Relationship Between Persistence of Abdominal Symptoms and Successful Outcome After Cholecystectomy

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Background: Patients frequently have persistent abdominal symptoms after undergoing cholecystectomy. The relationship between abdominal symptoms and biliary dysfunction is often unclear.

Objectives: To describe the persistence rate of abdominal symptoms in a large cohort of patients after elective cholecystectomy, to identify predictors of symptom persistence and operative success, to understand which symptoms improve after cholecystectomy, and to describe the important determinants of an unsuccessful operation.


Results: The mean ± SD number of abdominal symptoms per patient decreased from 3.1 ± 2.0 to 1.1 ± 1.3; 27% of patients who identified a symptom as most bothersome before surgery still had the symptom 6 months after surgery. Symptom persistence rates ranged from 5.6% (vomiting) to 40.2% (gas/flatulence). A balance score that quantified the abdominal symptom mix between dyspeptic and biliary symptoms shifted after surgery to the dyspeptic category. Predictors of persistence of a most bothersome symptom were dyspeptic symptom category, worse operative risk and self-rated health status, symptom duration longer than 6 months, and no previous episodes of acute cholecystitis. The major correlate of not achieving a very successful outcome (15.2% of patients) was the presence of postoperative abdominal pain. Other predictors included worse self-rated health status and physical functioning, symptom duration longer than 6 months before surgery, and no previous episodes of acute cholecystitis.

Conclusions: Symptoms categorized as dyspeptic were more likely to persist than were biliary symptoms, although all symptoms showed a decrease in prevalence after cholecystectomy. More attention to the rationale for gallbladder removal and clarification of patient expectations for symptom relief might be necessary to improve outcomes after elective cholecystectomy.

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Cholecystectomy is a common abdominal surgical operation performed to relieve distressing symptoms and prevent complications of acute cholecystitis. However, symptoms of abdominal pain, nausea, food intolerance, and others are common, and their relationship to biliary disease is often unclear. Two population-based studies demonstrated no association between cholelithiasis and many abdominal symptoms.

In surgical series a significant proportion of patients have pain and abdominal symptoms that persist after undergoing cholecystectomy. Two studies associated psychological factors with persistence of abdominal pain, whereas Bates and colleagues concluded that preoperative belching, longer duration of pain, and older age predicted an unsuccessful outcome. Dissatisfaction with the operation ranges from 7% to 47%

The study objectives were to describe the prevalence of abdominal symptoms in a large cohort undergoing elective cholecystectomy and to identify characteristics associated with symptom resolution. We specifically wanted to determine whether symptom complexes categorized as dyspeptic or biliary had different cure rates and whether there was a relationship between postoperative symptoms and patient-based assessment of operative success.

RESULTS

PATIENTS

The patient sample was predominantly female (77.8%) and had a mean age of 48 ± 17 years (range, 1-96 years); 99.6% of the sample was older than 18 years, and
PATIENTS AND METHODS

STUDY DESIGN

This study is an analysis of the Minnesota Clinical Comparative Assessment Project database created to assess the extent to which clinical care met guidelines for elective cholecystectomy. Thirty-five Minnesota hospitals comprising 85% of the state’s bed capacity enrolled patients during 9 months in 1992. Consecutive patients (N = 3448) gave informed consent and completed a demographic, symptom, and functional status questionnaire before undergoing elective cholecystectomy. Abstractors collected data from operative, hospital, and outpatient records. Some patients were not contacted for follow-up (n = 619, 18.0%) because consent for follow-up was not obtained at the time of cholecystectomy. Patients who gave consent were contacted 6 months after surgery and completed a questionnaire by mail or telephone. Of 2829 patients eligible for follow-up, 2481 completed the questionnaire, for a follow-up proportion of 87.7% and an overall response rate of 72.0% (2481/3448).

