The Visual Analog Scale Allows Effective Measurement of Preoperative Anxiety and Detection of Patients' Anesthetic Concerns

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The advent of managed care, reduction of costs, and advances in medical technology place increasing demands on anesthesiologists. Preoperative anxiety may go unnoticed in an environment that stresses increased productivity. The present study compares different methods for measuring preoperative anxiety, identifies certain patient characteristics that predispose to high anxiety, and describes the quantity and quality of anxiety that patients experience preoperatively. Seven hundred thirty-four patients participated in the study. We assessed aspects of anxiety by means of visual analog scales (VAS) and the State Anxiety Score of the Spielberger State-Trait Anxiety Inventory (STAI). The mean STAI anxiety score was 39 ± 1 ($n = 486$) and the mean VAS for fear of anesthesia was 29 ± 1 ($n = 539$). Patients feared surgery significantly more than anesthesia ($P < 0.001$). The VAS measuring fear of anesthesia correlated well with the STAI score ($r = 0.55$; $P < 0.01$). Young patients, female patients, and patients with no previous anesthetic experience or a previous negative anesthetic experience had higher anxiety scores. Patients worried most about the waiting period preceding surgery and were least concerned about possible awareness intraoperatively. Factor analysis of various anxiety items showed three distinct dimensions of fear: 1) the fear of the unknown 2) the fear of feeling ill, and 3) the fear for one's life. Among these dimensions, fear of the unknown correlated highest with the anxiety measuring techniques STAI and VAS. The simple VAS proved to be a useful and valid measure of preoperative anxiety. **Implications:** The study of qualitative aspects of anxiety reveals three distinct dimensions of preoperative fear: fear of the unknown, fear of feeling ill, and fear for one's life. Groups of patients with a higher degree of preoperative anxiety and their specific anesthetic concerns can be identified using the visual analog scale.

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Most patients awaiting elective surgery experience preoperative anxiety (1–3). This anxiety is influenced by the uncertainty of the impending anesthetic and surgical procedures, past experience, and a patient's personality and coping style. Anxiety is an unpleasant emotion and may cause patients to avoid a planned operation (4). It also may adversely influence anesthetic induction and patient recovery (5–7), as well as decrease patient satisfaction with the perioperative experience (8), an outcome measure increasingly used for marketing purposes and for monitoring quality of care. It is therefore not surprising that many studies examine interventions to reduce preoperative anxiety, including pharmacological anxiolysis, provision of information, distraction, attention focusing, and relaxation procedures (9,10). However, few studies have compared different methods to measure preoperative anxiety (11–13).

The aims of the present study are threefold: First, we examined the validity and utility of the self-report visual analog scale (VAS) to measure preoperative anxiety, comparing the VAS to the standard Spielberger State-Trait Anxiety Inventory (STAI) (14). The state anxiety scale of the STAI consists of twenty self-report statements that evaluate how respondents feel at any particular moment. Although previous investigators have reported a significant correlation between VAS and STAI (11–13), the studies were small, 40 to 60 patients, and examined only female patients in one clinical setting—therapeutic abortion, breast surgery, or ambulatory surgery. However, women experience more preoperative anxiety than men (1,2), and anxiety awaiting abortion, breast surgery, or minor ambulatory surgery may differ from that associated with

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other operations (15). This complicates the interpretation of these studies. We report a study of 734 patients, male and female, ASA physical status I–IV, admitted to a university hospital for a wide range of procedures. Patients were assessed for preoperative anxiety on the eve of surgery, a time reported to be representative of the anxiety occurring immediately preoperatively (1,16).

Second, we wanted to test the hypothesis that certain patient risk factors or operations that correlate with high preoperative anxiety could be identified. Few other studies have analyzed patient characteristics and demographics in sufficient numbers to predict preoperative anxiety (2,17,18). One study of 523 patients concluded that preoperative anxiety did not correlate with patient age, type of surgical procedure, or previous anesthetic experience (2). These findings were surprising, because anesthesiologists generally believe that preoperative anxiety is based on the surgical procedure and individual characteristics (1,15,19).

The third goal of the study was to itemize the concerns of patients admitted for elective anesthesia and surgery in a Swiss university hospital. The nature of preoperative anxiety has been studied primarily in Great Britain, America, and Australia, and almost no data exist for continental Europe (20).

