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Can patient and pain characteristics predict manometric sphincter of Oddi dysfunction in patients with clinically suspected sphincter of Oddi dysfunction?

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Abstract

Background—Biliopancreatic-type postcholecystectomy pain, without significant abnormalities on imaging and laboratory test results, has been categorized as “suspected” sphincter of Oddi dysfunction (SOD) type III. Clinical predictors of “manometric” SOD are important to avoid unnecessary ERCP, but are unknown.

Objective—To assess which clinical factors are associated with abnormal sphincter of Oddi manometry (SOM).

Design—Prospective, cross-sectional.

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Setting—Tertiary.

Patients—A total of 214 patients with suspected SOD type III underwent ERCP and pancreatic SOM (pSOM; 85% dual SOM), at 7 U.S. centers (from August 2008 to March 2012) as part of a randomized trial.

Interventions—Pain and gallbladder descriptors, psychosocial/functional disorder questionnaires.

Main Outcome Measurements—Abnormal SOM findings. Univariate and multivariate analyses assessed associations between clinical characteristics and outcome.

Results—The cohort was 92% female with a mean age of 38 years. Baseline pancreatic enzymes were increased in 5%; 9% had minor liver enzyme abnormalities. Pain was in the right upper quadrant (RUQ) in 90% (48% also epigastric); 51% reported daily abdominal discomfort. Fifty-six took narcotics an average of 33 days (of the past 90 days). Less than 10% experienced depression or anxiety. Functional disorders were common. At ERCP, 64% had abnormal pSOM findings (34% both sphincters, 21% biliary normal), 36% had normal pSOM findings, and 75% had at least abnormal 1 sphincter. Demographic factors, gallbladder pathology, increased pancreatobiliary enzymes, functional disorders, and pain patterns did not predict abnormal SOM findings. Anxiety, depression, and poorer coping were more common in patients with normal SOM findings (not significant on multivariate analysis).

Limitations—Generalizability.

Conclusions—Patient and pain factors and psychological comorbidity do not predict SOM results at ERCP in suspected type III SOD. (Clinical Trial registration number: NCT00688662.) (Gastrointest Endosc 2014;79:765-72.)

Approximately 700,000 cholecystectomies are performed each year in the United States for abdominal pain attributed to gallstones and/or biliary dyskinesia.[1] Approximately 10% of these patients present post-cholecystectomy with continued biliary-type pain; most of these patients are women.[2,3] The most likely explanation for continued pain is that the symptoms were not due to the biliary tree in the first place. However, in some patients, a functional disorder of the sphincter of Oddi is suspected, presumed to be caused by spasm and/or stenosis of the major papilla (sphincter of Oddi dysfunction [SOD]).[4,5]

Noninvasive tests for SOD have been proven in shamcontrolled randomized trials to be inaccurate and to not correlate with outcomes.[6,7] However, in contrast, ERCP with sphincter of Oddi manometry (SOM) does predict response, in so-called type II SOD patients (those with either laboratory or imaging evidence of obstruction, but not both). Suspected type II SOD patients undergoing sphincterotomy responded (significant improvement in pain) approximately twice as often if their manometry results were positive for basal hypertension, compared with when manometry results were normal, in both the small American and Australian randomized trials.[6,7] Sphincter “dyskinesia,” encompassing other manometric criteria not commonly used in the United States, was not predictive.[7] However, ERCP has a 10% to 20% pancreatitis rate and a 1 in 1000 mortality rate in suspected SOD patients, and type III SOD patients (normal laboratory test and imaging results) have tremendous overlap with functional epigastric pain syndromes[8] and are believed to be unlikely to benefit from

ERCP. Therefore, clinical predictors of manometric SOD are important in order to avoid unnecessary ERCP, but these data are lacking, particularly in type III SOD.

