Predictive factors of postoperative pain after day-case surgery

Predictive Factors of Postoperative Pain After Day-case Surgery

Hans-Fritz Gramke, MD, Janneke M. de Rijke, PhD,† Maarten van Kleef, MD, PhD,* Alfons G. H. Kessels, MD, MSc,‡ Madelon L. Peters, PhD,§ Michael Sommer, MD,* and Marco A. E. Marcus, MD, PhD**

Objectives: Despite the growing number of ambulatory operations knowledge of predictive factors of postoperative pain after ambulatory surgery is limited. Therefore, the aim of this study was to identify predictive factors of postoperative pain after ambulatory surgery.

Methods: In this cross-sectional study, 648 patients were included. A wide variety of elective ambulatory operations were performed. Pain assessments were made before the operation and during a 4-day period postoperatively, using a 100 mm visual analog scale. Patient characteristics, type of surgery, and type of anesthesia were recorded. In addition, preoperative expectations of postoperative pain by physician and patient were assessed. Finally, several scores about psychologic parameters were measured: pain catastrophizing, surgical anxiety, and optimism. Stepwise logistic regression analysis was performed to identify factors that independently predict the risk of having postoperative pain (defined by a visual analog scale >40 mm) on days 0 to 4.

Results: The most important predictor of postoperative pain was the presence of preoperative pain. Other predictors were anticipated postoperative pain by the clinician, preoperative high expectations of postoperative pain by the patient, younger age, and fear of short-term consequences of the operation. Regional anesthetic technique compared with general anesthesia decreased the risk of acute postoperative pain only on the day of the operation.

Discussion: Several predictive factors of postoperative pain after ambulatory surgery were identified in this study. These factors should be taken into account when planning postoperative analgesia for ambulatory surgery.

Key Words: predictor, postoperative pain, acute pain, day-case surgery, ambulatory surgery

(*Clin J Pain* 2009;25:455–460)

Sufficient control of postoperative pain remains a difficult problem. Despite extended research on this topic prevalence of postoperative pain has not changed very much over the last 20 years. About 30% to 60% of patients still have moderate-to-severe pain after surgery.[1–3] It has been demonstrated that postoperative pain can affect patient recovery after surgery as well.[4] In ambulatory surgery, it is very important that patients are ready to go home in predictable and short period. Delayed discharge or hospital admission must be avoided. Postoperative pain is an important factor that can delay or even impede discharge and therefore is interfering with the concept of ambulatory surgery.[5] Furthermore, ongoing postoperative pain is an important factor for not resuming work after surgery.[6]

Another potential consequence of acute postoperative pain is the development of persistent postoperative pain.[7–10] Prevalence rates of persistent postoperative pain after common operations as high as 10% to 50% have been reported.[11] A correlation of the intensity of acute postoperative pain and the risk of developing persistent postoperative pain has been described.[10,12,13]

A growing number of operations are performed on an ambulatory basis. In many countries, ambulatory surgery accounts for more than 50% of all elective surgeries. In the ambulatory setting good postoperative analgesia is a challenge, because patients have to control their pain at home by themselves. That is, analgesia must be effective, easy to apply, and safe. However, the prevalence of acute postoperative pain after ambulatory surgery is very high.[2,14] Therefore, preoperative detection of patients at high risk for postoperative pain would be very interesting for planning a tailor-made effective postoperative analgesic regimen for these patients. Knowledge of predictors of postoperative pain could help making decisions about optimal postoperative analgesia techniques.

Earlier reports evaluated several factors of somatic and psychologic nature in hospitalized patients.[15–19] Whether these data can be transferred to ambulatory operations is not clear. Despite the growing interest in ambulatory surgery only few studies on predictive factors of postoperative pain specifically focused on this kind of surgery. In addition, the studies available are relatively small and do not include psychologic factors.[14,20] Therefore, we designed this study to investigate predictive factors for postoperative pain after ambulatory surgery more extensively.

