Usefulness of single-operator cholangioscopy-guided laser lithotripsy in patients with Mirizzi syndrome and cystic duct stones: experience at a tertiary care center

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Background and Aims: ERCP is an established technique for the management of bile duct stones. Large bile duct stones (>1.2 cm) require additional techniques such as mechanical lithotripsy and balloon sphincteroplasty for ductal clearance. The literature on endoscopic management of cystic duct stones (CDSs) and Mirizzi syndrome (MS) is limited. We report our experience with cholangioscopy-assisted extraction of CDSs and MS in patients in whom conventional endoscopic and surgical techniques failed.

Methods: Between August 2011 and August 2014, 50 patients (15 males) diagnosed with MS (n = 40) and CDSs (n = 10) were recruited for the study. MRCP was the preferred diagnostic modality to outline the biliary anatomy. ERCP was performed by using an Olympus TJF 160/180 duodenoscope (Olympus, Tokyo, Japan). Cholangioscopy was performed by using the Spyglass system (Boston Scientific, Marlborough, Mass). Holmium laser lithotripsy (LL) was performed when conventional stone extraction techniques failed.

Results: Cholangioscopy-guided LL was required in 34 of 50 patients (68%) with MS and CDSs. Stone extractions using conventional endoscopy techniques were successful in 8 patients and with surgery in another 8 patients, and these patients were excluded from the final statistical analysis. The mean stone size for MS was 21 mm (range 15-41 mm), and the CDS size was 8 mm (range 6-12 mm). Single-session ductal clearance could be achieved in 32 patients (94%). Adverse events were mild and included fever (2 patients), transient abdominal pain (2 patients), and self-limited pancreatitis (2 patients).

Conclusions: Cholangioscopy-guided LL is a useful technique for extraction of CDSs and in MS with high single-session success rates. It is also a rescue technique in patients in whom surgical stone extraction failed. (Gastrointest Endosc 2016;84:56-61.)

ERCP is the primary therapeutic tool for the management of biliary stone disease. However, cystic duct stones (CDSs) and stones causing Mirizzi syndrome (MS) are not always amenable to removal by traditional ERCP methods. When residual CDSs are found in patients presenting with pain after cholecystectomy, stone removal by using standard ERCP methods is challenging because of the variable length and anatomy of the cystic duct stump. In addition, CDS impaction may prevent proximal passage of a guidewire, a prerequisite for most stone extraction techniques. MS refers to complete or partial obstruction of the common hepatic duct by a gallstone impacted in the cystic duct or gallbladder neck. It is an uncommon adverse event of gallstone disease and is seen in 0.05% to 4% of patients with symptomatic cholelithiasis undergoing surgery. Although ERCP with mechanical lithotripsy may allow stone extraction in 85% to 90% of patients in whom standard methods fail, 10% to 15% require more than 1 session, and success rates are lower for larger and impacted stones. Single-operator cholangioscopy (SOC) techniques have been developed to address some of these limitations by providing direct visualization of the bile duct. An SOC system allows clearance of difficult biliary stones under direct visualization by laser.
lithotripsy (LL).\textsuperscript{5} Holmium:YAG LL of biliary stones was first reported in 1998.\textsuperscript{6} We previously reported on the efficacy of SOC-mediated holmium LL for difficult biliary duct stones, including MS, with excellent outcomes. However, a limited number of patients with MS was recruited for the study.\textsuperscript{5} Alternative options to manage difficult biliary stones such as CDSs and those causing MS include surgery (open or laparoscopic),\textsuperscript{3} extracorporeal shock wave lithotripsy,\textsuperscript{7} and electrohydraulic lithotripsy.\textsuperscript{8,9} Surgery is the mainstay of treatment and continues to be the preferred option in our country as it can be a single-stage definitive treatment and is also cost-effective. However, surgery in patients with MS is a formidable challenge because it is accompanied by extensive adhesions in the cystohepatic (Calot’s) triangle, and the difficulty in separating the tissues can lead to bile duct injury, excessive bleeding, and other intraoperative and postoperative adverse events.\textsuperscript{5,10,11}

Despite the fact that some studies suggest the use of laparoscopic surgery to treat MS, this approach cannot be recommended as a standard procedure because of the increased risk of bile duct injuries except for type I MS. In addition, it requires well-equipped centers for advanced laparoscopy and an experienced surgeon.\textsuperscript{2}

We report here our experience of managing 50 patients with diagnoses of MS and CDSs and also outline the role of cholangioscopy-assisted extraction of CDSs in patients with MS in whom conventional endoscopic and surgical techniques failed.

