

BRIEF ARTICLES

A survey of ampullectomy practices

Stacy B Menees, Philip Schoenfeld, Hyungjin Myra Kim, Grace H Elta

Stacy B Menees, Eastern Virginia Medical School, Norfolk, Virginia 23502, United States

Philip Schoenfeld, Grace H Elta, Division of Gastroenterology, University of Michigan, Ann Arbor, MI 48109, United States

Hyungjin Myra Kim, VA Health Services & Research Department, Ann Arbor, MI; Center for Statistical Consultation and Research, University of Michigan, Ann Arbor, MI 48109, United States

Author contributions: Menees SB performed the research, collected the data, and wrote the paper; Schoenfeld P and Elta GH edited the paper; Kim HM analyzed the data and edited the paper.

Correspondence to: Stacy B Menees, MD, Eastern Virginia Medical School, 885 Kempsville Rd, Suite 114, Norfolk, Virginia 23502, United States. sbartnik@gmail.com

Telephone: +1-757-9611104 Fax: +1-757-4669082
Received: March 19, 2009 Revised: June 24, 2009

Accepted: July 1, 2009

Published online: July 28, 2009

CONCLUSION: Among biliary experts, there is less variation in ampullectomy practices than is reflected in the literature.

© 2009 The WJG Press and Baishideng. All rights reserved.

Key words: Endoscopic retrograde cholangiopancreatography; Ampullectomy; Papillectomy; Ampulla of Vater, Common bile duct neoplasms; Adenoma

Peer reviewer: Jin-Hong Kim, Professor, Department of Gastroenterology, Ajou University Hospital, San 5, Wonchondong, Yeongtong-gu, Suwon 442-721, South Korea

Menees SB, Schoenfeld P, Kim HM, Elta GH. A survey of ampullectomy practices. *World J Gastroenterol* 2009; 15(28): 3486-3492 Available from: URL: <http://www.wjgnet.com/1007-9327/15/3486.asp> DOI: <http://dx.doi.org/10.3748/wjg.15.3486>

Abstract

AIM: To investigate the endoscopic ampullectomy practices of expert biliary endoscopists.

METHODS: An anonymous survey was mailed to 79 expert biliary endoscopists to assess ampullectomy practices.

RESULTS: Forty six (58%) biliary endoscopists returned the questionnaire. Of these, 63% were in academia and in practice for an average of 16.4 years (± 8.6). Endoscopists performed an average of 1.1 (± 0.8) ampullectomies per month. Prior to ampullectomy, endoscopic ultrasound was "always" utilized by 67% of respondents *vs* "sometimes" in 31% of respondents. Empiric biliary sphincterotomy was not utilized uniformly, only 26% "always" and 37% "sometimes" performed it prior to resection. Fifty three percent reported "never" performing empiric pancreatic sphincterotomy prior to ampullectomy. Practitioners with high endoscopic retrograde cholangiopancreatography volumes were the most likely to perform a pancreatic sphincterotomy (OR = 10.9; $P = 0.09$). Participants overwhelmingly favored "always" placing a prophylactic pancreatic stent, with 86% placing it after ampullectomy rather than prior to resection (23%). Argon plasma coagulation was the favored adjunct modality (83%) for removal of residual adenomatous tissue. Practitioners uniformly (100%) preferred follow-up examination to be within 6 mo post-ampullectomy.

INTRODUCTION

Ampullary tumors account for approximately 5% of all gastrointestinal neoplasms^[1]. In autopsy series, these tumors are seen in 0.04%-0.64% of the general population^[2,3]. The most commonly affected patients are those with familial adenomatous polyposis with a 50%-100% lifetime incidence of peri-ampullary adenomas^[4-6]. Given that the adenoma-carcinoma sequence for ampullary adenomas follows a similar progression to that of colorectal cancer, there is a need for prophylactic removal^[7]. However, the associated morbidity and mortality of surgical resection for ampullary adenomas have led clinicians to seek less invasive techniques. Endoscopic ampullectomy was first described in the 1980s^[8-10]. Since then, numerous case and cohort series of ampullectomies, both retrospective and prospective, have been reported^[11-19]. The first prospective, randomized, controlled trial of the use of prophylactic pancreatic duct stenting for endoscopic ampullectomy was published in 2005^[20]. The trial was prematurely terminated because of an elevated incidence of pancreatitis in the unscented group (33% *vs* 0%) and suggested that pancreatic stent placement confers a protective effect.

