Endoscopic papillectomy for ampullary adenomatous lesions: A literature review

Shu-Ling Li, Wen Li, Jian Yin, Zi-Kai Wang

Abstract

Ampullary adenomatous lesions of the gastrointestinal tract are rare and can be asymptomatic. Therefore, ampullary adenomas with malignant potential require prompt removal, regardless of whether they are adenomatous or carcinomatous lesions. Endoscopic papillectomy is a safe and effective alternative therapy to surgery to treat duodenal papillary lesions in selected patients. Accurate preoperative diagnosis and staging of ampullary adenomatous lesions are critical for predicting prognosis and determining the most appropriate therapeutic approach. Furthermore, the management and prevention of adverse events and endoscopic treatment for remnant or recurrent lesions and surveillance are essential for successful endoscopic management of ampullary adenomatous lesions. This literature review was based on PubMed and MEDLINE and focused on recent advancements in the endoscopic papillectomy technique to provide a comprehensive view of endoscopic papillectomy to treat ampullary adenomatous lesions.

Key Words: Ampullary adenomatous lesions; Endoscopic papillectomy; Endoscopic ultrasonography; Endoscopic retrograde cholangiopancreatography; Complications; Surveillance

©The Author(s) 2021. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: The endoscopic papillectomy for ampullary adenomatous lesions are still controversial. This review mainly focused on the recent advancements of endoscopic
INTRODUCTION

Although rare in the gastrointestinal tract, ampullary neoplasms follow an adenoma-carcinoma sequence and can potentially transform into adenocarcinoma, which therefore requires prompt removal[1]. Although ampullary neoplasms may be asymptomatic, the detection of ampullary tumors has been increasing annually. It is more frequently identified at an early stage with the broader application of imaging modalities such as computed tomography, magnetic resonance imaging, magnetic resonance cholangiopancreatography, abdominal ultrasound and other advanced imaging techniques[2]. Moreover, some endoscopic examinations are helpful for the diagnosis of ampullary lesions, including esophagogastroduodenoscopy, endoscopic ultrasound (EUS) and endoscopic retrograde cholangiopancreatography (ERCP).

Pancreatocoduodenectomy and local surgical resection have been traditionally considered the treatments of choice for ampullary neoplasms because they achieve complete removal; however, they are invasive and associated with relatively high mortality and morbidity rates[3-5]. Endoscopic papillectomy (EP) was first described in 1983 by Suzuki et al[6], and the first large case series was reported in 1993 by Binmoeller et al[7]. Due to the efforts of many pancreaticobiliary endoscopists over the few years, EP has been established as an effective endoscopic therapy for the treatment of ampullary neoplasms in selected patients and has become an alternative to traditional surgical procedures[2,8]. Furthermore, the indications for EP have expanded, although they are not yet fully established. EP techniques have advanced considerably. Nevertheless, high-quality recommendations have never been established, and many challenges persist, including precise preoperative evaluation, optimal papillectomy technique and strategies to manage recurrences and adverse events.

INDICATIONS

Traditionally, the indications for EP were only benign lesions and patients who were poor surgical candidates. Following advancements in EP techniques, the indications for EP have expanded to include ampullary neoplasms such as early ampullary carcinoma, giant laterally spreading lesions and ampullary lesions with intraductal extension. Generally, ampullary adenomas with the intraductal extension of less than 10 mm are appropriate for endoscopic ampullectomy, including balloon traction technique[9]. Alternatively, surgical resection is required for lesions with more extensive intraductal involvement[10]. Recently, a study reported that ampullary tumors with ≤ 20 mm ductal extension, even in malignant forms or biliary and pancreatic involvement, could be managed by intraductal ablation[11], avoiding additional surgical treatment. The indications for ampullary carcinoma are expanding. Our study suggests that EP provides a more favorable prognosis for patients with T1a ampullary carcinoma without local lymphatic metastasis or distant metastasis; nevertheless, indications for stage T1b require further exploration, and close follow-up is necessary[2]. This conclusion was also confirmed by Yamamoto et al[12]. Precise preoperative evaluation of tumor staging is crucial for endoscopic therapy of ampullary lesions and is the key to determining the indications of EP.
CLINICAL EVALUATION

Most ampullary adenomas are diagnosed incidentally, and patients are asymptomatic. The most common manifestations are jaundice, chronic gastrointestinal bleeding, cholangitis, acute pancreatitis, nausea and vomiting, anorexia and weight loss. History of painless jaundice, chronic gastrointestinal bleeding and weight loss increases the index of suspicion for an underlying malignancy, and careful endoscopic examination is required.