Anecdotally, primary caregivers and specialists generally believe that psychological disturbances, coexisting irritable bowel syndrome, narcotic use, previous gallbladder objective pathology, and minor changes in laboratory test results help them to predict the presence or absence of objective findings of SOD at ERCP in patients with unexplained abdominal pain. This may be more personal bias than science because an Australian study (N = 72) found no association between clinical and psychological factors and basal hypertension at SOM,[9] and Winstead and Wilcox[10] found psychological disturbances to be either as common or less common in patients undergoing SOM for pain compared with patients undergoing ERCP for recurrent pancreatitis. Many also believe that objective imaging and laboratory tests are important, yet both randomized trials and a retrospective review found no evidence that provocation tests, duct dilation, or enzyme elevations predicted response to therapy.[6,7,11] Freeman et al[11] found that only abnormal pancreas SOM, along with 3 other factors (gastroparesis, daily opioids, and older than 40 years of age), predicted response. The EPISOD (Evaluating Predictors and Interventions in Sphincter of Oddi Dysfunction) trial is a National Institute of Diabetes and Digestive and Kidney Diseases–sponsored randomized, sham-controlled study representing the largest prospective cohort of suspected type III SOD patients and a unique opportunity to identify these predictors. The aim of this analysis was to assess whether suspected SOD patients' baseline characteristics predict pancreatic/biliary SOM (pSOM/bSOM) abnormalities.

METHODS

Patients

Seven centers in the United States prospectively recruited postcholecystectomy patients with epigastric or RUQ pain causing marked disability but without overt imaging or laboratory test evidence of biliary obstruction or pancreatitis, meeting modified Rome III criteria for functional biliary/pancreatic pain and not responding to acid antisecretories and antispasmodics,[12] to participate in a sham-controlled, randomized trial of sphincterotomy at ERCP from August 2008 to March 2012. Institutional review board approval was obtained at each center. All authors had access to the study data and had reviewed and approved the final manuscript.

The EPISOD study protocol has been reported in detail and is registered on clinicaltrials.gov (NCT00688662).[12] Eligibility criteria required patients to be 18 to 65 years of age with significant pain-related disability after cholecystectomy, with no pancreatic pathology or previous sphincter treatment, and not taking narcotics daily. Additional criteria included pain characteristics consistent with biliary SOD as defined by the ROME III criteria modified to include patients with daily abdominal discomfort in addition to episodes of pain, more than 11 days of disability due to pain in the 3 months before study enrollment, results of laboratory tests performed within 6 months of the baseline visit could not be more than 2 times the upper limit of normal for direct bilirubin, alkaline phosphatase, amylase, and lipase and no more than 3 times the upper limit of normal for transaminases; patients receiving antidepressants for pain control must have been taking them for a minimum of 1

month before the baseline assessment, and patients receiving psychopharmacological treatment must have been on a stable dose for at least 6 weeks. Patients were excluded if they had significant psychiatric disorders (psychotic and bipolar disorders), current substance abuse, eating disorders, severe depression [as defined by a Beck Depression Inventory II score of ≥22), or suicidal risk (assessed by Beck Depression Inventory II and the Mini International Neuropsychiatric Interview questionnaires).

When Rome III definitions are used, the main difference between functional abdominal pain and biliary pain is that the former is continuous or nearly continuous, with no or only occasional associations with physiologic events (eg, eating). The Rome III definitions for biliary pain versus the epigastric pain syndrome subset of functional dyspepsia are similar, except that the latter can be burning in quality and the former must be severe enough to bring one to an emergency department; must not be relieved by bowel movements, postural change, or antacids; and may radiate to the back or right subscapular region and/or be associated with nausea and vomiting.