PATIENTS AND METHODS

Patients

A cross-sectional study was performed. The study protocol was approved by the institutional review board of the University Hospital Maastricht, the Netherlands. During a 16-week period, we enrolled patients undergoing elective ambulatory surgery at our institution. All adult

Received for publication June 14, 2008; revised November 8, 2008; accepted December 8, 2008.

From the *Department of Anesthesiology and Pain Therapy; †Pain Management and Research Center; ‡Department of Clinical Epidemiology and Medical Technology Assessment, University Hospital Maastricht, AZ, Maastricht; and §Department of Clinical Psychological Science, Maastricht University, MD, Maastricht, The Netherlands.

Reprints: Hans-Fritz Gramke, MD, Department of Anesthesiology and Pain Therapy, University Hospital Maastricht, PO Box 5800, AZ 6202, Maastricht, The Netherlands (e-mail: hgra@sane.azm.nl).

patients scheduled for elective ambulatory surgery were approached. Excluded were patients younger than 18 years, patients with limitations of self-expression, visual dysfunction, or Dutch language problems. Patients undergoing acute surgery were not included in this study. The prevalence data of postoperative pain of this cohort of patients have already been reported elsewhere.[21]

Procedure

On arrival at the ambulatory surgery unit patients were approached by a trained research assistant who explained purpose and methods of the study. During the whole study period pain intensity was measured by using a 100 mm visual analog scale (VAS), anchored "no pain" and "worst pain I can imagine."

The type of anesthesia was not regulated by the study protocol. General and regional anesthesia techniques were used dependent on the choice of the individual anesthesiologist and patient.

Perioperative analgesia was applied according to the standard procedure at our ambulatory surgery unit. Preoperatively either acetaminophen 1000 mg/os (PO) or naproxen 500 mg PO were administered if not contraindicated. Immediately after surgery in the Post Anesthesia Care Unit (PACU), patients were treated with intravenous bolus administration of 1 to 5 mg piritramide if necessary until their pain scored less than 40 mm on the VAS. Analgesia was continued with acetaminophen 1000 mg PO 4 times daily or naproxen 500 mg PO twice daily. For use at home, the patients were provided with tablets of acetaminophen 500 mg (box of 20 tablets) or naproxen 500 mg (box of 10 tablets) together with written instruction concerning use and dosage. Additionally, a prescription for tramadol 50 mg PO up to a maximum of 3 times daily was provided, if the combination of acetaminophen and naproxen was not expected to be sufficient. The decision to provide acetaminophen or naproxen or both or to add a prescription for tramadol was left to the anesthesiologist.

The following criteria for discharge home were applied: ambulation sufficiently possible, alert and cooperative patient, no nausea and vomiting, oral intake of fluids, micturition, no severe postoperative pain, and person for escort available.

Data Acquisition

After obtaining written informed consent, sociodemographic variables were recorded (age, sex, level of education). The preoperative pain intensity was measured using the VAS before giving any analgesic. Only preoperative pain related to the planned surgery was registered. In addition we asked the patients about their expectations of the intensity of postoperative pain using the VAS. At last, we roughly divided the group in minor and intermediate surgery, based on the anticipated level of postoperative pain from the clinician's point of view (Table 1). Major surgery with anticipated severe postoperative pain, which makes a more sophisticated postoperative pain therapy necessary, is not performed in the ambulatory setting at our institution. Psychologic characteristics were assessed using questionnaires: (1) Pain Catastrophizing Scale: 13 items measuring exaggerated negative interpretation of the meaning of pain[22]; (2) surgical anxiety: the "Bypass Grafting Fear Scale" by Koivula and coworkers[23] was modified to fit for ambulatory surgery (cardiac specific items and 1 item referring to death were left out), measuring 9 common fears in ambulatory surgery patients; (3) Life Orientation Test: 8 items measuring the personality trait optimism.[24]