Endoscopic ampullectomy guidelines have not been established. Desilets *et al*^[14] performed endoscopic ampullectomy only in tumors less than 4.0 cm in size without induration/ulceration, and with the ability to be lifted by saline solution/epinephrine injection in the absence of

extension or stricturing into the pancreatic or biliary ducts. Similarly, Cheng *et al*^{18]} performed endoscopic ampullectomy in lesions less than 4.5 cm without endoscopic or pathologic evidence of malignancy and a soft consistency on palpation with any device. A recent editorial by Baillie *et al*^{21]} suggested a tumor size greater than 3 cm requires endoscopic ultrasound (EUS) assessment prior to ampullectomy. However, a recent literature review continues to reveal diverse endoscopic practices regarding the use of biliary/pancreatic sphincterotomy, use and timing of pancreatic stenting, thermal ablation therapy and follow-up in ampullectomy^{22]}. The majority of the literature guiding ampullectomy practice is comprised of case reports, retrospective and prospective clinical series, except for the aforementioned randomized, controlled trial by Harewood *et al*^{20]}. Subsequently, a consensus for endoscopic ampullectomy practices has not been established. In this respect, it is helpful to assess opinions on endoscopic ampullectomy practices in that it may set priorities for future research. Also, this type of data could be helpful for guideline development. Therefore, we surveyed expert biliary endoscopists on their endoscopic ampullectomy techniques to determine if a consensus exists in ampullectomy practice.

MATERIALS AND METHODS

Sample population

Seventy-nine expert biliary endoscopists were identified by the investigators, representing 55 medical centers in 33 States and Canada. Expert biliary endoscopists were identified by selecting the primary biliary endoscopists at tertiary care centers with a medium or large gastroenterology fellowship (2 or more fellows per year) ($n = 52$). Additional expert biliary endoscopists ($n = 27$) from private practice were selected based on the senior investigator's (G.E.) knowledge. No surveys were distributed at the sponsoring institution (University of Michigan and the Ann Arbor Veterans Affairs hospital). By utilizing biliary endoscopists from gastroenterology fellowship training institutions our study was likely to reflect routine gastroenterology practice since trainees tend to have similar practice patterns as their teachers.

Survey methods

An anonymous survey was sent to 79 potential respondents from May 2006 through October 2006. A self-addressed envelope was included with the survey to facilitate survey return. After 6 wk, a second survey was sent out to obtain results from endoscopists who did not respond initially with instructions to ignore the second mailing if they had already submitted the survey.

The survey instrument (Table 1) was composed of 16 questions based on an extensive literature review which identified diverse endoscopic ampullectomy practices. We performed an extensive literature search to identify endoscopic ampullectomy practices using the following search terms: ampullectomy, papillectomy, endoscopic ampullectomy/papillectomy, ampulla of Vater, major duodenal papilla and endoscopic retrograde

Table 1 Ampullectomy survey

1	Please list your age.
2	Gender: Male Female
3	Please specify your type of practice? Private practice Multi-specialty group Academic practice Health maintenance organization (HMO) Other
4	How many years have you been in practice?
5	On average, how many ERCPs do you perform in a month?
6	On average, how many ampullectomies for ampullary adenomas do you perform in a month?
7	How often do you perform an EUS or IDUS of the ampulla prior to ampullectomy? Always Sometimes-if there are concerning features known ahead of time Never
8	How often do you perform an empiric biliary sphincterotomy prior to ampullectomy? Always Sometimes Never
9	How often do you perform an empiric pancreatic sphincterotomy prior to ampullectomy? Always Sometimes Never
10	How often do you place a prophylactic pancreatic stent prior to ampullectomy? Always Sometimes Never
11	How often do you place a prophylactic stent after ampullectomy? Always Never Only if there is delayed pancreatic duct drainage or a remnant lesion close to the pancreatic orifice that needs additional treatment
12	How often do you perform a submucosal injection of the ampullary adenoma prior to resection? Always Sometimes Never
13	For endoscopic ampullectomy, what type of electro-surgical currents do you use most often? Pure coagulation current Blended current Pure cutting current ERBE-adjustable current
14	What is the largest ampullary adenoma that you have removed endoscopically?
15	What adjunct modality do you use most commonly to remove residual tissue after ampullectomy? Cold forceps biopsy Argon plasma coagulation Monopolar/multipolar electrocoagulation probe Nd: YAG laser photoablation
16	In general, after ampullectomy, at what interval do you recommend a follow-up endoscopic examination? 1 mo 3 mo 6 mo 12 mo

cholangiopancreatography (ERCP). Based upon the results of this literature search, we determined diverse approaches to the following practices: use of EUS, timing of pancreatic stent placement, pre-ampullectomy biliary sphincterotomy and pancreatic sphincterotomy, type of electro-surgical currents used, type of adjunct modality for residual tumor removal and interval for follow-up. In order

