PO Box 2345, Beijing 100023, China
www.wjgnet.com
wjg@wjgnet.com

World J Gastroenterol 2007 February 14; 13(6): 901-905
World Journal of Gastroenterology ISSN 1007-9327

RAPID COMMUNICATION

Endoscopic sphincterotomy in patients with stenosis of ampulla of Vater: Three-year follow-up of exocrine pancreatic function and clinical symptoms

Nils Ewald, Axel Michael Marzeion, Reinhard Georg Bretzel, Hans Ulrich Kloer, Philip Daniel Hardt

Nils Ewald, Axel Michael Marzeion, Reinhard Georg Bretzel, Hans Ulrich Kloer, Philip Daniel Hardt, Third Medical Department and Policlinic, University Hospital Giessen and Marburg, Giessen Site, D-35392 Giessen, Germany
Correspondence to: Dr. Nils Ewald, Third Medical Department and Policlinic, University Hospital Giessen and Marburg, Giessen Site, D-35392 Giessen,
Germany. nils.ewald@innere.med.uni-giessen.de
Telephone: +49-641-9942751 Fax: +49-641-9942757
Received: 2006-11-13 Accepted: 2007-01-21

Key words: Endoscopic sphincterotomy; Fecal elastase; Chronic pancreatitis; Papillary stenosis; Oddi dysfunction

Ewald N, Marzeion AM, Bretzel RG, Kloer HU, Hardt PD. Endoscopic sphincterotomy in patients with stenosis of ampulla of Vater: Three-year follow-up of exocrine pancreatic function and clinical symptoms. *World J Gastroenterol* 2007; 13(6): 901-905

http://www.wjgnet.com/1007-9327/13/901.asp

Abstract

AIM: To investigate retrospectively the long-term effect of endoscopic sphincterotomy (ES) including exocrine pancreatic function in patients with stenosis of ampulla of Vater.

METHODS: After diagnostic endoscopic retrograde cholangiopancreatography (ERCP) and ES because of stenosis of the ampulla of Vater (SOD Type Ⅰ), follow-up examinations were performed in 60 patients (mean follow-up time 37.7 mo). Patients were asked about clinical signs and symptoms at present and before intervention using a standard questionnaire. Before and after ES exocrine pancreatic function was assessed by determination of immunoreactive fecal elastase 1. Serum enzymes indicating cholestasis as well as serum lipase and amylase were measured.

RESULTS: Eighty percent of patients reported an improvement in their general condition after ES. The fecal elastase 1 concentrations (FEC) in all patients increased significantly after ES. This effect was even more marked in patients with pathologically low concentrations (< 200 μg/g) of fecal elastase prior to ES. The levels of serum lipase and amylase as well as serum alcaline phosphatase (AP) and gamma-glutamyltranspeptidase (GGT) decreased significantly after ES.

CONCLUSION: The results of this study demonstrate that patients with stenosis of the ampulla of Vater can be successfully treated with endoscopic sphincterotomy. The positive effect is not only indicated by sustained improvement of clinical symptoms and cholestasis but also by improvement of exocrine pancreatic function.

INTRODUCTION

Endoscopic sphincterotomy (ES) has been introduced as a treatment for sphincter of Oddi dysfunction (SOD)[1,2]. At least in SOD type I, which is caused by structural changes of the papilla in the majority of patients, ES is the treatment of choice[3,4]. In most of the recent papers the focus of clinical interest has been put on aspects of cholestasis.

Gallstones, bile duct microlithiasis and sludge may repeatedly induce ductal lesions leading to obstruction and stenosis of the papilla of Vater[5-7]. In addition to the resulting problems concerning the bile duct system, chronic obstruction of the papilla of Vater may also contribute to lesions of the pancreas. This might also play a role in the pathogenesis of chronic pancreatitis. Segmental or diffuse dilation of the main pancreatic duct as part of the spectrum of chronic pancreatitis has given rise to the concept of obstruction and pancreatic ductal hypertension as an important pathogenetic mechanism of chronic pancreatitis[8,9]. Data from an autopsy study also showed that the incidence of chronic pancreatitis is higher in patients with gallstones which emphasises the role of gallstones, sludge and papillary stenosis in the pathogenesis of chronic pancreatitis[10].

