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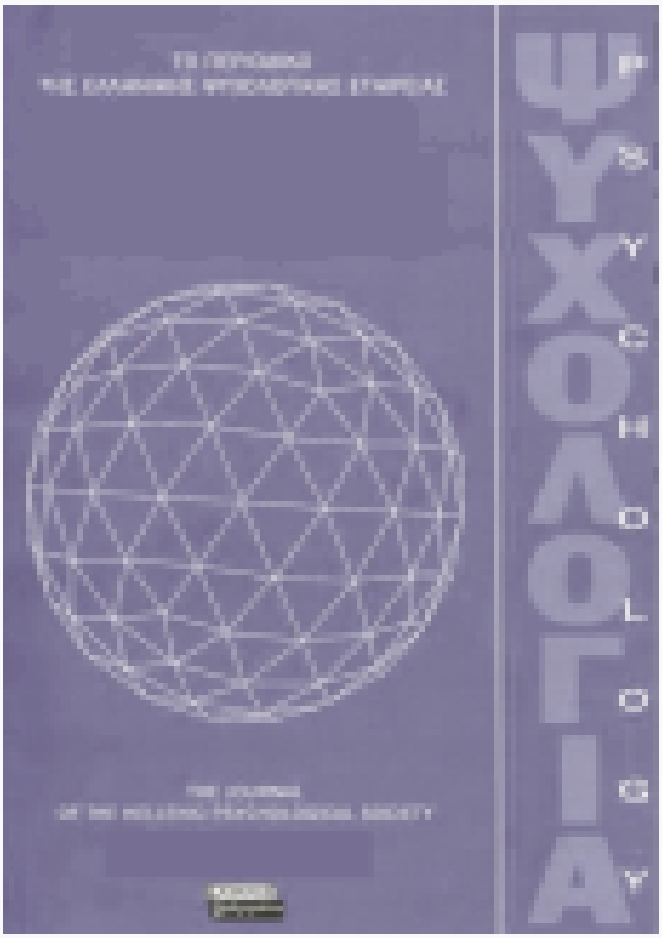


# Psychosocial functioning and anaesthetic requirements in patients undergoing coronary artery bypass grafting

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# Psychosocial functioning and anaesthetic requirements in patients undergoing coronary artery bypass grafting

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*ABSTRACT* This study examined the effects of emotional disclosure, active coping, and social support on general anaesthesia, in patients undergoing coronary artery bypass grafting. Three stages of anaesthesia were examined: Pre-medication, induction, and maintenance (analgesia, muscle relaxation). Age, weight, and number of grafts were included as control variable. One hundred and fifty seven Greek patients participated in the study. Results showed that active coping was associated with reduced amount of Pavulon, administered during maintenance to anaesthesia. Additionally high quantity of emotional disclosure mediated by preoperative distress was directly related to increased amount of Morphine, administered in the pre-medication phase. The study discusses the impact of different psychosocial factors on different stages of anaesthesia.

*Key words*: Preoperative distress, Coping, Cardiac Surgery, Anaesthesia.

## Introduction

An interest in how psychological processes can influence operative adaptation and postoperative recovery has generated a considerable amount of research (Johnston, 1996; O'Hara, Ghoneim, Hinrichs, Metha, & Wright, 1989). Surgery, regardless of type and severity, involves a multitude of stressors, and several preoperative interventions have been developed in an attempt to modify patient responses to these stressors. However, the assumption that preoperative anxiety is related to an increase in anaesthetic requirements and slower recovery from surgery has not received unequivocal support (Abbott & Abbott, 1995; Ehsan-Ul-Haq, 2004; Stabell, Andresen, Bakke, Bjornaes, Borchgrevink, et al., 2004). Empirical studies have produced opposite findings (Elkins, Rajab, Marcus, & Staniunas, 2004; Johnston & Carpenter, 1980; Linn, Linn, & Klimas, 1988; Manyande & Salmon, 1992; Stomberg, Sjostrom, & Haljamae, 2001).

