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Prediction of symptom improvement in children with biliary dyskinesia

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ABSTRACT

Background: Rates of cholecystectomy for biliary dyskinesia are rising. Our objective was to identify clinical determinants of symptom improvement in children undergoing cholecystectomy for biliary dyskinesia.

Methods: This retrospective cohort study included patients undergoing cholecystectomy for biliary dyskinesia from 2006–2013 who had their gallbladder ejection fraction (EF) measured by either cholecystokinin-stimulated hepatobiliary iminodiacetic acid scan and/or fatty meal ultrasound. Patients presenting from 2010–2013 were interviewed >1 y after cholecystectomy to determine symptom improvement, complete symptom resolution, and any postoperative clinical interventions related to biliary dyskinesia. Sensitivity and positive predictive values for the diagnostic tests for symptom improvement were calculated. Multivariable logistic regression models were used to identify preoperative characteristics associated with symptom improvement.

Results: Of the 153 included patients, 76% were female, 89% were Caucasian, and 39% were obese. At postoperative evaluation, symptom improvement was reported by 82% of the patients and complete symptom resolution in 56%. For both the hepatobiliary iminodiacetic acid and fatty meal ultrasound, the sensitivity of the test to predict symptom improvement increased with higher EF, whereas the positive predictive values remained around 80%. Of the 41 patients who participated in phone interview for long-term follow-up, 85% reported symptom improvement and 44% reported complete symptom resolution. Factors associated with symptom improvement included a shorter duration of pain, a history of vomiting, and a history of epigastric pain.

Conclusions: Despite not identifying an EF level that predicted symptom improvement, over 80% of patients undergoing cholecystectomy for biliary dyskinesia reported symptom improvement. These results support continuing to offer cholecystectomy to treat biliary dyskinesia in children.

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1. Introduction

Gallbladder disease is a common medical problem that leads to surgical intervention with the prevalence in children ranging from 1.9%–4.0% [1]. Diagnosis of gallbladder diseases such as cholecystitis, cholelithiasis, and biliary dyskinesia are increasing in frequency in the pediatric population primarily because of an increasing incidence of obesity and improved diagnostic modalities [2,3]. The number of pediatric patients undergoing cholecystectomy has increased 63% during the past 5 y [4].

Biliary dyskinesia is defined according to Rome III diagnostic criteria as patients having severe episodes of recurrent and progressive epigastric or right upper quadrant abdominal pain that interrupt daily activities, are associated with oral intake, and are not explained by any other structural disease [5]. For patients with biliary dyskinesia, the purpose of cholecystectomy is to provide relief from abdominal pain, indigestion, flatulence, nausea, and vomiting that may interfere with daily activities. However, cholecystectomy is an invasive procedure and is associated with surgical risks; 1.6%–4.5% of patients undergoing laparoscopic cholecystectomy will have a complication [6,7].

Existing studies have demonstrated symptom relief on short-term follow-up in patients undergoing cholecystectomy for biliary dyskinesia, but few studies have evaluated pain improvement or symptom relief on long-term follow-up [6,8,9]. Other studies have demonstrated inconsistent accuracy of cholecystokinin-stimulated hepatobiliary iminodiacetic acid (HIDA) scans in identifying patients who will have symptom improvement after cholecystectomy [8,9]. The purpose of this study was (1) to determine the preoperative characteristics associated with short-term and long-term symptom improvement in children who undergo cholecystectomy for biliary dyskinesia and (2) to evaluate the ability of the gallbladder ejection fraction (EF), as measured by cholecystokinin-stimulated HIDA scan or fatty meal ultrasound (FUS), to predict short-term and long-term pain improvement in these pediatric patients.

2. Materials and methods

This was a retrospective cohort study performed by reviewing the medical records of all patients aged ≤18 y who had a cholecystectomy for a diagnosis of biliary dyskinesia as identified by the operating surgeon between January 2006 and May 2013 at a pediatric tertiary care center. Patients with preoperative evidence of cholelithiasis, choledochal cysts, or other anatomic explanations for their symptoms were excluded. Patients who were not available for postoperative follow-up within 2 mo of surgery were also excluded. This study was approved by the Institutional Review Board of The Research Institute at Nationwide Children's Hospital, and patients were interviewed by phone after obtaining informed consent verbally.

Patient medical records were reviewed for demographic data, clinical signs and symptoms, the results of preoperative diagnostic imaging, pathologic findings, and symptoms at the time of short-term postoperative follow-up, defined as the first outpatient clinical encounter after surgery and routinely scheduled for all patients undergoing cholecystectomy. Obesity was defined as body mass index ≥95th percentile for age and gender. Preoperative symptoms included abdominal pain, nausea, and vomiting. Medical conditions and other preoperative characteristics known before cholecystectomy were also documented. Gastrointestinal (GI) disease was separated into three categories as follows: upper GI disease, lower GI disease, and hepatobiliary disease. Examples of upper GI disease included gastroesophageal reflux and pyloric stenosis. Examples of lower GI disease included Crohn disease and Hirschsprung disease. Hepatobiliary disease did not include biliary dyskinesia; examples included pancreatitis or fatty liver. All patients had their gallbladder EF measured by cholecystokinin-stimulated HIDA scan and/or FUS, which measures the change in gallbladder volume from fasting to after ingestion of a high-fat meal. Outcome information assessed at the initial postoperative follow-up included pain improvement and complete symptom resolution. Pain improvement was defined as patient-reported improvement in abdominal pain without worsening of nausea or vomiting as compared with the symptoms described preoperatively. Incisional soreness as expected for a typical postoperative course was considered to be separate from abdominal pain. Complete symptom resolution was defined as complete absence of abdominal pain, nausea, and vomiting. After chart review, patients who presented between 2010 and 2013 were interviewed by phone >1 y after surgery. This time point was defined as long-term follow-up. The prospective phone interview portion of this study was limited to patients undergoing cholecystectomy in the most recent half of the overall study period to maximize our ability to successfully contact the patients and to minimize the effects of recall bias and missing data. Patients who did not present for short-term postoperative follow-up but otherwise met study inclusion and exclusion criteria were also contacted for the prospective phone interview portion of this study. Patients were interviewed to assess for pain improvement, complete symptom resolution, and need for subsequent clinical care after surgery.

To detect any selection bias, for both short-term postoperative follow-up and long-term follow-up, patients who did and did not present for short-term postoperative follow-up or agree to participate in the phone call interview were compared. Patients who did and did not have pain improvement and patients who did and did not have complete symptom resolution on both short-term postoperative follow-up and long-term follow-up were also compared. Continuous variables were compared using Wilcoxon rank-sum tests, and categorical variables were compared using Pearson chi-square tests or Fisher exact tests. Sensitivity and positive predictive value (PPV) of HIDA and FUS for predicting pain improvement and complete symptom resolution at the short-term postoperative visit and on long-term follow-up were calculated. For patients who underwent both HIDA and FUS, the correlation between the EFs from both tests was evaluated by using a Pearson correlation coefficient.

Multivariable logistic regression models were fit for the outcomes of pain improvement and complete symptom