Digestive and Liver Disease 46 (2014) 639–644

Contents lists available at ScienceDirect

Digestive and Liver Disease

journal homepage: www.elsevier.com/locate/dld

Liver, Pancreas and Biliary Tract

Efficacy of pancreatic stenting prior to extracorporeal shock wave lithotripsy for pancreatic stones

Hiromu Kondo [a], Itaru Naitoh [a,*], Hirotaka Ohara [b], Takahiro Nakazawa [a], Kazuki Hayashi [a], Fumihiro Okumura [c], Katsuyuki Miyabe [a], Shuya Shimizu [a], Yuji Nishi [a], Michihiro Yoshida [a], Hiroaki Yamashita [a], Shuichiro Umemura [a], Yasuki Hori [a], Akihisa Kato [a], Takashi Joh [a]

[a] Department of Gastroenterology and Metabolism, Nagoya City University Graduate School of Medical Sciences, Nagoya, Japan
[b] Department of Community-based Medical Education, Nagoya City University Graduate School of Medical Sciences, Nagoya, Japan
[c] Department of Gastroenterology, Gifu Prefectural Tajimi Hospital, Tajimi, Japan

ARTICLE INFO

Article history:
Received 29 December 2013
Accepted 20 February 2014
Available online 3 April 2014

Keywords:
Extracorporeal shock wave lithotripsy
Pancreatic stenting
Pancreatic stone

ABSTRACT

Background: Extracorporeal shock wave lithotripsy is the first-line therapy for large pancreatic duct stones; however, it requires a long duration of therapy.
Aims: To clarify the effect of pancreatic stenting prior to extracorporeal shock wave lithotripsy on shortening the duration of therapy and reducing complications.
Methods: We retrospectively compared 45 patients who underwent pancreatic stenting prior to extracorporeal shock wave lithotripsy (stenting group) and 35 patients who did not undergo stenting prior to extracorporeal shock wave lithotripsy (non-stenting group) with regard to the cumulative number of shock waves required for stone fragmentation (stone size <3 mm) and the rate of complications.
Results: The stenting group was associated with a significantly lower cumulative number of shock waves in univariate analysis (log-rank, $p = 0.046$) and multivariate Cox proportional hazard analysis (hazard ratio, 1.88; 95% confidence interval, 1.13–3.14; $p = 0.015$) than the non-stenting group. The frequency of pancreatitis tends to be lower in the stenting group than the non-stenting group (2.2% [1/45] vs 11.4% [4/35]; $p = 0.162$).
Conclusions: Pancreatic stenting prior to extracorporeal shock wave lithotripsy reduced the cumulative number of shock waves required for pancreatic stone fragmentation, and could be useful to shorten the duration of therapy.

1. Introduction

Pancreatic stones in the main pancreatic duct (MPD) cause abdominal pain because obstruction of the MPD by pancreatic stone increases the intraductal/intraparenchymal pressure [1]. Extraction of these stones and duct decompression lead to relief of pain. Extracorporeal shock wave lithotripsy (ESWL), endoscopic stone extraction and surgery are treatment options for pancreatic stones. Two randomized controlled trials revealed that a better long-term control of pain is achieved with surgery than with endoscopic therapy and/or ESWL [2–4]. However, the morbidity and mortality associated with pancreatic surgery are relatively high. Therefore, non-surgical treatments such as endoscopic therapy and ESWL have been performed for pancreatic stones. Endoscopic stone extraction without prior stone fragmentation is associated with a low success rate and relatively high morbidity rate [5–7]. Therefore, ESWL is performed as a first step in patients with uncomplicated, large pancreatic stones obstructing the MPD prior to endoscopic stone extraction.

ESWL is a highly effective and safe procedure for the fragmentation of pancreatic stones [8]. The success rate of stone fragmentation by ESWL was reported to be high at 89% in a systematic review [9]. Recent study from the large single centre in India showed that stone fragmentation was achieved in 935 (93%) of 1006 patients [10]. Complications of ESWL were reported in 6.0% of cases [11–13], a majority of which were pancreatitis that is caused by the passage of stone fragments or obstruction after fragmentation.

* Corresponding author at: Department of Gastroenterology and Metabolism, Nagoya City University Graduate School of Medical Sciences, 1 Kawasumi, Mizuho-cho, Mizuho-ku, Nagoya 467-8601, Japan. Tel.: +81 52 853 8211; fax: +81 52 852 0952.
E-mail address: inaito@med.nagoya-cu.ac.jp (I. Naitoh).

http://dx.doi.org/10.1016/j.dld.2014.02.017
1590-8658/

Therefore, decreasing the rate of ESWL-related complications such as pancreatitis is important. Furthermore, ESWL is associated with a long duration of therapy because of the high number of shock waves required for stone fragmentation. Reducing the number of shock waves required for stone fragmentation could decrease the duration of therapy.

In recent years, endoscopic pancreatic stent placement has been used for the prevention of post-ERCP pancreatitis. Endoscopic pancreatic stenting is also performed to facilitate stone clearance and improve MPD strictures after ESWL. We hypothesized that endoscopic pancreatic stenting prior to ESWL (Pre-EPS) could prompt the excretion of stone fragments from the MPD and reduce the number of shock waves required for stone fragmentation and the frequency of ESWL-related pancreatitis.

On the basis of this background, we prospectively adopted Pre-EPS starting in 2008. In the present study, we retrospectively compared the number of shock waves required for stone fragmentation and ESWL-related complications between patients who underwent Pre-EPS and those who did not undergo Pre-EPS to determine the usefulness of pancreatic stenting prior to ESWL.