ENDOSCOPIC EVALUATION

Manifestations alone cannot distinguish among ampullary adenomas, carcinomas and non-adenomatous polyps. Therefore, endoscopic evaluation is required. Endoscopic inspection with a side-viewing endoscope (duodenoscope) is more suitable than a forward-viewing endoscope (gastroscope) because a side-viewing endoscope can evaluate the morphological features of the lesion adequately and obtain tissue by biopsy during procedure quickly. Ulceration, friability, and spontaneous bleeding are usually associated with malignant lesions. Preoperative histological diagnosis is crucial to managing ampullary tumors. Diagnostic agreement between preampullectomy biopsy and ampullectomy ranges from 45% to 85%, with a relatively high false-negative rate\[13-15\]. A recent study showed that 11% of invasive carcinomas were previously undiagnosed\[16\]; therefore, biopsy diagnosis of adenoma does not exclude the possibility of deeper carcinoma in ampullary adenomas. Therefore, techniques that enhance the accuracy of endoscopic biopsies need to be employed. A study reported that obtaining a biopsy specimen several days after sphincterotomy and taking at least six biopsies enhanced the accuracy of endoscopic biopsies\[17\]. Although the false-negative rate of endoscopic biopsies is relatively high, it is an essential method for preoperative assessment of ampullary lesions, and methods and its use to improve preoperative diagnosis should be further explored.

ENDOSCOPIC STAGING

Linear and circular EUS is an essential endoscopic technique for the assessment of ampullary lesions. It is widely used in the staging and treatment of ampullary tumors. Nevertheless, there is no consensus regarding whether EUS should be used as a routine examination before EP. Some experts suggested that EUS has a limited role in small ampullary lesions (< 1 cm) without suspicion of malignancy\[18,19\]. However, EUS is as good as ERCP for evaluating intraductal extension and can help measure the depth of mucosal invasion in suspected benign ampullary neoplasms. The technique is also accurate in the context of regional lymph node metastasis and major vascular invasion in patients with periamputillary neoplasms\[20-22\], especially those with a moderate strength of agreement with histopathology in preoperative staging\[23\]. A study showed that accurate preoperative T-staging of pancreaticobiliary malignancies was improved using contrast-enhanced harmonic imaging EUS\[24\]. These findings suggest that EUS should be considered for more extensive lesions or those with concern for invasive cancer\[25\]. Because EUS assessment is always considered for more extensive lesions or ampullary neoplasms with regional invasion, computed tomography and magnetic resonance imaging help detect distant metastases.

ERCP plays an essential role in pretreatment staging of ampullary adenomas, especially to determine intraductal extension. ERCP may deploy prophylactic pancreatic duct stents to reduce the risk of pancreatitis after EP and manage obstructive jaundice in ampullary adenomas. The performance of intraductal US during ERCP procedures also can provide helpful information for making therapeutic decisions for EP but with a shortcoming of overestimation in tumor staging\[26\]. Magnetic resonance cholangiopancreatography is an alternative non-invasive imaging technique that can also evaluate pancreaticobiliary conditions and intraductal invasion.

ENDOSCOPIC TECHNIQUES

The goal of EP is to achieve complete resection without severe complications.
Preoperative evaluation of indications and management of complications is crucial for performing EP successfully. EP is performed using a standard duodenoscope in a method similar to snare polypectomy of a mucosal lesion. Because it is an advanced therapeutic intervention, it must be undertaken by an experienced endoscopist. Several endoscopic resection techniques have been established for the lesions of the papilla, including snare polypectomy, argon plasma coagulation (APC) ablation, endoscopic mucosal resection and even endoscopic submucosal dissection. Nevertheless, a standardized endoscopic technique for EP has not been established, and there is no consensus regarding the power output and the mode of electrosurgical current (cutting or coagulation). A recent study showed that the efficacy and safety of autotcut and endocut modes were similar to EP, and the endocut mode prevented immediate bleeding in cases with large tumor sizes but caused more frequent crush artifacts[26].

Complete resection of ampullary tumors is the ultimate goal of EP. Resection of the entire lesion in one piece (“en bloc”) is recommended. Doing so increases the possibility of complete removal, providing clear margins for more precise histopathologic assessment, reducing procedure time and decreasing recurrence rates[13]. Large lesions and laterally spreading lesions around the ampulla of Vater are challenging to ensure en bloc resection; piecemeal resection might be recommended, albeit with a higher risk of bleeding and perforation[27,28].

Submucosal injection of dilute epinephrine has been suggested to lift tumors from the wall with the effect of yielding wider resection margins and reducing the risk of perforation and bleeding. However, unlike other gastrointestinal tract segments, the complexity of the duodenal ampulla structure makes the effect of submucosal injection uncertain. A study showed that submucosal injection before EP of ampullary tumors had a recurrence rate similar to simple snare papillectomy, without the advantage of achieving complete resection or reducing post-papillectomy adverse events such as bleeding[29]. Another study demonstrated that submucosal injection was related to more frequent residual tumor and shorter recurrence-free survival[30]. These findings suggest that simple EP without submucosal epinephrine injection may be recommended for patients with ampullary adenomas.

Although prophylactic pancreatic stent placement is debated and failed to demonstrate a reduction in some studies[31], experts nevertheless recommend placement of prophylactic pancreatic stents for selected patients at high risk for post-ERCP pancreatitis (PEP)[32,33], especially those with insufficient pancreatic juice drainage after EP. A series of studies demonstrated that prophylactic pancreatic stent placement significantly decreased the risk of post-EP pancreatitis[34,35]. A meta-analysis showed that pancreatic stent placement decreased the odds of post-procedure pancreatitis and potentially reduced the risk of late post-procedure papillary stenosis[36].