Pain intensity was measured by the research assistants at 1 and 2 hours postoperatively and at discharge. At discharge home, a pain diary was provided to the patients for further evaluation of pain. Again a 100 mm VAS was used. The patients were briefed to fill out the diary in the evening of the day of the operation [postoperative day (POD) 0] and then 3 times daily (9.00 AM, 3.00 PM, and 9.00 PM) until the end of POD 4. On POD 3, patients were contacted by phone to encourage them to return the diary

TABLE 1. Anticipated Level of Postoperative Pain for the Different Types of Surgery (Clinicians Point of View)

Anticipated Level of Postoperative Pain	Minor (n = 452)	Intermediate (n = 196)
Type of operation (n)	Anal surgery (14)	Arthroscopy knee ± meniscectomy (73)
	Carpal tunnel release (5)	Breast augmentation (8)
	Cataract surgery (79)	Breast reduction (5)
	Diagnostic laparoscopy (7)	Dacryocystorhinostomy (5)
	Dupuytren fasciotomy (11)	Hardware removal (28)
	Hernia epigastrica/umbilicalis (10)	Hernia inguinalis (24)
	Hysteroscopy (16)	Laparoscopic cholecystectomy (5)
	Laparoscopic sterilization (13)	Mastectomy ± axillary lymph node dissection (9)
	Laryngoscopy (9)	Replacement of breast implants (6)
	Liposuction (8)	Shoulder surgery (7)
	Lumpectomy (24)	Tonsillectomy (6)
	Sinus pilonidalis (5)	Miscellaneous (20)
	Skin biopsy-ganglion-lipoma (15)	
	Surgical abortion (9)	
	Surgical correction of scar (12)	
	Strabismus surgery (7)	
	Tenolysis (8)	
	Varicectomy (68)	
	Vulva condylomata-bartholin gland cyst-commissurotomy (9)	
	Miscellaneous (123)	

in a special prepaid envelope. When a diary was not returned within 14 days after surgery the patient was contacted by phone again.

Statistical Analysis

Mean pain scores on the day of the operation and on PODs 0 to 4 (POD 1 to 4) were calculated, using the average of the 3 scores obtained from each individual on each of the days. In this analysis, a mean pain score of higher than 40 mm on a VAS was considered to indicate relevant postoperative pain.[25–27]

The surgical anxiety questionnaire was subjected to principal component analysis with oblimin rotation to identify its factor structure. Two components were found that explained 60% of the total variance. The first component consisted of 6 items concerning the following fears: financial consequences, adverse health effects, non-successful operation, worries about family members, being dependent of care providers, and long duration of rehabilitation. Together these items constituted a subscale that was termed "fear of long-term consequences of the operation." The second component contained 3 items with fears concerning: the operation itself, anesthesia, and pain. This subscale was termed "fear of short-term (immediate) consequences of the operation."

Missing values in predictor variables were imputed according to the multiple imputation (MI) method described by van Buuren et al.[28] In MI, each missing value is replaced by a set of M > 1 plausible values drawn from their predictive distribution. We performed MI with M = 3, obtaining 3 complete datasets, with imputed values for short-term fear (n missing = 33; 5%), long-term fear (n = 37; 5.7%), pain catastrophizing (n = 15; 2.3%), expected pain (n = 1; 0.2%), preoperative pain (n = 1; 0.2%), and optimism (n = 37; 5.7%). On each of the 3 complete datasets stepwise multiple logistic regression analysis was performed to identify the factors that independently predicted the risk of having postoperative pain (defined by a VAS >40 mm) on days 0 to 4 after surgery. Easily obtainable predictors were included first. In the first block 3 variables were entered using a forced entrance procedure: anticipated pain level (minor, intermediate), age (3 groups: < 45 y, 45 to 59 y, and 60 y and older), and sex. In the second block education (low, middle, high), planned 24 hours admission (yes/no), type of anesthesia (general vs. regional), and preoperative pain (preoperative VAS >10 mm yes/no) were entered using a forward procedure. Expected pain (VAS >40 mm) and the psychologic parameters (pain catastrophizing, short-term and long-term fear, and optimism) were entered in the third block (forward procedure). Psychologic variables were dichotomized by median split. In all steps, a P value of 0.05 was used for keeping variables in the model. Next, the results (estimates of coefficients and standard errors) of the identical analyses on each of the 3 datasets were combined[28,29] to calculate overall estimates, standard errors, and 95% confidence intervals (95%CI). Predictors from step 2 and 3 were included in the final model if they were significant predictors in more than 3 datasets. The models' ability to discriminate between patients with and without unacceptable postoperative pain was estimated by the area under the receiver operating characteristics curve (AUC) for the successive blocks.