Methods

Patient Questionnaire

This study was conducted with the approval of the institutional committee for human investigation at the University of Basel. An interdisciplinary team developed a questionnaire after reviewing published reports on preoperative anxiety and after a psychologist (FA) performed open-ended interviews with patients to evaluate the different aspects of preoperative anxiety. The final questionnaire contained 91 items: 8 questions explored patients' demographic background, relevant medical and anesthetic history; 12 VAS scores, two of which assessed the overall fear of anesthesia and surgery and 10 different aspects of preoperative anxiety. The VAS was based on a 100-mm scale; the extreme left side indicated zero anxiety and the extreme right, maximal anxiety. Four items were multiple-choice questions designed to assess the impact of the preoperative visit by the anesthesiologist on the level of preoperative anxiety. We also incorporated the state anxiety score of the STAI (14), a validated test quantifying state anxiety, using the German form of this test (STAI-G Form X 1). Other items questioned the patients' satisfaction with different aspects of their preoperative care and the patients' perception of their anesthesiologist. All patients admitted preoperatively for surgery over a 3-mo period received the questionnaire on the day before surgery and were asked to complete it that evening. Exclusion criteria were age <18 yr, inability to read or speak German, or overt behavioral impairment (e.g., observable depression).

Assessment of VAS

Although VAS is widely used in behavioral sciences, there is no consensus on the value of parametric versus nonparametric techniques for statistical analysis of the VAS. Parametric tests are reported to be appropriate for analysis of VAS because they permit statistical interferences without increasing the likelihood of Type I and Type II errors (21–23). Accordingly, we used the Student's *t*-test to determine differences in VAS data in two groups and analysis of variance to test for differences in more than two groups. To describe the strength of association of two VAS variables, we used the parametric Pearson product-moment correlation.

We assessed concurrent validity of the VAS by determining the correlation coefficient, *r*, for the VAS score for anxiety of anesthesia and the STAI as well as the *r* for the surgery VAS anxiety score and the STAI. To assess construct validity, factor analysis was used. In addition, the VAS score for anxiety of anesthesia was analyzed by subgroup. For example, the STAI has shown that female patients experience more preoperative anxiety than male patients (1,18,24). Therefore, we hypothesized that this difference should also be detectable by using the VAS anxiety scale.

In addition, we attempted to identify the utility of the VAS in preoperative patients. A mean STAI anxiety score of 35 is considered normative for adults of different age groups (14). The literature suggests defining the high-anxiety state at 1 standard deviation above the normative mean, i.e., STAI > 45 (12,25). Therefore, the sensitivity, specificity, and positive and negative predictive values (26) of the VAS were examined for different cutoff points by using a STAI score of 45 as the reference point.

To further assess the construct validity of the VAS, one of the hypotheses of the study was operationalized by using standard factor analysis (27). Briefly, we used factor analysis to identify a few distinct dimensions of preoperative anxiety, each composed of conceptually meaningful items. If the VAS is a valid anxiety measure, these anxiety "dimensions" or "factors" will correlate in a similar way with the VAS and STAI. To test this hypothesis, we correlated the 10 anxiety item variables to form a matrix of correlation coefficients and used the squared multiple correlations as communality estimates. After the study of the magnitude of the unrotated loadings, two through five factors were rotated to orthogonal simple structure by using the Varimax method. Rotated solutions were evaluated according to the following criteria: 1) the

items defining each factor were conceptually meaningful, 2) single items had a loading of >0.5 on a factor, and 3) the resulting factor scales had high internal consistency reliabilities (Crohnbach's $\alpha \geq 0.7$). We found that a three-factor solution met these criteria most accurately.

Results

Of the 734 questionnaires distributed to patients, 685 were returned (Table 1). We found a significant correlation both between the VAS measuring fear of anesthesia and the STAI ($r = 0.55$, $P < 0.01$) and between the VAS measuring fear of surgery and the STAI ($r = 0.66$, $P < 0.01$) (Table 2). These correlations were not significantly different between male and female patients. One hundred twenty-three patients (25%) scored higher than 1 standard deviation above the normative mean (STAI > 45) and were defined as having high preoperative anxiety. The sensitivity, specificity, and positive and negative predictive values at different cutoff points on the VAS by using STAI of 45 as reference point are shown in Table 3.