The former gold standard imaging technique, endoscopic retrograde cholangiopancreaticographie (ERCP), is based on ductal abnormalities. Pancreatographic changes correlate with exocrine dysfunction[11]. As an indirect pancreatic function test measurement of fecal elastase-1 concentrations (FEC) shows a 93%-100% sensitivity for moderate and 96%-100% sensitivity for severe exocrine pancreatic insufficiency as well as a specificity of 93%-98%[12,13].

The aim of this study was to investigate the long-term effects of ES not only regarding clinical symptoms

and parameters of cholestasis, but also with a focus on exocrine pancreatic function.

MATERIALS AND METHODS

Patients

Nineteen male and 41 female patients aged between 21 and 80 years (mean age 57.4 ± 15.2 years) were investigated retrospectively. The follow-up period averaged 37.7 ± 7.0 mo (ranging from 28-51 mo). The mean body mass index was 24.4 ± 4.0 kg/m² (ranging from 18.4-35.5 kg/m²).

All patients, who initially presented with signs of either cholestasis or pancreatic inflammation and abdominal complaints, underwent ERCP and endoscopic sphincterotomy (ES) in our department after giving their informed consent. The period between the first ES and follow-up averaged 37.7 mo. Follow-up consisted of assessing clinical and laboratory data of the patients before and after ES by using the patients' records and personal interviewing based on a standardized questionnaire. Patients with malignancy of the pancreas and/or the bile duct system were not included.

ERCP and ES

All patients underwent ERCP and ES in our department. All procedures were performed by one experienced investigator using standard techniques. Radiological changes of the pancreatic duct system were evaluated according to the Cambridge classification[14]. In all patients ES was performed because of SOD type 1 [clinical symptoms, laboratory findings and findings in imaging techniques (ultrasound or ERCP)]. For ES a single use precurved sphincterotome (Wilson-Cook Medical Inc., NC, USA) and a single use guidewire 0.18 inch (Medwork, Neuss, Germany) were used. ES was performed as sphincterotomy of the pancreatic and/or biliary segment of the sphincter of Oddi. Some patients underwent ES more than once because of recurrent symptoms and/or signs of cholestasis and/or pancreatic inflammation. In some cases a precut of the papilla was necessary.

Questionnaire

The questionnaire included the following items: age, sex, and body mass index (BMI). The intensity of clinical symptoms such as nausea, emesis, and quantity of abdominal pain were assessed using the visual analogue scale (0 = not present, 10 = maximum complaint).

Laboratory methods

Blood samples were taken routinely prior to and after ES and checked for the following parameters: serum lipase (normal range 20-160 U/L), serum alpha-amylase (< 53 U/L), serum aspartate aminotransferase (AST/SGOT; male 5-20, female 5-17 U/L), serum alanine aminotransferase (ALT/SGPT; male 5-23, female 5-17 U/L), alcaline phosphatase (AP; male adult 60-170 U/L, female adult 40-160 U/L), gamma-glutamyltranspeptidase (GGT; male 6-28 U/L, female 4-18 U/L), and bilirubin (< 1.0 mg/dL). Fecal elastase-1 was determined by ELISA using two monoclonal antibodies specific for human elastase-1, which bind to different epitopes of the enzyme (elastase-1 stool kit; Schebo-Biotech, Giessen, Germany). Results were expressed in μg/g stool. Values < 200 μg/g were considered to represent exocrine insufficiency, values > 200 μg/g were regarded as normal.