Missing values in outcome measures (pain scores) were not imputed. However, missing data could be subject to selection processes. Therefore, we investigated with logistic regression analyses whether these missing outcomes could be predicted with available covariates (age, type of operation, sex, etc.). The results revealed some significant relationships and were used to calculate a weight factor for each case. Analyses were performed with STATA version 8 (StataCorp LP, College Station, TX) and SPSS version 12 (SPSS Inc, Chicago, IL).

RESULTS

Seven hundred forty-four eligible patients were approached during the study period. Six hundred and sixty patients consented to participate. Twelve patients were excluded afterward because of logistic problems and 77 patients (12%) did not return the pain diary.

Patient characteristics are shown in Table 2. A wide variety of operations were performed (general surgery, orthopedics, ophthalmology, plastic surgery, gynecology, otorhinolaryngology, urology, and oral and maxillofacial surgery). General anesthesia was used in 62% of the patients. Regional techniques were used in 38% of the patients (spinal anesthesia, peripheral nerve blocks, retrobulbar and sub-Tenon's anesthesia, intravenous regional anesthesia). Preoperatively, analgesic medication was used by 94 patients (15%) and preoperative pain was stated by 138 patients (21%) who reported pain intensity of more than 10 mm on the VAS.

Fifty-nine patients (9%) were treated in terms of a planned short-stay admission (< 24 h). Fifteen patients (2%) were admitted to the hospital on an unplanned basis, returned to the hospital or visited their general practitioner during the postoperative course.

Blockwise multiple logistic regression analysis was used to test for significant predictors of postoperative pain

TABLE 2. Patient Characteristics

	n	%
Age		
< 45 y	240	37
45-59 y	232	36
> 59 y	176	27
Sex		
Male	281	43
Female	367	57
Education		
Elementary school ("low")	221	34
Intermediate ("middle")	247	38
Higher degree/ university ("high")	170	26
Missing data	10	2
Preoperative pain		
VAS >10 mm	138	21
VAS >30 mm	71	11
Analgesic use before operation		
Acetaminophen	39	6
Nonsteroidal anti-inflammatory drugs	43	7
Weak opioids	12	2
None	554	85
Anticipated postoperative pain level, based on the type of surgery		
Minor	452	70
Intermediate	196	30
Type of anesthesia		
General	400	62
Regional	248	38

(defined by a VAS >40 mm) on POD 0 to 4. Separate analysis was carried out for each POD. The step 1 variables (anticipated pain level, age, and sex) yielded an AUC ranging from 0.62 (95%CI: 0.59-0.64) on POD 0 to 0.72 (95%CI: 0.63-0.80) on POD 4. Inclusion of the step 2 variables (educational level, preoperative pain, and anesthetic technique) improved the model, with an AUC ranging from 0.72 (95%CI: 0.70-0.74) on POD 0 to 0.78 (95%CI: 0.72-0.84) on POD 4. In the final step the psychologic variables were added to the model, increasing the discriminative ability of the model to an AUC ranging from 0.77 (95% CI: 0.75-0.80) on POD 0 to 0.81 (95% CI: 0.74-0.86) on POD 4.