Different patient characteristics such as age, sex, previous anesthetic experience, and tranquilizer use had a significant influence on preoperative anxiety (Table 4). Interestingly, patients with less education or insurance coverage also were more anxious. Patients who sought more information ["Monitors" (28)] showed significantly more preoperative anxiety than those who did not ["Blunters" (28)]. ASA physical status had no significant influence on preoperative anxiety, although we did observe a trend for higher anxiety with increasing ASA physical status. However, the nature of the scheduled surgery had a significant impact on preoperative anxiety. Male patients feared otorhinolaryngological surgery most (VAS 29 ± 6, $n = 20$) followed by suprainguinal vascular surgery (VAS 25 ± 6, $n = 10$), whereas neurosurgery evoked the lowest anxiety (VAS 14 ± 5, $n = 6$). Female patients were most afraid of thoracic surgery (VAS 58 ± 27, $n = 4$) followed by otorhinolaryngological surgery (VAS 53 ± 7, $n = 22$) and were significantly less afraid of major orthopedic surgery (VAS 30 ± 7, $n = 11$) or plastic/reconstructive surgery (VAS 28 ± 4, $n = 41$).

To determine the different aspects of preoperative anxiety, patients were offered ten specific causes for anxiety in relation to anesthesia. The specific anxieties with their respective VAS scores are summarized in Table 5. The different types of fear with their mean scores were studied after factor analysis as described in Methods. The factors of anxiety had the following characteristics (Table 6): The first factor was given the name "fear of the unknown." This factor consisted of four specific items—fear of the waiting period before surgery/anesthesia, of being at the mercy of physicians during anesthesia, of surgical outcome, and of not knowing what occurs while unconscious during anesthesia. The second factor, termed "fear of feeling ill," included the fear of postoperative nausea or vomiting and perioperative pain, as well as fear of the discomfort of postoperative awakening and of awareness intraoperatively. The third factor consisted of fear of "not regaining consciousness after the induction of anesthesia," i.e., a fear of dying or remaining in a coma and fear of anesthesia-induced physical or mental harm. We called this factor "fear for one's life". Among these three factors, Factor 1 correlated highest with the STAI scale ($r = 0.60$, $P < 0.001$); Factor 2 and Factor 3 correlated to a lesser degree ($r = 0.43$ and 0.37, respectively). The correlation coefficients for Factors 1 through 3 and the VAS score for fear of anesthesia were $r = 0.62$, 0.45, and 0.54, respectively.

Discussion

There are three prominent findings in this study. First, the VAS is a useful and valid method for measuring preoperative anxiety and compares well with the state anxiety score of the STAI. Second, we are able to distinguish certain patient demographics and characteristics associated with a higher degree of preoperative anxiety. Third, preoperative anxiety can be divided into three distinct dimensions of anxiety, i.e., fear of the unknown, fear of feeling ill, and fear for one's life. The first factor correlates highest with the different measures of anxiety.

Assessment of preoperative anxiety and evaluation of the effectiveness of interventions directed to reduction of such anxiety need a statistically valid and useful measurement tool. To date, the gold standard for anxiety evaluation is the STAI. This test has been used in more than one thousand peer-reviewed studies, but its architecture of 20 multiple-choice questions for state anxiety alone limits its use as a bedside instrument. Four newer, abbreviated scales to measure preoperative anxiety also have been reported: the Hospital Anxiety and Depression Scale (29), the Multiple Affect Adjective Check List (29), the Amsterdam Preoperative Anxiety and Information Scale (24), and the Yale Preoperative Anxiety Scale for children (25). The idea of using a VAS, which allows patients to easily indicate their degree of preoperative anxiety by simply marking a point on a horizontal line, is appealing. Because anesthesiologists appear to be inaccurate in assessing patient anxiety during the preoperative visit (1,30), the VAS would provide a tool for defining, then addressing, patient anxiety.

