

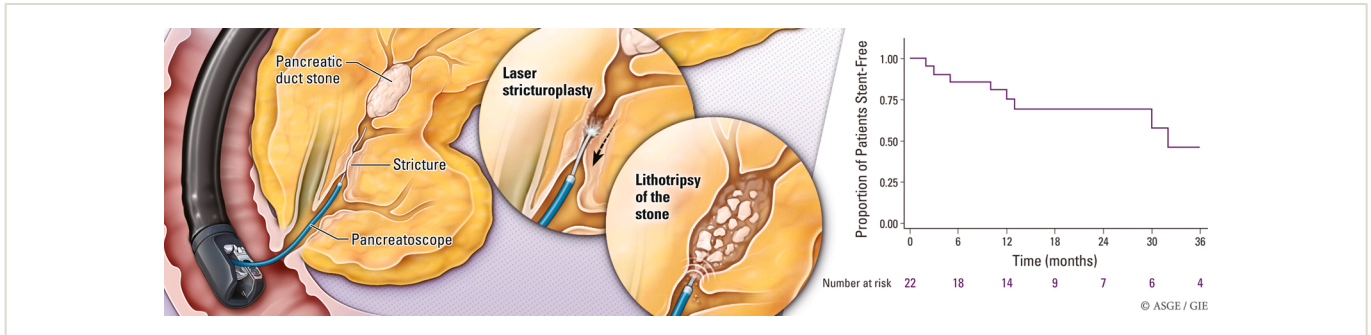


# Long-term follow-up of patients undergoing cholangiopancreatography-guided laser dissection and ablation for refractory pancreatic and biliary strictures (with video)

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## GRAPHICAL ABSTRACT



**Background and Aims:** A subgroup of patients with benign biliary duct (BD) and pancreatic duct (PD) strictures fail to resolve with ERCP-guided stenting. Novel endoscopic approaches are needed. Our study aims to evaluate the efficacy and safety of cholangiopancreatography-guided laser dissection or ablation (CPL) for the treatment of refractory pancreaticobiliary strictures.

**Methods:** This was a single-center retrospective review of all CPL cases performed for refractory BD or PD strictures. Primary outcome was stricture resolution. Secondary outcomes included technical success, adverse events, and stent-free survival assessed using Kaplan-Meier analysis.

**Results:** Thirty patients underwent CPL from May 2016 to August 2023 and had a median 3 (IQR 1-5) prior ERCPs to treat the stricture(s) of interest. Fifty-three CPLs were performed (median 1 per patient, IQR 1-2) for 49 strictures: 41 PD (83.7%; 17 body, 15 head, 6 neck, and 3 tail) and 8 BD (16.3%; 5 common hepatic duct, 2 common bile duct, and 1 hilum). Complete and partial resolution occurred in 30 (61.2%) and 17 (34.7%) of strictures, respectively. Technical success was 100%. Stent-free trial was attempted in 25 patients (83.3%) after a median of 6 months (IQR 3-8) and median of 4 ERCPs (IQR 2-4) including index CPL and ERCP with stent removal. In 22 patients with follow-up data, reintervention with stenting occurred in 45.5% ( $n = 10$ ) with a median survival time of 32 months (95% CI, 12-42). No severe adverse events occurred.

**Conclusions:** CPL has high technical success and an acceptable safety profile for the treatment of benign refractory BD and PD strictures.

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## INTRODUCTION

Symptomatic pancreaticobiliary strictures are common and are associated with high health care utilization.<sup>1,2</sup> Endoscopic management of pancreatic duct (PD) strictures involves plastic stent placement over a prolonged period with stent upsizing typically by placement of multiple side-by-side plastic stents.<sup>2</sup> Fully covered self-expandable metal stents (FCSEMSs) have gained favorability for the management of benign extrahepatic biliary strictures and are now routinely used.<sup>3</sup> However, their role in managing PD strictures remains uncertain with concerns of severe stent-related strictures and increased rates of adverse events (AEs) compared with plastic stents.<sup>4-6</sup> A proportion of patients will have a persistent symptomatic stricture despite stenting >1 year.<sup>7,8</sup>

Novel endoscopic techniques are needed for the management of complex pancreaticobiliary strictures, with many patients desiring minimally invasive and nonoperative interventions when available. Endoscopic-guided laser dissection/ablation has been demonstrated to be safe and effective for the management of select cases of benign ureteral strictures.<sup>9</sup> Emerging data have demonstrated a promising role for the management of select pancreatic and biliary strictures.<sup>6,7,9,10</sup>

We previously reported an initial small series of cholangiopancreatocopy-guided laser dissection or ablation (CPL) for refractory benign pancreaticobiliary strictures that carried a high immediate and short-term technical success rate.<sup>8</sup> This study aims to expand on the previous case series and evaluate the technical success, AEs, clinical efficacy, and longer-term follow-up of patients who underwent CPL for refractory pancreaticobiliary strictures.