In addition, the size and length of stents may also have an impact on post-procedure outcomes. Studies demonstrated that a 5-Fr pancreatic stent was preferable to a 3-Fr pancreatic stent for PEP prophylaxis[37,38]. A long (7 cm) pancreatic stent was more useful than a short (5 cm) stent for decreasing the incidence of PEP[39]. These findings suggest that longer and thicker diameter stents appear to better protect against post-procedure pancreatitis[40]. Nevertheless, the optimum lengths and diameters of prophylactic pancreatic stents require further investigation. Generally, biliary stenting after EP is helpful for cholangitis prevention. Bile juice drained far from the resection wound surface would reduce the risk of perforation and bleeding and to prevent biliary stenosis. However, preventive prophylactic plastic biliary stent placement is not uniformly recommended after EP, unless there is concern regarding inadequate biliary drainage[8,41].

**EP-ASSOCIATED COMPLICATIONS**

Post-ampullectomy adverse events for EP are lower than those of surgical resection; however, the overall rate of complications is 7.7% to 58.3%[42,43] and includes bleeding, pancreatitis, perforation, papillary cholangitis, papillary and duodenal luminal stenosis. EP-related mortality is very rare (approximately 0%–1.9%)[44]. Generally, most EP-associated complications could be successfully recovered through various endoscopic techniques (Table 1). However, endoscopic management for ampullary adenomatous lesions is technically challenging and has a higher risk of procedure-related complications. Therefore, the management of adverse events is indispensable for endoscopists.
Table 1 Endoscopic papillectomy associated complications and managements

| Main complications related to EP | Therapeutics |
|----------------------------------|--------------|
| **Bleeding**                     | Endoscopic hemostasis: (1) Injection; (2) Electrocoagulation; and (3) Endoclips |
|                                  | Vascular intervention |
|                                  | Surgical intervention |
| **Pancreatitis**                 | Prophylactic medical therapy: (1) NSAIDs such as indometacin, etc.; (2) Hydration such as Ringer’s lactate solution; and (3) Somatostatin or octreotide |
|                                  | Endoscopic therapy: (1) ERCP; and (2) Prophylactic pancreatic duct stenting |
| **Perforation**                  | Endoscopic managements: (1) Closure by endoclips; (2) Bile/pancreatic duct stenting; (3) Nasobiliary/nasopancreatic drainage; and (4) Jejunal feeding tube placement |
|                                  | Ultrasound/CT-guided interventional therapy |
|                                  | Surgical intervention |
| **Cholangitis**                  | ERCP |
|                                  | EST |
|                                  | Bile duct stenting |
|                                  | Medical therapy such as antibiotics |
| **Later pancreatic or biliary stenosis** | ERCP |
|                                  | EST |
|                                  | Balloon dilation |
|                                  | Stenting |

CT: Computed tomography; EP: Endoscopic papillectomy; ERCP: Endoscopic retrograde cholangiopancreatography; EST: Endoscopic sphincterotomy; NSAIDs: Nonsteroidal anti-inflammatory drugs.

Bleeding is a relatively common complication because of the substantial vascularization of the duodenal wall; it occurs in large laterally spreading and intraductal extension of ampullary adenomas more frequently. Bleeding includes intraoperative bleeding and postoperative bleeding. Most bleeding can be managed with conservative management and endoscopic treatment, including adrenaline injection, clips or APC ablation. For patients who have failed endoscopic hemostasis, arterial embolization or surgery may be needed. To reduce the risk of bleeding, antiplatelet and anticoagulant therapy must be discontinued before the procedure, as recommended by international guidelines.

Most episodes of post-procedural pancreatitis are mild and resolve with conservative management. Similar to PEP, the placement of prophylactic pancreatic stents reduced the incidence of post-procedural pancreatitis[45]. However, in some cases, a pancreatic stent cannot be easily placed after resection because of edema or bleeding. Various approaches have been proposed to facilitate pancreatic stent insertion, and the optimal technique has yet to be identified. Therefore, adjunctive prophylactic measures to prevent post-procedural pancreatitis must be further explored. Recently, rectal prophylactic nonsteroidal anti-inflammatory medications (100 mg diclofenac or indomethacin), administration of Ringer’s lactate solution, somatostatin and octreotide were recommended for pancreatitis prophylaxis[46-49].

Complications of perforation are uncommon but severe. A careful inspection of the resection plane and the fluoroscopy images is helpful to identify perforations. For patients with exposure or injury of the muscularis propria after EP, the placement of overlength biliary and pancreatic stents helped prevent delayed perforation[50]. If perforation is suspected, computed tomography with oral contrast is recommended because perforation is usually retroperitoneal. Antibiotics should be given as quickly as possible when perforation occurs. Most perforations can be treated with clip suturing or conservative treatment. If severe, surgical treatment is required[51].