Previous studies have reported a correlation coefficient r of 0.62 to 0.84 between VAS and STAI (11–13). However, all three studies were small, included only

Table 1. Demographic Data

	All patients (*n*)	Male patients (*n*)	Female patients (*n*)
Sex	100% (681)	51% (349)	49% (332)
Age (yrs, mean ± SEM)	52 ± 1 (662)	53 ± 1 (341)	50 ± 1 (321)
Education: High school/university	369/198	199/102	170/96
Insurance class: Private/general	127/370	74/195	53/175
ASA physical status I/II/III/IV	136/395/129/2	68/184/88/1	68/211/41/1
Previous anesthesia: Yes/no	458/109	240/56	218/53
Bad anesthetic experience: Yes/No	77/372	32/205	45/167
Use of tranquilizer: Never/at times/regularly	555/63/51	301/28/15	254/35/36

Table 2. Patient Visual Analog Scale (VAS) Scores and Spielberger State-Anxiety Scores (STAI) Demonstrating Fear of Anesthesia and Fear of Surgery

	All patients (*n*)	Male patients (*n*)	Female patients (*n*)
VAS fear of anesthesia (mm)	29 ± 1 (539)	23 ± 1 (287)	36 ± 2 (249)†
VAS fear of surgery (mm)	33 ± 1 (539)*	25 ± 1 (287)*	42 ± 2 (249)*†
STAI	39 ± 1 (486)	37 ± 1 (268)	42 ± 1 (217)†

Values are mean ± SEM.
* $P < 0.01$; paired Student's t-test comparing VAS fear of anesthesia with VAS fear of surgery within each group.
† $P < 0.001$; unpaired Student's t-test comparing scales between female and male patients.

Table 3. Characteristics of the Visual Analog Scale (VAS) Scores Anxiety of Anesthesia at Different Cutoff Points with a Spielberger State Anxiety Score of 45 as a Reference Point ($n = 486$)

	Cutoff score on the VAS anxiety scale				
	20	30	40	50	60
Sensitivity %	76.9	62.3	56.2	46.2	36.9
Specificity %	64.9	67.0	81.0	88.6	92.7
Positive predictive value	0.46	0.42	0.53	0.61	0.66
Negative predictive value	0.88	0.82	0.83	0.81	0.79
False positive rate %	35.1	33.0	19.0	11.4	7.3
False negative rate %	23.1	37.7	43.8	53.8	63.1

female and ASA physical status I or II patients, and were conducted in limited settings. The present study consisted of 734 patients including ASA physical status IV and both men and women who were admitted for a variety of operations. The VAS measuring fear of anesthesia and measuring fear of surgery correlated well with the STAI ($r = 0.55$ and $r = 0.66$, respectively). It is apparent from values in Table 3 that the VAS cannot provide a high true positive rate with a low false positive rate. By moving the cutoff point down the VAS scale, a greater proportion of patients with anxiety will report anxiety, so that the sensitivity increases, but fewer patients without anxiety will actually report no anxiety, that is, specificity decreases. Whether the anesthesiologist is willing to accept a low cutoff point on the VAS, thereby accepting a relatively high number of false-positive patients, depends on the amount of time she/he wants to spend on anxiety issues. However, when a positive test result directly leads to an elaborate intervention, such as anxiety reduction measures, high specificity with a low false positive rate is essential.

Construct validity of the VAS was further evaluated by factor analysis. Of the three anxiety factors identified, "fear of the unknown" showed the highest correlation with both VAS and STAI ($r = 0.62$ and 0.60, respectively). The qualities evaluated by the state anxiety scale STAI are apprehension, tension, nervousness, and worry (14). The transitory emotional condition of preoperative anxiety is best described by the anxiety factor fear of the unknown. That both STAI and VAS correlate well with this factor further indicates that the VAS can measure patients' preoperative anxiety.

The second goal of our study was to identify high-risk patients for preoperative anxiety. Domar et al. (2) concluded that anxiety did not correlate with the type of the surgical procedure, age and occupation of the patients, or previous experience with surgery and anesthesia. However, other investigators have reported a

