Prevalence and Predictors of Postoperative Pain After Ear, Nose, and Throat Surgery

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Objective: To determine postoperative pain in different types of ear, nose, and throat (ENT) surgery and their psychological preoperative predictors.

Design: Prospective cohort study.

Setting: Academic hospital.

Patients: A total of 217 patients undergoing ENT surgery.

Interventions: All ENT, neck, and salivary gland surgery.

Main Outcome Measures: Postoperative pain and predictors for postoperative pain.

Results: Fifty percent of the patients undergoing surgery on the oral, pharyngeal, and laryngeal region and on the neck and salivary gland region had a visual analog scale score higher than 40 mm on day 1. In the patients who underwent oropharyngeal region operations the VAS score remained high on all 4 days. A VAS pain score higher than 40 mm was found in less than 30% of patients after endoscopic procedures and less than 20% after ear and nose surgery. After bivariate analysis, 6 variables—age, sex, preoperative pain, expected pain, short-term fear, and pain catastrophizing—had a predictive value. Multivariate analysis showed only preoperative pain, pain catastrophizing, and anatomical site of operation as independent predictors.

Conclusions: Differences exist in the prevalence of unacceptable postoperative pain between ENT operations performed on different anatomical sites. A limited set of variables can be used to predict the occurrence of unacceptable postoperative pain after ENT surgery.


DEQUATE POSTOPERATIVE pain management is an essential part of perioperative care because postoperative pain results in patient discomfort and may decrease patient satisfaction. More important, it may increase the risk for pulmonary and cardiovascular complications and may even contribute to the development of chronic pain. Although in the last few decades a vast range of new therapeutic developments have occurred (eg, in new formulations of pain medication), postoperative pain remains a persistent problem. To improve postoperative pain control, it would be desirable to preoperatively distinguish patients and patient groups who are at risk of developing unacceptably high levels of postoperative pain. The type of surgery is a factor that determines the level of postoperative pain. However, with the exception of pain after tonsillectomy, a common and very painful procedure, surprisingly little literature is available on the amount of postoperative pain after ear, nose, and throat (ENT) surgery. Rates of absence from work for more than 2 weeks following routine ENT surgery and rates of readmission or overstay after day-case (outpatient) nasal surgery that are higher than 10% suggest that this patient group cannot be neglected and that the pain levels experienced by patients who have undergone ENT surgery is probably highly underestimated.

The type of surgery is not the only determinant of postoperative pain because patients undergoing the same procedure may require plasma levels of opiates varying more than 5-fold to provide satisfying analgesia. Other determinants (determined in groups that consisted of all types of surgery) that have been suggested to predict postoperative pain are female sex, younger age, the amount of preoperative
pain, and psychological factors including preoperative anxiety and catastrophizing.\textsuperscript{12-17}

The purpose of this study was to objectify postoperative pain in different types of ENT surgery, using a visual analog scale (VAS), and to identify somatic and psychological preoperative predictors for unacceptable high levels of pain in this patient group. A mean pain score of higher than 40 mm on a VAS is generally regarded as being unacceptable.\textsuperscript{18-20} Patients undergoing ENT surgical procedures participated in this study, which consisted of preoperative assessments of somatic and psychological variables and daily assessment of pain until postoperative day (POD) 4.

## Methods

### Design

This study is a secondary analysis of data from 2 prevalence studies\textsuperscript{21,22} with a longitudinal design that were performed to obtain short-term follow-up data on surgery-related pain on the day of surgery (POD 0) and PODs 1 to 4.\textsuperscript{23} In the 2 surveys, data were obtained from 2138 consecutive patients; 304 of them had been admitted for ENT surgery (hereinafter, ENT patients). The final study sample comprised 217 ENT patients. From these 217 subjects, 181 were admitted to a surgical ward and 36 to a day-case unit.

### Subjects

This study was performed in a general university teaching hospital with 715 beds; 183 of the beds are located on surgical wards. The institutional ethics committee approved the survey.

All patients aged 18 to 80 years scheduled for ENT surgery were approached for possible study participation from October 2002 through September 2003. From October 2002 through January 2003, the patients scheduled for ENT surgery in a same-day admission unit were approached, and from January 2003 through September 2003, ENT surgery inpatients were enrolled. Each subject was evaluated for eligibility to participate in the study (age \( \geq 18 \) years, no limitations of self-expression, no visual dysfunction or language problems). Patients admitted for acute surgery or requiring postoperative ventilatory support were excluded from the study. Also excluded were 82 patients, including 36 who did not meet inclusion criteria, 17 who refused to participate (less than 1%), and 29 who did not participate for other reasons. The characteristics of the patients who refused to participate were no different in demographics and type of operation from those of the participants. Data on a total of 217 patients were studied.

