RESEARCH LETTER

Pediatric Pancreaticobiliary Endoscopy Can Be Safely and Effectively Performed by Adult Advanced Endoscopists

Pancreaticobiliary endoscopy is routinely performed in the pediatric population by adult advanced endoscopists (AEs) but data regarding outcomes are limited.[1–3] Innovation in endoscopic ultrasound (EUS) and smaller caliber duodenoscopes for the performance of endoscopic retrograde cholangiopancreatography (ERCP) has created an increasing demand for these procedures but is limited by the lack of training programs for pediatric gastroenterologists. This study aims to evaluate the efficacy and safety of pancreaticobiliary endoscopy performed by adult AE at a large tertiary care center. Our secondary aim is to evaluate the sensitivity and specificity of magnetic resonance cholangiopancreatography (MRCP) and EUS for the diagnosis of choledocholithiasis in the pediatric population.

This is a retrospective cohort study of consecutive pediatric patients who underwent EUS or ERCP by an adult AE over a 10-year period (2012–2021) at a single, large tertiary-care center. Patients were identified through a comprehensive search using our electronic health record (EPIC) and endoscopy database (ProVation). Patient demographics (Table 1), body imaging, procedure reports, and labs were reviewed for each patient. Adverse events were recorded. Technical success (TS) was defined as the completion of the intended procedure. Clinical success (CS) was defined by the resolution of symptoms and/or improvement of laboratory data. Laboratory data focused on the normalization of liver function tests. Preprocedural risk of a bile duct stone was defined using the American Society for Gastrointestinal Endoscopy (ASGE) guideline for choledocholithiasis as high, intermediate, or low risk.[4] For demographic data, the patient's race, age at the time of the procedure, and relevant past medical and surgical history were collected. Relevant history included sickle cell, pancreatitis, primary sclerosing cholangitis, biliary atresia, annular pancreas, pancreas divisum, and others which represented any major medical issue not aforementioned. Relevant surgical history included liver transplantation, biliary bypass, lateral pancreatojejunostomy (Puestow) or pancreaticoduodenectomy (Whipple), and cholecystectomy. Additionally, other specific factors that could have affected the procedure outcome (eg, blood thinner usage, history of previous EUS/ERCP) were recorded.

For each ERCP and EUS, the procedure report was manually reviewed for procedural indication, findings, adverse events, and recommendations. Subsequently, the electronic health record was queried to identify the clinical course (procedural urgency), follow-up laboratory results, resolution of symptoms, and details of any body imaging performed before or after the procedure. For each ERCP, the following was recorded: cannulation technique, cannulation success, sphincterotomy performance, findings, treatments rendered, and adverse outcomes. If cannulation was successful and the appropriate treatments were performed, the procedure was considered a TS. For each EUS, the following was collected as relevant: the presence of cyst/mass, fine needle aspiration results, fluid analyses, the performance of cysgastrostomy/necrosectomy, type of stent deployed, and adverse outcomes. Completion of the desired diagnostic or therapeutic procedure was considered a TS for EUS.

The electronic health record was also queried for relevant clinical, laboratory, and imaging data that would define CS. Adverse events were divided into minor and major events. All descriptors were presented as counts (n) and percentages (%), except for age, which were presented as mean $\pm$ standard deviation. Sensitivity and specificity and 95% exact confidence intervals were estimated using the Clopper-Pearson formula of EUS and MRCP in detecting ERCP findings.

There were 202 unique patients who underwent 343 procedures that took place between 2012 and 2021. Patient characteristics included a mean age of 13.6 ($\pm$ 3.8) with a range of 2–18 years. Of the 343 procedures, there were 183 ERCP, 58 EUS, and 51 procedures with concurrent EUS and ERCP. Overall, ERCP was technically successful in 216/234 (92.3%) procedures, EUS was technically successful in 108/109 (99.1%) procedures, and CS was reported for 247 procedures and was achieved in 234/247 (94.7%) procedures. Success rates varied by indication with pancreatic indications having lower success rates for both ERCP and EUS (Table 2). Adverse event data were collected for 224 procedures. There were a total of 9 events (4.0%) on 8 patients (5.4%) with adverse events. Of those, there were 7 ($n = 6$) pancreatitis, and 2 were listed as "other." There were no significant predictors of TS, CS, or AE related to patient parameters such as age, sex, etc. ($P < .10$). For EUS patients, indication, difficulty of cannulation, and performance of sphincterotomy were not significant