Data on candidate predictors

We studied the following potential predictors: age, sex, race, location of pain, characterization of pain (including constant versus intermittent, daily vs nondaily discomfort), narcotic use, timing and pain-relief duration of cholecystectomy, precholecystectomy gallbladder findings and pathology, psychological comorbidity (anxiety and depression measured by Hospital Anxiety and Depression Scale anxiety and depression subscales and the Beck Depression Inventory II), concurrent functional disorders (Rome III), Coping Strategies Questionnaire-Catastrophizing scale (CSQ-CAT), and quality of life (SF-36). Pain-related disability was quantified by the RAPID (recurrent abdominal pain intensity and disability) scale validated specifically for the quantification of the combination of intermittent and chronic pain in these patients adapted from the Migraine Disability Assessment migraine pain score.[13]

Manometry outcome assessment

After successful pSOM with a triple-lumen perfusion catheter (final inclusion criteria), patients were enrolled in a randomized trial of sphincterotomy or sham at 7 U.S. Centers (August 2008-March 2012), even if manometry findings were normal. Manometric pancreatic SOD (pSOD) was defined a priori as a positive pancreatic SOM (pSOM) (basal pressures >40 mm Hg) in both proximal and distal leads. Biliary SOM (bSOM) was attempted and documented when feasible without increasing the risk of the procedure (eg, risking losing cannulation).

Statistical analysis

SAS software version 9.2 (SAS Institute Inc, Cary, NC) was used to perform statistical analyses. Baseline variables were described by using count and percentage for categorical data or mean and standard deviation (SD) for continuous normal data. For variables identified as clinically relevant, univariate tests were performed using the χ^2 and Student *t* tests to assess the association with abnormal pSOM. Multivariate logistic regression analysis

was conducted for predictors with $P < .10$ on univariate analysis. Secondary analyses to predict “any SOD” (any positive SOM) were also performed.

RESULTS

Demographic and patient characteristics

A total of 214 patients were randomized after successful pSOM. A nonrandomized cohort of patients refusing randomization was also followed (N = 72) with demographic characteristics comparable to those of the randomized cohort.

As anticipated, more than 90% of randomized subjects were women, and mean age was 38 years (SD 11) (Table 1). Less than 10% had minor pancreatobiliary enzyme increases documented before enrollment, but otherwise did not meet exclusion thresholds for those laboratory test results. Per protocol, all had undergone previous upper endoscopy that did not explain the symptoms and had trials of antacids and antispasmodics that failed. To assess the pre-enrollment imaging criteria for duct size and pancreatobiliary pathology, 54% had undergone an abdominal US scan, 77% had undergone CT, 61% had undergone MRCP, and 24% had undergone EUS. The final assessment for exclusion criteria included a lack of significant biliary or pancreatic pathology (or divisum) at their ERCP.

Almost half had gallstones at cholecystectomy and just more than half had abnormal gallbladder scintigraphy findings (biliary dyskinesia). Cholecystectomies occurred an average of 4 years before enrollment, and median pain response was 1 month, with a wide range. A third met criteria for irritable bowel syndrome, and 1 of 5 had functional abdominal pain. Twenty percent had been tested for gastroparesis, and 10% of those had a positive gastric emptying study.

Less than 10% met criteria for an anxiety disorder (2.3%, panic disorder and/or agoraphobia; 6.5%, generalized anxiety disorder) at baseline and less than 10% had current depression (major depressive episode or dysthymia). The average CSQ-CAT catastrophizing (lack of coping) score was 7.6 (comparable to healthy volunteers, before and after experimental pain: range 6.8-7.6 [SD 4-5]).[14]

Most patients had RUQ pain, with or without more central epigastric pain, whereas 10% had central pain alone. The epigastric pain was worsened by meals in just more than half of patients. Daily abdominal pain was reported by half of the enrolled population; one fourth reported taking narcotics, using narcotics 1 in 3 days on average (mean just more than 30 of the 90 days before enrollment). RAPID scores were high (O80, grade 4 of 4), and quality of life by the SF-36 was more than 1 SD lower than a normal population for the physical component, but comparable to the normal population for the mental component.