### Outcome and Candidate Predictors

The outcome of the present study was the presence of unacceptable postoperative pain, defined as a mean VAS pain score of 40 mm or higher\textsuperscript{10-12} (the mean of 3 scores on POD 0 and PODS 1-4).

Fourteen candidate predictors of unacceptable postoperative pain were selected. These included somatic variables (type of operation, age, sex, duration of surgery, American Society of Anesthesiology [ASA] score, preoperative pain, and type of admission) and psychological variables (expected pain, surgical fear, catastrophizing, and optimism). The ASA score describes the patient from the perspective of basic risk banding.

Research into perioperative outcome uses these scores widely as descriptors of the surgical population.

### Instruments and Procedures and Preoperative Assessment

The data collection instruments consisted of preoperative questionnaires and a postoperative pain and medication diary. Eligible patients received a letter describing the purpose and methods of the study and a set of questionnaires 1 to 3 weeks before treatment. The following questionnaires were included: (1) the pain catastrophizing scale (PCS) (13 items), which measures an exaggerated negative attitude toward pain, and (2) the Life Orientation Test (8 items), which measures dispositional optimism.\textsuperscript{14,16} Completion of questionnaires took 7 to 10 minutes. Patients were requested to bring the completed questionnaires to the hospital on the day of admission.

After admission to the surgical ward or day-case unit, a trained research assistant explained the purpose and methods of the study to each eligible patient who was willing to participate. Sociodemographic variables such as date of birth, sex, and education were recorded, and a questionnaire on surgical fear was filled out. This 10-item questionnaire on surgical fear was adapted from Koivula et al.\textsuperscript{24} For the present study, only the subscale “fear of immediate consequences” (4 items, Cronbach \( \alpha = 0.83 \); anesthetics, 0.90; operation, 0.84; unpleasant adverse effects, 0.7; pain, 0.66) was used.\textsuperscript{18} Furthermore, pain intensities at rest and while coughing and expected pain after the operation were scored, using a 100-mm VAS anchored to “no pain” and “the worst pain I can imagine.”

### Postoperative Pain Assessment

Pain intensity at rest and while coughing was scored at 1 and 3 hours after surgery. For day-case surgery, scoring took place at 1 hour after surgery and at the time of discharge. On PODs 0 to 4, pain was scored in a pain diary 3 times a day. All the inpatients who underwent surgery on the respective day were visited by trained research assistants at 9 PM. Furthermore, research assistants visited all the inpatients at least once a day to give help if necessary.

Day-case patients and patients from the surgical ward who were discharged from the hospital within 4 days after surgery took their pain and medication diary home and returned it to the research team in a special prepaid envelope. If diaries had not been returned within 14 days after surgery, we followed up by contacting the patient by telephone.

### Pain Management

The perioperative pain protocol that has been used at this hospital since 1995 is based on the stepwise approach of acute pain treatment described by Rawal.\textsuperscript{25} All the operations are categorized into 3 groups (minor, intermediate, and major surgery) based on the anticipated level of postoperative pain. Subsequently, all the surgical procedures were categorized according to the anatomical site. The ENT surgical patients were categorized in the minor and intermediate surgical groups. Procedures involving the ear and nose and endoscopies were mainly categorized as the minor procedure group, and procedures involving the oral cavity, pharynx, larynx, neck, and salivary glands were categorized in the intermediate procedure group (Table 1).

In agreement with the prevailing protocol, all patients received acetaminophen orally or rectally 1 hour before induction of anesthesia. After minor operations, the patients were treated with paracetamol, 1000 mg, 4 times a day combined with...
A mean VAS pain score higher than 40 mm was regarded as unacceptable.\textsuperscript{18-20} Actual pain scores (VAS, 0-100 mm) were used on the day before discharge and ward nurses. Rescue medicine for moderate or severe pain was piripramide given intramuscularly.

Pain after intermediate operations was treated using the same protocol combined with intravenous piritramide, 2 to 5 mg, which was repeated until the patient reported being pain free. This was followed by intramuscular piritramide, 10 to 15 mg, 6 times a day. All ENT operations were conducted under general anesthesia.