Two conflicting hypotheses about the relationship of preoperative anxiety to anaesthetic requirements have both received empirical support. The first hypothesis assumes that highly anxious patients require greater amount of anaesthetics in order to establish a clinically sufficient depth of anaesthesia (Goldman, Ogg, & Levey, 1988; Johnston & Carpenter, 1980). The second hypothesis suggesting a negative relation of preoperative anxiety and anaesthetic requirements was derived from the «work of worry» of Janis (1958). According to Janis, anticipatory stress helps the patient to adapt to the forthcoming surgery through the process of mental rehearsal.

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Consequently, patients with moderate or high levels of stress would be better prepared for the surgery and would require lower doses of anaesthetic (Schaefer, Kleeman, Krohne, Vrana, & Dick, 1996). The assumption has been supported by the physiological finding that psychological or pharmacological relief of anxiety compromises endocrine responses after surgery and decreases plasma levels of b-endorphin (Salmon, 1992; Walsh, Puig, & Lovitz, 1987). Research has shown that in stressful situations b-endorphin can potentially supplement anaesthesia requirements by inducing a phenomenon called «stress-induced analgesia» (Sternberg & Liebeskind, 1995).

The apparent disagreement in the empirical findings suggests that different anxiety inducing, or releasing factors might have different effects on anaesthetic requirements and surgical recovery. Indeed, psychological research concerning this topic has shifted emphasis from studying preoperative anxiety to studying the social resources, cognitive operations and coping strategies patients employ in order to deal with it (Krohne, Slangen, & Kleeman, 1996a, 1996b). Another source of contradictory findings may be related to the fact that psychological research has treated anaesthesia as a *uniform* procedure, and has failed to address the issue that psychological factors might have different effects, during the different stages of anaesthesia. Additionally, Vogele and Steptoe (1986) have recorded over 30 agents (anaesthetics, muscle relaxants, and analgesics), which have been given to patients in various combinations during the operative period.

This study explores the role of emotional disclosure, active coping, and social support on different stages of anaesthesia during coronary artery bypass grafting. Emotional disclosure refers to the extent to which patients verbally expressed their emotions with regard to the forthcoming operation. Active coping refers to any attempt to confront, influence, or change the stressful situation and the associated feelings. For the purposes of the study only perceived emotional support was assessed. Previous studies have consistently shown the beneficial effects of emotional disclosure on health and well being (Panagopoulou, Maes, Rime, & Montgomery, 2004; Smyth, 1998). Similarly, studies have shown emotional support to be related to improved psychosocial adjustment in patients in general, and surgical patients in specific (Hobfoll & Vaux, 1993; Kulik, Mahler, & Moore, 1996). It was therefore hypothesized that emotional disclosure and emotional support would be negatively related to amount of anaesthetic requirements and that the relationship would be mediated by preoperative distress. Alternatively active coping would be positively related to anaesthetic requirements and the relationship would be mediated by preoperative distress. The second prediction was based on evidence showing that in stressful situations with restricted controllability (such as being hospitalized for a cardiac operation), active, approach, or vigilant coping strategies lead to higher levels of emotional strain (Krohne, 1990). Age and number of grafts were also measured as control variables. In regard to the separate anaesthesia phases, a prediction was made that the relationships would be stronger for the premedication phase as compared to the induction phase, and for the induction phase as compared to the maintenance phase. The underlying assumption in that prediction was that the influence of preoperative psychological factors on anaesthetic requirements would be more evident, the closer it was assessed to the patients' conscious state of being.