Table 1. Baseline Characteristics

Characteristic	n (%) or mean ± SD
Age, y	13.6 ± 3.8
Race	
Caucasian	59 (29.2%)
Hispanic	70 (34.7%)
Black	24 (11.9%)
Other/unknown/declined	49 (24.3%)
Sex (female)	125 (62.2%)
Past medical history (n = 198)	
Sickle cell	17 (8.6%)
Pancreatitis	22 (11.1%)
Primary sclerosing cholangitis (PSC)	12 (6.1%)
Biliary atresia	4 (2.0%)
Annular pancreas	1 (0.5%)
Pancreas divisum	3 (1.5%)
Other	51 (25.8%)
Past surgical history (n = 197)	
Liver transplantation	19 (9.6%)
Biliary bypass	1 (0.5%)
Lateral pancreatojejunostomy (Puestow) or pancreaticoduodenectomy (Whipple)	2 (1.0%)
Cholecystectomy	30 (15.2%)
Medication history at time of procedure (n = 198)	
Antiplatelet agent(s)	4 (2.0%)
Anticoagulant(s)	0 (0.0%)
Immunosuppression	30 (15.2%)
Previous endoscopic procedure (n = 197)	
Previous EUS	6 (3.0%)
Previous ERCP	11 (5.6%)
Previous EUS and ERCP	1 (0.5%)

SD, standard deviation.

Table 2. Clinical Success Rates by Indication

Indication	Total (column %)	Clinical success (% of total)
Procedure[a]		
EUS	61 (24.7%)	61 (100%)
ERCP	140 (56.7%)	130 (92.9%)
EUS + ERCP[b]	46 (18.6%)	43 (93.5%)
ERCP indication (n = 191)		
Established common bile duct stone by imaging	63 (33.0%)	62 (98.4%)
Suspected common bile duct stone	28 (14.7%)	27 (96.4%)
Bile duct stricture	22 (11.5%)	21 (95.5%)
Elevated liver enzymes	21 (11.0%)	20 (95.2%)
Suspected bile leak	5 (2.6%)	5 (100%)
Pancreas divisum	3 (1.6%)	2 (66.7%)
Chronic pancreatitis/pancreatic duct stone	17 (8.9%)	14 (82.4%)
Other abnormal imaging	32 (16.8%)	27 (84.4%)
EUS indication (n = 98)		
Pancreatic cyst evaluation (FNA)	2 (2.0%)	2 (100%)
Pancreatic cyst drainage (cystgastrostomy)	7 (7.1%)	7 (100%)
Evaluation for suspected choledocholithiasis	34 (34.7%)	34 (100%)
Elevated liver enzymes	6 (6.1%)	6 (100%)
Unexplained pancreatitis	17 (17.4%)	15 (88.2%)
Other abnormal imaging	32 (32.7%)	31 (96.9%)

FNA, fine needle aspiration.
[a]Only includes procedures for which clinical and technical success data were available.
[b]For patients who underwent simultaneous EUS/ERCP, clinical success was recorded for both procedures combined.

predictors ($P < .10$). For ERCP patients, indication or performance of fine needle aspiration were not significant predictors ($P < .10$).

All patients with suspected choledocholithiasis were classified by the ASGE risk score. Using this grading, 53 patients (75.7%) of those deemed high risk, 27 patients (51.9%) deemed intermediate risk, and 13 (65.0%) deemed low risk were found to have choledocholithiasis during ERCP. In patients with intermediate risk, 43 had both an EUS and ERCP. Among those, EUS had a sensitivity of 82.1% (63.1%, 93.9%), a specificity of 100% (78.2%, 100%), a positive predictive value of 100%, and a negative predictive value of 75.0%. Sixty-four patients in the intermediate risk category had both MRCP and ERCP and the MRCP had a sensitivity of 76.5% (58.8%, 89.3%), a specificity of 93.3% (77.9%, 99.2%), a positive predictive value of 92.9%, and a negative predictive value of 77.8%.

The current communication provides important validation for the performance of pancreaticobiliary endoscopy in clinical practice but has limitations. The patients studied for ERCP and EUS were different pools limiting the comparison of their sensitivities. Additionally, the current data are retrospective and lacks a true comparator to pediatric gastroenterologists. However, given the lack of such endoscopists, the impact of this is less. With that said, the growing volume of pediatric pancreaticobiliary endoscopy warrants careful assessment of current training paradigms. Addressing clinical and technical barriers faced by adult endoscopists (eg, need for tailored endoscopes and devices) will be important as the volumes and needs continue to rise.

In summary, the current study highlights the safety and efficacy of EUS and ERCP performed by adult AE in the pediatric population. These data further emphasize the value that adult-trained AEs provide in performing pediatric EUS and ERCPs, given the limited access to formally trained pediatric AEs. Furthermore, this study validates the recent ASGE guideline regarding risk stratification

for choledocholithiasis, with EUS having a slightly higher sensitivity over MRCP in evaluating pediatric patients with intermediate risk for bile duct stones.

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Abbreviations used in this paper: **AEs, advanced endoscopists; CS, clinical success; ERCP, endoscopic retrograde cholangiopancreatography; EUS, endoscopic ultrasound; TS, technical success**

Most current article

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STROBE.