The results for the variables of all steps are listed in Table 3. In the final model, preoperative pain (defined by a preoperative VAS >10 mm) was most strongly associated with acute postoperative pain (VAS >40 mm) during the whole study period (Table 3) followed by anticipated pain level (anticipated by the clinician based on the type of surgery) and expected pain (by the patient). This association was not found for expected pain (by patient) on POD 2. Younger age (<45 y vs. >60 y) also increased the risk of acute postoperative pain (VAS >40 mm) in the period from POD 1 to 3. The independent variable short-term fear was only associated with acute postoperative pain (VAS >40 mm) during POD 0 to 2, and dropped out of the model for POD 3 and 4.

For the independent variables sex, level of education, anesthetic technique, long-term fear, the trait optimism (Life Orientation Test), and pain catastrophizing no consistent association with acute postoperative pain (VAS >40 mm) was found. Patients with elementary school and intermediate educational level had an increased risk of postoperative pain compared with patients with higher degree level of education only on POD 1. Regional anesthetic technique decreased the risk of acute postoperative pain only on the day of the operation. A high Pain Catastrophizing Scale elevated the risk of postoperative pain only on POD 3 score.

DISCUSSION

In this study, the presence of preoperative pain was the best predictor of moderate-to-severe pain at home after day-case surgery. Central sensitization of nociceptive spinal dorsal horn neurons by chronic noxious stimulation from the affected part of the body could be a possible explanation. Differences in pain thresholds provide a genetic or social explanation for the predictive value of preoperative pain possible as well. It has been demonstrated

TABLE 3. Results of the Logistic Regression Analyses for Postoperative Pain (Visual Analog Scale >40 mm) on the Day of Operation and on Postoperative Days 1 to 4

	Day of Operation		POD 1		POD 2		POD 3		POD 4	
	n = 644		n = 581		n = 581		n = 581		n = 581	
Independent Variable	OR (95% CI)	AUC	OR (95% CI)	AUC	OR (95% CI)	AUC	OR (95% CI)	AUC	OR (95% CI)	AUC
Step 1		0.62		0.66		0.67		0.72		0.72
Anticipated pain level										
Intermediate vs. minor	1.4 (0.9-2.2)		2.0 (1.2-3.3)		2.2 (1.3-3.9)		2.9 (1.5-5.5)		2.6 (1.4-5.5)	
Age (y)										
<45 vs. 60+	1.4 (0.8-2.5)		2.8 (1.5-5.5)		2.4 (1.2-5.1)		2.2 (1.0-5.1)		1.7 (0.7-4.0)	
45-59vs. 60+	1.0 (0.6-1.8)		2.0 (1.0-3.9)		1.3 (0.6-2.9)		1.0 (0.4-2.5)		0.7 (0.2-1.9)	
Sex										
Female vs. male	0.9 (0.6-1.4)		1.2 (0.7-2.0)		0.8 (0.5-1.5)		1.3 (0.7-2.5)		1.4 (0.7-2.9)	
Step 2		0.72		0.75		0.74		0.78		0.78
Level of education										
Low vs. high	NE		2.5 (1.3-4.8)		NE		NE		NE	
Middle vs. high			1.5 (1.3-2.9)							
Preoperative pain										
Yes vs. no	3.1 (2.0-4.9)		3.6 (2.1-6.2)		3.7 (2.1-6.5)		3.7 (1.9-7.0)		3.1(1.6-6.3)	
Anesthetic technique										
Regional vs. general	0.4 (0.2-0.6)		NE		NE		NE		NE	
Step 3		0.77		0.79		0.76		0.81		0.81
Expected pain (VAS>40 mm)										
Yes vs. no	2.1 (1.4-3.2)		2.4 (1.5-3.9)		NE		2.7 (1.4-5.2)		3.0 (1.5-6.2)	
Short-term fear										
High (>9) vs. low (≤9)	1.7 (1.1-2.6)		1.9 (1.2-3.2)		2.2 (1.3-3.8)		NE		NE	
Long-term fear										
High (>6) vs. low (≤6)	NE		NE		NE		NE		NE	
Optimism (LOT)										
High (>28) vs. low (≤28)	NE		NE		NE		NE		NE	
Pain catastrophizing (PCS)										
High (>11) vs. low (≤11)	NE		NE		NE		2.2 (1.1-4.6)		NE	

Step 1 used a forced entry procedure, whereas in steps 2 and 3 only significant variables ($P < 0.05$) entered the model (forward procedure). The AUC for each step are presented and OR and 95% CI for all variables in the final models are tabulated.