## PATIENTS AND METHODS

This study was approved by the Colorado Multiple Institutional Review Board.

### Patients

This retrospective case series included all adult patients with pancreaticobiliary strictures treated with CPL from May 1, 2016, to September 1, 2023, at a single tertiary academic medical center. Indications for CPL at our institution include management of complex pancreatic or biliary strictures refractory to conventional endotherapy (eg, balloon dilation, stent placement), facilitation of pancreatoscopy-guided laser lithotripsy when a PD stricture precludes targeting of stones, and for tissue or benign tumor ablation. All patients had at least 1 symptomatic benign pancreatic or biliary stricture refractory to conventional endotherapy that included balloon dilation, metal passage dilator, or multiple side-by-side plastic stenting. These were defined as discrete strictures with associated upstream dilatation and, for the purposes of this article, were identified based on the

endoscopist's clinical experience and judgment. Patients with extrinsic or nonobstructive strictures were not considered candidates for CPL. Patient-centered discussions regarding management were held before CPL. Alternative therapies, including medical and surgical when applicable, were discussed. All patients wished to proceed with a minimally invasive endoscopic approach. All procedures were performed by a single endoscopist (R.J.S.).

### Technique

A comprehensive description of the CPL technique (Video 1, available online at [www.giejournal.org](http://www.giejournal.org)) can be found in our case series.<sup>7</sup> The same technique was used for all cases in this study. After deep cannulation of the pancreatic or biliary duct using standard endoscopic techniques, a 10.5F single-operator cholangiopancreatocopy (Spyglass DS or DS2; Boston Scientific, Marlborough, Mass, USA) was advanced, typically over a guidewire, to visualize the stricture of interest. Once the stricture had been reached, the guidewire was removed and a 200- to 272- $\mu$ m laser fiber (MED-Fibers, Inc, Chandler, Ariz, USA) was advanced through the cholangiopancreatocopy working channel and holmium (Litho 100; Quanta System, Milan, Italy) or thulium (Cyber TM; Quanta System) laser was applied under saline immersion using soft-tissue settings (5-8 W) at the discretion of the endoscopist. Thulium is specific to soft tissue applications and delivers a relatively constant rate of cutting and vaporization. For stricture dissection, the laser probe was positioned at the upstream aspect of the stricture, and short gentle strokes using the "ablation" setting were applied from the upstream to downstream aspect of the stricture until a visible superficial defect with improved lumen patency was visualized. This process was typically performed in 3 quadrants to disrupt the fibrotic component of the stricture and facilitate more circumferential dilation. Four-quadrant dissection is often not technically feasible because of limitations in tip deflection with the cholangiopancreatocopy. For complete laser stricturoplasty, laser dissection was followed by balloon dilation and therapeutic stenting. Holmium lasers were used in cases where a pancreatic stricture was associated with PD stones to allow for same-session CPL and laser lithotripsy. For tissue ablation, shorter strokes were used in mostly the "coagulation" setting until adequate tissue dissection and obliteration had been achieved to increase lumen patency or ablate the lesion of interest.

### Outcomes

The primary outcome was stricture resolution. Degree of stricture resolution was determined by an experienced endoscopist with comparison of the cholangiogram or pancreatogram at the time of index CPL to the cholangiogram or pancreatogram obtained at time of stent-free trial (SFT) or last examination in those who did not achieve an SFT.

Complete, partial, and no resolution were defined as  $\geq 90\%$ ,  $89\%$  to  $50\%$ , and  $< 50\%$  resolution of the stricture of interest, respectively. Secondary outcomes included immediate technical success, stent-free survival, and AEs. Immediate technical success was defined as the ability to successfully perform laser dissection in at least 1 quadrant at the stricture of interest with subsequent endotherapy, including therapeutic stenting to bridge the stenosis or to perform intraductal laser lithotripsy. The durability of CPL was evaluated using stent-free survival defined as the period from stent removal without plans for same session or early stent replacement; reintervention with pancreatic or biliary stent placement was prompted because of a recurrence of symptoms. AEs were defined in accordance with the American Society for Gastrointestinal Endoscopy guidelines on ERCP-related AEs.<sup>10</sup> Post-ERCP pancreatitis required 2 of the following: (1) pain consistent with acute pancreatitis, (2) amylase or lipase greater than 3 times the normal limit, and (3) characteristic imaging findings.

### Statistical analysis

Descriptive statistics were reported using means with SDs for data with normal distribution and medians with IQRs for data with non-normal distributions. Kaplan-Meier analysis was performed to assess the stent-free survival after CPL. The event of interest was reintervention with pancreatic or biliary stent placement, which was prompted because of a recurrence of symptoms. Patients were censored at the end of follow-up and if they underwent surgical intervention for the management of their symptomatic stricture (eg, total pancreatectomy). Statistical analyses were conducted using Stata 19 (StataCorp, College Station, Tex, USA).