Table 4. Impact of Patient Characteristics on Preoperative Anxiety

Patients characteristics	STAI (*n*)	VAS fear of anesthesia (*n*)
Age		
Male patients		
<37 yr old	39 ± 1 (58)*	22 ± 3 (62)
37–66 yr old	37 ± 1 (150)	23 ± 2 (157)
>66 yr old	34 ± 1 (57)	24 ± 3 (69)
Female patients		
<37 yr old	45 ± 1 (76)*	38 ± 3 (86)
37–66 yr old	40 ± 1 (104)	34 ± 3 (118)
>66 yr old	40 ± 3 (31)	36 ± 4 (50)
Previous anesthesia		
Yes	39 ± 1 (384)	27 ± 1 (440)‡
No	39 ± 1 (97)	36 ± 3 (102)
Negative experience with anesthesia		
Yes	41 ± 1 (65)‡	34 ± 3 (76)‡
No	38 ± 1 (316)	26 ± 1 (358)
Use of Tranquilizers		
Never	38 ± 1 (411)	27 ± 1 (455)†
At times	42 ± 2 (44)	36 ± 4 (46)
Regularly	40 ± 2 (28)	35 ± 5 (35)
Education		
High School	39 ± 1 (289)	31 ± 2 (313)‡
College/university	40 ± 1 (106)	23 ± 2 (117)
Information seeking behavior		
"Monitors"	40 ± 1 (295)‡	31 ± 2 (325)‡
"Blunters"	37 ± 1 (171)	26 ± 2 (189)
Insurance class		
Private	36 ± 1 (95)‡	25 ± 2 (108)‡
General	40 ± 1 (260)	30 ± 2 (296)

Values are mean ± SEM.
STAI = Spielberger State-Anxiety Scores, VAS = visual analog scale.
"Monitors" are information seekers, and "Blunters" are information avoiders.
* $P < 0.001$ (analysis of variance). *Post hoc* tests confirm significant differences in the STAI of young patients (<37 yr) compared with the other age groups.
† $P < 0.001$ (analysis of variance). *Post hoc* tests confirm significant differences in the VAS fear of anesthesia of patients who never use tranquilizers compared with patients using tranquilizers at times or regularly.
‡ Unpaired Student's t-test was used to determine significant differences in the STAI or VAS between two groups ($P \leq 0.05$).

Table 5. Specific Anxieties Listed on Patients Questionnaire with Respective VAS Scores

	All patients		Male patients		Female patients	
	mean ± SEM (*n*)	Rank	mean ± SEM (*n*)	Rank	mean ± SEM (*n*)	Rank
Waiting for operation	35 ± 1 (536)	1	28 ± 2 (287)	1	43 ± 2 (246)	1
Being at mercy of medical staff	32 ± 1 (528)	2	27 ± 2 (284)	2	39 ± 2 (241)	3
Result of the operation	32 ± 1 (524)	3	25 ± 2 (284)	3	39 ± 2 (237)	2
Postoperative pain	30 ± 1 (527)	4	25 ± 1 (285)	4	36 ± 2 (239)	4
Time after waking up after operation	26 ± 1 (517)	5	21 ± 1 (282)	5	35 ± 2 (235)	5
Postoperative nausea and vomiting	26 ± 1 (526)	6	19 ± 1 (284)	8	32 ± 2 (241)	6
Not knowing what is happening	25 ± 1 (528)	7	21 ± 2 (281)	6	30 ± 2 (244)	7
Physical and/or mental harm after operation	25 ± 1 (526)	8	21 ± 1 (282)	7	29 ± 2 (241)	8
Not awakening from anesthesia	22 ± 1 (518)	9	19 ± 2 (278)	9	27 ± 2 (237)	9
Awareness during anesthesia	19 ± 1 (518)	10	14 ± 1 (276)	10	24 ± 2 (239)	10

VAS = visual analog scale.

significant impact of age (15), sex (15,18,31), and previous anesthetic experience (1,30) on preoperative anxiety. Our results clearly support the presence of a high degree of preoperative anxiety in young patients, female patients, patients with no or negative experience with previous anesthesia, and patients using tranquilizers. High anxiety scores also occurred in patients with less education and insurance coverage,

Table 6. Anxiety Factor Validation Matrix (after Varimax Rotation) and Internal Consistency Reliability of the Anxiety Factor Scales

