ANNALS OF SURGERY
Vol. 224, No. 5, 621–627

The Management of Tumors of the Ampulla of Vater by Local Resection

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Objective

The authors report on indications and results of local excision of tumors of the ampulla of Vater.

Summary Background Data

Local excision of ampullary tumors has been performed for nearly a century but remains controversial. The use of this procedure for benign conditions is clear, but its place, if any, in the management of ampullary malignancy is debated.

Methods

The presentation, evaluation, and treatment of 26 patients who underwent local resection of ampullary tumors between January 1987 and November 1994 are reviewed.

Results

There were 16 men and 10 women, with a median age of 58 years. Eighteen patients had adenomas, whereas 8 patients had adenocarcinomas. Patients presented predominantly with jaundice (50%), pain (35%), and pancreatitis (27%) and were evaluated with endoscopic retrograde cholangiopancreatography and biopsy. All patients with benign lesions had accurate preoperative biopsies. Two of eight patients shown intraoperatively to have malignant lesions had preoperative biopsies read as benign. There were no deaths. Postoperative complications included two wound infections and one episode each of cholangitis, lower gastrointestinal bleeding, and adhesive gastrointestinal obstruction. All patients had prompt resolution of jaundice if present before surgery, and the mean postoperative stay was 7.5 days. Six of eight patients with malignant lesions have had recurrent disease.

Conclusions

Local excision of malignant ampullary tumors is effective palliative therapy when the patient is unfit for the Whipple procedure. Ampullary resection usually is curative for patients with benign lesions without a polyposis syndrome. In this series, intraoperative frozen section routinely was accurate.

Mass lesions of the ampulla of Vater represent less than 10% of pancreatic and periampullary tumors. Most recognized ampullary masses are carcinomas, although adenomas and neuroendocrine tumors are being found more frequently with the increased used of endoscopic retrograde cholandiopancreatography (ERCP). There were fewer than 50 reported ampullary adenomas described in the English literature before 1980.[1]

Halsted performed the first ampullary resection in 1897. The technique has been refined and standardized over the years and is well documented in the literature.[2–4] Controversy remains, however, over the extent of resection necessary and the accuracy of preop-

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Accepted for publication September 25, 1995.

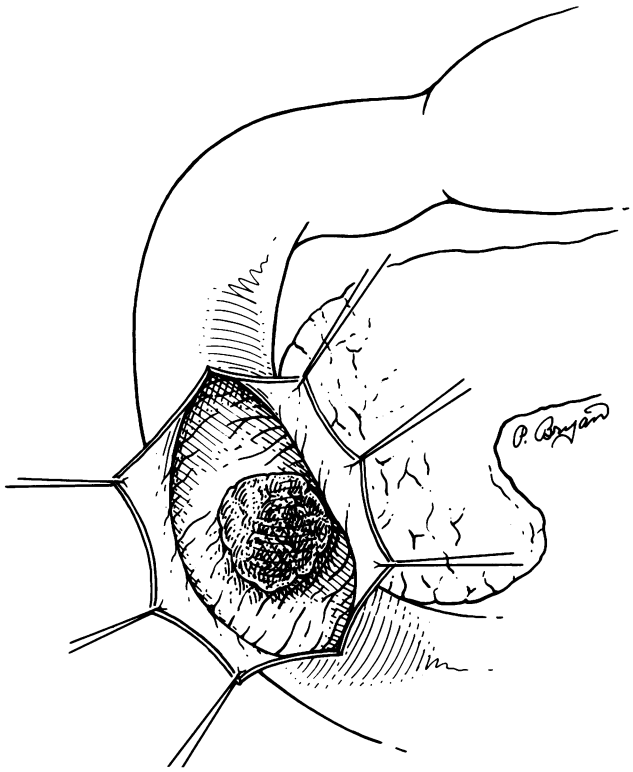


Figure 1. A generous Kocher maneuver is performed to the fourth portion of the duodenum and posteriorly to the vena cava. A duodenotomy is performed after palpation of the tumor or stent or both and extended to yield adequate exposure of the ampulla and surrounding mucosa. Stay sutures are placed circumferentially and secured.

erative and frozen section histopathologic analysis, which might alter the course of management. Local resection was performed as the primary therapy in 26 patients in 7 years' time at Duke University Medical Center. The diagnosis, surgical management, and follow-up of these patients are described.

MATERIALS AND METHODS

The hospital course, operative record, and follow-up evaluations of 26 patients who underwent local resection for ampullary tumors at Duke University Medical Center between 1987 and 1994 are reviewed.