Table 2 Respondent characteristics (mean \pm SD)

Characteristic	
Male, <i>n</i> (%)	46 (100)
Practice type, <i>n</i> (%)	
Academic	29 (63)
Private	14 (30)
Multi-specialty group	3 (7)
Years in practice	16.4 \pm 8.6
ERCPs per month	36.78 \pm 26.2
Ampullectomies per month	1.1 \pm 0.8

ERCP: Endoscopic retrograde cholangiopancreatography.

to establish content validity, the results of this literature search were used to develop a draft questionnaire which was then reviewed by expert biliary endoscopists at the University of Michigan, followed by revision of the survey instrument. Since an adequate sample of expert biliary endoscopists were not available, test-retest reliability of the survey instrument could not be performed.

The study was approved by the Institutional Review Board (IRB) at the University of Michigan. In accordance to standard IRB guidelines, the need for documentation of informed consent was waived because of survey's anonymity.

Statistical analysis

All returned surveys were included in the analysis, regardless of the completeness of the survey. Percentage calculations were performed to determine if there were variations among expert biliary endoscopists in ampullectomy practices, including the use of biliary sphincterotomy, pancreatic sphincterotomy, timing of placement of pancreatic stents, use of submucosal injection, adjunctive ablative therapies and EUS. Multivariate models were used to determine if ampullectomy practices varied by academic or private practice and by volume of ERCPs. Since our ampullectomy practice data were collected as 3-level categories of "always", "sometimes" or "never", we first used multinomial logistic regression models for the 3-level outcomes and followed with logistic regression models for 2-level outcomes after collapsing the 3 levels into appropriate 2 levels. Given that the volume of ERCPs was highly skewed to the right, we considered this in various ways: as the number of ERCPs performed per month, as the number categorized into intervals (\leq 20, 20-40, 40-60, $>$ 60 per month), and as the number dichotomized to high ($>$ 10 per month) versus low volume^[23]. All statistical analyses were done using STATA 9.2 (StataCorp LP, College Station).

RESULTS

Demographic data

Forty-six respondents completed and returned the survey (58% response rate). Two-thirds of participants were from an academic medical practice. All respondents were male. Respondents had been in practice for a mean of 16.4 years (\pm 8.6 SD) at the time of the survey. There was

Table 3 Pre-ampullectomy practices

Practice	<i>n</i> (%)
EUS	
Always	30 (67)
Sometimes	14 (31)
Never	1 (2)
Biliary sphincterotomy	
Always	11 (26)
Sometimes	16 (37)
Never	16 (37)
Pancreatic sphincterotomy	
Always	10 (23)
Sometimes	10 (23)
Never	23 (53)
Pancreatic stent	
Always	10 (23)
Sometimes	15 (35)
Never	18 (42)
Submucosal injection	
Always	5 (12)
Sometimes	21 (49)
Never	17 (39)

EUS: Endoscopic ultrasound.

a wide range in ERCP volume among respondents (ranging from 5 to 135 ERCPs per month) with an average of 36.7 (\pm 26.2, median = 30) ERCPs per month. One respondent stated that he no longer performed ERCPs. Thirty-nine (85%) reported a high volume ($>$ 10) of ERCPs per month. Participants reported an average of 1.1 (\pm 0.79) ampullectomies per month (Table 2).

Practices performed prior to ampullectomy

Prior to ampullectomy, 67% of participants "always" used EUS to correctly assess tumor infiltration, 31% "sometimes" used EUS prior to ampullectomy, while only 2% "never" used EUS regularly. To maximally expose the affected ampullary epithelium, 26% of the respondents "always" performed biliary sphincterotomy and 23% "always" performed pancreatic sphincterotomy prior to resection. However, 53% of participants "never" performed pancreatic sphincterotomy and 37% "never" performed biliary sphincterotomy prior to ampullectomy. Only 12% of respondents "always" utilized submucosal injection of the ampullary adenoma to decrease the depth of thermal injury to the duodenal wall, while 49% and 39% of participants "sometimes" and "never" utilized this technique, respectively. For endoscopic ampullectomy, the most common type of electro-surgical current utilized was ERBE (67%) and blended current (17%) (Table 3).