## RESULTS

### Patients and disease characteristics

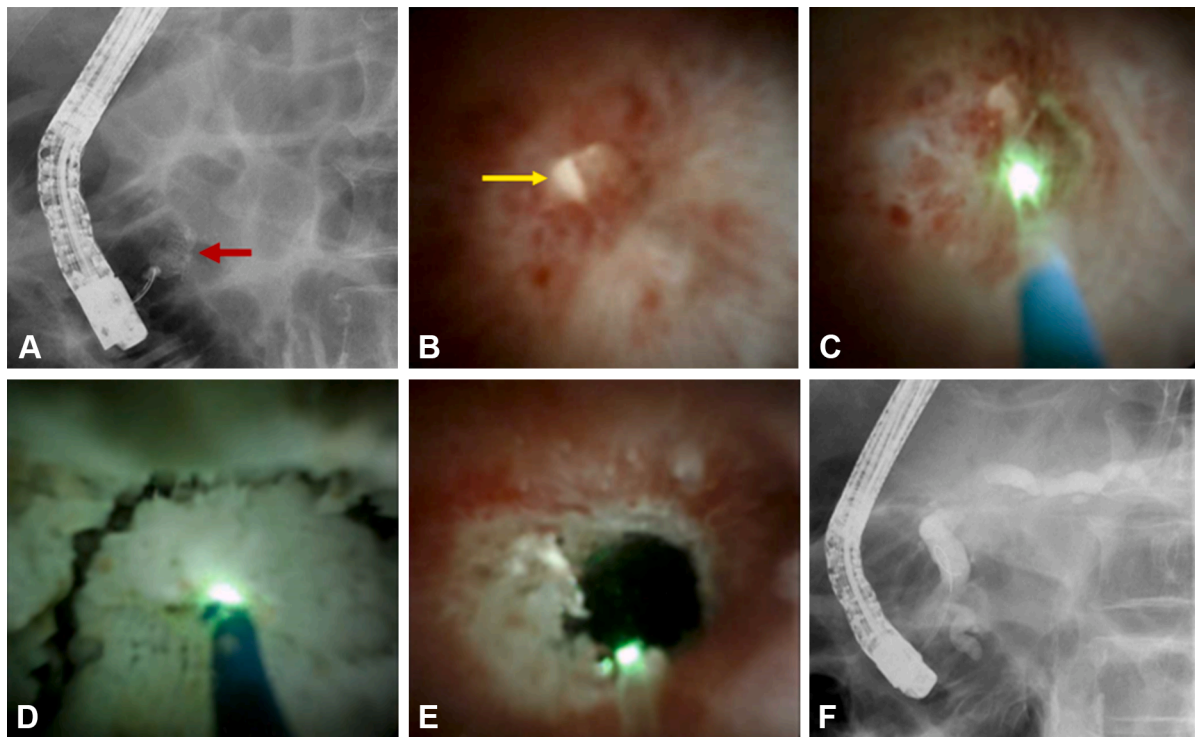
Thirty patients underwent CPL from May 1, 2016, to September 1, 2023. Patient and disease-specific characteristics are outlined in Table 1. Most patients were female (56.7%), and the median age was 61.5 years at index CPL. Approximately one-third of patients reported active tobacco use at index CPL. Symptomatic PD stricture(s) was the indication for CPL in 23 patients (76.7%), with the remaining 7 (23.3%) having a symptomatic biliary stricture(s). The etiologies of PD stricture(s) were as follows: chronic pancreatitis due to alcohol and/or tobacco ( $n = 14$ ; 60.9%), chronic pancreatitis due to pancreatic divisum (2; 8.7%), surgical or anastomotic (2; 8.7%), intraductal papillary mucinous neoplasm (1; 4.3%), and other etiologies (4; 17.4%). The etiologies of biliary strictures were as follows: trauma or postsurgical (2; 28.6%), anastomotic (2; 28.6%), idiopathic (2; 28.6%), and tissue ingrowth of an uncovered self-expandable metal stent (1; 14.3%). More

**TABLE 1. Patient- and disease-specific characteristics**

Characteristics	n (%) or median (IQR)
All patients, $n = 30$	
Age, y	61.5 (52, 68)
Sex, female	17 (56.7)
Active tobacco use	11 (36.7)
Location of disease	
Pancreatic	23 (76.7)
Biliary	7 (23.3)
Disease duration, mo	18 (7, 43)
ERCPs treating stricture of interest prior to index CPL	3 (1, 5)
Patients with pancreatic stricture(s), $n = 23$	
Discrete strictures targeted with CPL	
Patients with concomitant PD stones	17 (56.7)
Etiology of disease	
Chronic pancreatitis due to alcohol and/or tobacco	14 (60.9)
Chronic pancreatitis due to pancreatic divisum	2 (8.7)
Surgical or anastomotic	2 (8.7)
Intraductal papillary mucinous neoplasm	1 (4.3)
Other	4 (17.4)
Location of strictures, $n = 41$	
Head	15 (36.6)
Neck	6 (14.6)
Body	17 (41.5)
Tail	3 (7.3)
Maximum outer stent diameter prior to CPL, F ( $n = 22$ )	9.3 (7, 10)
Patients with biliary stricture(s), $n = 7$	
Etiology of disease	
Trauma or postsurgical	2 (28.6)
Anastomotic	2 (28.6)
Idiopathic	2 (28.6)
Tissue Ingrowth of uSEMS	1 (14.3)
Location of strictures, $n = 8$	
Common bile duct	2 (25.0)
Common hepatic duct	5 (62.5)
Hepatic bifurcation	1 (12.5)
Maximum outer stent diameter prior to CPL, F ( $n = 7$ )	28.5 (10, 40)