Table 1 ERCP findings in 60 patients

	Patients *n* (%)
Papilla	
Papillitis (chronic/acute)	20 (33)
Periampullary diverticulum	7 (12)
Pancreas	
Pancreas divisum	0
Pancreatitis Cambridge 0	2 (3)
Pancreatitis Cambridge Ⅰ	11 (18)
Pancreatitis Cambridge Ⅱ	25 (42)
Pancreatitis Cambridge Ⅲ	10 (17)
No pancreatogram	12 (20)
Bile duct system	
Cholangitis	10 (17)
Biliary sludge and stones	15 (25)
Bile duct dilation (any)	31 (52)
Common bile duct stenosis	4 (6)
Negative cholecystography	7 (12)

Table 2 Amount and kind of sphincterotomies in 60 patients

	Patients *n* (%)
Biliary sphincterotomy	35 (58)
Pancreatic spincterotomy	3 (5)
Both	22 (37)
Amount of necessary sphincterotomies	
One	34 (57)
Two	10 (17)
Three	9 (15)
Four and more	7 (12)

Statistical analysis

Results are expressed as mean ± SD and range of values if not otherwise indicated. Statistics were carried out by the Statistical Package for Social Sciences (SPSS) for Windows, version 11.01. Wilcoxon-test was performed to test for significant differences between pre-treatment and post-treatment values. $P < 0.05$ was considered statistically significant.

RESULTS

Table 1 shows findings in ERCP, Table 2 indicates the amount as well as the kind of ES (biliary/pancreatic sphincterotomy). Fifty patients (83%) showed either impaired exocrine pancreatic function (fecal elastase-1 < 200 μg/g) or were classified as Cambridge Ⅰ-Ⅲ based on radiological changes of the pancreas irrespective of the initial indication for ERCP.

Clinical symptoms

After ES, 80% of the patients reported a general relief of

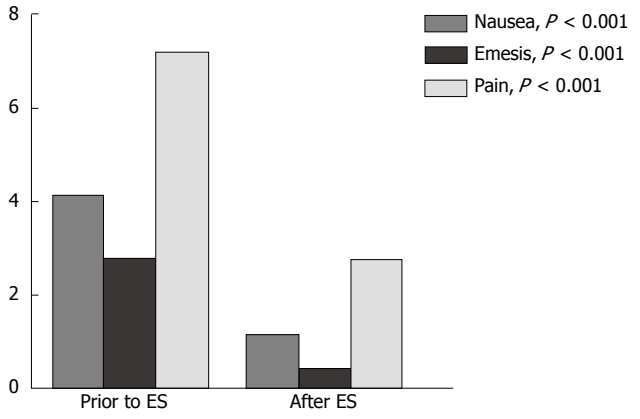

Figure 1 Clinical symptoms prior to and after endoscopic sphincterotomy due to the visual analogue scale (0 = not present, 10 = maximum complaint), *n* = 55.

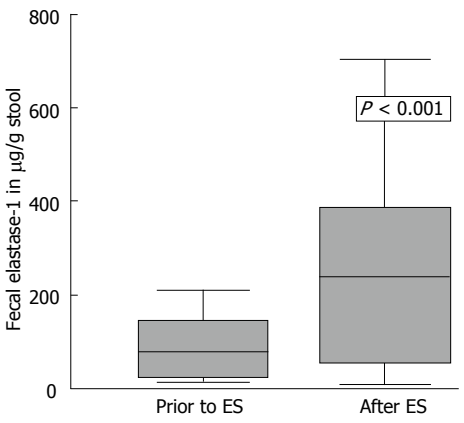

Figure 2 Levels of fecal elastase-1 of patients with initially impaired exocrine pancreatic function (< 200 μg/g; *n* = 26) prior to and after endoscopic sphincterotomy. Medians and interquartiles given.

symptoms, 6.7% reported the same general condition by their own assessment, whereas only 5.0% reported a worse condition. No data were given in 8.3% of all patients. There was a significant reduction of clinical symptoms such as nausea, emesis and abdominal pain after ES (Figure 1).

Laboratory findings

Serum enzymes indicating cholestasis such as Gamma-glutamyltranspeptidase, alcaline phosphatase and bilirubin showed a significant reduction after ES. Serum alpha-amylase and serum lipase also significantly decreased to normal levels after ES (data given in Table 3).