Cholangitis is rare (0%–7.3%) and is easily controlled with antibiotics and endoscopic sphincterotomy or biliary stent placement. Nevertheless, the evidence for prophylactic endoscopic sphincterotomy with biliary stenting to prevent cholangitis is weak[8].
Papillary and duodenal luminal stenosis are late complications. Papillary stenosis can be managed by sphincterotomy, stent placement and balloon dilation. Duodenal luminal stenosis occurs after resection of laterally spreading lesions of the papilla with extensive duodenal circumferential or longitudinal involvement and can be managed with stent placement.

OUTCOME

The success rates for endoscopic removal of ampullary adenomas range from 76% to 90%, and recurrences have been reported in up to 25% of cases despite presumed complete removal[52]. Jaundice, intraductal extension, occult adenocarcinoma in the resected specimen and piecemeal resection were associated with lower rates of complete resection[53]. Resected margin-positive or uncertain cases after EP may be managed with endoscopic treatment, including APC, even in adenocarcinoma cases [54]. Recurrence requires special attention after EP, and incomplete resection, final pathology diagnosis, intraductal involvement and coexisting familial adenomatous polyposis are associated with recurrence[2,10,55]. If local recurrence was observed, repeated snaring and cutting, such as snare polypectomy, APC and endoscopic mucosal resection, can be performed until all visible lesions are completely resected. A recent report showed that hybrid endoscopic submucosal dissection using a duodenoscope is technically feasible for recurrent, laterally spreading papillary adenomas < 2 cm in diameter[56]. Intraductal adenoma growth is a risk factor for recurrence[10], and intraductal radiofrequency ablation achieved significant success eradicating neoplasia in patients with residual adenomatous tissue in the bile after EP; these findings suggest this treatment is superior to surgical intervention[57].

SURVEILLANCE

Although a standardized protocol is lacking, post-EP surveillance is obligatory because of recurrence and residual lesion risks. The final pathology results may determine surveillance intervals. For patients with complete resection of ampullary adenoma, a side-viewing endoscope and multiple biopsies are recommended at 3 mo, 6 mo and 12 mo and every year after EP for a total of 5 years. Close endoscopic surveillance can be continued for patients with residual lesions or cancer every 2–3 mo until pathological clearance is achieved. Familial adenomatous polyposis can potentially be managed with surveillance alone in patients with nonadvanced ampullary lesions. Generally, surveillance intervals vary anywhere from 0.5 to 4 years, depending on the patient’s Spigelman score (which considers the number and size of polyps and their histology)[58]. For patients with familial adenomatous polyposis after EP, intensive follow-up is required due to the high rates of recurrence. For patients with incomplete resection of cancer lesions, radical surgical treatment should be considered.

CONCLUSION

EP is a safe and effective alternative to surgery in selected patients. Following the substantial development of endoscopic techniques, the indications have expanded; nevertheless, exploration of the boundaries of indications continues. EN bloc resection and prophylactic pancreatic stenting are recommended. The management of complications and the treatment of remnants or recurrent lesions has also made significant progress. Long-term post-EP surveillance is crucial.

REFERENCES

1 Kaiser A, Jurowich C, Schönekäs H, Gebhardt C, Wünsch PH. The adenoma-carcinoma sequence applies to epithelial tumours of the papilla of Vater. Z Gastroenterol 2002; 40: 913-920 [PMID: 12436368 DOI: 10.1055/s-2002-35414]
2 Li S, Wang Z, Cai F, Linghu E, Sun G, Wang X, Meng J, Du H, Yang Y, Li W. New experience of endoscopic papillectomy for ampullary neoplasms. Surg Endosc 2019; 33: 612-619 [PMID: 30421083 DOI: 10.1007/s00464-018-6577-2]
3 Tran TC, Vitale GC. Ampullary tumors: endoscopic versus operative management. Surg Innov 2004; 11: 255-263 [PMID: 15756395 DOI: 10.1177/155353060401100409]

4 Song J, Liu H, Li Z, Yang C, Sun Y, Wang C. Long-term prognosis of surgical treatment for early ampullary cancers and implications for local ampullectomy. BMC Surg 2015; 15: 32 [PMID: 25888004 DOI: 10.1186/s12893-015-0019-z]

5 Lee H, Park JY, Kwon W, Heo JS, Choi DW, Choi SH. Transduodenal Ampullectomy for the Treatment of Early-Stage Ampulla of Vater Cancer. World J Surg 2016; 40: 967-973 [PMID: 26546182 DOI: 10.1007/s00268-015-3316-x]

6 Suzuki K, Kantou U, Murakami Y. Two cases with ampullary cancer who underwent endoscopic excision. Prog Dig Endosc 1983; 23: 236-239

7 Binmoeller KF, Boaventura S, Ransperger K, Soehendra N. Endoscopic snare excision of benign adenomas of the papilla of Vater. Gastrointest Endosc 1993; 39: 127-131 [PMID: 8495831 DOI: 10.1016/S0016-5107(93)70051-6]