CPL, Cholangiopancreatocopy-guided laser dissection or ablation; PD, pancreatic duct; uSEMS, uncovered self-expandable metal stent.

than two-thirds (16 of 23; 69.6%) of patients with a PD stricture had an associated stone at the level of or immediately upstream to the stricture of interest.



**Figure 1.** Representative photos from a case of pancreatotomy-guided laser dissection in which a large, obstructing, stone conglomerate in the head of the pancreas (**A**, red arrow) resulted in ineffective balloon dilation. Pancreatotomy revealed a severe stricture with an upstream stone conglomerate (**B**, yellow arrow). Pancreatotomy-guided laser dissection (**C**) facilitated access to the stone conglomerate for laser lithotripsy (**D**) with subsequent stone clearance and stricture improvement as seen on pancreatotomy (**E**) and pancreatogram (**F**).

### Therapy prior to CPL

Prior to index CPL, patients had a median disease duration of 18 months (IQR 7-43) and had undergone a median of 3 ERCPs (IQR 1-5) with therapeutic intent toward the stricture of interest. Most patients (23 of 30; 76.7%) were treated with a combination of therapeutic stent placement and dilation prior to CPL, and 6 (20.0%) were treated with therapeutic stenting alone. One patient (3.3%) with a PD stricture in the head of the pancreas associated with an upstream 21-mm conglomerate of stones that prevented therapeutic stenting and in which balloon dilation was unsuccessful, proceeded directly to CPL with concomitant laser lithotripsy (Fig. 1). The median maximal outer stent diameter prior to CPL was 9.3F (IQR 7-10) and 28.5F (IQR 10-40) in those with PD and biliary strictures, respectively. Of the 16 patients with a PD stricture associated with stones, 8 had previously undergone treatment with extracorporeal shock wave lithotripsy or pancreatotomy-guided lithotripsy.

### CPL

Thirty patients with 49 discrete strictures (41 pancreatic and 8 biliary) were treated with laser during 53 CPL sessions (median 1 per patient, IQR 1.0-2.0) (Table 2). Seventeen strictures (34.7%) required 2 or more CPL sessions. Forty-one PD strictures (83.7%) were treated in the body

**TABLE 2.** Treatment characteristics for all patients undergoing CPL ( $n = 30$ )

Characteristic	<i>n</i> , <i>n</i> (%), median (IQR)
Number of CPL sessions	53
Number of pancreatic and biliary strictures	49
Median CPL sessions per patient	1.0 (1.0, 2.0)
Type of laser	
Holmium	34 (64.2)
Thulium	19 (35.8)
Balloon dilation performed	39 (73.6)
Concomitant laser lithotripsy of stones performed	29 (54.7)

CPL, Cholangiopancreatotomy-guided laser dissection or ablation.

(17; 41.5%), head (15; 36.6%), neck (6; 14.6%), and tail (3; 7.3%) of the pancreas. Eight biliary strictures (16.3%) were treated in the common hepatic duct (5; 62.5%), the common bile duct (2; 25.0%), and at the hilum (1; 12.5%). Multiple strictures were treated during a single CPL session in 14 (26.4%) of the 53 CPL sessions. This included 1 biliary CPL session (1.9%) with treatment of 2 biliary strictures and 13 pancreatic CPL sessions with treatment of 2 or more PD strictures. Of the 13 pancreatic CPL sessions with treatment of multiple strictures, 2 discrete

PD strictures were treated in 9 (17.0%) and 3 discrete PD strictures were treated in 4 CPL sessions (7.5%). Overall technical success was 100%.

Holmium laser was used in most cases (34; 64.2%). Adjunctive balloon dilation was performed in 39 sessions (73.6%). Maximal balloon diameter ranged from 4 to 8 mm for PD strictures and 6 to 10 mm for biliary strictures. Therapeutic stent placement occurred in 100% of the cases after CPL. The median maximal outer stent diameter was 10F (IQR 7-10) and 24F (IQR 20-28.5) for PD and biliary strictures, respectively. A plastic stent was used in the majority of cases (49 of 53; 92.5%). A fCSEMS was placed after treatment of 3 biliary strictures (Viabil; Gore Medical, Newark, Del, USA) and 1 PD stricture (WallFlex; Boston Scientific). Side-by-side stent placement with 2 or more plastic stents was performed in 7 sessions (70.0%) for biliary strictures and 2 sessions (4.7%) for PD strictures. A main PD stone was associated with at least 1 PD stricture of interest in 32 cases (74.4%). Balloon stone extraction after CPL was performed in 31 sessions (96.9%) and targeting for concomitant laser lithotripsy was successfully performed for a main PD stone in 29 sessions (90.6%) in which a PD stricture of interest was associated with a PD stone.