SYMPTOM ASSESSMENT

Before Surgery

Preoperative pain was considered present if the participant gave a positive response to the following question (item 1): Have you had pain attributable to your gallbladder? Nonpain abdominal symptoms were assessed in a check-all-that-apply response format (item 2): In the past 4 weeks, what are the symptoms, other than pain, that you have experienced? nausea, belching, food intolerance, heartburn, flatulence/gas, vomiting, tenderness to touch, other (specify), none. Participants then designated a single most bothersome symptom, other than pain (item 3). Subsequent items about symptom duration and severity refer to the single most bothersome symptom chosen.

After Surgery

Postoperative pain was considered present if the participant indicated a response other than “no pain now” to item 4: Pain is in the right upper or middle part of the abdomen. Sometimes it goes to the back or right shoulder. It lasts 30 minutes to several hours. Once it starts it is constant and does not come and go in waves. The attacks are often intermittent and unpredictable. Periods in between attacks may be days or months. How similar is any current pain you are having now to this description: very similar, somewhat similar, not similar, very dissimilar, somewhat dissimilar, very dissimilar, or no pain now?

Nonpain symptoms (item 5) were assessed in a response format similar to item 2: In the past 2 weeks, have you experienced any of the following symptoms other than pain? Preoperative patients could chose 0 to 7 symptoms (within the previous 4 weeks) but only 1 most bothersome symptom. Postoperative patients could choose 0 to 7 symptoms (within the previous 2 weeks) but did not indicate a most bothersome symptom.

DEFINITIONS

The symptom persistence rate (including abdominal pain) is calculated as follows: (number of patients with the symptom before and after surgery + number of patients with the symptom before surgery) × 100. The symptom incidence rate is 100 minus the persistence rate. The symptom incidence rate is calculated as follows: (number of patients with the symptom after but not before surgery + the number of patients without the symptom before surgery) × 100.

To avoid post hoc classification bias by the results of our investigation, we defined the elements of the 2 symptom complexes before initiating the analysis. We distinguished between dyspeptic symptoms (gas, flatulence, heartburn, and belching) and biliary symptoms (nausea, food intolerance, vomiting, and tenderness to touch). The taxonomy of upper abdominal symptoms has become obscure in the past decade because investigators have shown considerable overlap in symptom complexes designated as reflux, dysmotility, or ulcerlike. Although a meta-analysis by Kraag and colleagues lends support to categorizing symptoms of nausea, vomiting, and food intolerance apart from flatulence, heartburn, and belching in patients with cholecystolithiasis, we did not intend the categories to represent exclusive anatomical or pathological domains but as qualifiers in common clinical use.

We developed a balance score to quantify the mix of dyspeptic and biliary symptoms in abdominal symptom items 2 and 5. The score ranges from 0 to 7 for patients who checked at least 1 abdominal symptom and represents the “purity” of the abdominal symptom(s) complex: balance score = (number of biliary symptoms – number of dyspeptic symptoms) + 3 (3 is added to the sum to make all the sums ≥0). For instance, a patient who checked all 3 dyspeptic symptoms and 2 biliary symptoms has a score of 2. Patients with no abdominal symptoms are not assigned a balance score.

GENERAL HEALTH MEASURES

General health measures were adapted from the 36-Item Short Form Health Survey, a measure of self-rated health status. Current health status was designated as excellent, very good, good, fair, or poor. We determined preoperative physical functioning by the patient’s ability to perform 10 activities of decreasing exercise capacity, yielding scores ranging from 10 (low functioning) to 30 (high functioning). Comorbidity was measured using the method of Charlson et al. whereas the operative risk class (range, 1-5) was abstracted from the anesthesiology flowsheet.