## Method

### Participants

All consecutive patients admitted for non urgent coronary artery bypass grafting (CABG) in the cardio thoracic surgery unit of a city-hospital in Greece, between January 1998 and February 1999 were considered potentially eligible for the

study. Inclusion criteria were: (a) fluency in Greek, (b) physical mobility, (c) ability to complete psychological questionnaires and respond to an interview situation, and (d) minimum scheduled preoperative stay of two days. Patients were excluded if they were under any form of psychoactive medication. During the period of data collection 256 patients were approached. Ten people refused to participate; 16 were excluded due to inability to understand Greek, or complete the questionnaires; 27 were scheduled for operation the day after admission; 12 left the hospital without having the operation; 12 could not finish the first interview due to physical pain, tiredness, or severe stress symptoms; 4 people were excluded due to hearing problems and 1 due to medication for psychotic episodes. Finally, due to reasons of administration, 17 patients were admitted for operation couldn't be contacted. The final sample was composed of 157 patients representing a completion rate of 64%. The participants were predominantly male (91.7%), and married (87.8%). Sixty percent of the participants ($N$ = 94) were 60 years old or older. Detailed information on the sample of the study are shown in Table 1.

**Materials**

Emotional disclosure was measured daily, between admission day and the day before surgery, using the «diary method» used by Rimé and colleagues (Rimé et al., 1992). Each participant was given a diary comprising of one page for each preoperative day. Participants were asked to rate on a 5-point Likert scale (1 = not at all, 5 = very much so), every night before they went to bed, the extent to which they talked about their feelings concerning the forthcoming operation. The final score for each patient was derived by the sum of the daily scores divided by the number of preoperative days they gave information on (range: 1-5). The use of multiple, daily assessments, was expected to increase the reliability of the instrument, by avoiding memory biases often associated with one-time retrospective statements. The internal consistency coefficient of surgery-related emotional disclosure was satisfactory ($a$ = 0.93).

Active coping was assessed on the day before surgery with the task-oriented coping subscale of the Coping Inventory for Stressful Situations, the Situation Specific version (CISS-SSC; Endler & Parker, 1994). Sample items include: «I think about what I can do to change the situation»; «I make a plan of action». The internal reliability coefficient for the sample of this study was satisfactory ($a$ = 0.82).

Emotional support was assessed on admission day with the social support subscale of the Leiden Screening Questionnaire for Heart patients (Van Elderen, Chatrou, Weeda, & Maes, 1997). For the purposes of the study we only used the sub-scale on perceived emotional support ($a$ = 0.70). The respondents were given a list of eight possible support providers and were asked to indicate in a 3-point Likert scale (0 = not all, 1 = partially, 2 = completely) to what extent they relied on each one every time they needed support for personal or emotional problems. The final score for each patient was derived as the sum of all answers (range: 0-16).

Preoperative distress was measured with the negative affect subscale ($a$ = 0.78) of the Positive Affect Negative Affect Scale, the extended version (PANAS-X; Watson & Clark, 1994) on the day before surgery. The total scale comprises of 59 items describing different emotions (e.g. angry, sad). Participants were asked to indicate in a 5-point Likert scale (1 = not at all, 5 = very much so) the extent to which they feel the emotion described by each item.

Information on number of grafts and demographic characteristics was taken from the medical records.

Stages of anaesthesia and anaesthetic agents were defined by the hospital anaesthesiologist, and in consultation with the Greek Index of Pharmacological Substances and Prescriptions (1996). Three stages were examined: Pre-

**Table 1**
**Demographic and medical characteristics of the sample of the study (%) (*N* = 157)**

| | |
|---|---|
| Gender | |
| *Male* | 91.7 |
| *Female* | 8.3 |
| Age | |
| *< 30* | 2.0 |
| *31-40* | 2.0 |
| *41-50* | 11.2 |
| *51-60* | 24.5 |
| *61-70* | 47.7 |
| *> 71* | 12.6 |
| Occupational status | |
| *Working* | 40.1 |
| *Non-working* | 7.7 |
| *Retired* | 52.2 |
| Marital status | |
| *Married* | 87.8 |
| *Single* | 2.6 |
| *Divorced* | 3.8 |
| *Widowed* | 5.8 |
| NYHA | |
| *I* | 17.5 |
| *II* | 26.5 |
| *III* | 35.0 |
| *IV* | 21.0 |
| Grafts | |
| *1* | 10.9 |
| *2* | 24.6 |
| *3* | 43.5 |
| *4* | 21.1 |
| Previous MI | |
| *Yes* | 46.8 |
| *No* | 53.2 |