### Stricture resolution

Complete and partial stricture resolution was observed in 30 (61.2%) and 17 (34.7%) of the 49 discrete strictures treated with CPL, respectively (Table 3). No resolution was observed in 2 strictures (4.1%) after CPL. There were 41 PD strictures. Complete resolution occurred in 23 (56.1%), partial resolution in 16 (39.0%), and no resolution in 2 (4.9%). There were 8 biliary strictures. Complete resolution occurred in 7 (87.5%) and partial resolution in 1 (12.5%).

### SFT and follow-up

The median follow-up after index CPL was 30.5 months (IQR 12-43). An SFT was attempted in 25 patients (83.3%). This included 20 patients (87.0%) with a PD stricture(s) and 5 patients (71.4%) with a biliary stricture(s). The median time to SFT from index CPL was 6 (IQR 3-8) months after a median of 4 (IQR 2-4) ERCPs, including the index CPL session and final ERCP with stent removal. Eleven patients (44.0%) required multiple CPL sessions before an SFT. Two CPL sessions were performed in 4 patients, 3 CPL sessions in 6 patients, and 5 CPL sessions in 1 patient.

Follow-up after attempted SFT was available in 22 patients (88.0%) with a median follow-up time of 23 months (IQR 10-36). The median stent-free survival was 32 months (95% CI, 12-42) (Fig. 2). Reintervention with stenting occurred in 10 patients (45.5%), including 8 with PD stricture(s) and 2 with biliary stricture(s). In patients requiring reintervention with stenting, the median time to reintervention was 12.5 (IQR 5-32) months. One patient underwent video-assisted thoracoscopy with splanchnicectomy for recurrent abdominal pain after a patient-centered dis-

**TABLE 3. Outcomes after CPL**

Outcomes	n (%)
Stricture resolution (n = 49)	
Complete	30 (61.2)
Partial	17 (34.7)
No resolution	2 (4.1)
Technical success (n = 53)	53 (100)
Attributable adverse events (n = 53)	9 (17.0)
Severe adverse events	0 (0)

CPL, Cholangiopancreatography-guided laser dissection or ablation.

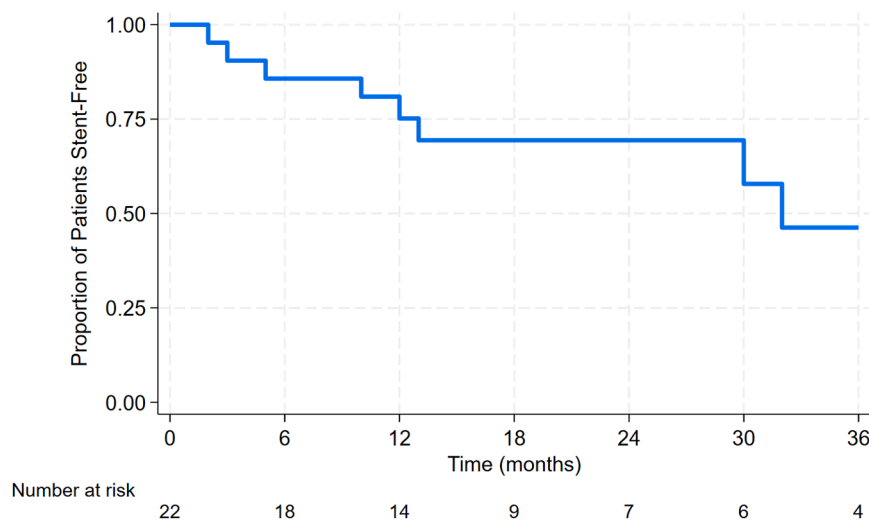
cussion because further endotherapy was felt to have a low likelihood of improving symptoms because of a high suspicion for neuropathic pain and less invasive strategies, including celiac plexus block, were declined. At time of last follow-up, SFT had not been achieved in 5 patients (16.7%) because of the following: ongoing treatment (3; 60.0%), death due to unrelated causes (1; 20.0%), and total pancreatectomy due to persistent abdominal pain related to chronic pancreatitis (1; 20.0%).