STATISTICAL METHODS

Interval data are summarized as mean ± SD. Comparisons between groups were tested with nonparametric (χ²) or parametric (t) tests as appropriate for the variable distribution, and the null hypothesis was rejected at P < .05. Variables tested for association with a dependent variable in a series of univariate logistic regression models were selected on the basis of clinical sensitivity (eg, physician-diagnosed episode of acute cholecystitis, general health status, and age) and results of published studies (eg, symptom duration and medications used). Variables with P < .10 were then entered into multivariate logistic models (SAS statistical software version 6.11; SAS Institute Inc, Cary, NC). To aid in model comparison and to obtain an unbiased estimation of key parameters, we did not use stepwise techniques and show odds ratios and P values for all covariates. We assessed model discrimination using the C statistic, which is equivalent to the area under the receiver operating characteristic curve (range, 0-1), in which a model with a greater C value has better discrimination. Goodness-of-fit testing was performed with the Hosmer-Lemeshow statistic (H). A small H value and a corresponding high P value suggests a good model fit.
patients were in generally good health; 92.8% had 0 or 1 of the Charlson comorbidities. Most patients (90.3%) rated their health as good, very good, or excellent, and 82.3% were in preoperative risk class 1 or 2. Most patients (94.5%) received a preoperative diagnosis of symptomatic cholelithiasis by their surgeon, and 96.1% had gallstones documented at operation or pathology report. The sample without follow-up was slightly different from the 2481 patients with follow-up. Those without follow-up were more likely to be male (27.9% vs 22.2%), to have a slightly higher mean preoperative risk scores, and to have more often undergone open cholecystectomy (36.2% vs 24.3%).

**SYMPTOMS**

Eighty-nine percent of patients had abdominal pain that they attributed to their gallbladder; 62.0% rated the pain as severe and 27.9% as moderate; 37.5% said the pain started more than 6 months previously. Most patients (85.7%) had at least 1 of 7 abdominal symptoms in the 4 weeks before undergoing cholecystectomy, and 60.6% had 3 or more symptoms. After surgery, 43.6% of patients had no abdominal symptoms, 41.0% had 1 or 2 symptoms, and 15.5% had 3 or more symptoms. The mean number of symptoms per patient decreased from 3.1 ± 2.0 to 1.1 ± 1.3 (difference significant at \( P<.001 \) by \( t \) test).

**Figure 1** shows that the point prevalence of individual symptoms before cholecystectomy declined at 6-month follow-up. In patients with a specific symptom before surgery, the postoperative prevalence (persistent symptom) ranged from 5.6% to 40.2% (Table 1). In patients who did not have the symptom before surgery, the postoperative prevalence (incident symptom) ranged from 1.7% to 24.5%. All the symptoms in the dyspeptic symptom group had persistence rates above 27%, whereas all the symptoms in the biliary group had rates below 20%. The rate for abdominal pain (24.2%) fell between those for the 2 symptom groups. The dyspeptic group had incident symptom rates greater than 9.5%, whereas the biliary group symptoms were all below 9.5%.

Many patients (\( n = 1776, 71.6\%) identified 1 of 7 abdominal symptoms as most bothersome, with the individual counts (percentages) as follows: nausea, 393 (18.6%); food intolerance, 233 (11.0%); vomiting, 171 (8.1%); tenderness to touch, 205 (9.7%); gas/flatulence, 317 (15%); belching, 104 (5.0%); heartburn, 353 (16.7%); and 332 (15%) identified other symptoms as most bothersome. The specified “other” bothersome symptom (\( n = 332, 15\% \)) was frequently diarrhea or loose stools. More than 70% of patients rated their most bothersome symptom as moderate or severe.

**Figure 2** demonstrates that symptoms in the dyspeptic group were more likely to persist relative to biliary symptoms whether they are identified as most bothersome or not. In addition, in all but one case (food intolerance), the symptom identified as most bothersome was more likely to persist than the identical symptom chosen from the check-all-that-apply list (although not all of the differences were statistically significant).

