CASE REPORT

Laser Lithotripsy to Treat Basket Impaction during Mechanical Lithotripsy of a Pancreatic Duct Stone

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ABSTRACT

Context Though uncommon, pancreatic duct stones can cause significant discomfort and morbidity. Endoscopic removal of pancreatic stones may decrease intraductal pressure by augmenting ductal drainage. Endoscopy is shown to be most effective when used early in the course of the disease. Endoscopic methods such as mechanical lithotripsy are often successful in removing the majority of pancreatic stones. However, its complication rate is quite high, with basket malfunction being the one most frequently encountered. **Case report** We report a case of a patient with idiopathic chronic calcific pancreatitis presenting with symptomatic pancreatic duct stones. During one attempt of basket mechanical lithotripsy, the basket wires fractured. The basket and stone thus became entrapped in the patient's pancreatic duct. Holmium laser lithotripsy was applied via the mother-baby system of the endoscope. The stone was crushed, and the basket and stone fragments were able to be removed. **Conclusions** To our knowledge, this is the first time laser lithotripsy has been employed to relieve basket impaction during attempted mechanical lithotripsy of a pancreatic duct stone. This method may be considered as a rescue technique by endoscopists encountering basket impaction in the future.

INTRODUCTION

Pancreatic duct stones occur most commonly in patients with chronic pancreatitis from long-term alcohol abuse [1]. Many of the methods used to remove biliary stones are also effective in removing pancreatic stones [2]. However, the latter are more difficult to access, due to the location and narrow diameter of the pancreatic duct. Complication rates for removal of pancreatic stones are higher than for biliary stones as well. For example, endoscopists face three times the number of complications during mechanical lithotripsy of pancreatic versus biliary stones [3]. Thus, removal methods have not been extensively attempted nor studied in patients with pancreaticolithiasis.

Nonetheless, numerous types of removal methods are available. The Puestow and Whipple procedures are the most common surgical methods used to remove pancreatic stones. Endotherapeutic options include: pancreatic sphincterotomy, stricture dilation, balloon catheter and basket extraction, extracorporeal shock-wave lithotripsy (ESWL), and intracorporeal litho-tripsy, which includes electrohydraulic (EHL), basket mechanical, and laser lithotripsy.

Balloon catheter and basket extraction are considered standard endotherapeutic techniques for pancreatico-lithiasis. However, large stones often require lithotripsy fragmentation before ductal clearance is achieved. Currently, the most common type of lithotripsy used on pancreatic duct stones is mechanical [2]. When stones are too hard for the lithotripter to break, though, baskets and stones may become impacted in pancreatic ducts [3]. Surgery or a second form of lithotripsy is often required to relieve impaction. To date, the only types of lithotripsy reported to have been used for this purpose are ESWL and EHL.

CASE REPORT

A 76-year-old white male was referred to Methodist Dallas Medical Center with diarrhea and imaging consistent with chronic pancreatitis. The patient had no history of alcohol abuse. He was diagnosed with steatorrhea due to idiopathic chronic calcific pancreatitis. MRCP revealed pancreatic duct stones within a dilated duct. Initial ERCP confirmed obstruction due to large stones being in the distal pancreatic duct. Sphincterotomy and standard removal techniques were attempted, but they failed to remove the stones. Partial stone clearance was achieved via ERCP after two sessions of ESWL.

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Abbreviations EHL: electrohydraulic lithotripsy

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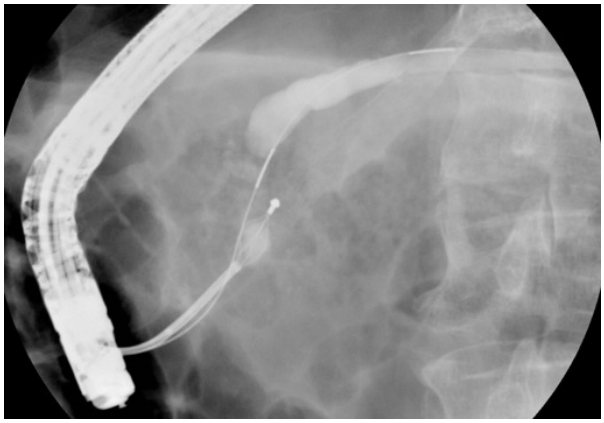

Figure 1. Basket impaction of pancreatic duct stone during mechanical lithotripsy.

A residual 8 mm stone fragment was captured in a basket for mechanical lithotripsy. However, it was too hard for the metal sheath to crush. While attempting to crush the stone by applying traction, the basket wires fractured near the lithotripter handle outside the patient's mouth. The stone and basket thus became impacted inside the patient's pancreatic duct (Figure 1).

