Pancreatic stones: Treat or ignore?

DA Howell MD

DA Howell. Pancreatic stones: Treat or ignore. Can J Gastroenterol 1999;5(6):461-465. Painful, chronic pancreatitis is of complex etiology, but increasing clinical experience suggests that removal of pancreatic duct stones in many cases significantly improves patients’ symptoms. The development and refinement of therapeutic endoscopic retrograde cholangiopancreatography have permitted improved access to the pancreatic duct, which makes the development of new techniques of stone fragmentation and fragment removal a much more successful nonsurgical intervention. A major step forward has been the understanding of the safety and efficacy of pancreatic sphincterotomy, which is necessary for the removal of these difficult stones. The recognition that extracorporeal shock wave lithotripsy can be delivered safely with good efficacy has revolutionized the nonsurgical management of pancreatic duct stones. Nevertheless, advanced and sophisticated therapeutic endoscopy is necessary to achieve clearance of the duct, which can generally be accomplished in the majority of selected patients. State-of-the-art treatments are described, and some new approaches using pancreatoscopy and electrohydraulic lithotripsy are discussed. Newly recognized long term complications are reviewed. Finally, it must be recognized that chronic pancreatitis is an ongoing disease that does not have a simple treatment or cure, and frequently represents a process of remissions and relapses requiring interventions and problem solving.

Key Words: Endoscopic retrograde cholangiopancreatography; Endoscopy; Pancreatic stones

The pain of chronic pancreatitis is of complex etiology. Many investigators have found pancreatic ductal hypertension, as well as increased tissue pressure, to be a nearly universal factor (1,2). Ductal decompression by lateral pancreaticojejunosotomy is effective in relieving the pain of chronic pancreatitis in approximately 75% of patients with dilated ducts, often with intraductal stones, and serves as the rationale for endoscopic decompression by pancreatic sphincterotomy and stent placement. The role of obstructing stones in contributing to the pain of chronic pancreatitis has been controversial because not all patients benefit from ductal decompression. In fact, not all patients have pain relief following total pancreatectomy and/or celiac plexus neurolysis. Nevertheless, studies of endoscopic intervention aimed at improving ductal drainage with stent placement or pancreatic duct stone removal have reported marked clinical improvement in patients’ pain scores varying from 50% to 93% of those of the total group treated (3-8). The potential for pancreatic duct stones to obstruct warrants consideration of removal, especially in patients who receive symptomatic benefit from temporary plastic stent placement.

At the Maine Medical Centre (Portland, Maine), we se-
the axis of the stent generally in the 1 to 2 o’clock position. A needle-knife sphincterotome incision is directed along the stone, and the relative tightness of the stone within the duct. Frequently pancreatic stones are encysted with a very tight fibrotic reaction around them making basket removal problematic.

We frequently perform balloon dilation using a high pressure balloon in view of the very intense fibrosis associated with calculus chronic pancreatitis (Figure 1). Among 44 patients, we employed balloon dilation in 10 (23%) using 8 or 10 mm Olert PVC-3 balloons (Microvasive, Watertown, Massachusetts), which deliver 2533 kPa of pressure. We take care not to place the balloon alongside the stone because of the extremely hard nature of the calculi, which might induce tearing or rupture of the opposite wall of the duct. It is important to note that patients experience significant pain during balloon dilation and uniformly require additional conscious sedation. We have observed no other short term complications using the technique (11).

Stone removal: Following sphincterotomy and balloon dilation, an attempt to extract the stones can be made with an occlusion balloon placed over a guidewire. The presence of the guidewire insures the ability to re-enter the duct in case the stone is impacted by the effort to extract it using the balloon. The extreme hardness and sharp crystalline nature of pancreatic duct stones frequently induce rupture of the bal-
loon. In addition, the vector of force during balloon extraction may drive the stone laterally into the wall, preventing extraction despite an adequately dilated tract. Importantly, pancreatic stones are frequently isodense compared with injected contrast, and extraction may be complicated by the inability to observe the stone under fluoroscopy (Figure 2). Minimizing contrast installation or flushing the duct with saline is occasionally necessary to permit direct observation during extraction techniques.

The employment of a Dormia basket (Figure 3) raises the possibility of basket entrapment, which we have experienced as a complication in our series. The employment of extracorporeal shock wave lithotripsy (ESWL) and the use of endoscopic retrograde cholangiopancreatography (ERCP) techniques to free the basket proved successful in our two experiences. As an adjunct to stone fragmentation, we employ a 7 French mechanical lithotripter (Olympus America Inc, Melville, New York) because the tip of the 10 French lithotripter is usually too large to negotiate the very small space between the fibrotic duct and stone. Mechanical lithotripsy is rarely successful because of difficulties of stone capture as well as the extreme hardness of the stones, which resist the forces of mechanical crushing.