AUC indicates area under the receiver operating characteristics curves; CI, confidence interval; LOT, Life Orientation Test; NE, variable not in the equation; OR, odds ratio; PCS, Pain Catastrophizing Scale; POD, postoperative day.

that patients with lower pain thresholds will have more intense postoperative pain.[30] In addition, psychologic effects due to preoperative pain could play a role: for example, an effect on preoperative anxiety. In a report about predictors of postoperative pain in hospitalized patients preoperative anxiety levels correlated highly with postoperative pain. In addition, the level of preoperative pain was found to be an independent predictor of severe postoperative pain in the immediate postoperative period in this investigation (within the first hour after arrival at the PACU).[16]

Contradictory results are reported in the literature regarding preoperative expectations of postoperative pain (by the patient) contradictory results are reported in the literature. In our study, the results of the logistic regression analysis showed a positive association between preoperative expectations of pain and the de facto occurrence of postoperative pain. A recent report of Mamie et al[18] showed a predictive value of preoperative pain expectations as well. However, a validation procedure in a second patient group did not confirm these results. Preoperative expectation of pain is a parameter, which is influenced by many factors like previous experiences with surgery, memory, psychologic profile, and anxiety state of the patient. Besides, different definitions of "preoperative expectation of pain" are used in the different publications.[18,31] For example, in our study we used, a quite distinct definition of "expectation of pain," an expected VAS greater than 40 mm, others used less specific definitions like expectation of low or high postoperative pain.[18] Thus, contradictory results are not surprising and the clinical importance of this parameter is still difficult to evaluate.

The anticipated level of pain by the clinician also correlated well with postoperative pain in our study, indicating that clinicians are not completely ignorant about how much pain to expect after ambulatory surgery. Previous reports showed indeed that certain types of surgery are correlated with more postoperative pain than others.[16,20] Example high levels of postoperative pain are commonly reported after orthopedic surgery, whereas levels of postoperative pain after cataract surgery are very low.[20] A criticism may be that the anticipation of severe pain could have influenced the choice of anesthesia technique and postoperative analgesic treatment. This implicates a potential for confounding regarding postoperative pain and the interpretation of patient factors. We tried to minimize this by standardizing the postoperative pain treatment as much as possible.

Many investigations on postoperative pain after day-case surgery did not include the age of the patient into their analysis[2,32–34] or did not find an association between age and postoperative pain.[14] However, our results indicate that younger patients (< 45 y) are more likely to experience at least moderate pain (VAS > 40 mm) in the postoperative course. Age-related changes of pharmacokinetic and pharmacodynamic variables such as volume of distribution of opioids and sensitivity to antinociceptive effects of opioids could explain this phenomenon in part.[35] Furthermore, experiences with postoperative pain from previous operations could influence expectations of the patients about postoperative pain. Finally, differences in activity level between age groups are another explanation for the higher risk of postoperative pain in the younger age group, as younger patients probably tend to resume activities like work or taking care of children sooner than the older age groups. These differences in activity level are not taken into account by the VAS.

Sex as a predictive factor for postoperative pain has been investigated in previous studies with conflicting results.[14,18] In our study, sex was not an independent predictor for postoperative pain. Surprisingly, anesthetic technique is not considered in many reports on predictors of postoperative pain. In our study, regional techniques decreased the risk of acute postoperative pain on the day of the operation, which can be explained by residual blockade. However, this protecting effect of loco-regional techniques was not seen on the other days.