Pancreatic stenting

For both pre- and post-ampullectomy, 98% of respondents reported placing a prophylactic pancreatic stent. A majority of participants (86%) favored "always" placing a pancreatic stent after resection. Some overlap in practice was identified with our 2 separate questions assessing the specific timing of pancreatic stent placement. Twenty-three percent of respondents always placed a pancreatic stent prior to resection, 35% "sometimes"

Table 4 Post-ampullectomy practices

Practice	n (%)
Pancreatic stent	
Always	37 (86)
Sometimes	4 (9)
Never	2 (4)
Adjunct therapy ¹	
APC	35 (83)
Multi/monopolar	3 (7)
Nd-Yag	1 (2)
Cold biopsy	3 (7)
Follow-up ²	
One month	6 (16)
Three months	21 (55)
Six months	11 (29)
One year	0 (0)

¹One respondent who checked both argon plasma coagulation (APC) and multipolar/monopolar electrocoagulation probe is not included here; ²Four respondents who checked 2 follow-up intervals are not included here. They each checked 1 and 6 mo, 3 mo and 1 year, 1 and 3 mo, 3 and 6 mo.

placed a pancreatic stent prior to ampullectomy whereas 42% “never” placed a pancreatic stent prior to resection.

Practices performed after ampullectomy

The most frequently used adjunct modality to remove residual tissue post-ampullectomy was Argon Plasma Coagulation (83%). Follow-up examination at 3 mo was the most common time frame chosen (55%) by expert biliary endoscopists. Repeat examination at 6 mo (29%) and 1 mo (16%) were less frequently used. The largest reported adenoma removed by experts was 8.0 cm (Table 4).

Predictors of ampullectomy practices

Academic vs non-academic: Multinomial logistic regression showed that for empiric biliary sphincterotomy, the relationships between factors associated with a response of “sometimes” were similar to those associated with “never”. On the other hand, for pancreatic sphincterotomy, the relationships between factors associated with “always” were similar to “sometimes”. Thus for biliary sphincterotomy, we dichotomized the practice responses to “always” vs “sometimes or never”, while for pancreatic sphincterotomy, we dichotomized the responses to “always or sometimes” vs “never”. Logistic regression analysis showed that after controlling for years in practice and high ERCP volume, an odds of “always” doing empiric biliary sphincterotomy was 0.22 (95% CI = 0.05, 1.04; $P = 0.06$) for academic relative to private physicians, and an odds of “always or sometimes” doing empiric pancreatic sphincterotomy was 0.23 (95% CI = 0.05, 1.04; $P = 0.06$) for academic relative to private physicians. These indicated that academic practitioners tended to be less likely to do sphincterotomy than non-academic practitioners. Regarding prophylactic stenting, academic practitioners tended to be less likely to “always” do pre-ampullectomy prophylactic pancreatic stenting (OR = 0.42; $P = 0.28$), while they tended to be more likely to “always” do post-ampullectomy prophylactic

pancreatic stenting (OR = 2.1; $P = 0.45$); however, these differences between academic vs private physicians were not statistically significant. Of the 18 practitioners who “never” placed a prophylactic pancreatic stent prior to ampullectomy, 17 “always” placed a prophylactic pancreatic stent after ampullectomy and only 1 “never” placed a prophylactic pancreatic stent after ampullectomy. These findings emphasize that regardless of the timing, almost all respondents utilized pancreatic stenting.

Volume of ERCPs

ERCP volumes were not associated with practice variation in empiric biliary sphincterotomy, but practitioners with high volumes of ERCPs (> 8 per month) tended to be more likely to “always or sometimes” do empiric pancreatic sphincterotomy (OR = 10.9; $P = 0.09$), controlling for academic status and years in practice. Practitioners with high volumes of ERCPs were also significantly less likely to “always” place prophylactic pancreatic stents prior to ampullectomy (OR = 0.08; $P = 0.04$), and more likely to “always” place prophylactic pancreatic stents after ampullectomy (OR = 12.8; $P = 0.06$).