### Table 1. Ear, Nose, and Throat Operations According to Anatomical Region

<table>
<thead>
<tr>
<th>Anatomical Region (No. of Procedures)</th>
<th>Type of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ear (n=54)</td>
<td>Incision; drainage of ear canal, drainage retroauricular abscess, partial excision auricle, first-phase BAHA, mastoid screw, reconstruction with transplantation</td>
</tr>
<tr>
<td>Middle ear (n=46)</td>
<td>Transmeatal drainage and ventilation tubes, inspection; diagnostic, radical mastoidectomy, cleaning of the middle ear and nose, stapledectomy or stapledotomy, tympanoplasty type II, tympanoplasty type I, tympanoplasty type I and OCR; Chain reconstruction, tympanoplasty, facial nerve decompression, cochlear implantation, excision of glomus tumor</td>
</tr>
<tr>
<td>Nose (n=51)</td>
<td>Extraction nasal polyps; infludibulum, 1-sided; extraction of nasal polyps; infludibulum, 2-sided; polypectomy, 1-sided; conchotony, 1-sided; concha cautereization, 1-sided, biopsy, 1-sided; concha luxation</td>
</tr>
<tr>
<td>Paranasal sinuses (n=15)</td>
<td>Endonasal ethmoidectomy; external ethmoidectomy, 1-sided; ethmoid operation, nose; sphenoidal exploration, 1-sided; combined operations, Moure, Caldwell-Luc, endonasal excision tumor, lateral rhinotomy</td>
</tr>
<tr>
<td>External nose and nasal skeleton (n=22)</td>
<td>Correction of cartilaginous pyramid nose; septal perforation closure; open rhinoplasty; nasal septum correction; left lateral osteotomy, total resection; excision of tumor, cyst, or fistula</td>
</tr>
<tr>
<td>Throat (n=22)</td>
<td>Partial glossectomy, excision of malignant tumor of mouth floor</td>
</tr>
<tr>
<td>Oral cavity (n=4)</td>
<td>Adenotony or adenoidectomy, tonsillectomy, laser excision tumor hypopharynx, excision tumor</td>
</tr>
<tr>
<td>Pharynx (n=16)</td>
<td>Reduction stenosis or webs, insertion voice prosthesis</td>
</tr>
<tr>
<td>Larynx (n=2)</td>
<td>Radical neck dissection, myotomy cricopharyngeal muscle, excision branchial cyst, total laryngectomy</td>
</tr>
<tr>
<td>Neck and salivary glands (n=28)</td>
<td>Total parotidectomy, lateral parotidectomy, excision of other salivary glands, partial parotidectomy, excision of the submandibular gland</td>
</tr>
<tr>
<td>Salivary glands (n=13)</td>
<td>Pharyngoscopy (diagnostic), esophagoscopy (diagnostic), transoral nasopharyngoscopy (diagnostic), microlaryngoscopy (therapeutic), direct laryngoscopy (therapeutic), direct laryngoscopy (diagnostic), microlaryngoscopy (diagnostic), endoscopic treatment of Zenker diverticulum, esophagus (dilation)</td>
</tr>
</tbody>
</table>

**Table 1.** Ear, Nose, and Throat Operations According to Anatomical Region

Abbreviations: BAHA, bone-anchored hearing aid; OCR, ossicular chain reconstruction; UPPP; uvulopharyngoplasty.

with nonsteroidal anti-inflammatory drugs administered by the ward nurses. Rescue medicine for moderate or severe pain (VAS > 40 mm) was piritramide given intramuscularly.

Pain after intermediate operations was treated using the same protocol combined with intravenous piritramide, 2 to 5 mg, which was repeated until the patient reported being pain free. This was followed by intramuscular piritramide, 10 to 15 mg, 6 times a day. All ENT operations were conducted under general anesthesia.

### STATISTICAL ANALYSES

Actual pain scores (VAS, 0-100 mm) were used on the day before the operation. Mean pain scores were calculated from each individual, measured on PODs 0 to 4, using the mean of the 3 scores obtained on each of the days. Because the pain diaries were sometimes incomplete, totals could vary from day to day. A mean VAS pain score higher than 40 mm was regarded as being unacceptable.\textsuperscript{18-20}

To determine which variables independently predict the risk of a postoperative VAS of 40 mm or higher on PODs 0 to 4, we first estimated the association between region of operation and endoscopies with each candidate predictor and the outcome (bivariate analysis). The operation regions and endoscopies, specified in Table 1, were considered very important for prediction of unacceptable pain and therefore remained in the model. All preselected candidate predictors with a $P < .15$ were considered in the multivariable analysis using logistic regression modeling.