medication, induction, and maintenance to anaesthesia. Maintenance was divided into analgesia and muscle-relaxation. During pre-medication patients received Morphine, on the evening before the surgery. Induction to a clinically sufficient depth of anaesthesia was achieved by intravenously administering Hypnomidate (etomidate). Finally Pavulon (pancuronium bromide) was administered intravenously for muscle relaxation and Fentanyl (fentanyl citrate) for analgesia purposes. The above pharmacological agents were administered gradually and in several combinations. Information on the final dose of each anaesthetic, normalised for body weight (mg agent/kg body weight) was derived from the anaesthesiologist records.

**Procedure**

Patients were approached in their wards by one of the interviewers on admission day. They were asked to participate in a research project investigating the way Greek patients deal with the experience of cardiac surgery. Interviews were conducted by the researcher and by two trained postgraduate clinical psychology students, in a private room. After obtaining an informed consent, patients were given the emotional disclosure diary and were asked to fill in one page in the end of each pre-operative day, before they go to sleep. To make sure patients understood the questions, they completed the first (admission) day with the interviewer. During the first interview they were also administered the emotional support scale. The second interview took place on the day before surgery. Due to hospital administration procedures, the length of preoperative waiting was different for each patient. Consequently, the second interview took place between the third and the tenth day of preoperative hospitalisation, before the visit of the anaesthesiologist. Patients completed the last preoperative day of the diary with the interviewer during the second interview, and they were also administered the active coping and preoperative distress scales. Patients in the study received no psychosocial preparatory intervention, and unless medically required, they were visited by the consulting surgeon on admission day, and on the day before the surgery. On the evening before the surgery, they were also visited by the hospital anaesthesiologist and were pre-medicated.

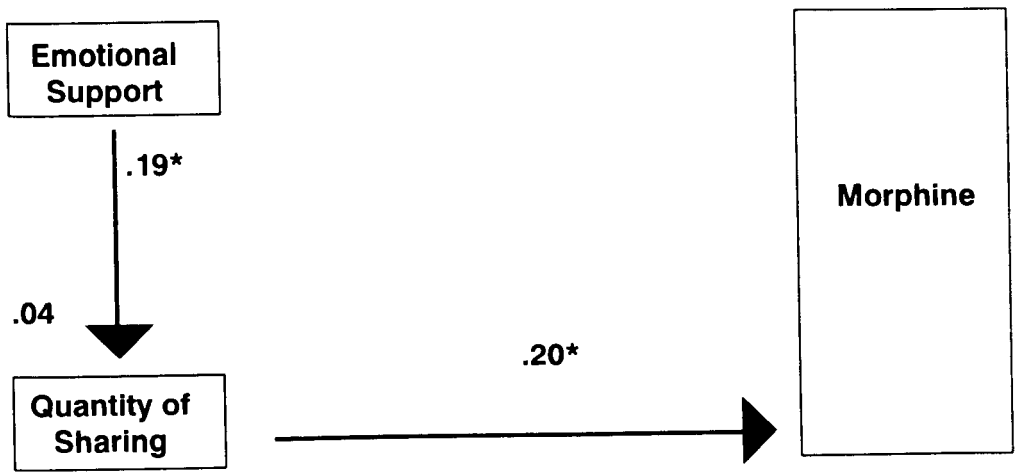
## Results

Out of 157 participants interviewed on admission day, 9 had to be urgently re-scheduled for an operation on the day following admission and 6 refused to continue with the study on the second interview. In total 142 patients participated in the second interview.