Previous reports showed a correlation of several psychologic parameters with postoperative pain. Preoperative anxiety, pain catastrophizing, and neuroticism were predictive factors for postoperative pain in previous investigations.[19,36,37] Most of these studies investigated hospitalized patients and so not much data about psychologic parameters and postoperative pain after ambulatory surgery are available. Our study showed only limited associations of psychologic factors and postoperative pain in ambulatory patients. Fear of short-term consequences of the operation was associated with postoperative pain (POD 0 to 2). Pain catastrophizing increased the risk for postoperative pain only on POD 3. The other psychologic factors we tested showed no association with postoperative pain. Possibly, ambulatory surgery causes less emotional distress than "major" surgery in combination with hospitalization. This could be one contributing factor to the lesser impact of psychologic parameters on postoperative pain after ambulatory surgery.

The influence of the educational level on postoperative pain has received little investigation. Lower educational level was a significant predictor for postoperative pain after elective gallbladder surgery in a previous report.[37] It has been suggested that differences in character trait and ability to cope with the pain could be the reason for this association. However, in the present investigation educational level was a significant predictor of postoperative pain only on POD 1. So, only a limited predictive value of this factor in ambulatory patients has been shown. The impact of postoperative pain on quality of life and functional status is an important aspect, which was not investigated in this study and should be considered in future research.

In conclusion, the present study shows the results of a large cohort of day-case surgery patients with a 4-day postoperative follow-up. The best predictor of postoperative pain in this population was the presence of preoperative pain. Other predictors were anticipated postoperative pain by the clinician, preoperative high expectations of postoperative pain by the patient, younger age, and fear of short-term consequences of the operation. Most of these factors are easily detectable and should be taken into account when planning postoperative analgesia for ambulatory surgery.

REFERENCES

1. McGrath B, Elgendy H, Chung F, et al. Thirty percent of patients have moderate to severe pain 24 hours after ambulatory surgery: a survey of 5,703 patients. *Can J Anaesth*. 2004;51:886–891.
2. McHugh GA, Thoms GMM. The management of pain following day-case surgery. *Anaesthesia*. 2002;57:270–275.

