Universiteit te Rotterdam.