Manometry results

Of the 214 subjects, 64% had abnormal pSOM findings (ie, pSOD). This included 34% with both sphincters abnormal, 21% with pSOM abnormal but bSOM normal (isolated pSOD), and 9% who did not have attempted or successful bSOM. The other 36% had normal pSOM findings: 19% had both sphincters assessed and both were found to be normal; in 6%, the

biliary sphincter was not assessed, and in the remaining 11%, bSOM alone findings were abnormal (isolated biliary SOD). Including the 11% with abnormal findings on bSOM alone, the proportion with "any SOD" was 64% + 11% = 75% (n = 161). Of those 182 who underwent successful bSOM, 53% of bSOM findings were abnormal.

Clinical associations/correlations with manometry

Age, sex, previous gallbladder pathology, minor liver/pancreatic enzyme increases, pain location, meal relatedness, and daily (vs nondaily/intermittent) pattern did not predict abnormal pSOM findings (Table 1). The inability to finish a meal at least daily or weekly and claiming feeling uncomfortably full after a meal were also not different between groups (data not shown). There was a numerically higher proportion of narcotic users in the normal pSOM findings group, but this was not statistically significant. Minor liver enzyme increases were actually slightly less common (not significantly) in the manometric pSOD group. Coexisting depression and/or other functional bowel or gastric motility disorders did not correlate with manometric pSOD. Limited data (n = 127) were available on the influence of occupational background (perhaps influencing doctor-seeking behavior), but health-care workers were equally common in normal and abnormal pSOM findings groups (30% in each).

The lack of predictive associations of pain type, functional or motility disease, psychological comorbidity, and narcotic use with SOD also generally held true for "any SOD" (Table 2) or biliary SOD (Table 3). Age was slightly older in the any-SOM-abnormal finding group (39 vs 36 years; $P = .04$), but this is not likely clinically relevant. CSQ-CAT catastrophizing score (poor coping) was higher (6.8 vs 8.6; $P = .05$), and anxiety (6% vs 14%; $P = .07$) and depression disorders (6% vs 11%; $P = .28$) were more common in patients with normal bSOM findings; a similar nonsignificant trend for these factors was seen in the any-SOM-abnormal finding versus both-SOM-normal finding analysis. CSQ-CAT catastrophizing scores and RAPID scores were also assessed as quartiles, but no significant trends were seen (data not shown).

On multivariate analysis, none of the identified variables (age, baseline RAPID score, and catastrophizing score) for predicting any-positive-SOM finding were statistically significant. Similar results were found when modeling bSOM for the MINI anxiety and catastrophizing score. Also, although 40 mm Hg is the standard threshold for sphincter basal pressure normality and was the one defined a priori, it is notable that similar results were seen when exploring 60- and 100-mm Hg cutoffs for manometry; in fact, the few borderline trends seen with the standard definition were no longer significant, with higher *P* values (data not shown).

DISCUSSION

Contrary to perceptions by caregivers, many of the factors that are commonly thought to be "objective" (abnormal results on laboratory tests, stones at previous cholecystectomy), "typical" (intermittent, nondaily, RUQ) pain, and "nonfunctional" (lack of other functional disorders, depression, anxiety, and narcotic use) disease status do not predict sphincter manometry results at ERCP in patients suspected of having type III SOD. At present,

sphincter manometry is our best predictor of pain response after sphincterotomy, based on data extrapolated from prospective, randomized trials in type II SOD. Given the risks of ERCP with manometry, it was hoped that clinical criteria could predict who would benefit from the procedure by predicting manometry results. However, our results are disappointing; there does not appear to be a noninvasive clinical way to predict which of these patients are best suited for the risks of an ERCP. There was only a weak signal in univariate analyses for a higher rate of anxiety, depression, and poor coping (catastrophizing) in patients with normal manometry results (ie, those with lack of objective, manometrically confirmed SOD), particularly for bSOM; these were not significant on multivariate analysis.