The decision was then made to utilize the mother-baby system and insert a FCP-9P Therapeutic Choledocho-fiberscope (Pentax of America, Montvale, NJ, USA) baby scope alongside the duodenoscope's mother/ working channel. A laser lithotripter was introduced into the pancreatic duct via the baby scope. The stone fragment at the tip of the basket was easily visualized. It was then targeted for lithotripsy. Laser energy was applied at a level of 1 J and frequency of 10 Hz. This successfully fulgurated the stone (Figure 2).

After fulguration of the stone, the basket and stone fragments were easily removed by applying gentle traction on the wires outside the patient's mouth (Figure 3).

DISCUSSION

Due to the potential of causing persistent ductal obstruction and recurrent pancreatitis, it is recommended that all pancreatic duct stones found be removed, if possible [1]. Endoscopic sphincterotomy, balloon, and basket techniques are current standard removal methods. These succeed in 50-75% of cases of pancreatic duct stones [2]. Lithotripsy methods entail more risk and are thus less frequently employed. Due to its relative ease of use, mechanical lithotripsy is the most common type of lithotripsy used. For biliary stones, it has resulted in complete ductal clearance in about 80-90% of cases [3]. For pancreatic stones, the clearance rate is between 71-100% [4].

However, in one large, multi-center study, complications of mechanical lithotripsy occurred in 11.6% of pancreatic stone cases but in only 3.6% of biliary stone cases [3]. Although the number of pancreatic stones cases were much fewer than that of biliary stone cases, the complication rate being three times higher is still significant. The most common setback for pancreatic stone removal was basket-breaking (due to stones being too hard for the litho-tripters' metal sheaths to crush). Other complications included: cable or wire fracture (such as occurred with our patient), breakage of the device's handle, and pancreatic duct leak.

Basket impaction usually occurs inside the pancreatic duct. Several salvage methods are available, including: open surgery, salvage lithotripters, sphincterotomy extension, stent placement, EHL, and ESWL. In the past, open surgery was the most frequently used salvage option [3]. However, mortality rates of open surgery for trapped baskets have been reported to be as high as 3% [5]. Now the most commonly used methods are ESWL and the Soehendra® (Cook Endoscopy, Winston-Salem, NC, USA) salvage lithotripter [3]. ESWL (and EHL) usually requires multiple sessions to achieve complete ductal clearance. The Soehendra® lithotripter consists of a metal sheath that is shorter and thicker than the one originally used during basket mechanical lithotripsy. The sheath is slid over the wires and then functions as the original lithotripter was supposed to. The difficulty with this method is that the

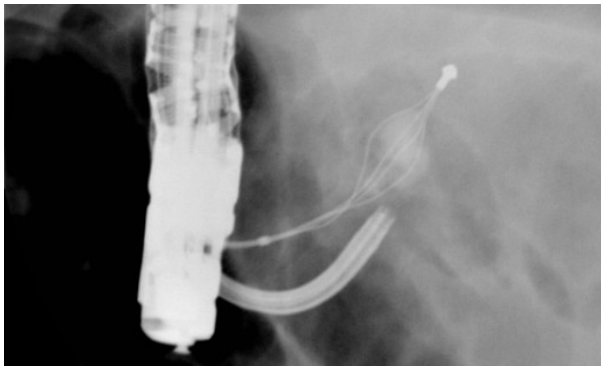

Figure 2. Pancreatic stone pieces in basket after laser lithotripsy.

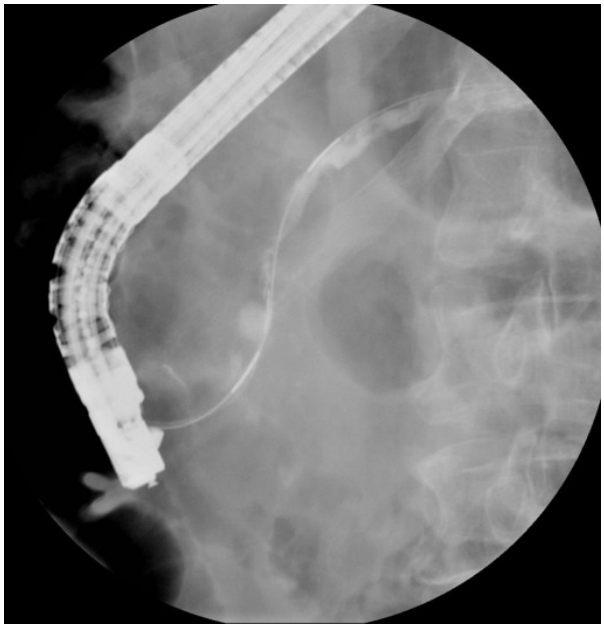

Figure 3. Relief of impacted basket after laser lithotripsy.

endoscope must first be removed from the esophagus before the Soehendra® can be inserted. Furthermore, if the wires are accidentally let go of while removing the endoscope, the new sheath becomes entrapped along with the original basket and wires.