Local Resection Technique

The abdomen is explored through a subcostal or midline incision, and a generous Kocher maneuver is performed along with a cholecystectomy. There often is an endoscopic stent in place, and the mass usually is palpable through the duodenal wall. A small duodenotomy is performed over the lesion to ensure its position (Fig. 1). The duodenotomy then is extended proximally and distally until enough room for the resection of the tumor is obtained. Silk stay sutures are placed in the duodenal wall circumferentially, and identification of the ampulla, bile duct, and pancreatic ducts is undertaken. It may be necessary to resect a portion of the tumor or enter the duodenal wall to identify the exact position of the ducts to place the cannulae (Fig. 2). Once identification of the ducts has been accomplished, a circumferential resection of duodenal mucosa to a depth necessary to excise the tumor is undertaken with a needle electrocautery (Fig. 3). Frozen section should be performed to ensure negative margins, and if negative margins cannot be obtained or if, in the process of the local resection, it becomes obvious that the entire tumor cannot be removed, then one should proceed with pancreaticoduodenectomy. The bile and pancreatic ducts will have been transected or spatulated variable distances from the duodenal mucosa. The reconstruction is critical to ensure adequate biliary and pancreatic drainage and to repair the transduodenal defect. Loupe magnification is rather useful for accurate reconstruction. Reconstruction is accomplished by ap-

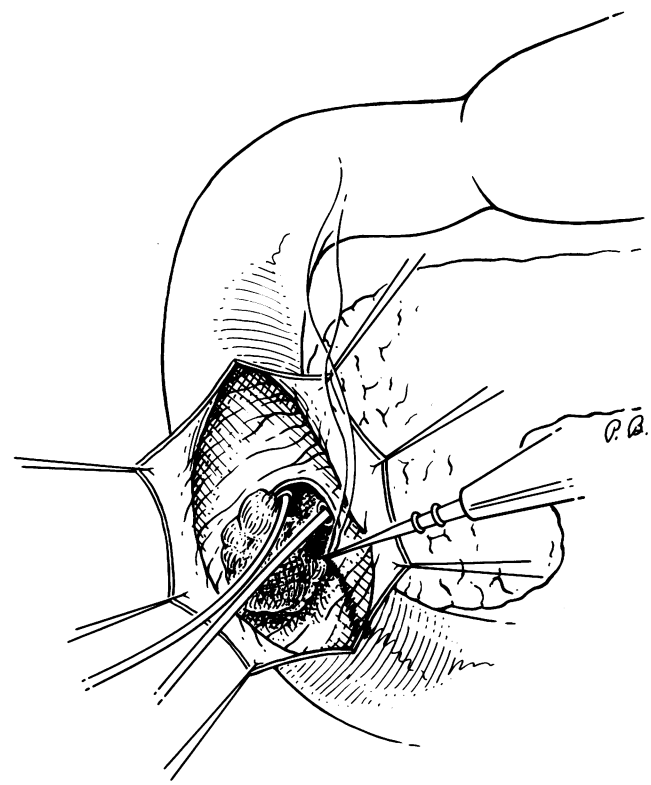


Figure 2. The position of the bile and pancreatic ducts is determined by cannulation using small biliary or lacrimal duct probes. It may be necessary to begin elevation of the duodenal mucosa to be able to identify the orifices of the ducts at the 11 o'clock and 2 o'clock positions. This identification is critical to accurate reconstruction and to duct patency.