3. Sommer M, de Rijke JM, van Kleef M, et al. The prevalence of postoperative pain in a sample of 1490 surgical inpatients. *Eur J Anaesthesiol*. 2008;25:267–274.
4. Brodner G, Mertes N, Buerkle H, et al. Acute pain management: analysis, implications and consequences after prospective experience with 6349 surgical patients. *Eur J Anaesthesiol*. 2000;17:566–575.
5. Wu CL, Berenholtz SM, Pronovost PJ, et al. Systematic review and analysis of postdischarge symptoms after outpatient surgery. *Anesthesiology*. 2002;96:994–1003.
6. Bay-Nielsen M, Thomsen H, Heidemann Andersen F, et al. Convalescence after inguinal hernioraphy. *Br J Surg*. 2004; 91:362–367.
7. Callesen T, Bech K, Kehlet H. Prospective study of chronic pain after groin hernia repair. *Br J Surg*. 1999;86:1528–1531.
8. Katz J, Jackson M, Kavanagh BP, et al. Acute pain after thoracic surgery predicts long-term post-thoracotomy pain. *Clin J Pain*. 1996;12:50–55.
9. Perkins FM, Kehlet H. Chronic pain as an outcome of surgery: a review of predictive factors. *Anesthesiology*. 2000;93: 1123–1133.
10. Peters ML, Sommer M, de Rijke JM, et al. Somatic and psychologic predictors of long-term unfavorable outcome after surgical intervention. *Ann Surg*. 2007;245:487–494.
11. Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. *Lancet*. 2006;367:1618–1625.
12. Poleshuck EL, Katz J, Andrus CH, et al. Risk factors for chronic pain following breast cancer surgery: a prospective study. *J Pain*. 2006;7:626–634.
13. Nikolajsen L, Brandsborg B, Lucht U, et al. Chronic pain following total hip arthroplasty: a nationwide questionnaire study. *Acta Anaesthesiol Scand*. 2006;50:495–500.
14. Beauregard L, Pomp A, Choinière M. Severity and impact of pain after day-surgery. *Can J Anaesth*. 1998;45:304–311.
15. Pavlin DJ, Sullivan MJL, Freund PR, et al. Catastrophizing: a risk factor for postsurgical pain. *Clin J Pain*. 2005;21:83–90.
16. Kalkman CJ, Visser K, Moen J, et al. Preoperative prediction of severe postoperative pain. *Pain*. 2003;105:415–423.
17. Caumo W, Schmidt AP, Schneider CN, et al. Preoperative predictors of moderate to intense acute postoperative pain in patients undergoing abdominal surgery. *Acta Anaesthesiol Scand*. 2002;46:1265–1271.
18. Mamie C, Bernstein M, Morabia A, et al. Are there reliable predictors of postoperative pain? *Acta Anaesthesiol Scand*. 2004;48:234–242.
19. Perry F, Parker RK, White PF, et al. Role of psychological factors in postoperative pain control and recovery with patient-controlled analgesia. *Clin J Pain*. 1994;10:57–63.
20. Chung F, Ritchie E, Su J. Postoperative pain in ambulatory surgery. *Anesth Analg*. 1997;85:808–816.
21. Gramke HF, de Rijke JM, van Kleef M, et al. The prevalence of postoperative pain in a cross-sectional group of patients after day-case surgery in a university hospital. *Clin J Pain*. 2007;23:543–548.
22. Sullivan MJL, Bishop SR, Pivik J. The Pain Catastrophizing Scale: development and validation. *Psychol Assess*. 1995;7: 524–532.
23. Koivula M, Tarkka MT, Tarkka M, et al. Fear and anxiety in patients at different time-points in the coronary artery bypass process. *Int J Nurs Stud*. 2002;39:811–822.
24. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *J Pers Soc Psychol*. 1994;67:1063–1078.
25. Collins SL, Moore RA, McQuay HJ. The visual analogue pain intensity scale: what is moderate pain in millimetres? *Pain*. 1997;2:95–97.
26. Jensen MP, Chen C, Brugger AM. Interpretation of Visual Analog Scale ratings and change scores: a reanalysis of two clinical trials of postoperative pain. *J Pain*. 2003;4:407–414.
27. Dolin SJ, Cashman JN, Bland JM. Effectiveness of acute pain treatment: I. Evidence from published data. *Br J Anaesth*. 2002;89:409–423.
28. van Buuren S, Boshuizen HC, Knook DL. Multiple imputation of missing blood pressure covariates in survival analysis. *Stat Med*. 1999;18:681–694.
29. Rubin DB. *Multiple Imputation for Non-response in Surveys*. New York, NY: J. Wiley & Sons; 1987.
30. Nielsen PR, Nørgaard L, Rasmussen LS, et al. Prediction of post-operative pain by an electrical stimulus. *Acta Anaesthesiol Scand*. 2007;51:582–586.
31. Svensson I, Sjöström B, Haljamäe H. Influence of expectations and actual pain experiences on satisfaction with postoperative pain management. *Eur J Pain*. 2001;5:125–133.
32. Watt-Watson J, Chung F, Chan VWS, et al. Pain management following discharge after ambulatory same-day surgery. *J Nurs Manage*. 2004;12:153–161.
33. Pavlin DJ, Chen C, Penaloza DA, et al. A survey of pain and other symptoms that affect the recovery process after discharge from an ambulatory surgery unit. *J Clin Anesth*. 2004;16: 200–206.
34. Rawal N, Hylander J, Nydahl PA, et al. Survey of post-operative analgesia following ambulatory surgery. *Acta Anaesthesiol Scand*. 1997;41:1017–1022.
35. Macintyre PE, Jarvis DA. Age is the best predictor of postoperative morphine requirements. *Pain*. 1995;64:357–364.
36. Granot M, Goldstein Ferber S. The roles of pain catastrophizing and anxiety in the prediction of postoperative pain intensity. *Clin J Pain*. 2005;21:439–445.
37. Taenzer P, Melzack R, Jeans ME. Influence of psychological factors on postoperative pain, mood and analgesic requirements. *Pain*. 1986;24:331–342.