**SYMPTOM BALANCE SCORE**

We tested the clinical validity of the balance score by examining its association with other clinical data. We hypothesized that biliary symptoms would be associated with severe abdominal pain, whereas dyspeptic symptoms would be associated with medications that patients use to alleviate dyspeptic symptoms (more so than biliary symptoms). **Figure 3** demonstrates graphically that as the balance score increases (ie, the abdominal symptoms become predominantly biliary), the proportion of patients who also complain of severe abdominal pain.

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**Table 1. Abdominal Symptom Persistence and Incidence Rates**

<table>
<thead>
<tr>
<th>Symptom Column</th>
<th>Column A</th>
<th>Column B</th>
<th>Persistence Rate (B=A), %</th>
<th>Column C</th>
<th>Column D</th>
<th>Incidence Rate (C-D), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biliary Nausea</td>
<td>1225</td>
<td>199</td>
<td>16.2</td>
<td>55</td>
<td>1238</td>
<td>4.4</td>
</tr>
<tr>
<td>Food intolerance</td>
<td>1158</td>
<td>226</td>
<td>19.5</td>
<td>120</td>
<td>1305</td>
<td>9.2</td>
</tr>
<tr>
<td>Vomiting</td>
<td>669</td>
<td>37</td>
<td>5.5</td>
<td>31</td>
<td>1797</td>
<td>1.7</td>
</tr>
<tr>
<td>Tenderness to touch</td>
<td>1169</td>
<td>143</td>
<td>12.2</td>
<td>107</td>
<td>1294</td>
<td>8.3</td>
</tr>
<tr>
<td>Dyspeptic Gas/flatulence</td>
<td>1292</td>
<td>519</td>
<td>40.2</td>
<td>287</td>
<td>1171</td>
<td>24.5</td>
</tr>
<tr>
<td>Belching</td>
<td>1151</td>
<td>314</td>
<td>27.3</td>
<td>126</td>
<td>1312</td>
<td>9.6</td>
</tr>
<tr>
<td>Heartburn</td>
<td>1017</td>
<td>393</td>
<td>38.6</td>
<td>207</td>
<td>1446</td>
<td>14.3</td>
</tr>
</tbody>
</table>

*Column A indicates number of patients with the symptom before surgery; column B, number of patients with the symptom before and after surgery; column C, number of patients without the symptom before but present after surgery; and, column D, number of patients without the symptom before surgery.*
months after cholecystectomy. We wanted to identify most bothersome preoperative symptom persisted 6 For a substantial proportion of patients (27.5%), their symptoms (85.7% before surgery and 56.4% after surgery).

calculated only for patients with 1 or more abdominal dominantly biliary symptoms. The balance score is calculated that removal of the gallbladder eliminated pre

currence of bothersome symptoms and hypothesized that pa-

tients with persistent symptoms would more likely judge that their operation was not successful.

**Table 2** shows a series of univariate logistic regression models with persistence of any bothersome symptom as the dependent variable (ie, 488 “events”). Bother-

somes symptoms of nausea, food intolerance, vomiting, and tenderness to touch (ie, biliary symptoms) and physician-

designated history of acute cholecystitis were associated with resolution of a bothersome symptom (odds ratio, <1). Bother-

some symptoms of gas/flatusulence and heartburn (ie, dyspeptic symptoms); worse general health status, opera-

tive risk, and physical functioning; longer duration of symptoms; use of acid-reducing medications; and older age were associated with persistence of a bothersome symptom. Combining the individual symptoms into a dyspeptic or biliary symptom complex was almost 5 times more likely to persist than biliary symptoms.

**Table 3** shows the results of an analysis when the symptom complex (dyspeptic vs biliary) and other vari-

bles from Table 2 are entered simultaneously in a re-

health characteristics that were associated with persistence of bothersome symptoms and hypothesized that pa-

tients with persistent symptoms would more likely judge that their operation was not successful.
gression model. Independent predictors of most bothersome symptom persistence were the categories of symptom (dyspeptic), worse health status, operative risk, and longer duration of symptoms. A previous episode of acute cholecystitis decreased the odds of bothersome symptom persistence. The C statistic was .73 and the model fit was good ($H = 7.0; P = .54$).