A series of bivariate correlations were conducted to explore the initial pattern of associations in the variables of the study. No differences were found in emotional disclosure between the first and the last day, so the mean score was used. Amount of Morphine used in the pre-medication phase was positively related to emotional disclosure ($r = 0.19$, $p < .05$), and preoperative distress ($r = 0.18$, $p < .05$). Amount of Pavulon used in the maintenance phase was negatively related to active coping ($r = -0.23$, $p < .05$), and preoperative distress ($r = -0.25$, $p < .05$). No significant relationship was found between emotional support and any of the anaesthetic agents. In terms of control variables, no relationship was found between age and any of the outcome variables. Number of grafts was only related to Fentanyl. Additionally, due to the fact that the number of days patients spent in the hospital before the surgery differed, number of preoperative days was also correlated to all other variables included in the study. No significant relationship was found between preoperative days and any of the variables included in the study. Therefore, the number of preoperative days was not included in further analyses.

Based on the correlation tables two models were tested: The first model tested the mediating effects of preoperative distress in the relationship between emotional disclosure and morphine. The second model tested the mediating effects of preoperative distress in the relationship between active coping and Pavulon. Since no control variables were related to neither Pavulon nor Morphine, they were not included in the models. The models were tested through LISREL 8 structural equation analyses (Jöreskog & Sörbom, 1993), using the AMOS computer program (Arbuckle, 1997). LISREL generates a chi-square goodness of fit statistic to test the extent to which a hypothesized model is consistent with the data. A small, non-significant chi-square value indicates that the model fits the data well. Additionally, the fit of the model to the data was examined with the goodness of fit index

**Figure 1**
**Standardized solution for the model, for Morphine.**




$x^2 = .169, p = .681, df = 1, GFI = .999, NFI = .985, IFI = 1.080$

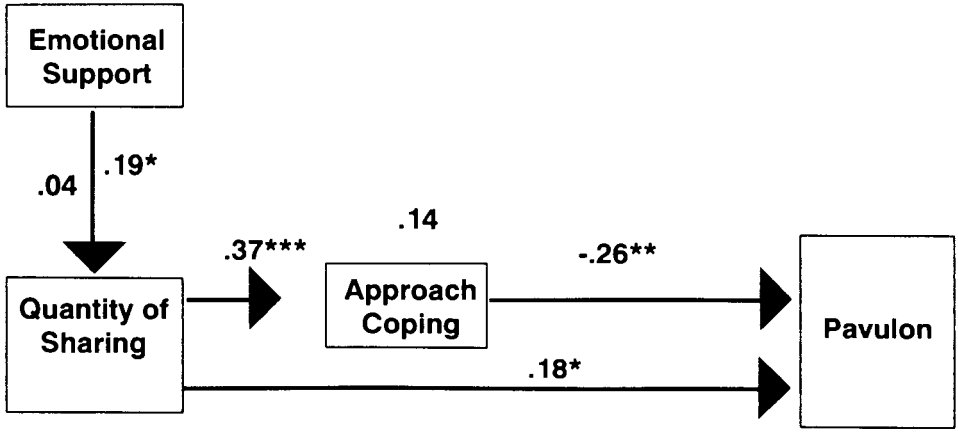
*Note*: All non-significant paths are omitted. Coefficients in italics represent explained variance for the dependent variable.
* $p < .05$.

(*GFI*) and the root mean square error of approximation (*RMSEA*). Further, the normed fit index (*NFI*), the comparative fit index (*CFI*) and the incremental fit index (*IFI*; Bollen, 1989) were utilized. In general, models with fit indices > .90 and an *RMSEA* < .05 indicate a good fit. The overall number of parameters to be estimated was 18. Following the requirements of AMOS, missing values were replaced with the series mean. The ratio of sample size to number of free parameters to be estimated was 8:1 ($N$ = 157), which was well above the cut-off ratio of 5:1 suggested by Bentler (1993) as adequate to obtain trustworthy $z$-tests on the significance of the parameters. The standardized coefficients of the specified model were obtained using the Maximum Likelihood Method of estimation.

The standardized model solutions for Morphine and Pavulon are shown in Figures 1 and 2.