Missing values in predictor variables were imputed. This was performed because of a presumed nonresponse problem in which the occurrence of missing data is related to the outcome value. Patients who did not fill in all data may have had severe pain at that point in time or, in contrast, no pain at all. Either way, this could influence the outcome. Missing predictor values were imputed according to the multiple imputation (MI) method described by Rubin and Schenker.\textsuperscript{20} Assuming a missing at-random mechanism, each missing value can be imputed using a regression model with the other covariates and outcome as predictor. The imputation is a stochastic process because the value is drawn from a density function generated by the regression model. In this way, a complete data set is generated, and this process is repeated at least twice. For the present study, the imputation procedure was performed 5 times, obtaining 5 complete datasets, with imputed values for expected pain (n=4 [1.6%]), surgical fear (n=6 [2.8%]), pain catastrophiing (n=8 [3.7%]), and optimism (n=10 [4.6%]). For each of the 5 datasets that were obtained after MI, multiple logistic regression analysis was performed to identify the factors that independently predicted the risk of having unacceptable postoperative pain (VAS $\geq$ 40 mm) on POD 0 and PODs 1 to 4. Missing values in outcome measures (pain scores) were not imputed. However, these missing data could be subject to selection processes as well. Therefore, logistic regression analyses were used to investigate whether these missing outcomes could be predicted with available covariates (ASA grade, preoperative pain, sex, etc). The results revealed some significant relationships and were used to calculate a $P$ value weight factor for each case.

For the multivariable logistic model, the continuous quality of the psychological variables was retained. Using a forward entry procedure, the criterion for adding a variable was $P > .05$ based on the log-likelihood ratio test. A variable was included in the final analyses when the variable appeared at least 3 times in the 5 imputation sets. The model’s ability to dis-
Baseline characteristics are presented in **Table 2**. More male patients (59.4%) were included than female (40.6%). The **Figure** indicates the distribution of mean pain scores on the day before surgery until POD 4 at rest and while coughing. The ENT operations performed in the region of the mouth, throat, neck, and salivary glands were painful (VAS score ≥ 40 mm) on POD 0. Approximately 48% of the patients in these groups had unacceptable pain at rest, and 58% had a mean VAS score greater than 40 mm while coughing on POD 0 (Figure). For mouth and throat surgery, this condition persisted almost throughout the whole study period.

Of the initial 10 predictors other than operation region and endoscopies, only 6 remained after bivariate analysis (ie, age, sex, preoperative pain, expected pain, surgical fear, and pain catastrophizing). The multivariable regression analysis with these 6 predictors and the anatomical site of the intervention yielded a receiver operating characteristic curve area of 0.76 to 0.72 for POD 0 until POD 4 (**Table 3**). Predictors that seemed relevant for the model (eg, sex, age, and surgical fear) were not independent predictors in multivariate analysis. Apparently, the retained predictors already provided for their predictive information. Anatomical site (ie, oral cavity, pharynx, larynx, neck salivary glands, and, on POD 2, also including endoscopic procedures), preoperative pain on POD 1, and pain catastrophizing on PODs 2 to 4 remained in the model as predictors of significant higher risk of unacceptable pain. Multivariate analysis indicates that the risk of pain is 4 to 10 times higher in the oral cavity, pharynx, larynx, and neck salivary gland surgery category compared with the ear surgery category (**Table 3**). Pain catastrophizing is measured on a scale of 0 to 52. When comparing 2 groups, the interpretation of the odds ratio (OR) of the pain catastrophizing score is dependent on the difference of this score between these groups; for example, an increase of 10 points in the PCS scale would mean an

**Table 2. Baseline Characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Subjects, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>217</td>
</tr>
<tr>
<td>Sex, No.</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>129 (59.4)</td>
</tr>
<tr>
<td>Female</td>
<td>88 (40.6)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>18-39</td>
<td>65 (30)</td>
</tr>
<tr>
<td>40-59</td>
<td>86 (39.6)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>66 (30.4)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
</tr>
<tr>
<td>Elementary</td>
<td>58 (26.7)</td>
</tr>
<tr>
<td>High school</td>
<td>59 (27.2)</td>
</tr>
<tr>
<td>College and university</td>
<td>62 (28.6)</td>
</tr>
<tr>
<td>Preoperative VAS &gt; 40 mm</td>
<td>14 (6.5)</td>
</tr>
<tr>
<td>Type of admission</td>
<td></td>
</tr>
<tr>
<td>Inpatient</td>
<td>181 (83)</td>
</tr>
<tr>
<td>Outpatient</td>
<td>36 (17)</td>
</tr>
<tr>
<td>ASA score</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>105 (48)</td>
</tr>
<tr>
<td>2</td>
<td>80 (37)</td>
</tr>
<tr>
<td>3</td>
<td>30 (14)</td>
</tr>
<tr>
<td>4</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Surgery time, min</td>
<td></td>
</tr>
<tr>
<td>&lt;60</td>
<td>126 (58.0)</td>
</tr>
<tr>
<td>60-180</td>
<td>77 (35.5)</td>
</tr>
<tr>
<td>&gt;180</td>
<td>14 (6.5)</td>
</tr>
<tr>
<td>Expected VAS &gt; 40 mm</td>
<td>85 (39)</td>
</tr>
</tbody>
</table>