### PATIENT-RATED SUCCESS OF THE OPERATION

Most patients (84.8%) considered the operation “very successful” at “relieving their problem,” 12.8% considered it “somewhat successful,” and 2.4% considered it “not successful.” We combined the last 2 responses into a category designated as “not very successful.” Twenty-eight percent of patients with a persistent bothersome symptom considered the operation not very successful compared with 11% whose symptom resolved. Forty-two percent of patients with a persistent bothersome symptom; 30% with 7% without abdominal pain (both differences were significant at $P < .001$ by $x^2$ test).

The same variables used in the model shown in Table 3 were entered into a regression model with “not very successful” as the dependent variable (Table 4). We entered additional variables of sex, procedure type (open vs laparoscopic), and presence of postoperative abdominal pain on the basis of clinical sensibility and to test whether sex was associated with postoperative success. Postoperative abdominal pain (at 6-month follow-up) was the major determinant of a not very successful operation and increased the odds that a patient considered the operation not very successful 10-fold relative to those without abdominal pain. Persistence of a bothersome symptom, worse health status, longer symptom duration, and male sex were also independently associated with a not very successful outcome, although the latter 2 variables had weak effects. The C statistic was .81 and the model fit was good ($H = 8.0; P = .43$). Whether the persistent bothersome symptom was in the biliary or dyspeptic class was important: a persistent biliary symptom as most bothersome (data not shown).

We performed our final analysis to more closely mimic the clinical situation of a patient scheduled to undergo cholecystectomy. The variables were identical to those in the previous analysis only if available before surgery (ie, symptom persistence, postoperative pain, and procedure type were not entered). We also tested symptom mix (balance score) and pain attributable to the gallbladder (item 1) as possible predictors of outcome. Table 5 demonstrates that the statistically significant predictors were similar to the analysis in Table 4 with the exception that sex was no longer associated with outcome. The balance score was not predictive of outcome. Although the model fit was adequate ($H = 4.0; P = .86$),

### Table 3. Multivariable Logistic Model Predicting the Persistence of a “Most Bothersome” Symptom

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR for Persistent Symptom (95% CI)</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspeptic symptom category</td>
<td>4.5 (3.6-5.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Self-rated health status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good</td>
<td>1.2 (0.8-1.7)</td>
<td>.32</td>
</tr>
<tr>
<td>Good</td>
<td>1.4 (1.0-2.0)</td>
<td>.09</td>
</tr>
<tr>
<td>Fair or poor</td>
<td>2.0 (1.2-3.2)</td>
<td>.008</td>
</tr>
<tr>
<td>ASA class 3, 4, 5§</td>
<td>1.5 (1.0-2.0)</td>
<td>.02</td>
</tr>
<tr>
<td>Worse physical functioning¶</td>
<td>1.3 (1.0-1.6)</td>
<td>.08</td>
</tr>
<tr>
<td>Symptom duration $&gt;6$ mo</td>
<td>1.5 (1.1-1.8)</td>
<td>.002</td>
</tr>
<tr>
<td>Previous episode of cholecystitis¶</td>
<td>0.65 (0.46-0.93)</td>
<td>.02</td>
</tr>
<tr>
<td>Using H2Bl or antacid</td>
<td>0.9 (0.7-1.1)</td>
<td>.39</td>
</tr>
<tr>
<td>Age $&gt;50$ y</td>
<td>1.0 (0.8-1.3)</td>
<td>.94</td>
</tr>
</tbody>
</table>

*OR indicates odds ratio; CI, confidence interval; ASA, American Society of Anesthesiologists; and H2Bl, histamine type 2 receptor antagonist.
†Relative to a binary bothersome symptom complex.
‡Excellent health is the reference category.
§ASA operative risk class, with the low-risk category (1, 2) as the reference category.
¶Dichotomized at the 36-Item Short Form Health Survey physical functioning score median value of 29.
††Defined as not selecting the response “no pain now” to a description of typical biliary colic.
†††Persistence of any of the 7 most bothersome symptoms.
§Excellent health is the reference category.
‖Dichotomized at the 36-Item Short Form Health Survey physical functioning score median value of 29.
#Physician diagnosed as recorded in the preoperative history.
** Relative to female sex.
††Relative to laparoscopic cholecystectomy.