DISCUSSION

This research describes the most commonly used endoscopic ampullectomy techniques by expert biliary endoscopists. This survey raises some interesting findings about current practices, showing some uniformity by expert endoscopists, which is important for future guideline development. For other practices, there is more variability. Therefore, these practices should be studied in prospective trials to help refine the best practice for our patients. In this regard, our survey has helped to identify key questions for future studies.

Universal agreement among participants regarding the use of prophylactic pancreatic stenting for ampullectomy was seen. This corresponds to findings by Brackbill *et al*²⁴ where 100% of respondents utilized prophylactic pancreatic stenting when performing ampullectomy. Previously, in some retrospective case series, prophylactic pancreatic stenting was performed only in the setting of delayed pancreatic duct drainage^[11,15,16,19]. However, recent findings by Harewood *et al*²⁰ showing a markedly reduced rate of pancreatitis in those receiving prophylactic pancreatic stenting. Prophylactic pancreatic stenting was most commonly performed after ampullectomy by our expert biliary endoscopists. An argument against pre-ampullectomy pancreatic stenting is that it precludes *en bloc* removal of the adenomatous tissue by practitioners who favor complete transection of the polyp with a snare, rather than piecemeal resection. Only a minority of our respondents placed pancreatic stents prior to ampullectomy. For some practitioners, the possibility of not being able to find the pancreatic duct post-resection, and the increased risk of post-ampullectomy pancreatitis without a pancreatic stent may dictate their practice of pre-ampullectomy stent placement. To alleviate this concern, endoscopists may also consider wire placement in the pancreatic duct before ampullectomy, with snare

resection over the wire as an option.

EUS is frequently utilized by biliary experts prior to resection. EUS has the benefits of assessing the depth of tumoral infiltration with 70%-90% accuracy since endoscopic biopsies are not always reliable because of sampling error^[25-31]. Size and characteristics of the ampullary tumor (evidence of ulceration, friability or spontaneous bleeding) should determine the need for EUS. Baillie suggested that EUS should be performed in large lesions to determine the need for surgery^[32]. If concerning findings are noted, it obviates the need for endoscopic therapy. In the literature, there has been concern about overstaging the tumor with EUS. Desilets *et al*^[14] felt that the suspicion for invasive disease is more accurately predicted by the behavior of the lesion with submucosal injection and careful evaluation of the cholangiogram and pancreatogram. Adding fine needle aspiration at the time of EUS is also a consideration. Defrain *et al* found adenocarcinoma in lesions ranging in size of 1.3-3.0 cm with sensitivity, specificity, positive and negative predictive values of 82.4%, 100%, 100% and 76.9%, respectively.

Endoscopic biliary and pancreatic sphincterotomy is utilized to assess ductal involvement prior to ampullectomy. In the literature, the use of biliary sphincterotomy prior to ampullectomy is not well defined. Ideally, biliary sphincterotomy maximally exposes the affected ampullary epithelium, aiding in future surveillance and preventing biliary stenosis. In the 2 largest series reporting ampullectomy outcomes, both reported using biliary sphincterotomy at the discretion of the endoscopists, although this was not well defined^[18,33]. In other series, authors always performed biliary sphincterotomy in patients undergoing ampullectomy^[13-16,19,20]. However, in a recent "Expert's Corner" on endoscopic ampullectomy, biliary sphincterotomy was not mentioned^[32]. Auira *et al*^[34] argued against biliary sphincterotomy since it carries the risk of bleeding, may interfere with *en bloc* resection and has the theoretical risk of seeding malignant cells present within the tumor. Unlike biliary sphincterotomy, the routine use of pancreatic sphincterotomy prior to ampullectomy has been advocated in the literature^[14,19,32]. Our respondents utilized pancreatic sphincterotomy less frequently than biliary sphincterotomy prior to ampullectomy. However, Desilets *et al*^[14], Kahaleh *et al*^[19], and Baillie^[32] all preferred pre-ampullectomy pancreatic sphincterotomy. The pancreatic sphincterotomy techniques that Desilets *et al*^[14] described were wire-guided, involving sphincterotomies extending into normal duodenal tissue within the limits of safety. This was performed to further isolate the lesion, to remove the pancreatic orifice from the resection site and to ensure adequate drainage post-resection. Kahaleh and Baillie go on to further specify performing the pancreatic sphincterotomy solely with pure cutting current^[19,32]. Our respondents with a high volume of ERCP were more likely to perform pre-resection sphincterotomy. However, Lee *et al*^[35] questioned the use of pre-resection pancreatic sphincterotomy because of the higher risk of bleeding

with papillary tumors, and the distortion of the resected specimen resulting from mechanical and thermal injury, making histopathologic interpretation of the lesion difficult.