Exocrine pancreatic function

In all the 60 patients, fecal elastase-1 increased significantly from a mean of 264.38 ± 184.01 μg/g (range 10-741 μg/g) prior to ES to 337.05 ± 185.35 μg/g (range 10-816 μg/g) after ES ($P < 0.05$) (Figure 2). In patients with very low levels of fecal elastase-1 (< 200 μg/g) prior to ES, fecal elastase-1 rose significantly from a mean of 82.46 ± 60.22 μg/g (range 15-187 μg/g) to 253.42 ± 200.18 μg/g (range 10-705 μg/g) after ES ($P = 0.001$). In seven patients with fecal elastase-1 levels between 200 and 300 μg/g prior to ES, fecal elastase-1 increased significantly from a mean of 262 ± 36.47 μg/g (range 212-297 μg/g) prior to ES to 442.29 μg/g (range 360-610 μg/g) after ES ($P = 0.018$).

Table 3 Levels of GGT, AP, bilirubin, serum lipase and serum alpha-amylase in all patients (*n* = 60) prior to and after endoscopic sphincterotomy (mean ± SD)

	Prior to ES	After ES	*P*
GGT (U/L)	102.13 ± 146.21 (range 4-711)	41.02 ± 69.24 (range 7-337)	= 0.001
AP (U/L)	205.23 ± 214.88 (35-1645)	146.62 ± 135.2 (36-1047)	= 0.001
Bilirubin (mg/dL)	1.4 ± 2.44 (0.3-15.0)	0.65 ± 0.75 (0.1-6.0)	< 0.001
Serum lipase (U/L)	817.37 ± 1391.45 (11-7200)	29.60 ± 13.18 (6-71)	< 0.001
Serum amylase (U/L)	192.92 ± 336.44 (15-1714)	61.63 ± 19.98 (21-102)	< 0.05

ES: Endoscopic sphincerotomy.

DISCUSSION

In sphincter of Oddy dysfunction (SOD), especially in type 1 displaying structural changes of the papilla in most cases, endoscopic sphincterotomy (ES) has been introduced as a definitive treatment[3]. Most of the available research efforts focus on the beneficial effects of ES concerning clinical symptoms and parameters of cholestasis. In the present study all patients with cholestatic problems prior to ES showed an improvement after treatment. In 94% of our patients biliary sphincterotomy could effectively improve cholestasis as indicated by the normalized GGT and AP. Obviously these positive effects, lasting a mean of three years so far, are results from optimized biliary drainage without stenting. This is remarkable because pancreatobiliary drainage by endoscopic placement of an endoprothesis (needing exchange of stents at intervals of 2 to 4 mo) is accompanied with complications and shows poor long-term results[15,16].

Since papillary stenosis has been suggested to play a possible role as a pathogenetic factor in pancreatitis[6,17,18], the present study included patients with pancreatitis type symptoms and focused on changes in exocrine pancreatic function. Therapeutical approaches in patients with chronic pancreatitis aim to alleviate pain, prevent attacks of pancreatitis, reduce the effects of pancreatic insufficiency and manage complications no matter what the etiology of chronic pancreatitis might be. Medical management may include oral analgesics, enzymatic replacement, diet, and abstinence from alcohol. If obstruction of the pancreatic duct is present, invasive options must be considered. Endoscopic therapeutic techniques such as insertion of endoprothesis, balloon or catheter dilation or sphincterotomy are applied increasingly[19]. The facilitation of pancreatic ductal drainage should lead to a reduction of ductal pressure which is the rationale for the endoscopic intervention. The exact role of increased pressure in the pancreatic ductal system in the pathogenesis of chronic pancreatitis is not known, although elevated pressures have been documented in different animal models and human beings[20-22]. It was reported that patients with chronic pancreatitis and pain have higher main pancreatic duct pressures than controls and experience pain relief after surgical decompression[23]. Cholelithiasis, bile duct microlithiasis and biliary sludge might induce

papillitis or papillary stenosis followed by recurrent or permanent elevation of pancreatic ductal pressure with the consequence of chronic pancreatitis. This role of cholelithiasis and sludge in the pathogenesis of chronic pancreatitis still remains a controversy. However, several reports indicate that in patients who are thought to have 'idiopathic' pancreatitis, bile duct microlithiasis, sludge and bile crystals may account for the pancreatitis[24-28]. There are individual reports on patients with sphincter of Oddi dysfunction or stenosis and recurrent episodes of pancreatitis which have been treated successfully with sphincterotomy.