### Table 4. Logistic Model With Preoperative and Postoperative Variables Associated With a “Not Very Successful” Outcome

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR for “Not Very Successful” Outcome (95% CI)</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative abdominal pain†</td>
<td>10.0 (7.3-13.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Persistence of a bothersome symptom‡</td>
<td>1.7 (1.3-2.4)</td>
<td>.001</td>
</tr>
<tr>
<td>Self-rated health status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good§</td>
<td>0.83 (0.51-1.30)</td>
<td>.44</td>
</tr>
<tr>
<td>Good§</td>
<td>1.2 (0.7-1.9)</td>
<td>.54</td>
</tr>
<tr>
<td>Fair or poor§</td>
<td>1.9 (1.0-3.4)</td>
<td>.04</td>
</tr>
<tr>
<td>ASA class 3, 4, 5§</td>
<td>0.98 (0.6-1.5)</td>
<td>.93</td>
</tr>
<tr>
<td>Worse physical functioning¶</td>
<td>1.4 (1.0-1.9)</td>
<td>.07</td>
</tr>
<tr>
<td>Symptom duration $&gt;6$ mo</td>
<td>1.4 (1.0-1.9)</td>
<td>.04</td>
</tr>
<tr>
<td>Previous episode of cholecystitis¶</td>
<td>0.95 (0.60-1.5)</td>
<td>.83</td>
</tr>
<tr>
<td>Male sex**</td>
<td>1.5 (1.0-2.3)</td>
<td>.03</td>
</tr>
<tr>
<td>Using H2Bl or antacid</td>
<td>1.1 (0.8-1.5)</td>
<td>.51</td>
</tr>
<tr>
<td>Age $&gt;50$ y</td>
<td>1.5 (0.8-1.5)</td>
<td>.61</td>
</tr>
<tr>
<td>Open operative procedure†</td>
<td>1.3 (0.9-1.8)</td>
<td>.16</td>
</tr>
</tbody>
</table>

* “Not very successful” outcome is defined as endorsing “somewhat successful” or “not successful” to the item “How successful was this operation in relieving your problem?” ASA indicates American Society of Anesthesiologists; H2Bl, histamine type 2 receptor antagonist.
†Defined as not selecting the response “no pain now” to a description of typical biliary colic.
‡Persistent of any of the 7 most bothersome symptoms.
§Excellent health is the reference category.
‖Dichotomized at the 36-Item Short Form Health Survey physical functioning score median value of 29.
#Physician diagnosed as recorded in the preoperative history.
** Relative to female sex.
††Relative to laparoscopic cholecystectomy.
Possible reasons for the decrease in postoperative prevalence, including pain, is substantially reduced 6 months after elective cholecystectomy. In addition, we report that symptoms pathophysiologically associated with intermittent gallbladder dysfunction were more frequently than do other abdominal symptoms. This conclusion is based on concordant results from 3 analyses: (1) resolution of a single symptom chosen from a checklist of abdominal symptoms, (2) resolution of a single symptom designated as most bothersome, and (3) change in a balance score that weights the “purity” of the symptom mix.