### Adverse events

There were AEs in 11 (20.8%) of the 53 CPL sessions, with 9 (17.0%) felt definitely or probably attributable to the associated ERCP and/or CPL session. Attributable AEs occurred during 5 sessions targeting PD stricture(s) and 4 sessions targeting biliary stricture(s). This included post-procedural abdominal pain resulting in presentation to the emergency department and/or hospitalization (5; 9.4%), post-ERCP pancreatitis (2; 3.7%), biliary obstruction requiring ERCP with biliary stenting (1; 1.9%), and PD leak (1; 1.9%). The single PD leak was identified at the time of the CPL session and was successfully bridged with PD stent placement. The patient was hospitalized for 6 days and managed conservatively with intravenous antibiotics and analgesics before discharging home. No bleeding AEs occurred. All AEs were mild or moderate. The AEs felt unlikely to be attributable to the associated CPL session included presentation to the emergency department for shortness of breath in the setting of underlying chronic obstruction lung disease (1; 1.9%) and presentation to the emergency department for evaluation of chest pain (1; 1.9%).

### DISCUSSION

In this study, we expand on our previous case series and provide longer-term follow-up. We report a high rate of stricture response, high technical success rate, and an acceptable safety profile for CPL in the management of complex pancreatic or biliary strictures. Patients demonstrated timely improvement in their strictures,



**Figure 2.** Kaplan-Meier curve for stent-free survival after initial stent-free trial after cholangiopancreatography-guided laser dissection or ablation of benign pancreaticobiliary strictures.

and an SFT was attempted after a median of 6 (IQR 3-8) months from index CPL in the 25 patients (83.3%) who had attempted an SFT. Notably, frequent intervention prior to an SFT was required and patients underwent a median of 4 ERCPs after index CPL. However, it is important to place this in the context of a difficult-to-manage patient cohort predominantly composed of patients with complex pancreaticobiliary strictures that had persisted despite a median of 3 therapeutic ERCPs prior to CPL. In 1 case, a severe stricture in the head of the pancreas precluded traditional pancreatic endotherapy (PET) with both PD stenting and balloon dilation. CPL facilitated access and initial lithotripsy of a large upstream stone conglomerate in a single session (Fig. 1). Despite the disease complexity observed in this cohort, complete stricture response was observed in more than one-half of the cohort and at least partial stricture response was observed in nearly all patients. In patients who achieved an SFT, the response appeared durable with a median stent-free survival time of 32 months (95% CI, 12-42); however, nearly half required reintervention with stenting during follow-up. This shows the intensity of PET required in this highly selected cohort.

Safety is a critical aspect of emerging techniques. Two case series of percutaneous laser stricturotomy for the management of benign biliary stricture have reported a technical success rate of 100% and an acceptable safety profile among a combined 17 patients.<sup>11,12</sup> Our case series expands on the only known case series describing the use of peroral cholangioscopy- or pancreatoscopy-guided laser dissection or ablation of pancreaticobiliary strictures. AEs attributable to CPL occurred in approximately one-fifth of cases, which is double the AE rate of 9.3% reported in a meta-analysis of patients undergoing pancreatoscopy-guided lithotripsy for PD stones.<sup>13</sup> Postprocedural abdom-

inal pain accounted for half of the AEs in this study, and the high proportion of patients with chronic pancreatitis may account for the higher rates of AEs. Notably, no severe AEs occurred. The observed rate of AEs is similar to those reported in the Stent Versus Indomethacin trial, in which 21.9% of patients undergoing high-risk outpatient ERCP were hospitalized within 30 days.<sup>14</sup> The rates of post-ERCP pancreatitis observed in our cohort were low at 3.7%, likely related to the inclusion of patients with biliary strictures with prior biliary sphincterotomy and categorizing postprocedural abdominal pain not associated with lipase elevations in the setting of chronic pancreatitis as a separate entity. Although PD or biliary leaks related to ductal trauma from laser application are a concern, this only occurred in a single case and was successfully treated with therapeutic stent placement at the time of the procedure; however, it did result in unintended hospitalization. Larger studies will be needed to better quantify and understand this risk.

The advent of FCSEMSs for the management of benign extrahepatic biliary strictures may limit the need for cholangioscopy-guided laser dissection in most patients. However, there may be a role for refractory strictures or severe hilar strictures that preclude FCSEMS placement.<sup>15</sup> In fact, approximately 25% of patient with a benign extrahepatic biliary stricture secondary to chronic pancreatitis were found to have a persistent stricture at 24 months in a recent randomized trial comparing metal and multiple plastic stents.<sup>16</sup> Our cohort included 7 patients with benign biliary strictures refractory to conventional endotherapy, and an SFT was ultimately achieved in 5 of these patients. Future studies focusing on the role of CPL in patients with biliary strictures refractory to FCSEMSs and optimal timing of CPL to reduce procedural burden would be of clinical interest.