2. Patients and methods

2.1. Patients

ESWL was performed in 200 patients with pancreatic stones at the Nagoya City University Graduate School of Medical Sciences from January 1990 to December 2012. Ninety-three patients who received ESWL using a Dornier Lithotripter S (Dornier MedTech, Wessling, Germany) between 2004 and 2012 were enrolled in the study. Patients who received ESWL for stones <5 mm in size were excluded from this study. Patients with radiolucent stones were also excluded because we insert naso pancreatic tube before ESWL [10]. All patients had MPD stones and upstream MPD dilation. The main indication for ESWL is pancreatic pain and relative indication is preservation of exocrine or endocrine function. MPD stones and upstream dilation were detected by computed tomography (CT) or ultrasonography. Stone size was determined by CT or radiograph scans. Endoscopic retrograde pancreatography (ERP) was performed in all patients before ESWL to confirm the presence of pancreatic stones in the MPD and to determine the feasibility of removing the impacted stone fragments through the orifice or stricture of the MPD in emergency cases. We performed ESWL until stone fragmentation was confirmed by radiograph scans. Stone fragmentation was defined as a stone size of <3 mm. Endoscopic stone extraction was performed using a basket catheter and balloon after stone fragmentation by ESWL.

This research was approved by the Institutional Review Board at Nagoya City University Graduate School of Medical Sciences. Written informed consent was obtained from all patients in accordance with the Helsinki declaration.

2.2. Methods

Patients were divided into 2 groups: the Pre-EPS group and the non-Pre-EPS group (Fig. 1). The Pre-EPS group comprised those patients who underwent successful pancreatic stent placement before ESWL, and ESWL was performed with the pancreatic stent. On the other hand, the non-Pre-EPS comprised those patients who had not attempted to undergo pancreatic stent placement before ESWL. Patients with unsuccessful stent placement prior to ESWL were excluded from this study. Two periods were defined as first (2004–2010) and second (2010–2012) periods corresponding to before and after the introduction of Soehendra Stent Retriever (SSR) in patients undergoing Pre-EPS. The cumulative number of shock waves required for stone fragmentation was compared between the Pre-EPS and non-Pre-EPS groups. We also compared the cumulative number of shock waves between patients with stones ≥15 mm and those with stones <15 mm in size, and between patients with and without severe MPD stricture, diabetes, alcohol, pancreatic pseudocyst, endoscopic pancreatic sphincterotomy (EPST) and other parameters. Patients who could not achieve stone fragmentation within a consecutive period were censored in this study. The association between cumulative number of shock waves required for stone fragmentation and variables above mentioned including Pre-EPS was evaluated by univariate and multivariate analyses. In addition, the incidence of complications was compared between the Pre-EPS and non-Pre-EPS groups. Complications were divided into ERCP-related and ESWL-related complications. Complications occurring within 7 days after ERCP were defined as ERCP-related complications. Other complications occurring during the period of ESWL were defined as ESWL-related complication. Finally, we evaluated the success rate of the Pre-EPS procedure and compared the success rate of Pre-EPS between the first and second periods.

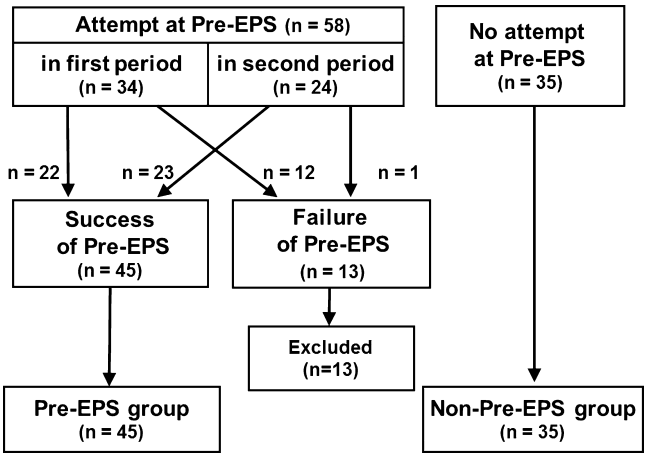

Fig. 1. Flowchart of this study (Pre-EPS, endoscopic pancreatic stenting prior to extracorporeal shock wave lithotripsy; first period, before the introduction of Soehendra Stent Retriever; second period, after the introduction of Soehendra Stent Retriever).

2.3. Pancreatic stenting prior to ESWL

ESWL was mostly performed without pancreatic stenting before 2008. After 2008, pancreatic stenting was performed prior to ESWL when possible, and the stent placement procedure was performed under conscious sedation. A hydrophilic guidewire (Jagwire; Microvasive Endoscopy, Boston Scientific Co., Natick, MA, USA or Revowave; Piolax Medical Devices Inc., Yokohama, Japan) was inserted across the pancreatic stone after EPST. A dilator catheter (Soehendra dilation catheter; Cook Endoscopy, Winston-Salem, NC, USA) was inserted across the stone or MPD stricture over the guidewire. Since 2010, patients with impacted stones or an MPD stricture that impedes the passage of the dilation catheter have been treated using a stent retriever (Soehendra Stent Retriever; Cook Endoscopy, Winston-Salem, NC, USA). Finally, 5, 7, or 10 Fr and 5, 7, 9, or 12 cm in length pancreatic stent (Geenen; Cook Endoscopy, Winston-Salem, NC, USA) was inserted across the pancreatic stone (Fig. 2).

2.4. Extracorporeal shock wave lithotripsy

The Dornier Lithotripter S is a third generation electromagnetic lithotripter. Pancreatic stones were targeted using the X-ray focusing system. The number of shock waves per session was 3000–4000 with an intensity of 20–60% and a frequency of 90–70 shots/min