Pancreatography and electrohydraulic lithotripsy: The availability of through the scope 10 French cholangiopancreatoscopes (baby scopes) has made direct visual access to the pancreatic duct more possible, principally because of their small size. The mother-daughter scope system has been employed in the pancreatic duct, but the larger size of both scopes makes complete pancreatoscopy more difficult, and insertion is often limited by associated strictures. Using a new baby scope, we have developed preliminary experience with electrohydraulic lithotripsy in fragmenting pancreatic duct stones. This technology uses readily available spark gap lithotripsy during saline infusion through the channel of the baby scope. We have been able to fragment partially stones that were insufficiently fragmented by extracorporeal lithotripsy, as well as treat a single patient with an extremely large stone as primary therapy. Experience is limited, but to date no serious side effects have been noted using power settings similar to those employed for common duct stone contact lithotripsy. Other authors have published preliminary experience using pulse dye lasers in an operative setting without serious complication (12,13). Laser lithotripsy delivered by a 3.4 mm baby scope has been reported by the Munich group (14). Finally, after all techniques of endoscopic stone management have been completed, we believe it is important to confirm clearance of the duct by direct pancreatoscopy. This is especially apparent in view of the difficulties with isodense stones, which cannot be visualized in the presence of in-
stilled radiocontrast. Small and even large fragments are frequently detected on pancreatoscopy despite having concluded that the duct has been completely cleared.

**Drainage:** It is important to provide pancreatic drainage following vigorous efforts at stone removal, especially in the setting of incomplete clearance or failure (Figure 4). Stent placement in the setting of an impacted pancreatic stone is quite difficult, but every effort should be made to pass the stent beyond the stone to ensure drainage. The employment of a Soehendra metal screw stent extractor (Wilson-Cook Medical, Winston Salem, North Carolina) can grind a groove even in a hard stone after a guidewire has been placed across the stone. In general, an 8.5 French extractor permits placement of a 7 French Geenen type pancreatic stent, and a 10 French stent extractor permits placement of an 8.5 French stent. Measuring the length of the stent is important because the course of the pancreatic duct is generally toward the fluoroscope in the head and neck region in the usual ERCP patient positioning. If the patient is to undergo prompt ESWL, we often insert a 5 or 6 French nasopancreatic drain, which is particularly valuable in targeting the offending stone when multiple calcifications may exist within the side branches or parenchyma of the gland. In addition, this ensures drainage in the postoperative period if repeat ESWL is to be done promptly.

**ESWL:** Because of the technical difficulties of stone extraction using endoscopic methods, electrohydraulic shock wave lithotripsy has proved to be a major form of adjunctive therapy in nonoperative duct clearance. More than 300 patients treated with ESWL have been reported to the literature. The largest reported experiences have been with 123 patients reported in 1992 (15) and with 70 new patients in a more recent report (4). Many other centres have reported similar successful results with ESWL using a variety of machines (6-8,12,15-18). The general consensus is that ESWL is extremely safe, with only a few reported complications related to the treatment itself, including a single intramural hematoma and a few instances of mild post-treatment pancreatitis. It is possible that the piezoelectric machine (16), which is less powerful than the electromagnetic or electrohydraulic machines, is less successful, although randomized data are not available. Bidirectional fluoroscopic x-ray focusing is desirable because ultrasound may have difficulty targeting the stone in the presence of overlying bowel gas and with multiple adjacent calcifications. Some centres permit spontaneous passage of fragmented stones, but most proceed with post-treatment ERCP for clearance of fragments and confirmation of duct clearance, which is our preferred approach. One study from Japan reported a complete clearance of stones in 24 of 32 patients (75%) after multiple ESWL treatments (mean = 4.6) without any therapeutic ERCP (7). This technique has not been confirmed in other centres, and a cost-benefit analysis was not provided. Because the mean number of treatments in other larger series that employed adjunctive therapeutic ERCP was significantly lower (ie, 1.8 sessions [14]), this approach seems likely to be significantly more costly.

**COMPLICATIONS**

Surprisingly few complications of endoscopically managed patients have been reported. Notably, most patients are treated in advanced centres of endoscopic excellence where these often complex procedures are frequently done. Similar low complication rates may not be achievable in hospitals with a low volume of complex cases. Nevertheless, patients with chronic pancreatitis likely have a lower risk of acute pancreatitis with only a single such instance among 53 patients in Amsterdam (6) and none among 44 patients in our series. Entrapped baskets, which, in our experience, may respond to an additional treatment with ESWL, have been reported in other centres (9).

Pancreatic sepsis has been reported as a consequence of both pancreatic stent occlusion and incomplete pancreatic drainage (15). Pancreatic infections complicated these series 4% to 20% of the time, which by one author was described as ‘pancreatic cholangitis’ due to impaction of fragments following ESWL. In general, these episodes of infection were considered minor and generally responded to antibiotics, clearance of fragments and/or temporary stent placement. Overall complication rates range from 8% to 38%, with the death rate under 1% in all series.

The need for surgery varies widely depending on case selection and is employed in patients who have persistent symptoms despite clearance of the duct, failed cases, and where significant complications such as perforation or severe postphincterotomy bleeding occur. Surgical rates range from 5% to 25% and emphasize the importance of a team approach to endoscopic management of pancreatic stones.