	Loading of anxiety items on			VAS (mean)	*n*	Item-scale correlation	Scale reliability (Crohnbach α)
	Factor 1	Factor 2	Factor 3				
Factor 1 (fear of the unknown)					506		0.83
Waiting for operation	0.84	0.18	0.18	35		0.83	
Being at mercy of medical staff	0.77	0.16	0.35	32		0.78	
Result of the surgery	0.67	0.42	0.07	32		0.64	
Being unaware of what happens	0.62	0.24	0.45	25		0.57	
Factor 2 (fear of feeling ill)					500		0.75
Nausea and vomiting	0.10	0.77	0.13	26		0.69	
Pain	0.36	0.68	0.11	30		0.68	
Awakening after the operation	0.42	0.60	0.26	26		0.61	
Awareness during anesthesia	0.12	0.57	0.47	19		0.53	
Factor 3 (fear for one's life)					514		0.70
Harm through anesthesia	0.15	0.35	0.79	25		0.68	
Not to wake up after operation	0.41	0.04	0.74	22		0.66	

and in those who sought more information. That "known-group" anxiety cases, such as female patients (1,18,24), information seekers (24), or patients without anesthetic experience (1,30) could be detected by the VAS (Table 4) further supports the validity of this anxiety measurement technique.

Operations associated with high preoperative anxiety include thoracic and otorhinolaryngological surgery. Whereas high preoperative anxiety in thoracic surgery patients has been previously reported (15), the finding that otorhinolaryngological surgery also is associated with relatively high preoperative anxiety is new. It can perhaps be explained by the mutilation often associated with these procedures. Our focus on a broad surgical population typical of a university hospital differs from that of Domar et al. (2). This difference in study population may account for their finding no association between type of surgery and the presence of preoperative anxiety. Moreover, they studied preoperative anxiety during an ambulatory preoperative visit approximately 48 hours before surgery. Preoperative anxiety at this time might correlate less with the anxiety experienced immediately before surgery than does anxiety on the eve of surgery (1,16).

The third and last goal of our study was to understand our patients' concerns regarding anesthesia. Data on the nature of preoperative anxiety have been collected in England, Australia, and the United States (4,18–20,30) but are rare for continental Europe. In our study, both men and women ranked the specific fears in the same order, with the possible exception that female patients were more concerned with postoperative nausea and vomiting (Table 5). We were surprised to find that patients' greatest concern was the time in-hospital awaiting surgery and not, as we expected, fear of postoperative pain (4,30), not waking from surgery (18), or intraoperative awareness (32). Only a few other investigators have reported waiting time as an important factor contributing to preoperative distress (33,34). Placing patients with high anxiety early on the operating schedule has been shown to alleviate the distress of waiting (35).

In summary, our study shows that the VAS may be a useful tool to measure preoperative anxiety and that certain patient characteristics might serve to warn the anesthesiologist about the potential presence of increased preoperative anxiety. Because anesthesiologists have no proven ability to predict preoperative anxiety during the preoperative visit, the use of a VAS might allow detection of patients with high anxiety, encouraging appropriate steps to ameliorate this anxiety. However, further work is needed to establish normative values for the VAS.

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References

1. Badner NH, Nielson WR, Munk S, et al. Preoperative anxiety: detection and contributing factors. Can J Anaesth 1990;37:444–7.
2. Domar AD, Everett LL, Keller MG. Preoperative anxiety: is it a predictable entity? Anesth Analg 1989;69:763–7.
3. Johnston M. Anxiety in surgical patients. Psychol Med 1980;10:145–52.
4. McCleane GJ, Cooper R. The nature of pre-operative anxiety. Anaesthesia 1990;45:153–5.
5. Scott LE, Clum GA, Peoples JB. Preoperative predictors of postoperative pain. Pain 1983;15:283–93.
6. Quinn AC, Brown JH, Wallace PG, Asbury AJ. Studies in postoperative sequelae: nausea and vomiting-still a problem. Anaesthesia 1994;49:62–5.
7. Goldmann L, Ogg TW, Levey AB. Hypnosis and daycase anaesthesia: a study to reduce pre-operative anxiety and intraoperative anaesthetic requirements. Anaesthesia 1988;43:466–9.
8. Thomas T, Robinson C, Champion D, et al. Prediction and assessment of the severity of post-operative pain and of satisfaction with management. Pain 1998;75:177–85.