However, all 7 symptoms, in addition to pain, had substantial “cure rates.” Although differences in patient selection, questionnaire wording, and follow-up interval make comparison between studies problematic, these findings are consistent with those of previous studies. The Minnesota Clinical Comparative Assessment Project elective cholecystectomy database represents the largest study of symptom outcomes after cholecystectomy. We confirmed with considerable precision that the prevalence of abdominal symptoms, including pain, is substantially reduced 6 months after elective cholecystectomy. In addition, we report that symptoms pathophysiologically consistent with intermittent gallbladder dysfunction resolve more frequently than do other abdominal symptoms. This conclusion is based on concordant results from 3 analyses: (1) resolution of a single symptom chosen from a checklist of abdominal symptoms, (2) resolution of a single symptom designated as most bothersome, and (3) change in a balance score that weights the “purity” of the symptom mix.

However, all 7 symptoms, in addition to pain, had substantial “cure rates.” Although differences in patient selection, questionnaire wording, and follow-up interval make comparison between studies problematic, these findings are consistent with those of previous studies. Possible reasons for the decrease in postoperative prevalence of all symptoms include the following: patients with residual postoperative symptoms were expeditiously evaluated and treated, thereby eliminating the symptom before 6-month follow-up; patients who have experienced abdominal surgery increased the frequency or severity threshold necessary for them to admit to the presence of a symptom; gallbladder disease was variably responsible for all of the symptoms, and cholecystectomy effected a cure of symptoms; there was a placebo effect of an abdominal operation; patients made postoperative dietary changes, thereby decreasing food-related symptoms; and short-lived symptoms were not detected at follow-up because of sampling error.

Symptoms identified as most bothersome were more likely to persist compared with the same symptom not so designated. Patients might perceive a symptom as most bothersome for a variety of reasons, such as severity, duration, inconvenience, or perceived relationship to serious illness. These qualifiers might affect the threshold for endorsing that a symptom is present after surgery.

In this study, postoperative abdominal pain was the major determinant of a patient-based assessment of operative success. However, many patients have 1 or more nonpain symptoms after surgery and still report that the operation was successful, an observation reported by others. Our analysis shows that the category of persistent symptom is important in determining success; although persistent biliary symptoms are less prevalent, they are associated with a poor outcome, whereas the greater number of patients with persistent dyspeptic symptoms usually consider the operation successful. Luman et al reported that bloating, constipation, and use of psychotropic medication were associated with poor outcome, whereas Bates et al showed that preoperative flatulence and a longer duration of symptoms predicted postoperative dissatisfaction. McMahon et al did not confirm the association of symptom duration with outcome, and Scriven et al and Ure et al were unable to identify any significant predictors of poor outcomes. Although we identified 4 statistically significant preoperative predictors of operative success (Table 5), the weak discriminatory power of these variables suggests that other influential factors determine a successful patient-based outcome.

Our finding of the consistent effect of worse health or functional status on persistence of a symptom designated as bothersome and an unsuccessful outcome has not been previously reported. Poorer health could affect the perception and interpretation of abdominal symptoms; nongastrointestinal conditions or medications taken for other conditions also could be a more proximate cause of persistent symptoms. Removal of the gallbladder in chronically ill patients may increase the risk of perpetuating symptoms by causing a decrease in lower esophageal sphincter pressure, increasing duodenogastric reflux, or inducing sphincter of Oddi dysfunction.

In our study, patients with a previous episode of acute cholecystitis (14%) were more likely to report a successful operation. Although these patients also were more likely to resolve their abdominal pain, an additional interpretation suggests that patients who have experienced a significant complication of biliary disease (likely requiring hospitalization) might feel that the prevention of a recurrent severe illness constitutes a successful outcome. Other patients, not having experienced severe biliary disease, might expect a more complete resolution of a variety of abdominal symptoms.