Submucosal injection prior to ampullectomy has been recommended by some authors^[14,19,36]. The technique is performed to separate the tumor from the muscularis propria. As a submucosal cushion, the fluid prevents deeper coagulation into the duodenal wall and theoretically reduces the risk of perforation and pancreatitis^[37,38]. Epinephrine is added to prevent bleeding. Another benefit of submucosal injection is that it can serve as an indicator of malignancy. Lack of elevation with injection suggests invasive tumor growth. However, submucosal injection may actually impede optimal snare placement. This can be seen particularly in smaller tumors since the center of these lesions are tethered by the ducts and may not lift well. The surrounding normal tissue will lift and mushroom around the adenoma, thus partially burying it^[36]. However, few respondents "always" performed this technique prior to ampullectomy. Factors determining when 48% of practitioners "sometimes" utilized submucosal injection were not defined.

Our study has several potential limitations. First, because of our study population, our findings may not apply to other practice settings. Unfortunately, a strict definition for "expert biliary endoscopists" does not exist. We therefore relied on the personal knowledge of leaders in the field to choose our sample population. This was the same method utilized by Brackbill *et al*^[24]; however, we expanded the field to include more community gastroenterologists. Recall bias may also be present in these data since we are relying on self-reported data. There is also the possibility that our results may reflect what the respondents think they should do versus what they actually do in everyday practice.

In endoscopic ampullectomy, experts agreed (> 50%) on the use of EUS for large lesions, prophylactic pancreatic stenting, follow-up examination and adjunct modality for residual tissue removal. Few respondents used empiric pancreatic sphincterotomy. Practitioners with high volumes were more likely to "always" perform biliary and pancreatic sphincterotomy and place pancreatic stents after ampullectomy. Among biliary experts, there was less variation in ampullectomy practices than is reflected in the literature.

COMMENTS

Background

Ampullary tumors account for 5% of gastrointestinal neoplasms. Because of the morbidity and mortality associated with surgery, endoscopic retrograde cholangiopancreatography (ERCP) has been utilized as a less invasive procedure to perform an ampullectomy for removal of the ampullary tumor. Specific endoscopic guidelines for ampullectomy have not been established.

Research frontiers

Endoscopic ampullectomy has been reported widely in case reports and case series. Further study needs to be dedicated to the techniques involved in ampullectomy, in particular the use of biliary and pancreatic sphincterotomy, timing of pancreatic stenting and possible routine use of submucosal injection and endoscopic ultrasound (EUS).

Applications

This survey demonstrated the ampullectomy practices of expert endoscopists which is important for future guideline development. Experts agreed on the use of EUS for large lesions, prophylactic pancreatic stenting, follow-up examination and adjunct modality for residual tissue removal. Variability existed among experts regarding the use of biliary and pancreatic sphincterotomy prior to ampullectomy. Therefore, these practices should be studied in prospective trials to help refine the best practice for our patients.

Terminology

The ampulla is an orifice in the second portion of the duodenum where the biliary tree and pancreas drain. Ampullectomy describes a technique to remove a tumor at the ampulla. This can be performed by surgery or using a less invasive procedure named ERCP. ERCP is an endoscopic procedure used to access the biliary tree and pancreatic duct from the second portion of the duodenum. EUS is an endoscopic procedure where an endoscope with an ultrasound probe is used to obtain images of the internal organs.

Peer review

This article is very interesting and helpful to assess guidelines in endoscopic ampullectomy techniques for expert biliary endoscopists in North America.