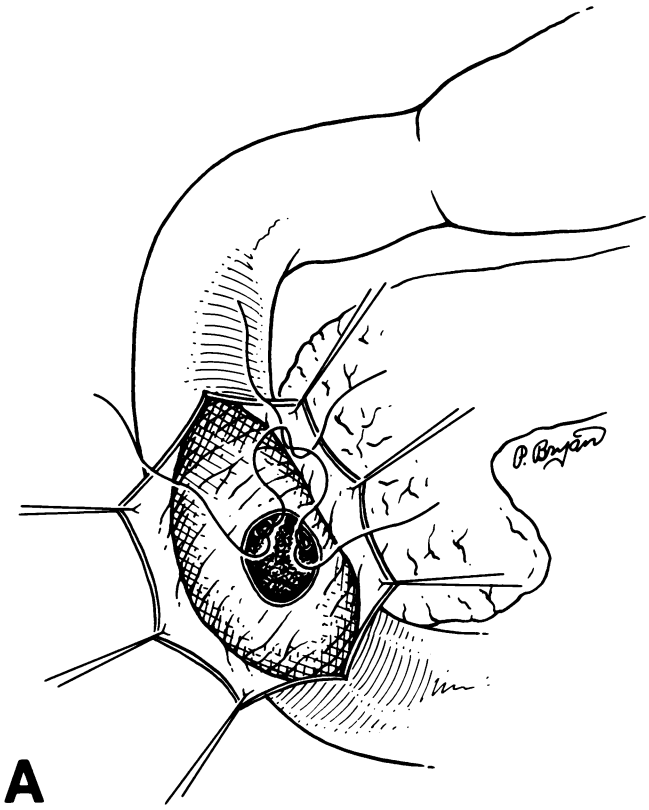
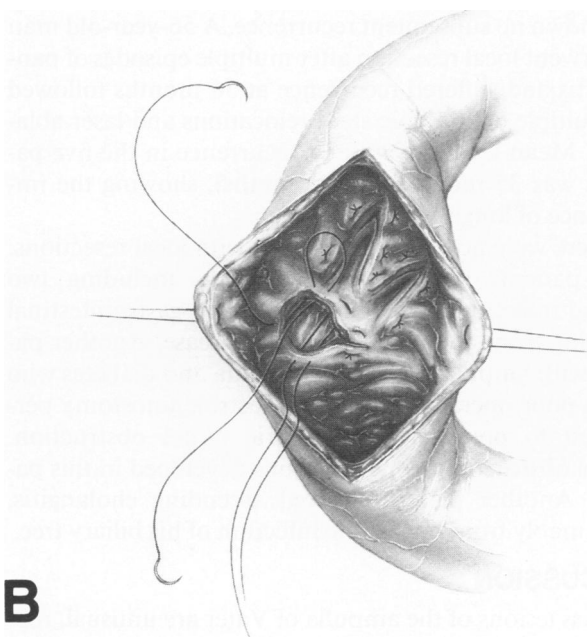


Figure 3. The tumor is excised to whatever depth is necessary for complete removal using needle electrocautery. Depending on tumor size and ductal anatomy (dual or common channel), the bile and pancreatic ducts will be (A) transected at right angles or (B) spatulated along their anterior surfaces. In either case, the adjacent walls are coapted to begin the reconstruction. (Fig. 3B from Meyers WC. Excision of ampulla of Vater and bile duct. In: Sabiston DC, ed. Atlas of General Surgery. p517.).

proximating the common walls of the pancreatic and bile ducts (Fig. 4). It may be necessary to spatulate the ducts somewhat to accomplish a wide-open reconstruction (Fig. 5). After the approximation of the common wall of the ducts, a circumferential reapproximation of the duodenal mucosa to the pancreatic and bile ducts is undertaken with absorbent monofilament sutures. After this reapproximation, the ducts should be probed with biliary dilators to ensure appropriate size. A diameter of 6 to 8 mm for the bile duct and 4 to 5 mm for the pancreatic duct should be obtained, assuming that scarring will reduce these diameters by 50%. Once adequate patency has been ensured, the duodenotomy is closed transversely with sutures or the TA 55 stapler.



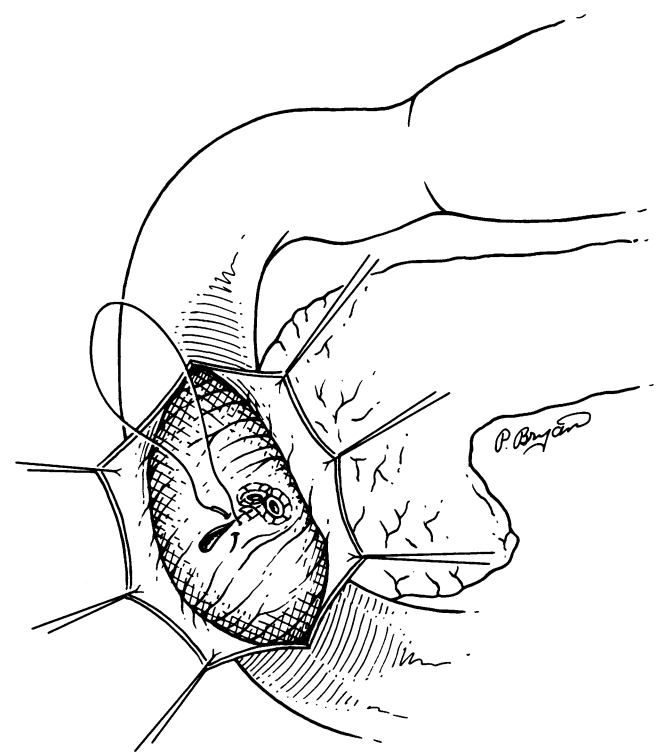


Figure 4. After the common walls of the bile and pancreatic ducts are approximated, duct mucosa is anastomosed circumferentially to duodenal mucosa using absorbable monofilament suture. There often will be a segment of residual duodenal mucosa to close separately.