8 Cheng CL, Sherman S, Fogel EL, McHenry L, Watkins JI, Fukushima T, Howard TJ, Lazzell-Pannell L, Lehman GA. Endoscopic snare papillectomy for tumors of the duodenal papilla. Gastrointest Endosc 2004; 60: 757-764 [PMID: 15557951 DOI: 10.1016/S0016-5107(04)02029-2]

9 Bohnacker S, Seitz U, Nguyen D, Thonke F, Seewald S, de Weert A, Pommurud R, Omar S, Soehendra N. Endoscopic resection of benign tumors of the duodenal papilla without and with intraductal growth. Gastrointest Endosc 2005; 62: 551-560 [PMID: 16185970 DOI: 10.1016/j.gie.2005.04.053]

10 Kawashima H, Ohno T, Ishikawa T, Ida T, Tanaka H, Furukawa K, Nakamura M, Honda T, Hashimoto S, Itoh A, Ishigami M, Hirooka Y, Fujishiro M. Endoscopic papillectomy for ampullary adenoma and early adenocarcinoma: Analysis of factors related to treatment outcome and long-term prognosis. Dig Endosc 2021; 33: 858-869 [PMID: 33101254 DOI: 10.1111/den.13871]

11 Pérez-Cuadrado-Robles E, Pieseuxvass H, Moreels TG, Yeung R, Aouattah T, Komuta M, Dano H, Jouret-Mourin A, Deprez PH. Combined excision and ablation of ampullary tumors with biliary or pancreatic intraductual extension is effective even in malignant neoplasms. United European Gastroenterol J 2019; 7: 369-376 [PMID: 31019705 DOI: 10.1007/s00535-018-5272-5]

12 Yamamoto K, Ito T, Sofuni A, Tsuichiya T, Tanaka R, Tonozuka R, Honjo M, Mukai S, Fujita M, Asai Y, Matsunami Y, Kurosawa T, Yamaguchi H, Nagakawa Y. Expanding the indication of endoscopic papillectomy for T1a ampullary carcinoma. Dig Endosc 2019; 31: 188-196 [PMID: 30161275 DOI: 10.1111/den.13265]

13 Yamaguchi K, Enjoji M, Kitamura K. Endoscopic biopsy has limited accuracy in diagnosis of ampullary tumors. Gastrointest Endosc 1990; 36: 588-592 [PMID: 2279648 DOI: 10.1016/S0016-5107(90)71170-4]

14 Bellizzi AM, Kahaleh M, Stelow EB. The assessment of specimens procured by endoscopic ampullectomy. Am J Clin Pathol 2009; 132: 506-513 [PMID: 19762527 DOI: 10.1309/AJCPUWJ8WA2HBBG]

15 Sauvanet A, Chapuis O, Hammel P, Fléjou JF, Ponsot P, Bernades P, Belghiti J. Are endoscopic procedures able to predict the benignity of ampullary tumors? Am J Surg 1997; 174: 355-358 [PMID: 9324155 DOI: 10.1016/S0002-9610(97)00096-2]

16 Alali A, Espino A, Moris M, Martel M, Schwartz I, Cirocco M, Streutker C, Mosko J, Kortan P, Barkun A, May GR. Endoscopic Resection of Ampullary Tumours: Long-term Outcomes and Adverse Events. J Can Assoc Gastroenterol 2020; 3: 17-25 [PMID: 32010876 DOI: 10.1093/jcag/gwz007]

17 Bougeois N, Dunham F, Verheest A, Cremer M. Endoscopic biopsies of the papilla of Vater at the time of endoscopic sphincterotomy: difficulties in interpretation. Gastrointest Endosc 1984; 30: 163-166 [PMID: 6753092 DOI: 10.1016/S0016-5107(84)72357-1]

18 ASGE Standards of Practice Committee. Chathadi KV, Khashab MA, Acosta RD, Chandrasekharra V, Eloubeidi MA, Faul AL, Fonkalsrud L, Lightdale JR, Saltzman JR, Shaukat A, Wang A, Cash BD, DeWitt JM. The role of endoscopy in ampullary and duodenal adenomas. Gastrointest Endosc 2015; 82: 773-781 [PMID: 26260385 DOI: 10.1016/j.gi.2015.06.027]

19 Baillé J. Endoscopic ampullectomy. Am J Gastroenterol 2005; 100: 2379-2381 [PMID: 16279887 DOI: 10.1111/j.1572-0241.2005.00332.x]

20 Ito K, Fujita N, Noda Y, Kobayashi G, Horaguchi J, Takasawa O, Ohana T. Preoperative evaluation of ampullary neoplasm with EUS and transpapillary intraduodenal US: a prospective and histopathologically controlled study. Gastrointest Endosc 2007; 66: 740-747 [PMID: 17905107 DOI: 10.1016/j.gie.2007.03.1081]