Laser lithotripsy is a technique that was first used to crush kidney stones more than 40 years ago [6]. Endoscopists have since applied it to biliary and pancreatic stones, with an overall complication rate of 7-9% [3]. When compared to biliary stones, the use of laser lithotripsy on pancreatic stones is still in its infancy. Two reasons for this are: the pancreatic duct is more difficult to access due to angulation, and the diameter of the distal pancreatic duct is quite narrow compared to the bile duct [7]. Thus, as laser energy carries a substantially high risk of tissue injury and ductal perforation, endoscopists must demonstrate great precision when treating pancreatic stones. Furthermore, while laser lithotripsy has been performed under fluoroscopic guidance alone [6], ERCP is recommended, as it may decrease the risk of damaging surrounding tissues by allowing direct visualization and thus greater targeting accuracy of stones.

Laser lithotripsy has been used in multiple ways to treat pancreaticobiliary lithiasis, first as a primary method for removing stones [8, 9], second as a salvage method in cases of basket impaction of biliary stones [6]. There has been one report from Germany that laser lithotripsy was used as a salvage method for an impacted pancreatic stone [8]. However, a mother-baby endoscope system was not utilized; the endoscope first had to be disengaged from the patient and fluoroscopy employed for visualization. Only then could laser lithotripsy be performed. Our use of the mother-baby endoscope system seems to be a novel, safer salvage method utilizing laser lithotripsy for the case of basket entrapment of a pancreatic duct stone. Furthermore, presuming results would be similar to those of retained biliary stone cases, laser lithotripsy versus other salvage methods like ESWL and EHL would require less time to stone disintegration and a fewer number of treatment sessions [10].

Ideally no complications would occur during mechanical lithotripsy. However, until and unless technology improves (i.e., having stronger wires and metal sheaths better capable of crushing hard stones), endoscopists must still have salvage methods readily at hand. Soehendra® lithotripters, EHL, and other devices have been used in the past. We were able to successfully use laser lithotripsy alongside a mechanical lithotripter when basket impaction occurred in our patient with stones from chronic calcific pancreatitis. To our knowledge, this is the first report of using laser lithotripsy as a salvage method for pancreatic stone basket impaction. As our patient tolerated the procedure well and suffered no complications from it, we propose that it may be tried in similar cases in the future. More studies have yet to be done to establish the efficacy, safety, and tolerability of laser lithotripsy in patients with pancreatic duct stones.

Notification of conflicts of interest None

References

1. Li L, Zhang S. Management of Pancreatic Duct Stone. Hepatobiliary Pancreatic Diseases International. 2008; 7(1):9-10. [PMID 18234631]

2. DiSario J, et al. Technology status evaluation report: Biliary and pancreatic lithotripsy devices. Gastrointestinal Endoscopy. 2007; 65(6):750-756. [PMID 17383651]

3. Thomas M, Howell DA, Carr-Locke D, Wilcox CM, Chak A, Raijman K, et al. Mechanical lithotripsy of pancreatic and biliary stones: complications and available treatment options collected from expert centers. Am J Gastroenterol 2000; 102(9):1896-902. [PMID 17573790]

4. Dumonceaus J, Deviere J, Lemoine O, Delhaye M, Vandermeeren A, Baize M, et al. Endoscopic pancreatic drainage in chronic pancreatitis associated with ductal stone: Long term results. Gastrointestinal Endoscopy. 1996; 43:547-55. [PMID 8781931]

5. Neoptolemos JP, Carr-Locke DL, Fossard DP. Prospective randomized study of preoperative endoscopic sphincterotomy versus surgery alone for common bile duct stones. British Medical Journal. 1987; 294:470-4. [PMID 3103731]

6. Dretler SP. Laser lithotripsy: a review of 20 years of research and clinical applications. Lasers Surg Med. 1988; 8:341-356. [PMID 2902498]

7. Jung M. Mini-Endoscopy of the Biliopancreatic System. Revista de Gastroenterología del Perú (electronic version). 1999; 19(1). [ISSN 1609-722X]

8. Maier M, Jakobs R, Kohler B, Riemann JF. Fluoroscopically Guided Laser Lithotripsy of a Pancreatic Duct Stone. Endoscopy. 1994; 26:247-9. [PMID 8026375]

9. Neuhaus H, Hoffman W, Classen M. Endoscopic laser lithotripsy with an automatic stone recognition system for basket impaction in the common bile duct. Endoscopy. 1992; 24(6):596-9. [PMID 1356755]

10. Jakobs R, Adamek HE, Maier M, Kromer M, Benz C, Martin WR, et al. Fluoroscopically guided laser lithotripsy versus extracorporeal shock wave lithotripsy for retained bile duct stones: a prospective randomised study. Gut. 1997; 40(5):678-82. [PMID 9203950]