REFERENCES

- 1 Scarpa A, Capelli P, Zamboni G, Oda T, Mukai K, Bonetti F, Martignoni G, Iacono C, Serio G, Hirohashi S. Neoplasia of the ampulla of Vater. Ki-ras and p53 mutations. *Am J Pathol* 1993; **142**: 1163-1172
- 2 Shapiro PF, Livvendahl RA. Tumors of the Extrahepatic Bile-ducts. *Ann Surg* 1931; **94**: 61-79
- 3 Rosenberg J, Welch JP, Pyrtek LJ, Walker M, Trowbridge P. Benign villous adenomas of the ampulla of Vater. *Cancer* 1986; **58**: 1563-1568
- 4 Yao T, Ida M, Ohsato K, Watanabe H, Omae T. Duodenal lesions in familial polyposis of the colon. *Gastroenterology* 1977; **73**: 1086-1092
- 5 Burke CA, Beck GJ, Church JM, van Stolk RU. The natural history of untreated duodenal and ampullary adenomas in patients with familial adenomatous polyposis followed in an endoscopic surveillance program. *Gastrointest Endosc* 1999; **49**: 358-364
- 6 Shemesh E, Bat L. A prospective evaluation of the upper gastrointestinal tract and periampullary region in patients with Gardner syndrome. *Am J Gastroenterol* 1985; **80**: 825-827
- 7 Spigelman AD, Talbot IC, Penna C, Nugent KP, Phillips RK, Costello C, DeCosse JJ. Evidence for adenoma-carcinoma sequence in the duodenum of patients with familial adenomatous polyposis. The Leeds Castle Polyposis Group (Upper Gastrointestinal Committee). *J Clin Pathol* 1994; **47**: 709-710
- 8 Ponchon T, Berger F, Chavaillon A, Bory R, Lambert R. Contribution of endoscopy to diagnosis and treatment of tumors of the ampulla of Vater. *Cancer* 1989; **64**: 161-167
- 9 Shemesh E, Nass S, Czerniak A. Endoscopic sphincterotomy and endoscopic fulguration in the management of adenoma of the papilla of Vater. *Surg Gynecol Obstet* 1989; **169**: 445-448
- 10 Lambert R, Ponchon T, Chavaillon A, Berger F. Laser treatment of tumors of the papilla of Vater. *Endoscopy* 1988; **20** Suppl 1: 227-231
- 11 Binmoeller KF, Boaventura S, Ramsperger K, Soehendra N. Endoscopic snare excision of benign adenomas of the papilla of Vater. *Gastrointest Endosc* 1993; **39**: 127-131
- 12 Vogt M, Jakobs R, Benz C, Arnold JC, Adamek HE, Riemann JF. Endoscopic therapy of adenomas of the papilla of Vater. A retrospective analysis with long-term follow-up. *Dig Liver Dis* 2000; **32**: 339-345
- 13 Zadorova Z, Dvofak M, Hajer J. Endoscopic therapy of benign tumors of the papilla of Vater. *Endoscopy* 2001; **33**: 345-347
- 14 Desilets DJ, Dy RM, Ku PM, Hanson BL, Elton E, Mattia A, Howell DA. Endoscopic management of tumors of the major duodenal papilla: Refined techniques to improve outcome and avoid complications. *Gastrointest Endosc* 2001; **54**: 202-208
- 15 Norton ID, Geller A, Petersen BT, Sorbi D, Gostout CJ. Endoscopic surveillance and ablative therapy for periampullary adenomas. *Am J Gastroenterol* 2001; **96**: 101-106
- 16 Norton ID, Gostout CJ, Baron TH, Geller A, Petersen BT, Wiersema MJ. Safety and outcome of endoscopic snare excision of the major duodenal papilla. *Gastrointest Endosc* 2002; **56**: 239-243
- 17 Fujii T, Maguchi H, Obara T, Tanno S, Itoh A, Shudo R, Takahashi K, Saito H, Ura H, Kohgo Y. Efficacy of endoscopic diagnosis and treatment for postoperative biliary leak. *Hepatogastroenterology* 1998; **45**: 656-661
- 18 Cheng CL, Sherman S, Fogel EL, McHenry L, Watkins JL, Fukushima T, Howard TJ, Lazzell-Pannell L, Lehman GA. Endoscopic snare papillectomy for tumors of the duodenal papillae. *Gastrointest Endosc* 2004; **60**: 757-764
- 19 Kahaleh M, Shami VM, Brock A, Conaway MR, Yoshida C, Moskaluk CA, Adams RB, Tokar J, Yeaton P. Factors predictive of malignancy and endoscopic resectability in ampullary neoplasia. *Am J Gastroenterol* 2004; **99**: 2335-2339
- 20 Harewood GC, Pochron NL, Gostout CJ. Prospective, randomized, controlled trial of prophylactic pancreatic stent placement for endoscopic snare excision of the duodenal ampulla. *Gastrointest Endosc* 2005; **62**: 367-370
- 21 Baillie J. Endoscopic ampullectomy: does pancreatic stent placement make it safer? *Gastrointest Endosc* 2005; **62**: 371-373
- 22 Han J, Kim MH. Endoscopic papillectomy for adenomas of the major duodenal papilla (with video). *Gastrointest Endosc* 2006; **63**: 292-301
- 23 Freeman ML, DiSario JA, Nelson DB, Fennerty MB, Lee JG, Bjorkman DJ, Overby CS, Aas J, Ryan ME, Bochna GS, Shaw MJ, Snady HW, Erickson RV, Moore JP, Roel JP. Risk factors for post-ERCP pancreatitis: a prospective, multicenter study. *Gastrointest Endosc* 2001; **54**: 425-434
- 24 Brackbill S, Young S, Schoenfeld P, Elta G. A survey of physician practices on prophylactic pancreatic stents. *Gastrointest Endosc* 2006; **64**: 45-52
- 25 Midwinter MJ, Beveridge CJ, Wilsdon JB, Bennett MK, Baudouin CJ, Charnley RM. Correlation between spiral computed tomography, endoscopic ultrasonography and findings at operation in pancreatic and ampullary tumours. *Br J Surg* 1999; **86**: 189-193
- 26 Quirk DM, Rattner DW, Fernandez-del Castillo C, Warshaw AL, Brugge WR. The use of endoscopic ultrasonography to reduce the cost of treating ampullary tumors. *Gastrointest Endosc* 1997; **46**: 334-337
- 27 Cannon ME, Carpenter SL, Elta GH, Nostrant TT, Kochman ML, Ginsberg GG, Stotland B, Rosato EF, Morris JB, Eckhauser F, Scheiman JM. EUS compared with CT, magnetic resonance imaging, and angiography and the influence of biliary stenting on staging accuracy of ampullary neoplasms. *Gastrointest Endosc* 1999; **50**: 27-33
- 28 Rosch T, Braig C, Gain T, Feuerbach S, Siewert JR, Schusdziarra V, Classen M. Staging of pancreatic and ampullary carcinoma by endoscopic ultrasonography. Comparison with conventional sonography, computed tomography, and angiography. *Gastroenterology* 1992; **102**: 188-199
- 29 Buscaill L, Pages P, Berthelemy P, Fourtanier G, Frexinos J, Escourrou J. Role of EUS in the management of pancreatic and ampullary carcinoma: a prospective study assessing resectability and prognosis. *Gastrointest Endosc* 1999; **50**: 34-40
- 30 Blackman E, Nash SV. Diagnosis of duodenal and ampullary epithelial neoplasms by endoscopic biopsy: a clinicopathologic and immunohistochemical study. *Hum Pathol* 1985; **16**: 901-910
- 31 Yamaguchi K, Enjoji M, Kitamura K. Endoscopic biopsy has limited accuracy in diagnosis of ampullary tumors. *Gastrointest Endosc* 1990; **36**: 588-592
- 32 Baillie J. Endoscopic ampullectomy. *Am J Gastroenterol* 2005;