21 Riditidit W, Schmidt SE, Al-Haddad MA, LeBlanc J, DeWitt JM, McHenry L, Fogel EL, Watkins JL, Lehman GA, Sherman S, Coté GA. Performance characteristics of EUS for locoregional evaluation of ampullary lesions. Gastrointest Endosc 2015; 81: 380-388 [PMID: 25291823 DOI: 10.1016/j.gie.2014.08.005]

22 Azih LC, Broussard BL, Phadnis MA, Heslin MJ, Eloubeidi MA, Varadarajanu S, Arnolleti JP. Endoscopic ultrasound evaluation in the surgical treatment of duodenal and peri-ampullary adenomas. World J Gastroenterol 2013; 19: 511-515 [PMID: 23382629 DOI: 10.3748/wjg.v19.i4.511]

23 Trikudanathan G, Njei B, Attam R, Arain M, Shaukat A. Staging accuracy of ampullary tumors by endoscopic ultrasound: meta-analysis and systematic review. Dig Endosc 2014; 26: 617-626 [PMID: 24539318 DOI: 10.1111/den.12234]

24 Imazu H, Uchiyama Y, Matsunaga K, Ikeda K, Kakutani H, Sasaki Y, Sumiyama K, Ang TL, Omar
S, Tajiri H. Contrast-enhanced harmonic EUS with novel ultrasonographic contrast (Sonazoid) in the preoperative T-staging for pancreaticobiliary malignancies. Scand J Gastroenterol 2010; 45: 732-738 [PMID: 20205504 DOI: 10.3109/03055210103690269]

25 Defrain C, Chang CY, Srikureja W, Nguyen PT, Gu M. Cytologic features and diagnostic pitfalls of primary ampullary tumors by endoscopic ultrasound-guided fine-needle aspiration biopsy. Cancer 2005; 105: 289-297 [PMID: 15986397 DOI: 10.1002/cncr.21306]

26 Iwasaki E, Minami K, Itoi T, Yamamoto K, Tsuji S, Sofuni A, Tsuchiya T, Tanaka R, Tonozuka R, Machida Y, Takimoto Y, Tamagawa H, Katayama T, Kawasaki S, Seino T, Horiibe M, Fukuhara S, Kitago M, Ogata H, Kanai T. Impact of electrical pulse cut mode during endoscopic papillotomy. DOI: 10.1111/den.13468

27 Klein A, Qi Z, Bahn FF, Awadie H, Nayyar D, Ma M, Voermans RP, Williams SJ, Lee E, Bourke MJ. Outcomes after endoscopic resection of large laterally spreading lesions of the papilla and conventional ampullary adenomas are equivalent. Endoscopy 2018; 50: 972-983 [PMID: 29768645 DOI: 10.1055/a-0587-5228]

28 Yamamoto K, Sofuni A, Tsuchiya T, Ishii K, Tsuji S, Tanaka R, Tonozuka R, Honjo M, Mukai S, Fujita M, Asai Y, Matsunami Y, Nagakawa Y, Yamaguchi H, Itoi T. Clinical Impact of Piecemeal Resection Concerning the Lateral Spread of Ampullary Adenomas. Intern Med 2019; 58: 901-906 [PMID: 30588115 DOI: 10.2169/internalmedicine.1147-18]

29 Hyun JJ, Lee TH, Park JS, Han JH, Jeong S, Park SM, Lee HS, Moon JH, Park SH. A prospective multicenter study of submucosal injection to improve endoscopic snare papillotmy for ampullary adenoma. Gastrointest Endosc 2017; 85: 746-755 [PMID: 27566056 DOI: 10.1016/j.gie.2016.08.013]

30 Chung KH, Lee SH, Choi JH, Kang J, Park WH, Ahn DW, Ryu JK, Kim YT. Effect of submucosal injection in endoscopic papillotomy for ampullary tumor: Propensity-score matching analysis. United Endosc Int 2018; 6: 576-585 [PMID: 29881610 DOI: 10.1177/1756284818745549]

31 Chang WJ, Min YW, Yun HS, Lee KH, Lee JK, Lee KT, Rhee PL. Prophylactic pancreatic stent placement for endoscopic duodenal ampullectomy: a single-center retrospective study. Gut Liver 2014; 8: 306-312 [PMID: 24827628 DOI: 10.5009/gnl.2014.8.3.306]

32 Dumonceau JM, Kapral C, Abakerken L, Papanikolaou IS, Tringali A, Vanbiervliet G, Beyna T, Dinis-Ribeiro M, Hriz I, Mariani A, Paspatis G, Radaelli F, Lakhtakia S, Veitch AM, van Hooft JE. ERCP-related adverse events: European Society of Gastrointestinal Endoscopy (ESGE) Guideline. Endoscopy 2020; 52: 127-149 [PMID: 31863440 DOI: 10.1055/a-1075-4080]

33 Napoléon B, Alvarez-Sanchez MV, Veclercq P, Mion F, Pialat J, Gincul R, Ribeiro D, Cambou M, Lefort C, Rodríguez-Girondo M, Scoazec JY. Systematic pancreatic stenting after endoscopic snare resection concerning the lateral spread of ampullary adenomas. Gut Liver 2019; 13: 3377-3387 [PMID: 23549765 DOI: 10.1007/s00464-013-2920-9]