Perhaps the most promising utility of CPL is for the management of recurrent and refractory PD strictures in the setting of chronic pancreatitis and to permit targeting of main PD stones for lithotripsy. Strictures refractory to traditional PET are common, and recurrence after multiple plastic PD stents occurs in 11% of patients.<sup>4</sup> Pancreatocopy-guided laser dissection is an option for the management of difficult main PD strictures. Our study included 23 patients with main PD strictures, of which 20 (86.9%) eventually underwent an SFT. Durable response was seen in approximately half of patients in a cohort composed predominantly of patients with complex chronic pancreatitis refractory to traditional PET. Early CPL in patients at risk for recalcitrant strictures, opposed to salvage therapy, could be expected to demonstrate more favorable outcomes. Ultimately, studies comparing CPL to multiple-plastic stent placements for refractory strictures are needed to better understand the role of CPL in this population.

Main PD stones occur in approximately 60% of patients with chronic pancreatitis.<sup>17</sup> Extracorporeal shock wave lithotripsy (ESWL) and pancreatocopy-guided laser lithotripsy have emerged as effective treatment modalities for large (>5-mm) PD stones; however, both possess limitations.<sup>2</sup> Access to ESWL is limited within the United States and frequently requires a subsequent ERCP for removal of stone fragments.<sup>18,19</sup> Pancreatocopy-guided lithotripsy may reduce the need for additional procedures for stone clearance; however, densely fibrotic PD strictures can pose a challenge to accessing upstream main PD stones.<sup>20</sup> Pancreatocopy-guided laser dissection can improve lumen patency in patients with main PD stones associated with downstream pancreatic duct strictures to facilitate same-session laser lithotripsy. When anticipated, the use of holmium is advised given the ability to use both soft-tissue and lithotripsy settings. This mitigates a key limitation for pancreatocopy-guided laser lithotripsy without the need for an additional procedure or equipment.

Despite the promise of CPL for the management of chronic pancreatitis, this current study did not assess the impact of CPL on pain or quality of life. The pathophysiology of pain in chronic pancreatitis is complex and multifactorial.<sup>21</sup> Early surgical intervention has been demonstrated to be more effective than PET for the management of pain in a highly selected population, and discussion of surgery is recommended for all appropriate patients with obstructive chronic pancreatitis before proceeding with PET.<sup>5,22,23</sup> However, many patients prefer minimally invasive options or are not candidates for surgical intervention because of a lack of sufficiently dilated pancreatic ducts or having multifocal ductal disease. PET has been shown to result in an improvement in quality-of-life scores and reduce opioid requirements in patients with chronic pancreatitis.<sup>24</sup> The role of CPL on patient-centered outcomes in those with chronic pancreatitis requires further investigation.

There are limitations to our study. This was a single-center study, and all procedures were performed by a single

endoscopist, which limits generalizability. There was no control arm, and the decision to proceed with CPL was at the discretion of the performing endoscopist, who had experience in what constituted a refractory stricture. The cohort was heterogeneous and contained pancreatic and biliary strictures of various etiologies, which limit the ability to assess the impact on a specific disease entity. Finally, the limited availability of laser systems in endoscopy units because of the need for additional equipment, added costs, and certification requirements reduces the reproducibility of this study. Locoregional leasing options, collaboration of resources with other departments using laser systems (eg, urology), and institutional credentialing programs, when available, may mitigate these barriers.

In summary, this case series supports a role for cholangioscopy- or pancreatocopy-guided laser dissection or ablation for patients with refractory pancreaticobiliary strictures. Application of this technique at other institutions is needed to validate our single-center experience. Early implementation of laser dissection in patients with pancreaticobiliary strictures, particularly when associated with intraductal stones, may provide even more promising results compared to this cohort, which consisted predominantly of patients who failed previous endotherapy. Studies comparing early laser dissection to conventional endotherapy for management of pancreaticobiliary strictures are needed.

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None.

## DISCLOSURE

The following authors disclosed financial relationships: S. Han: Consultant for Boston Scientific. R.J. Shah: Consultant and Advisory Board Member for Cook Medical; Consultant for Boston Scientific and Olympus. All other authors disclosed no financial relationships.

## REFERENCES

1. Gardner TB, Kennedy AT, Gelrud A, et al. Chronic pancreatitis and its effect on employment and health care experience: results of a prospective American multicenter study. *Pancreas* 2010;39:498-501.
2. Strand DS, Law RJ, Yang D, et al. AGA clinical practice update on the endoscopic approach to recurrent acute and chronic pancreatitis: expert review. *Gastroenterology* 2022;163:1107-14.
3. Elmunzer BJ, Maranki JL, Gomez V, et al. ACG clinical guideline: diagnosis and management of biliary strictures. *Am J Gastroenterol* 2023;118:405-26.
4. Sofi AA, Khan MA, Ahmad S, et al. Comparison of clinical outcomes of multiple plastic stents and covered metal stent in refractory pancreatic ductal strictures in chronic pancreatitis—a systematic review and meta-analysis. *Pancreatology* 2021;21:854-61.
5. ASGE Standards of Practice Committee; Sheth SG, Machicado JD, Chalhoub JM, et al. American society for gastrointestinal endoscopy