The strengths of this study are the rigorous inclusion criteria, including manometry criteria standardized across centers, and pSOM in all patients. As well, the in-depth clinical and psychological questionnaires are unprecedented in this population. The weaknesses include the lack of bSOM in some patients. In addition, it remains to be seen whether manometric SOD in type III SOD patients is as predictive of response as it was in the 2 trials mainly including type II SOD patients. The increase in lipase or liver enzymes, especially if only on 1 or 2 occasions, and often with a high prevalence of nonalcoholic fatty liver disease interfering with the interpretation of a mild liver enzyme increase, is a source of controversy. Some may argue that the small percentage of patients with these mild abnormalities should have been termed SOD type II. However, we only accepted minor increases, and they were not predictive of SOD. In addition, a patient with several months of abdominal pain, with repeatedly normal results on laboratory tests, and with only 1 set with minor increases is arguably not in the spirit of the type II SOD designation.

Provocation and nuclear imaging tests were not mandated in this study and were seldom, if ever, done before ERCP. Although 1 study showed promise for scintigraphic drainage tests in predicting biliary SOD (with a high proportion of patients with dilated biliary trees),[15] this has not been reproduced by others: Darweesch et al,[16] 67% sensitivity; Corazziari et al,[17] 50% specificity; and Craig et al,[18] 25% to 38% sensitivity. It is not surprising that patients with normal-size bile ducts will likely have different drainage determinants and that biliary scintigraphy is not likely to predict pancreatic sphincter abnormalities well. As stated earlier, biliary provocation tests were not predictive of outcome in 2 randomized trials with morphine and neostigmine/prostigmine,[6,7] despite some promise shown many years earlier of more than 90% sensitivity and specificity.[19] Cholecystokinin-stimulated magnetic resonance imaging (58% specificity),[20] secretin-stimulated magnetic resonance imaging (27% sensitivity),[21] and secretin-stimulated EUS (57% sensitivity with intravenous secretin)[22] have all performed poorly. Fibrotic criteria on EUS did not seem to predict manometric SOD at our institution.[23] Botulinum toxin injected near the sphincter has been shown in some preliminary studies to potentially predict response to therapy,[24,25] but defining response and differentiating brief placebo responses from real responses is difficult. In addition, it had a high rate of post-ERCP pancreatitis in 1 study.[26]

In summary, although the perception has been that using patient characteristics, including functional and psychological comorbidities, previous gallbladder pathology, and more typical pain patterns, can predict who will have objective (manometrically confirmed) SOD

during ERCP, this does not appear to be the case. Selecting patients for whom ERCP is appropriate in type III SOD remains difficult.

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Abbreviations

bSOM	biliary sphincter of Oddi manometry
CSQ-CAT	Coping Strategies Questionnaire-Catastrophizing Scale
pSOD	pancreatic SOD
pSOM	pancreatic sphincter of Oddi manometry
RAPID	recurrent abdominal pain intensity and disability
RUQ	right upper quadrant
SOD	sphincter of Oddi dysfunction

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Take-home Message

- Selecting patients for ERCP and manometry in suspected type III sphincter of Oddi dysfunction, without obvious obstruction on laboratory tests/imaging, should not be biased by the coexistence of irritable bowel syndrome, depression or anxiety, or objective previous gallbladder disease because these do not predict manometry results.
- Classic pain (intermittent, meal related) features are equally likely to be manometry positive than more constant epigastric and right upper quadrant pain syndromes; the arbitrary criterion regarding biliopancreatic pain not occurring daily in ROME III may not be appropriate.