**RESULTS**

Symptomatic improvement has been uniformly reported in all centres employing techniques of nonsurgical management of pancreatolithiasis. Response of rates approaching 95% of at least partial improvement have been noted. A range of response from 50% to 93% with follow-ups approaching four years underscores the value of these treatments in this difficult group of patients. Treatment results and techniques of management are summarized in Table 1.

**RECURRANCE AND LATE COMPLICATIONS**

A few authors have reported recurrence and late complications. Costamagna et al (3) noted 22 pain relapses occurring in nine of his 35 ESWL-treated patients. Occlusion of indwelling pancreatic stents and recurrence of pancreatic ductal strictures explained most of the occurrences. However, he did note that four patients (11%) of the total developed recurrent obstructing stones that were thought to be due to migration of side branch stones.

We have experienced six recurrent pancreatic duct stone obstructions in five of 44 patients (11%) occurring between three months and 23 months after cessation of endoscopic intervention, including withdrawal of pancreatic duct stents (19). What was more significant was that in four of these patients, infection complicated the reobstruction including ab-
TABLE 1
Summary of treatment techniques and results

<table>
<thead>
<tr>
<th>Author, year (reference)</th>
<th>Number of patients</th>
<th>Treatment modality</th>
<th>Complete ductal clearance</th>
<th>Improved pain</th>
<th>Follow-up, months (mean)</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sherman et al, 1991 (5)</td>
<td>32</td>
<td>Endoscopic</td>
<td>23 (72%)</td>
<td>22 (68%)</td>
<td>6 to 91</td>
<td>4 (12%)</td>
</tr>
<tr>
<td>Sauerbruch et al, 1992 (8)</td>
<td>24</td>
<td>Multimodal</td>
<td>10 (42%)</td>
<td>12 (50%)</td>
<td>3 to 55 (24)</td>
<td>not stated</td>
</tr>
<tr>
<td>Delhaye et al, 1992 (15)</td>
<td>123</td>
<td>Multimodal</td>
<td>72 (59%)</td>
<td>75/88 (85%)</td>
<td>not stated</td>
<td>53 (43%)</td>
</tr>
<tr>
<td>Smits et al, 1996 (6)</td>
<td>53</td>
<td>Multimodal</td>
<td>39 (73%)</td>
<td>38 (71%)</td>
<td>4 to 131 (33)</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>Ohara et al, 1996 (7)</td>
<td>32</td>
<td>ESWL</td>
<td>24 (75%)</td>
<td>25 (79%)</td>
<td>16 to 63 (44)</td>
<td>None</td>
</tr>
<tr>
<td>Costamagna et al, 1997 (3)</td>
<td>35</td>
<td>Multimodal</td>
<td>26 (74%)</td>
<td>25 (72%)</td>
<td>6 to 70 (27)</td>
<td>8 (23%)</td>
</tr>
<tr>
<td>Present study</td>
<td>44</td>
<td>Multimodal</td>
<td>32 (72%)</td>
<td>41 (93%)</td>
<td>2 to 68 (22)</td>
<td>6 (14%)</td>
</tr>
<tr>
<td>Total</td>
<td>343</td>
<td></td>
<td>226 (66%)</td>
<td>238 (69%)</td>
<td>~30</td>
<td>76 (22%)</td>
</tr>
</tbody>
</table>

ESWL Extracorporeal shockwave lithotripsy

smears formation in three and a pancreatic ductal infection with purulent discharge in one. After initial percutaneous drainage in an outside hospital, one patient returned with recurrence of the abscess requiring repeat endoscopic intervention. This incidence of 9% late infection is cause for concern, but the infections were managed successfully with stent placement in four and with urgent surgical drainage in two. Elective lateral pancreateojunostomy was performed after clearance of the sepsis by stent placement in an additional patient. The rarity of spontaneous pancreatic infection in the setting of pancreaticolithiasis suggests that prior endoscopic manipulation predisposes patients to infection when there is reobstruction likely secondary to colonization of the duct and stone material due to previous ablation of the sphincter. This incidence of late infection has not been reported by other authors but, if confirmed, may require a re-evaluation of the alternatives to pancreatic sphincterotomy during pancreatic duct stone removal.

REFERENCES


CONCLUSIONS

The clinical success in improving pain scores, preventing recurrent painful episodes, and avoiding hospitalizations following nonsurgical techniques of pancreatic duct stone removal support intervention in many patients with intraductal calculi. Care should be used in selecting cases to optimize the likelihood of nonsurgical duct clearance in patients who are not actively abusing alcohol or drug seeking. Techniques to clear the duct are improving but frequently require staged therapy with multiple sessions of intervention. Candidates for this form of treatment should be understanding, motivated and compliant. The development of intraductal therapy with miniscopes holds promise of increased success and lower costs. Recent experience with late pancreatic infections raises concern that transpapillary drainage may be insufficient at times and predispose a subset of patients who continue to suffer from the long term consequences of this debilitating disease to late infection.

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