Results showed a good fit of the model for Morphine (pre-medication stage), ($\chi^2$ = 5.938, $p$ = .430, $df$ = 2), and Pavulon (muscle relaxation stage) ($\chi^2$ = 5.953, $p$ = .429, $df$ = 2). The sample-size independent fit-indices of the two models were close to 1 values, indicating a very good fit (for Morphine: *GFI* = 0.988, *NFI* = 0.954, *IFI* = 1.000, *RMSEA* = 0.035; for Pavulon: *GFI* = 0.988, *NFI* = 0.954, *IFI* = 1.000, *RMSEA* = 0.035). The total explained variance was 8% for Morphine and 7% for Pavulon. An examination of the $t$-tests for significance of the path coefficients revealed that the path linking preoperative distress to Pavulon was not significant. The direct effect of active coping on Pavulon, when distress was not included, was $\beta$ = -0.26, $p$ = .002, indicating that

**Figure 2**
**Standardized solution for the model, for Pavulon.**




$x^2 = 1.463, p = .481, df = 2, GFI = .995, NFI = .964, IFI = 1.014$

*Note*: All non-significant paths are omitted. Coefficients in italics represent explained variance for the dependent variable.
* $p < .05$, ** $p < .01$, *** $p < .001$.

the relationship of active coping to Pavulon was not mediated by distress. The same procedure indicated that the effects of emotional disclosure on morphine were not mediated by preoperative distress ($\beta = 0.20, p = .031$).

## Discussion

Results of the study show that emotional disclosure mediated by preoperative distress is positively related to the amount of anaesthetic required in the pre-medication phase: The more patients disclose their emotions with regard to the forthcoming operation, the more distressed they become, and as a result the more anesthesia they require during the premedication phase. Alternatively, results show a negative association between active coping and amount of anaesthetic required for muscle-relaxation purposes during maintenance phase. The more patients engage in an attempt to change or influence the situation, one day before surgery, the less amount of anaesthetic they require for muscle-relaxation purposes, during maintenance phase.

Pharmacological agents administered during the other stages of general anaesthesia (induction, maintenance-analgesia) were not related to any of the psychological variables.

In contrast to our hypothesis, active coping was negatively associated to amount of anaesthetic required during maintenance phase. A similar relationship was reported in a study conducted with patients undergoing lumbar nucleotomy, where high vigilant coping was associated with reduced levels of Thiopentone used for induction to general

anaesthesia (Schaefer, Kleeman, Krohne, Vrana, & Dick, 1996). The reduction in anaesthetic requirements associated with active coping strategies can be attributed to the gain of surgery-relevant information. Patients who are presented with the unfamiliar and threatening environment of the hospital are expected to use vigilant coping in an attempt to seek relevant information that would help them reduce their stress. Early studies have shown the positive effects of surgery-relevant information presented preoperatively, on operative and postoperative adaptation (Anderson, 1987; Suls & Wan, 1989). The gained information helps patients to psychologically prepare for the forthcoming operation, and thus according to Janis's' «work of worry», reduces the amount of muscle relaxants required for maintenance to anaesthesia.

In contrast to our hypothesis, findings also show a positive association between emotional disclosure and amount of anaesthetic required for pre-medication purposes. Emotional disclosure has been found to lead to a transient increase in negative mood and physiological arousal (Kelley, Lumley, & Leisen, 1997). Previous studies have shown that during, or immediately after disclosing emotional material individuals experience an increase in distress, physiological changes, immunological functioning, and physical symptoms (Greenberg, Wortman, & Stone, 1996; Pennebaker, Hughes, & O' Heeron, 1987; Petrie, Booth, Pennebaker, Davison, & Thomas, 1995). Morphine is administered on the day before surgery when patients are still likely to disclose their feelings about the forthcoming surgery. Independently of the beneficial effect of the attained information one day later, the physiological arousal experienced as an immediate result of the disclosure, may increase the need to pharmacologically reverse it.