TABLE 1

Prevalence of candidate baseline predictors in patients with and without abnormal pancreatic manometry

	pSOM abnormal (n = 137 (64%))	pSOM normal (n = 77)	Total sample (n=214)	*P* value
Demographic factors and laboratory tests				
Sex, % female	93	90	92	.32
Age, y, mean (SD)	39 (11.1)	38 (10.9)	38 (11.0)	.67
Elevated amylase, %	1.5	1	1	1.00
Elevated lipase, %	5	4	5	1.00
Liver enzyme abnormalities, %	7	13	9	.11
Gallbladder details				
Gallstones at cholecystectomy, %	47	48	47	.32
Abnormal nuclear scan findings before cholecystectomy, no. (%)	54 (81)	50 (48)	53 (129)	.48
Years since cholecystectomy, mean (SD)	4.5 (5.0)	4.1 (6.1)	4.2 (5.4)	.88
Days of pain response after cholecystectomy (median (min, max))	31 (0, 7300)	55 (0, 14,965)	31 (0, 14,965)	.55
Functional/psychological comorbidity				
Irritable bowel syndrome, Rome III, %	39	42	40	.76
Functional abdominal pain, Rome III, %	20	18	19	.79
Abnormal gastric emptying study, no. (%)	12.5 (24)	10 (20)	11 (44)	.79
Catastrophizing, CSQ-CAT, mean (SD)	7.5 (6.9)	7.8 (6.4)	7.6 (6.7)	.54
MINI depressive disorder, %	7	9	8	.64
MINI anxiety disorder, %	9	9	9	.93
Pain pattern, disability, quality of life				
RUQ pain only, %	39	48	42	
Central epigastric pain only, %	10	10	10	.37
Both RUQ and epigastric pain, %	51	42	48	
Epigastric pain worsened by meals, no. (%)	56 (95)	46 (46)	53 (141)	.11
Daily discomfort for the past month, %	55	46	51	.42
Narcotic use, %	23	31	26	.46
Days taking narcotics, mean (SD)	33 (26.8)	33 (28.2)	33 (27.1)	.93
RAPID score (pain-related disability) (SD)	85.7 (55.4)	82.5 (62.9))	84.5 (58.1)	.37
SF-36 physical score (SD)	38.3 (8.3)	39.4 (7.0)	38.7 (7.9)	.47
SF-36 mental score (SD)	48.1 (9.8)	49.8 (9.2)	48.7 (9.6)	.25

pSOM, Pancreatic sphincter of Oddi manometry; *SD*, standard deviation; *CSQ-CAT*, Coping Strategies Questionnaire–Catastrophizing Scale; *MINI*, Mini International Neuropsychiatric Interview; *RUQ*, right upper quadrant; *RAPID*, recurrent abdominal pain intensity and disability.

TABLE 2

Prevalence of candidate baseline predictors in patients with and without any (pancreatic/biliary) abnormal SOM

	Any SOM abnormal findings, (n = 161, 75%)	Normal SOM findings in both (n = 53, 25%)	Total sample (N = 214)	*P* value
Demographic factors and laboratory tests				
Sex, % female	93	91	92	.77
Age, y, mean (SD)	39 (11.0)	36 (10.5)	38 (11.0)	.04
Elevated amylase, %	1	2	1	1.00
Elevated lipase, %	5	4	5	1.00
Liver enzyme abnormalities, %	8	11	9	.58
Gallbladder details				
Gallstones at cholecystectomy, %	48	45	47	.67
Abnormal nuclear scan before cholecystectomy, no. (%)	52 (94)	54 (35)	53 (129)	.81
Years since cholecystectomy (SD)	4.5 (5.9)	3.3 (3.6)	4.2 (5.4)	.91
Days of pain response after cholecystectomy, median (min, max)	31 (0, 14,965)	61 (0, 5475)	31 (0, 14,965)	.48
Functional/psychological comorbidity				
Irritable bowel syndrome, Rome III, %	39	43	40	.58
Functional abdominal pain, Rome III, %	19	21	19	.73
Abnormal gastric emptying study, no. (%)	10 (29)	13 (15)	11 (44)	1.00
Catastrophizing score (CSQ-CAT), mean (SD)	7.2 (6.7)	8.7 (6.6)	7.6 (6.7)	.09
MINI depressive disorder, %	7	11	8	.38
MINI anxiety disorder, %	8	11	9	.58
Pain pattern, disability, quality of life				
RUQ pain only, %	40	49	42	
Central epigastric pain only, %	10	11	10	.40
Both RUQ and epigastric pain, %	50	40	48	
Epigastric pain worsened by meals, no. (%)	54 (109)	47 (32)	53 (141)	.33
Daily discomfort for the last month, %	52	51	51	.52
Narcotic use, %	26	28	26	.85
Days taking narcotics, mean (SD)	34 (27.1)	30 (28.0)	33 (27.1)	.63
RAPID score, mean (SD)	87.6 (57.1)	75.3 (60.5)	84.5 (58.1)	.08
SF-36 physical, mean (SD)	38.4 (8.2)	39.8 (7.0)	38.7 (7.9)	.33
SF-36 mental, mean (SD)	48.4 (9.8)	49.9 (9.1)	48.7 (9.6)	.32