In this study the long term effect of ES on pancreatic function and clinical symptoms of 60 patients with stenosis of ampulla of Vater was investigated. Regarding the clinical symptoms such as abdominal pain, nausea and emesis, most of our patients (80%) experienced a long-term improvement after ES. In the majority of patients we could also observe an improvement of exocrine pancreatic function as measured by FEC. It must be stressed that the follow-up study was performed at least 28 mo (maximum 51 mo) after endoscopic treatment. Other studies have reported similar immediate symptomatic improvements in patients who underwent dilation of the pancreatic duct followed by placement of an endoprothesis, but the long-term results are not very promising as symptomatic stent occlusion often occurs[15,29]. As reported elsewhere[30], in some of our patients several sphincterotomies (up to six) had to be performed, if symptoms and pathological laboratory findings persisted. It appears possible, that recurrent cholestasis or clinical symptoms can be caused by papillary restenosis which is a known complication of sphincterotomy, usually occurring years after intervention[31]. We think that the patients' long-term clinical improvement concerning pancreatic pathology is due to a decrease of pancreatic ductal pressure after overcoming the underlying pathogenetic factor of papillary stenosis. Few of our patients (11.7%) reported no improvement or even aggravation in their clinical condition after ES. Most of these cases were classified as chronic pancreatitis Ⅲ according to the Cambridge-Classification. They showed persisting impaired exocrine pancreatic function after ES indicated by persisting reduced FEC. This sub-group of patients had proven advanced structural and functional abnormalities, which were probably progressive and irreversible. Since pain is often a cardinal symptom of chronic pancreatitis, many studies focus on it beside other clinical symptoms when judging the effect of treatment. This is the first time that the effect of endoscopic spincterotomy on exocrine pancreatic function based on fecal elastase-1 was investigated. In summary, all patients showed a significant increase in fecal elastase-1 levels after ES, which was even more marked in patients with pathologically low concentrations of fecal elastase-1 prior to ES, indicating that endoscopic sphincterotomy has positive effects on exocrine pancreatic function. A similar effect was found in patients with low, but still normal fecal elastase-1 levels (200-300 μg/g) prior to ES. The results are due to effective treatment of the underlying ethiological factor which leads to normalized ductal pressure of the pancreas and regeneration of pancreatic parenchyma. In contrast to the common belief of irreversibel structural and functional impairment of the pancreas in chronic pancreatitis, the findings of the present study confirm that there is at least a subset of patients with chronic pancreatitis in which a recovery of functional capacity is possible[32].

In conclusion, patients with stenosis of the ampulla of Vater can be successfully treated with endoscopic sphincterotomy. The positive effect is indicated not only by sustained improvement of biliary type clinical symptoms and laboratory markers of cholestasis, but also by improvement of exocrine pancreatic function and pancreatitis type clinical symptoms. Without question there is a need for prospective, randomized, controlled trials which investigate endoscopic sphincterotomy versus pancreatobiliary stenting and conservative medical therapy in chronic pancreatitis.

COMMENTS

Background

Endoscopic sphincterotomy has been introduced as a treatment for sphincter of Oddi dysfunction. In most recent papers the focus of clinical interest has been put on aspects of cholestasis. In addition to the resulting problems concerning the bile duct system, chronic obstruction of the papilla of Vater may also contribute to lesions of the pancreas, and may also play a role in the pathogenesis of chronic pancreatitis. The aim of this study was to investigate the long-term effects of ES not only on clinical symptoms and parameters of cholestasis, but also on exocrine pancreatic function.

Innovations and breakthroughs

The study showed that patients with stenosis of the ampulla of Vater could be successfully treated with endoscopic sphincterotomy. The positive effect was indicated not only by sustained improvement of biliary type clinical symptoms and laboratory markers of cholestasis, but also by improvement of exocrine pancreatic function and pancreatitis type clinical symptoms. The improvement in exocrine pancreatic function and pancreatic regeneration after endoscopic sphincterotomy is remarkable.