Alternatively, the different pattern of relationships shown for the different anaesthetic requirements could be attributed to the assessment of patient's anaesthetic needs prior to, and during the surgery: Anaesthesia for the purposes of the surgery can be defined as the maintenance, or even the restoration of normal physiological processes by the administration to the patient of appropriate agents, which will make the surgical processes possible (Coetzee, 1986). One of the main complexities of establishing general anaesthesia is the fact that anaesthetic depth is difficult to measure objectively. As of yet, there is no direct monitor to assess the depth of anaesthesia, and the anaesthesiologist has to rely on observing patients' parameters intra-operatively, or subjectively assessing patients' needs preoperatively (Spiekerman, 1998). Morphine is administered on the evening before surgery, while patients are awake and in full consciousness. It is possible that the emotional disclosure patients engage in on the same evening, may influence the interaction with the anaesthesiologist during the preoperative visit, and therefore his/her preoperative assessment of patients' anaesthetic needs. Patients can directly ask for higher doses of anaesthetic. Alternatively, patients can show or express more distress, which might prompt the anaesthesiologist to assess them as in higher need of preoperatively induced relaxation. This assessment may be changed during the surgery due to the use of more objective criteria. Pavulon is administered during the operation when the patient is unconscious, and the anaesthesiologist has to rely on objective parameters in order to evaluate anaesthetic requirements. A similar pattern of interaction between patients' expressive behavior and medical decision-making has been described by Johnston (1988), for surgical patients in the phase of recovery. The communication hypothesis proposed by Johnston argues that patient's behavior communicates a different level of recovery to the medical staff that decides on medication and discharge, and suggests that patients who express more pain and distress are also perceived as showing slower recovery (Johnston, 1988).

In contrast to our prediction, no relationships were found in the present study with the amount

of narcotic agent used for induction purposes. This finding seems contradictory with many studies investigating intra-operative adaptation and demonstrating effects on induction to general anaesthesia. This result could be due to the differences in the pharmacological action of the various agents, or in the types of surgeries, or an interaction of both. Most of the effects on induction agents have been shown for Thiopentone or Proposal, which are widely used and preferred for surgeries of small duration. Patients in our study were administered Hypnomidate which is suggested for longer-duration operations such as the CABG (National Index of Pharmacological Substances, 1996).

Findings suggest that studies investigating the influence of preoperative psychosocial factors on anaesthetic requirements should not treat anaesthesia as a uniform procedure, but take into account the different pharmacological, surgical, and human factors that can influence the emerged relationships. Additionally, findings have clinically important applications for the development of cost-effective preparatory interventions for surgical patients.

While the significant effects shown in the study account for a small percentage of the explained variance, they are important considering that they are attributed uniquely to psychological factors. Moreover, psychological factors explain more variance than the demographic and medical ones. Finally, the influence of psychological factors was evident after controlling for age and body weight, which are the main factors influencing decisions on anesthetic requirements. However, other confounding factors might have influenced the pattern of results. For example, given that different doctors performed anaesthesia, it is possible that the presence or absence of effects in the study could be influenced by the individual anaesthetic technique employed by each anesthesiologist or the preferences of the surgical team. Additionally, the possibility that chemical interactions occur between the various pharmacological agents used for anaesthesia purposes cannot be excluded. Consultation with the hospital anaesthesiologists suggested that the drugs included in this study were of significant interest to be analyzed independently.

The focus of the present investigation was on patients' cognitive and verbal attempts to focus on the operation, and their association to anaesthetic requirements. Results suggested the potential mediating role of the amount of preparatory information and the actual contact with the medical staff. Therefore, future studies should explore the mediating role of practical or sensory preparatory information. In addition, they should also try to include objective as well as subjective measures of preoperative distress when assessing its implication in surgical outcome (Asendorpf & Scherer, 1983; Weinberger & Davidson, 1994). Results of this study suggest the need for multidisciplinary collaboration in preparing patients for major surgeries. They also confirm the clinical importance of interventions designed to reduce preoperative anxiety.

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