34 Harewood GC, Pochron CJ. Prospective, randomized, controlled trial of prophylactic pancreatic stent placement for endoscopic snare excision of the duodenal ampulla. Gastrointest Endosc 2005; 62: 367-370 [PMID: 16111953 DOI: 10.1016/j.gie.2005.04.020]

35 Gambitta P, Aseni P, Villa F, Fontana P, Armellino A, Verrutemi M. Safety of Endoscopic Snare Ampullectomy for Adenomatous Ampullary Lesions: Focus on Pancreatic Stent Placement to Prevent Pancreatitis. Surg Laparosc Endosc Percutan Tech 2021 [PMID: 33558546 DOI: 10.1097/SLE.0000000000000909]

36 Wang Y, Qi M, Hao Y, Hong J. The efficacy of prophylactic pancreatic stents against complications of post-endooscopic papillotomy or endoscopic ampullectomy: a systematic review and meta-analysis. Therap Adv Gastroenterol 2019; 12: 1756284819855342 [PMID: 31263509 DOI: 10.1177/1756284819855342]

37 Afghani E, Akshintala VS, Khashab MA, Law JK, Huttlless SM, Kim KJ, Lennon AM, Kalloo AN, Singh VK. 5-Fr vs. 3-Fr pancreatic stents for the prevention of post-ERCAP pancreatitis in high-risk patients: a systematic review and network meta-analysis. Endoscopy 2014; 46: 573-580 [PMID: 24830399 DOI: 10.1055/s-0034-1365701]

38 Zolotarevsky E, Fehmi SM, Anderson MA, Schoenfeld PS, Elmunzer BJ, Kwon RS, Piraka CR, Wamstecker EJ, Scheiman JM, Korsnes SJ, Normolle DP, Kim HM, Elta GH. Prophylactic 3-Fr pancreatic duct stents are superior to 3-Fr stents: a randomized controlled trial. Endoscopy 2011; 43: 325-330 [PMID: 21455872 DOI: 10.1055/s-0030-1256305]

39 Minami K, Iwasaki E, Kawasaki S, Fukuhara S, Seino T, Katayama T, Takimoto Y, Tamagawa H, Machida Y, Horiibe M, Kitago M, Ogata H, Kanai T. A long (7 cm) prophylactic pancreatic stent decreases incidence of post-endoscopic papillotomy pancreatitis: a retrospective study. Endosc Int Open 2019; 7: E1663-E1670 [PMID: 31788550 DOI: 10.1055/a-1010-5581]

40 Olsson G, Löbbe J, Arnelo U, Jonas E, Törnqvist B, Lundell L, Enochsson L. The impact of prophylactic pancreatic stenting on post-ERCAP pancreatitis: A nationwide, register-based study. United European Gastroenterol J 2017; 5: 111-118 [PMID: 28405329 DOI: 10.1177/2050640616645434]

41 Standards of Practice Committee, Adler DG, Qureshi W, Davila R, Gan SJ, Lichtenstein D, Rajan E, Shen B, Zuckerman MJ, Fanelli RD, Van Guider T, Baron TH. The role of endoscopy in ampullary and duodenal adenomas. Gastrointest Endosc 2006; 64: 849-854 [PMID: 17140885 DOI: 10.1016/j.gie.2006.08.044]

42 Desilets DJ, Dy RM, Kuo 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
comparisons. *Gastrointest Endosc* 2001; 54: 202-208 [PMID: 11474391 DOI: 10.1067/mge.2001.116564]

43 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 [PMID: 12145603 DOI: 10.1016/s0016-5107(02)70184-3]

44 Kang SH, Kim KH, Kim TN, Jung MK, Cho CM, Cho KB, Han JM, Kim HG, Kim HS. Therapeutic outcomes of endoscopic papillectomy for ampullary neoplasms: retrospective analysis of a multicenter study. *BMC Gastroenterol* 2017; 17: 69 [PMID: 28558655 DOI: 10.1186/s12878-017-0626-5]

45 Spadaccini M, Fugazza A, Frazzoni L, Leo MD, Aurienma F, Carrara S, Maselli R, Galtieri PA, Chandrasekar VT, Fuccio L, Aljahdli E, Hassan C, Sharma P, Anderloni A, Repici A. Endoscopic papillectomy for neoplastic ampullary lesions: A systematic review with pooled analysis. *United European Gastroenterol J* 2020; 8: 44-51 [PMID: 32213054 DOI: 10.1177/205064619868367]

46 Sperna Weiland CJ, Engels MML, Poen AC, Bhatta A, Venneman NG, van Hoof JE, Bruno MJ, Verdonck RC, Fockens P, Drenth JPH, van Geenen EJM; Dutch Pancreatitis Study Group. Increased Use of Prophylactic Measures in Preventing Post-Endoscopic Retrograde Cholangiopancreatography Pancreatitis. *Dig Dis Sci* 2021 [PMID: 33630216 DOI: 10.1007/s10620-020-06796-0]