- guideline on the role of endoscopy in the management of chronic pancreatitis: summary and recommendations. *Gastrointest Endosc* 2024;100:584-94.
6. Sherman S, Kozarek RA, Costamagna G, et al. Soft self-expandable metal stent to treat painful pancreatic duct strictures secondary to chronic pancreatitis: a prospective multicenter trial. *Gastrointest Endosc* 2023;97:472-81.e3.
  7. Hanada Y, Shah RJ. Pancreatocopy-guided endotherapies for pancreatic diseases. *Gastrointest Endosc Clin N Am* 2024;34:417-31.
  8. Han S, Shah RJ. Cholangiopancreatocopy-guided laser dissection and ablation for pancreas and biliary strictures and neoplasia. *Endosc Int Open* 2020;8:E1091-6.
  9. Herrmann TR, Liatsikos EN, Nagele U, et al; EAU Guidelines Panel on Laser Technologies. EAU guidelines on laser technologies. *Eur Urol* 2012;61:783-95.
  10. Cotton PB, Eisen GM, Aabakken L, et al. A lexicon for endoscopic adverse events: report of an ASGE workshop. *Gastrointest Endosc* 2010;71:446-54.
  11. Trivedi P, Saben JL, Liu L, et al. Preliminary safety and efficacy of laser stricturotomy for treatment of refractory biliary anastomotic strictures following liver transplantation. *Am J Transplant* 2023;23:573-6.
  12. Thai BN, Tra MTT, Lan Oanh DT, et al. Percutaneous transhepatic endoscopic thulium laser vaporesction for management of severe and focal benign biliary strictures. *Clin Ter* 2023;174:360-4.
  13. Siranart N, Kozai L, Simadibrata DM, et al. Per-oral pancreatocopy-guided lithotripsy versus extracorporeal shock wave lithotripsy in pancreatic stone: a meta-analysis. *Dig Dis Sci* 2025;70:2506-20.
  14. Yachimski P, Zhang J, Cote GA, et al. Thirty-day hospital admission following high-risk outpatient ERCP: incidence and analysis of risk factors based on a secondary analysis of the stent versus indomethacin trial data set. *Gastrointest Endosc* 2025;102:375-81.e1.
  15. Khan MA, Baron TH, Kamal F, et al. Efficacy of self-expandable metal stents in management of benign biliary strictures and comparison with multiple plastic stents: a meta-analysis. *Endoscopy* 2017;49:682-94.
  16. Ramchandani M, Lakhtakia S, Costamagna G, et al. Fully covered self-expanding metal stent vs multiple plastic stents to treat benign biliary strictures secondary to chronic pancreatitis: a multicenter randomized trial. *Gastroenterology* 2021;161:185-95.
  17. Frulloni L, Gabbrielli A, Pezzilli R, et al. Chronic pancreatitis: report from a multicenter Italian survey (PanCroInfAISP) on 893 patients. *Dig Liver Dis* 2009;41:311-7.
  18. Dumonceau JM, Costamagna G, Tringali A, et al. Treatment for painful calcified chronic pancreatitis: extracorporeal shock wave lithotripsy versus endoscopic treatment: a randomised controlled trial. *Gut* 2007;56:545-52.
  19. Nguyen-Tang T, Dumonceau JM. Endoscopic treatment in chronic pancreatitis, timing, duration and type of intervention. *Best Pract Res Clin Gastroenterol* 2010;24:281-98.
  20. Guzman-Calderon E, Martinez-Moreno B, Casellas JA, et al. Per-oral pancreatocopy-guided lithotripsy for the endoscopic management of pancreatolithiasis: a systematic review and meta-analysis. *J Dig Dis* 2021;22:572-81.
  21. Drewes AM, Bouwense SAW, Campbell CM, et al. Guidelines for the understanding and management of pain in chronic pancreatitis. *Pancreatology* 2017;17:720-31.
  22. van Veldhuisen CL, Kempeneers MA, de Rijk FEM, et al. Long-term outcomes of early surgery vs endoscopy first in chronic pancreatitis: follow-up analysis of the ESCAPE randomized clinical trial. *JAMA Surg* 2025;160:126-33.
  23. Issa Y, Kempeneers MA, Bruno MJ, et al. Effect of early surgery vs endoscopy-first approach on pain in patients with chronic pancreatitis: the ESCAPE randomized clinical trial. *JAMA* 2020;323:237-47.
  24. Han S, Rueb N, Nikahd M, et al. The impact of pancreatic endotherapy on quality of life in chronic pancreatitis. *Gastrointest Endosc* 2025;102:79-86.

*Abbreviations:* AEs, Adverse events; BD, benign biliary duct; CPL, cholangiopancreatocopy-guided laser dissection or ablation; ESWL, extracorporeal shock wave lithotripsy; FCEMS, fully covered self-expandable metal stents; IQR, interquartile range; PD, pancreatic duct; PET, pancreatic endotherapy; SFT, stent-free trial.

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