9. Elsass P, Eikard B, Junge J, et al. Psychological effect of detailed preanesthetic information. Acta Anaesthesiol Scand 1987;31: 579–83.
10. Markland D, Hardy L. Anxiety, relaxation and anaesthesia for day-case surgery. Br J Clin Psychol 1993;32:493–504.
11. Arellano R, Cruise C, Chung F. Timing of the anesthetist's preoperative outpatient interview. Anesth Analg 1989;68:645–8.
12. Millar K, Jelicic M, Bonke B, Asbury AJ. Assessment of preoperative anxiety: comparison of measures in patients awaiting surgery for breast cancer. Br J Anaesth 1995;74:180–3.
13. Vogelsang J. The visual analog scale: an accurate and sensitive method for self-reporting preoperative anxiety. J Post Anesth Nursing 1988;3:235–9.
14. Spielberger CD, Gorsuch RL, Lushene RE, et al. Manual for the State-Trait Anxiety Inventory. Palo Alto: Consulting Psychologists Press, 1983.
15. Grabow L, Buse R. Preoperative anxiety-anxiety about the operation, anxiety about anesthesia, anxiety about pain? Psychother Psychosom Med Psychol 1990;40:255–63.
16. Lichtor JL, Johanson CE, Mhoon D, et al. Preoperative anxiety: does anxiety level the afternoon before surgery predict anxiety level just before surgery? Anesthesiology 1987;67:595–9.
17. MacKenzie JW. Daycase anaesthesia and anxiety: a study of anxiety profiles amongst patients attending a day bed unit. Anaesthesia 1989;44:437–40.
18. Shevde K, Panagopoulos G. A survey of 800 patients' knowledge, attitudes, and concerns regarding anesthesia. Anesth Analg 1991;73:190–8.
19. Ramsay MA. A survey of pre-operative fear. Anaesthesia 1972; 27:396–402.
20. Klafta JM, Roizen MF. Current understanding of patients' attitudes toward and preparation for anesthesia: a review. Anesth Analg 1996;83:1314–21.
21. Maxwell C. Sensitivity and accuracy of the visual analogue scale: a psycho-physical classroom experiment. Br J Clin Pharmacol 1978;6:15–24.
22. Dexter F, Chestnut DH. Analysis of statistical tests to compare visual analog scale measurements among groups. Anesthesiology 1995;82:896–902.
23. Philip BK. Parametric statistics for evaluation of the visual analog scale [letter]. Anesth Analg 1990;71:710.
24. Moerman N, van Dam FS, Muller MJ, Oosting H. The Amsterdam Preoperative Anxiety and Information Scale (APAIS). Anesth Analg 1996;82:445–51.
25. Kain ZN, Mayes LC, Cicchetti DV, et al. The Yale Preoperative Anxiety Scale: how does it compare with a "gold standard?" Anesth Analg 1997;85:783–8.
26. Coggon D. Statistics in clinical practice. London: BMJ Publishing Group, 1995:56–58.
27. Linder-Pelz S, Struening EL. The multidimensionality of patient satisfaction with a clinic visit. J Community Health 1985;10: 42–54.
28. Miller SM. Monitoring versus blunting styles of coping with cancer influence the information patients want and need about their disease: implications for cancer screening and management. Cancer 1995;76:167–77.
29. Hicks JA, Jenkins JG. The measurement of preoperative anxiety. J Royal Soc Med 1988;81:517–9.
30. Shafer A, Fish MP, Gregg KM, et al. Preoperative anxiety and fear: a comparison of assessments by patients and anesthesia and surgery residents. Anesth Analg 1996;83:1285–91.
31. van Wijk MG, Smalhout B. A postoperative analysis of the patient's view of anaesthesia in a Netherlands' teaching hospital. Anaesthesia 1990;45:679–82.
32. Hume MA, Kennedy B, Asbury AJ. Patient knowledge of anaesthesia and peri-operative care. Anaesthesia 1994;49:715–8.
33. Shafer A, White PF, Urquhart ML, Doze VA. Outpatient premedication: use of midazolam and opioid analgesics. Anesthesiology 1989;71:495–501.
34. Soni JC, Thomas DA. Comparison of anxiety before induction of anaesthesia in the anaesthetic room or operating theatre. Anaesthesia 1989;44:651–5.
35. Panda N, Bajaj A, Pershad D, et al. Pre-operative anxiety. Effect of early or late position on the operating list. Anaesthesia 1996; 51:344–6.