Applications

There is a definite need for prospective, randomized, controlled trials which investigate endoscopic sphincterotomy versus pancreatobiliary stenting and conservative medical therapy in chronic pancreatitis.

Terminology

Sphincter of Oddi dysfunction (SOD): Sphincter of Oddi dysfunction refers to structural or functional disorders involving the sphincter of Oddi that may result in impedance of bile and pancreatic juice flow. Geenen *et al* have divided SOD patients into three types. Type Ⅰ patients exhibit all three criteria (biliary pain, abnormal liver serology and bile duct dilation). Type Ⅱ patients have typical biliary pain and either abnormal liver serology or dilation of the bile duct, but not both. In type Ⅲ patients, the extrahepatic bile duct is not dilated, and abnormal liver serology is not found, whereas pain is present.

Peer review

The authors retrospectively audited a series of 60 patients with stenosis of the ampulla Vater (SOD) who had undergone endoscopic sphincterotomy (ES) and their 3-year follow-up concerning symptom improvement & pancreatic exocrine function. I agree with the acceptance of this manuscript for publication in the WJG.

REFERENCES

1 **Hogan WJ**, Geenen JE. Biliary dyskinesia. *Endoscopy* 1988; **20** Suppl 1: 179-183

2 **Sugawa C**, Park DH, Lucas CE, Higuchi D, Ukawa K. Endoscopic sphincterotomy for stenosis of the sphincter of Oddi. *Surg Endosc* 2001; **15**: 1004-1007