SOM, Sphincter of Oddi manometry; *SD*, standard deviation; *CSQ-CAT*, Coping Strategies Questionnaire–Catastrophizing Scale; *MINI*, Mini International Neuropsychiatric Interview; *RUQ*, right upper quadrant; *RAPID*, recurrent abdominal pain intensity and disability.

TABLE 3

Prevalence of candidate baseline predictors in patients with and without abnormal biliary manometry

	Abnormal findings on bSOM (n = 97, 53%)	Normal findings on bSOM (n = 85, 47%)	Total sample (N = 182)	*P* value
Demographic factors and laboratory tests				
Sex, % female	92	92	92	.99
Age, y, mean (SD)	39 (10.0)	37 (11.0)	38 (10.5)	.11
Elevated amylase, %	1	2	2	.60
Elevated lipase, %	5	5	5	1.00
Liver enzyme abnormalities, %	8	7	8	.76
Gallbladder details				
Gallstones at cholecystectomy, %	51	44	47	.37
Abnormal nuclear scan before cholecystectomy, no. (%)	48 (of 58)	59 (of 54)	54 (of 112)	.39
Years since cholecystectomy, mean (SD)	4.8 (6.0)	4.1 (4.9)	4.5 (5.5)	.41
Days of pain response after cholecystectomy, median (min, max)	61 (0, 14,965)	31 (0, 7300)	61 (0, 14,965)	.33
Functional/psychological comorbidity				
Irritable bowel syndrome, Rome III, %	43	44	43	.97
Functional abdominal pain (Rome III), %	16	20	18	.42
Abnormal gastric emptying study, no. (%)	12.5 (16)	5 (19)	9 (35)	.58
Catastrophizing score (CSQ-CAT), mean (SD)	6.8 (6.5)	8.6 (6.9)	7.6 (6.8)	.05
MINI depressive disorder, %	6	11	8	.28
MINI anxiety disorder	6	14	10	.07
Pain pattern, disability, quality of life				
RUQ pain only, %	44	41	43	
Central epigastric pain only, %	11	12	11.5	.91
Both RUQ and epigastric pain, %	44	47	46	
Epigastric pain worsened by meals, no. (%)	58 (62)	57 (58)	58 (120)	.78
Daily discomfort for the past month, %	55	46	51	.27
Narcotic use, %	25	32	28	.29
Days taking narcotics, mean (SD)	34 (27.9)	34 (28.3)	34 (27.8)	.85
RAPID score (pain-related disability), mean (SD)	91.0 (56.3)	86.6 (62.4)	89.0 (59.1)	.36
SF-36 physical, mean (SD)	38.4 (8.6)	39.8 (7.1)	38.6 (7.9)	.78
SF-36 mental, mean (SD)	48.5 (9.9)	48.4 (9.5)	48.4 (9.7)	.88

bSOM, Biliary sphincter of Oddi manometry; *SD*, standard deviation; *CSQ-CAT*, Coping Strategies Questionnaire–Catastrophizing Scale; *MINI*, Mini International Neuropsychiatric Interview; *RUQ*, right upper quadrant; *RAPID*, recurrent abdominal pain intensity and disability.