47 Andrade-Dávila VF, Chávez-Tostado M, Dávalos-Cobían C, García-Correa J, Montaño-Loza A, Fuentes-Orozco C, Maclías-Amezcua MD, García-Renteria J, Rendón-Félix J, Cortés-Lares JA, Ambriz-González G, Cortés-Flores AO, Alvarez-Villaseñor Adel S, González-Ojeda A. Rectal indomethacin versus placebo to reduce the incidence of pancreatitis after endoscopic retrograde cholangiopancreatography: results of a controlled clinical trial. *BMC Gastroenterol* 2015; 15: 85 [PMID: 26195123 DOI: 10.1186/s12878-015-0314-2]

48 Park CH, Paik WH, Park ET, Shin CS, Lee TY, Kang C, Noh MH, Yi SY, Lee JK, Hyun JI. Aggressive intravenous hydration with lactated Ringer's solution for prevention of post-ERCP pancreatitis: a prospective randomized multicenter clinical trial. *Endoscopy* 2018; 50: 378-385 [PMID: 29237204 DOI: 10.1055/s-0043-122386]

49 Mok SRS, Ho HC, Shah P, Patel M, Gaughan JP, Elfant AB. Lactated Ringer's solution in combination with rectal indomethacin for prevention of post-ERCP pancreatitis and readmission: a prospective randomized, double-blinded, placebo-controlled trial. *Gastrointest Endosc* 2017; 85: 1005-1013 [PMID: 27816497 DOI: 10.1016/j.gie.2016.10.033]

50 Wu L, Liu F, Zhang N, Wang XP, Li W. Endoscopic pancreaticobiliary drainage with overlength stents to prevent delayed perforation after endoscopic papillectomy. A pilot study. *World J Gastroenterol* 2020; 26: 7036-7045 [PMID: 33311948 DOI: 10.3748/wjg.v26.i44.7036]

51 Ardengh JC, Lemos de Bonotto M, Surjan R, Pereira Lima J, Machado MA. Unprecedented case of duodenal papillary disinsertion after endoscopic papillectomy for a neuroendocrine tumor. *Endoscopy* 2015; 47 Suppl 1 UCTN: E127-E128 [PMID: 25857473 DOI: 10.1055/s-0043-1391339]

52 Catalano MF, Linder JD, Chak A, Sivak MV Jr, Rajiiman I, Geenen JE, Howell DA. Endoscopic management of adenoma of the major duodenal papilla. *Gastrointest Endosc* 2004; 59: 225-232 [PMID: 14745396 DOI: 10.1016/s0016-5107(03)02366-6]

53 Biderditid W, Tan D, Schmidt SE, Fogel EL, McHenry L, Watkins JL, Lehman GA, Sherman S, Coté GA. Endoscopic papillectomy: risk factors for incomplete resection and recurrence during long-term follow-up. *Gastrointest Endosc* 2014; 79: 289-296 [PMID: 24094466 DOI: 10.1016/j.gie.2013.08.006]

54 Sakai A, Tsujimae M, Masuda A, Iemoto T, Ashina S, Yamakawa K, Tanaka T, Tanaka S, Yamada Y, Nakano R, Sato Y, Kurosawa M, Ikegawa T, Fujigaki S, Kobayashi T, Shiomi H, Arisaka Y, Itoh T, Kodama Y. Clinical outcomes of ampullary neoplasms in resected margin positive or uncertain cases after endoscopic papillectomy. *World J Gastroenterol* 2019; 25: 1387-1397 [PMID: 30918431 DOI: 10.3748/wjg.v25.i11.1387]

55 De Palma GD. Endoscopic papillectomy: indications, techniques, and results. *World J Gastroenterol* 2014; 20: 1537-1543 [PMID: 24587629 DOI: 10.3748/wjg.v20.i6.1537]

56 Wang ZK, Liu F, Wang Y, Wang XD, Tang P, Li W. Preliminary experience of hybrid endoscopic submucosal dissection by duodenoscope for recurrent laterally spreading papillary lesions. *World J Gastroenterol* 2020; 26: 5673-5681 [PMID: 33088160 DOI: 10.3748/wjg.v26.i37.5673]

57 Larghi A, Rimbaş M, Tringali A, Boškoski I, Rizzatti G, Costamagna G. Endoscopic radiofrequency biliary ablation treatment: A comprehensive review. *Dig Endosc* 2019; 31: 245-255 [PMID: 30444457 DOI: 10.1111/den.13290]

58 Angusuwatcharakon P, Ahmed O, Lynch PM, Lam P, Gonzalez GN, Weston B, Corona E, Katz MHG, Folloder J, Lee JH. Management of ampullary adenomas in familial adenomatous polyposis syndrome: 16 years of experience from a tertiary cancer center. *Gastrointest Endosc* 2020; 92: 323-330 [PMID: 32145286 DOI: 10.1016/j.gie.2020.02.040]