3 **NIH state-of-the-science statement on endoscopic retrograde cholangiopancreatography (ERCP) for diagnosis and therapy**. *NIH Consens State Sci Statements* 2002; **19**: 1-26
4 **Bistritz L**, Bain VG. Sphincter of Oddi dysfunction: managing the patient with chronic biliary pain. *World J Gastroenterol* 2006; **12**: 3793-3802
5 **Bernhard JP**, Laugier R. The pathogenesis of chronic pancreatitis. In: Johnson CD, Imrie CW, editors. Pancreatic disease: progress and prospects. Berlin: Springer Verlag, 1991: 185-193
6 **Tarnasky PR**, Hoffman B, Aabakken L, Knapple WL, Coyle W, Pineau B, Cunningham JT, Cotton PB, Hawes RH. Sphincter of Oddi dysfunction is associated with chronic pancreatitis. *Am J Gastroenterol* 1997; **92**: 1125-1129
7 **Ros E**, Navarro S, Bru C, Garcia-Pugés A, Valderrama R. Occult microlithiasis in 'idiopathic' acute pancreatitis: prevention of relapses by cholecystectomy or ursodeoxycholic acid therapy. *Gastroenterology* 1991; **101**: 1701-1709
8 **Karanjia ND**, Singh SM, Widdison AL, Lutrin FJ, Reber HA. Pancreatic ductal and interstitial pressures in cats with chronic pancreatitis. *Dig Dis Sci* 1992; **37**: 268-273
9 **Okazaki K**, Yamamoto Y, Nishimori I, Nishioka T, Kagiyama S, Tamura S, Sakamoto Y, Nakazawa Y, Morita M, Yamamoto Y. Motility of the sphincter of Oddi and pancreatic main ductal pressure in patients with alcoholic, gallstone-associated, and idiopathic chronic pancreatitis. *Am J Gastroenterol* 1988; **83**: 820-826
10 **Olsen TS**. The incidence and clinical relevance of chronic inflammation in the pancreas in autopsy material. *Acta Pathol Microbiol Scand A* 1978; **86**A: 361-365
11 **Bozkurt T**, Braun U, Leferink S, Gilly G, Lux G. Comparison of pancreatic morphology and exocrine functional impairment in patients with chronic pancreatitis. *Gut* 1994; **35**: 1132-1136
12 **Löser C**, Möllgaard A, Fölsch UR. Faecal elastase 1: a novel, highly sensitive, and specific tubeless pancreatic function test. *Gut* 1996; **39**: 580-586
13 **Stein J**, Jung M, Sziegoleit A, Zeuzem S, Caspary WF, Lembcke B. Immunoreactive elastase I: clinical evaluation of a new noninvasive test of pancreatic function. *Clin Chem* 1996; **42**: 222-226
14 **Sarner M**, Cotton PB. Classification of pancreatitis. *Gut* 1984; **25**: 756-759
15 **Smits ME**, Badiga SM, Rauws EA, Tytgat GN, Huibregtse K. Long-term results of pancreatic stents in chronic pancreatitis. *Gastrointest Endosc* 1995; **42**: 461-467
16 **Devière J**, Devaere S, Baize M, Cremer M. Endoscopic bili**ary** drainage in chronic pancreatitis. *Gastrointest Endosc* 1990; **36**: 96-100
17 **Cattell RB**, Colcock BP, Pollack JL. Stenosis of the sphincter of Oddi. *N Engl J Med* 1957; **256**: 429-435
18 **Doubilet H**, mulholland JH. Eight-year study of pancreatitis and sphincterotomy. *J Am Med Assoc* 1956; **160**: 521-528
19 **Geenen JE,** Rolny P. Endoscopic therapy of acute and chronic pancreatitis. *Gastrointest Endosc* 1991; **37**: 377-382
20 **Bradley EL.** Pancreatic duct pressure in chronic pancreatitis. *Am J Surg* 1982; **144**: 313-316
21 **Binmoeller KF**, Rathod VD, Soehendra N. Endoscopic therapy of pancreatic strictures. *Gastrointest Endosc Clin N Am* 1998; **8**: 125-142
22 **Frey CF**, Smith GJ. Description and rationale of a new operation for chronic pancreatitis. *Pancreas* 1987; **2**: 701-707
23 **Nealon WH**, Townsend CM, Thompson JC. Operative drainage of the pancreatic duct delays functional impairment in patients with chronic pancreatitis. A prospective analysis. *Ann Surg* 1988; **208**: 321-329
24 **Feller ER**. Endoscopic retrograde cholangiopancreatography in the diagnosis of unexplained pancreatitis. *Arch Intern Med* 1984; **144**: 1797-1799
25 **Lee SP**, Nicholls JF, Park HZ. Biliary sludge as a cause of acute pancreatitis. *N Engl J Med* 1992; **326**: 589-593
26 **Marotta PJ**, Gregor JC, Taves DH. Biliary sludge: a risk factor for 'idiopathic' pancreatitis? *Can J Gastroenterol* 1996; **10**: 385-388
27 **Testoni PA**, Caporuscio S, Bagnolo F, Lella F. Idiopathic recurrent pancreatitis: long-term results after ERCP, endoscopic sphincterotomy, or ursodeoxycholic acid treatment. *Am J Gastroenterol* 2000; **95**: 1702-1707
28 **Ponchon T**, Bory RM, Hedelius F, Roubein LD, Paliard P, Napoleon B, Chavaillon A. Endoscopic stenting for pain relief in chronic pancreatitis: results of a standardized protocol. *Gastrointest Endosc* 1995; **42**: 452-456
29 **Binmoeller KF**, Jue P, Seifert H, Nam WC, Izbicki J, Soehendra N. Endoscopic pancreatic stent drainage in chronic pancreatitis and a dominant stricture: long-term results. *Endoscopy* 1995; **27**: 638-644
30 **Elton E**, Howell DA, Parsons WG, Qaseem T, Hanson BL. Endoscopic pancreatic sphincterotomy: indications, outcome, and a safe stentless technique. *Gastrointest Endosc* 1998; **47**: 240-249
31 **Freeman ML**, Nelson DB, Sherman S, Haber GB, Herman ME, Dorsher PJ, Moore JP, Fennerty MB, Ryan ME, Shaw MJ, Lande JD, Pheley AM. Complications of endoscopic biliary sphincterotomy. *N Engl J Med* 1996; **335**: 909-918
32 **Mergener K**, Baillie J. Chronic pancreatitis. *Lancet* 1997; **350**: 1379-138**5**

S- Editor Liu Y **L- Editor** Wang XL **E- Editor** Lu W