Introduction

Pancreatic duct stones are found in approximately 22 to 60% of patients with chronic pancreatitis (CP). The stones can lead to obstruction of the outflow of pancreatic juice, causing increased intraductal pressure, tissue hypertension and ischemia, which may be a major factor causing pain in patients with CP.

Successful stone extraction during ERCP depends upon the size, number and location of the stones. Extracorporeal shock wave lithotripsy (ESWL) is a method of stone disruption prior to endoscopic extraction and was shown to improve the results of endoscopic therapy for CP.

Indications of ESWL

ESWL for pancreatic stones is indicated for patients with recurrent attacks of pancreatic pain, moderate to marked changes in the pancreatic ductal system and obstructing ductal stones (calcified or radiolucent) inducing upstream dilatation of the main pancreatic duct (MPD), regardless of the etiology of the CP.

Methods of ESWL

In the majority of patients, a two-dimensional radiologic targeting system is required during ESWL, because ultrasound localization of pancreatic stones is insufficiently precise. Therefore, prior to ESWL, good quality plain films of the pancreatic area, as well as a magnetic resonance cholangiopancreatography (MRCP) or a CT scan are essential for assessment of the pancreatic ductal obstruction related to pancreatic stones. For very small stones or radiolucent stones, visualization can be improved by instillation of contrast medium through a naso-pancreatic catheter.

The first step of endotherapy is the fragmentation of obstructive pancreatic ductal stones by shock waves focused on the most distally located stone and then on the other calculi proceeding from the head to the tail. Stone fragmentation is considered successful when one of the following findings is seen on plain films following ESWL: a) a decreased stone density, b) an increased stone surface, c) an heterogeneity of the stone, which appears as powder-like material filling the pancreatic and the surrounding secondary ducts.
Table. Technical and clinical results of ESWL for pancreatic stones: European and US experience

<table>
<thead>
<tr>
<th>Author, year</th>
<th>SW system*</th>
<th>Number of patients</th>
<th>Fragmentation percent</th>
<th>Complete or partial pain relief, percent</th>
<th>Need for surgery, percent</th>
<th>Mean follow-up, months</th>
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<tr>
<td>Delhaye, 1992</td>
<td>EM</td>
<td>123</td>
<td>99</td>
<td>85</td>
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<td>Sauerbruch, 1992</td>
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<td>87.5</td>
<td>83</td>
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<td>Schneider, 1994</td>
<td>P</td>
<td>50</td>
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<td>Johanns, 1996</td>
<td>EH</td>
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<td>Costamagna, 1997</td>
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* SW: shock wave; EM: electromagnetic; EH: electrohydraulic; P: piezoelectric

Usually, stone fragmentation by ESWL is followed by endoscopic ductal drainage including pancreatic sphincterotomy, fragmented stone extraction and pancreatic stenting in the case of a ductal stricture.

Results of ESWL and endotherapy for pancreatic duct stones

ESWL is a low risk and technically highly successful method with a fragmentation rate ranging from 82 to 99% in most large series.

A meta-analysis including a total of 588 patients found that ESWL was effective in relieving MPD obstruction and alleviating pain in CP, most often in combination with endoscopic therapy. ¹

Complete or partial pain relief following ESWL was achieved in 62 to 85% of patients during a mean follow-up ranging from 7 to 40 months.

Immediate relief of, or improvement in pain is associated with successful decompression of the MPD. At long-term follow-up, definitive pain relief can be expected in about two-thirds of patients, especially in patients who do not smoke and in patients treated as early as possible in the course of CP.

Moreover, endoscopic ductal drainage, including ESWL, can delay the development of pancreatic exocrine insufficiency by about 10 years compared to the natural history of CP patients. However, it did not change the development of diabetes in the course of CP.²

In selected patients with uncomplicated CP, ESWL alone was found to be a safe and effective treatment, showing spontaneous stone clearance after ESWL alone, similar decrease in the MPD diameter one month after treatment and similar outcome of pancreatic pain at a lower cost than for the combined ESWL and endoscopic drainage therapy.³

Conclusions

ESWL can be considered as a first-line approach in patients with uncomplicated painful CP associated with obstructive ductal stones ≥ 5 mm, and dilated MPD.

Usually, stone fragmentation by ESWL is followed by endoscopic ductal drainage leading to definitive pain relief in about two-thirds of patients at long-term follow-up.

The best clinical results are seen in patients who do not smoke and in patients who receive early treatment in
the course of their CP.

References