- 100: 2379-2381
- 33 **Catalano MF**, Linder JD, Chak A, Sivak MV Jr, Raijman I, Geenen JE, Howell DA. Endoscopic management of adenoma of the major duodenal papilla. *Gastrointest Endosc* 2004; **59**: 225-232
- 34 **Aiura K**, Imaeda H, Kitajima M, Kumai K. Balloon-catheter-assisted endoscopic snare papillectomy for benign tumors of the major duodenal papilla. *Gastrointest Endosc* 2003; **57**: 743-747
- 35 **Lee SK**, Kim MH, Seo DW, Lee SS, Park JS. Endoscopic sphincterotomy and pancreatic duct stent placement before endoscopic papillectomy: are they necessary and safe procedures? *Gastrointest Endosc* 2002; **55**: 302-304
- 36 **Martin JA**, Haber GB. Ampullary adenoma: clinical manifestations, diagnosis, and treatment. *Gastrointest Endosc Clin N Am* 2003; **13**: 649-669
- 37 **Norton ID**, Wang L, Levine SA, Burgart LJ, Hofmeister EK, Rumalla A, Gostout CJ, Petersen BT. Efficacy of colonic submucosal saline solution injection for the reduction of iatrogenic thermal injury. *Gastrointest Endosc* 2002; **56**: 95-99
- 38 **Inoue H**, Kawano T, Tani M, Takeshita K, Iwai T. Endoscopic mucosal resection using a cap: techniques for use and preventing perforation. *Can J Gastroenterol* 1999; **13**: 477-480

S- Editor Tian L L- Editor Cant MR E- Editor Ma WH