\textbf{METHODS}

This is a retrospective analysis of our prospectively collected data of patients diagnosed with MS and CDSs who were managed with SOC-guided holmium LL over a 3-year period (August 2011 to August 2014). CDSs were defined as isolated, retained stones in the cystic duct stump; these patients had persistent abdominal pain or acute pancreatitis as their presenting symptom, requiring further treatment. Patients with MS were classified as type I to type IV subtypes per the historical classification.\textsuperscript{5,11} Inclusion criteria were patients with MS and CDSs not amenable to standard endoscopic techniques and/or in whom surgical extraction of stones had failed. Exclusion criteria were patients with bleeding diathesis, portal hypertension, distorted anatomy, malignant biliary obstruction and those with successful basket retrieval, mechanical lithotripsy, or surgery. Study participants were outpatients or inpatients transferred to our center for ERCP procedures. All patients or family members provided written informed consent to undergo the procedure and for participation in this study. The study protocol was approved by the institutional ethics committee.

The diagnosis of MS was made depending on the findings of the combination of 2 or more imaging modalities (US abdomen, CT, MRCP, or EUS). However, MRCP was the preferred diagnostic modality and was performed in 80% of patients (Figs. 1A and B). ERCP was considered the criterion standard for diagnosis of MS and CDSs in this study (Fig. 1C).

ERCP was performed by using the Olympus TJF 160/180 duodenoscope (Olympus, Tokyo, Japan). SOC was performed by using Spyglass technology (Spyglass Direct Visualization System; Boston Scientific Corp, Marlborough, Mass.). LL was performed when conventional stone extraction techniques failed.

All procedures were performed with patients under deep sedation by using intravenous midazolam and propofol administered by an anesthesiologist, with continuous monitoring of pulse rate, oxygen saturation, and blood pressure. All patients received intravenous antibiotics (broad-spectrum third-generation cephalosporin or fluoroquinolone).

In brief, the ERCP technique involves wire-guided biliary cannulation by using a sphincterotome (CleverCut; Olympus) and 0.032 angled Terumo radiofocus hydrophilic guidewire (Terumo Corporation, Tokyo, Japan); biliary sphincterotomy was performed in naive papilla or was extended if needed in a papilla with previous intervention. Stone extraction was initially attempted by using a standard stone extraction basket or balloon. When this failed, mechanical lithotripsy (Trapezoid basket, Boston Scientific or BML 3Q, Olympus) and/or balloon sphincteroplasty by using a 12-mm to 15-mm CRE balloon (Boston Scientific) was attempted. Cholangioscopy-guided holmium LL was used when both of these techniques failed and was done as described by us previously.\textsuperscript{9} In brief, the SOC was inserted through the 4.2-mm accessory channel of a therapeutic duodenoscope. The cholangioscope was inserted through the papilla under direct endoscopic visualization and advanced toward the stone with cholangioscopic visualization and intermittent fluoroscopy. The laser fiber was preloaded in the endoscope’s accessory channel. We used holmium laser technology (Medilas H20; Dornier MedTech, Munich, Germany) delivered via a 365-μm diameter fiber, with energy levels set at 800 to 1500 mJ at a frequency of 8 to 15 Hz. A green aiming beam was used to target the stone, and direct apposition was confirmed via the cholangioscopic view. Laser bursts of less than 5 seconds were delivered under continuous saline solution irrigation via the cholangioscope’s irrigation channel at the maximal setting for bile duct stones (Fig. 1D). Stone fragmentation was deemed complete when fragments were no longer lumen filling and dispersed easily with fluid irrigation. The pulverized stone fragments were then extracted by using a stone extraction balloon or basket, and complete ductal clearance was achieved (Fig. 1E). A stent was placed in the bile duct in patients having associated gallstones or if an inflammatory narrowing of the terminal bile duct was present.