Abbreviations: ASA, American Society of Anesthesiology; VAS, visual analog scale.

a The mean (SD) age was 16 (50) years, with 152 patients (70%) older than 40 years.

b Data were not available for 17% of the subjects.

**RESULTS**
stimuli could predict the level of postoperative pain.12,28-32 Pain. Recent data indicate that the response to these pressure test, electrical skin stimulation, or heat stimuli, assumed that the missing data hardly affected the results. Only marginally attributed to the total variance, it was percentage of missing data is low and the imputation method assumed in a clinical setting. In contrast, the use of the PCS score in relation to the other possible predictors. It would be interesting to measure the predicting power of these tests in relation to the other possible predictors. Multivariate analysis indicates that the risk of pain is 4 to 10 times higher in these groups compared with those in the ear surgery category. The anatomical site seems to play an important role as a predictor of postoperative pain after ENT surgery.

The data from this study demonstrate that there are remarkable differences in postoperative pain sensations at the different anatomical sites of ENT surgery. A large group of patients have an unacceptable level of pain after surgery on the oral region, pharynx, larynx, neck, and salivary glands. Multivariate analysis indicates that the risk of pain is 4 to 10 times higher in these groups compared with those in the ear surgery category. The anatomical site seems to play an important role as a predictor of postoperative pain after ENT surgery.

A problem in this study was missing data on predictor variables (4%) and the outcome variable pain (day before surgery, 1.6%; for PODs 1-4 the mean was 9.6%). However, for the missing predictors an MI method was used as suggested by Rubin and Schenker26 and van Buuren et al.27 We adjusted for the missing outcome by using R coefficient 1.046 in Table 3 to the power of 100). OR or risk increase on POD 4 of 1.57 (this equals the coefficient 1.046 in Table 3 to the power of 100).

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though some large studies measured the amount of ENT surgery if the anatomical site is considered. Although some large studies measured the amount of pain in different surgical categories, like abdominal or orthopedic surgery, this study shows that this categorization is probably not sufficient because major differences in pain sensation manifest themselves within ENT surgery.

Many endoscopic procedures are considered to be relatively painless and, at worst, associated with mild discomfort. This study seems to prove otherwise. Compared with nose surgery on POD 3 there is an OR, or risk increase, of unacceptable pain occurring of 7.6. As yet, there is no explanation for this phenomenon.

The presence or absence of unacceptable levels of postoperative pain after general anesthesia in patients undergoing ENT surgery can be predicted with a limited amount of variables (ie, operation region, preoperative pain, and pain catastrophizing). Because preoperative use of PCS and the VAS for pain in an attempt to predict postoperative pain is considered feasible in current clinical practice, given that every patient should be screened preoperatively, these findings can be helpful in improving postoperative pain treatment.

How the catastrophizing postoperative patient should best be treated, with pain medication or otherwise, remains an unanswered question and could be a topic for future research. The results of this study will assist in improving postoperative pain treatment and in tailoring individual pain management.

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Analysis and interpretation of data: Sommer, Geurts, Stessel, Kessels, Peters, and Marcus.

Drafting of the manuscript: Sommer, Geurts, Stessel, Peters, Patijn, van Kleef, and Marcus.

Critical revision of the manuscript for important intellectual content: Sommer, Geurts, Kessels, Peters, Kremer, and Marcus.

Statistical analysis: Geurts, Kessels, Peters, and Marcus.

Obtained funding: Geurts, Patijn, van Kleef, and Marcus.

Administrative, technical, and material support: Sommer, Geurts, Stessel, Patijn, van Kleef, and Marcus.

Study supervision: Geurts, Peters, Patijn, van Kleef, and Marcus.

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