### Table 5. Logistic Model With Preoperative Variables Predicting a “Not Very Successful” Outcome

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR for “Not Very Successful” Outcome (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-rated health status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good†</td>
<td>1.1 (0.7-1.6)</td>
<td>.78</td>
</tr>
<tr>
<td>Good†</td>
<td>1.7 (1.1-2.5)</td>
<td>.01</td>
</tr>
<tr>
<td>Fair or poor†</td>
<td>2.6 (1.6-4.3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>ASA class 3, 4, 5§</td>
<td>0.98 (0.70-1.40)</td>
<td>.34</td>
</tr>
<tr>
<td>Worse physical functioning§</td>
<td>1.6 (1.2-2.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Symptom duration &gt;6 mo</td>
<td>1.4 (1.1-1.8)</td>
<td>.01</td>
</tr>
<tr>
<td>Previous episode of acute cholecystitis§</td>
<td>0.68 (0.46-0.99)</td>
<td>.04</td>
</tr>
<tr>
<td>Balance score</td>
<td>0.96 (0.88-1.00)</td>
<td>.34</td>
</tr>
<tr>
<td>Male sex¶</td>
<td>1.2 (0.9-1.6)</td>
<td>.34</td>
</tr>
<tr>
<td>Using H2Bl or antacid</td>
<td>1.0 (0.8-1.3)</td>
<td>.97</td>
</tr>
<tr>
<td>Age &gt;50 y</td>
<td>0.97 (0.74-1.30)</td>
<td>.82</td>
</tr>
<tr>
<td>Preoperative abdominal pain#</td>
<td>1.2 (0.8-1.9)</td>
<td>.35</td>
</tr>
</tbody>
</table>

* OR indicates odds ratio; CI, confidence interval; ASA, American Society of Anesthesiologists; and H2Bl, histamine type 2 receptor antagonist.
†Excellent health is the reference category.
‡ASA operative risk class, with the low-risk category (1, 2) as the reference category.
§Dichotomized as the 36-Item Short Form Health Survey physical functioning score median value of 28.
¶Physician diagnosed as recorded in the preoperative history and physical examination.
†Relative to female sex.
#Positive response to “Have you had pain attributable to your gallbladder?”

The C statistic decreased to .64, suggesting that a model incorporating only preoperative variables has a substantially decreased ability to discriminate between 6-month postoperative outcomes.

### COMMENT

The...
Although procedure type was not associated with the presence of abdominal pain or patient-rated operative success at 6 months, the contribution of laparoscopic cholecystectomy to early hospital discharge and more rapid convalescence has been clearly established.20,21 This study is limited by its observational design; data obtained from examining a single group before and after surgery are subject to referral and treatment bias and lack of a control group without surgical intervention. In addition, abdominal symptoms are difficult to study because they are often short-lived and of varying intensity, recur unexpectedly, and might be caused by a variety of pathological processes.21 Patients’ reports of symptoms such as nausea and heartburn have relatively low reliability (κ = 0.43-0.67).24 A desire to maintain a productive physician-patient relationship might bias patients’ responses regarding operative success; however, our survey method of mailing confidential questionnaires to patients’ residences long after hospital discharge likely minimizes caregiver influences. Finally, we have no information on the diagnostic evaluation of persistent symptoms, and patients who were not followed up had slightly different preoperative characteristics compared with the study sample.

How do these findings relate to the evaluation and treatment of cholelithiasis? In this cohort, 89% of patients noted pain attributable to their gallbladder and almost all patients received a preoperative diagnosis of symptomatic cholecystolithiasis, yet a quarter of the patients had a symptom they designated as most bothersome still present 6 months later. Fifteen percent of patients judged their operation to be not very successful. This discrepancy suggests that the criteria for operative intervention are not sufficiently rigorous or that patients’ expectations about symptom relief are unrealistic. Our findings support the need for further research to determine whether more intensive preoperative diagnostic evaluation or greater patient education can decrease postoperative symptom prevalence and improve outcome. Patients at higher risk for poor outcomes or symptom persistence (eg, dyspeptic symptoms, worse health status, and longer duration of symptoms) may be appropriate target populations for such interventions.

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REFERENCES