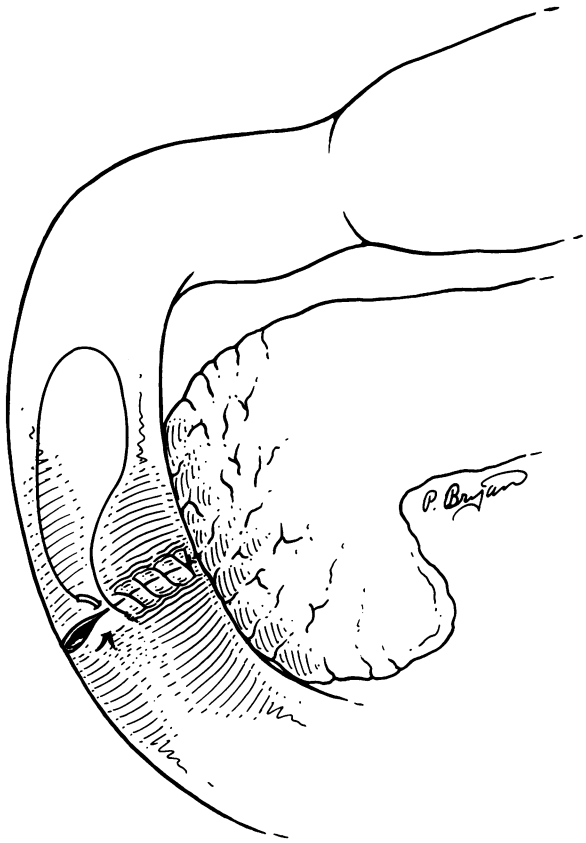


Figure 5. Once adequate patency of the bile and pancreatic ducts has been ensured using biliary dilators, the duodenum is closed transversely with sutures or a TA 55 stapler.

RESULTS

The 26 patients ranged in age from 31 to 79 years, with a median age of 58 years. There were 16 men and 10 women. Eighteen patients had benign villous, tubulovillous, or papillary adenomas and had a mean age of 54 years (median, 55). Eight patients had adenocarcinomas and were 20 years older (mean and median, 74 years).

Patients' signs and symptoms on presentation are listed in Table 1. Thirteen patients presented with jaundice; seven patients had painless jaundice and six had jaundice associated with either pain, pancreatitis, or sepsis. Nine patients presented with pain; six had multifocal pain, whereas only three had abdominal pain alone. Seven patients presented with pancreatitis. Weight loss and nausea and vomiting were present in two patients. Twelve patients had undergone prior hepatobiliary procedures (Table 2).

All 26 patients underwent preoperative ERCP with biopsy. All 18 patients with benign lesions on final pathologic analysis had preoperative or frozen section biopsies, confirming the preoperative histologic results. Six of eight patients with malignant lesions had adenocarcinomas diagnosed by preoperative biopsy. Two of eight patients with adenocarcinomas on intraoperative frozen section had preoperative diagnosis of adenoma. The combination of preoperative and frozen section biopsies was 100% accurate for the diagnosis of adenoma or adenocarcinoma.

Pancreaticoduodenectomy was considered in all eight patients with adenocarcinoma. These patients ranged in age from 70 to 78 years. Three patients (aged 72, 74, and 77 years) were considered good candidates but refused the procedure. Four patients (aged 70, 70, 76, and 78 years) had significant pulmonary, cardiac, or vascular disease precluding safe performance of the Whipple procedure. One woman (aged 75) had a 0.5-cm carcinoma resected with widely clear margins. Five of these patients died of recurrent or metastatic tumor. Recurrences in these patients were discovered at a mean of 27 months (21–36 months). One patient died of unrelated cause at 36 months. One patient had recurrent mucosal disease at 30 months, which was treated by laser ablation. He remains alive without apparent recurrence at 7 years follow-up. The final patient remains disease-free at 21 months.

Five of 19 patients with benign disease have shown recurrence. Four patients (aged 31, 39, 56, and 56 years) had re-excision (1) or laser–diathermy ablation (3) of recurrent adenomatous tissue. One fit 54-year-old patient opted for a Whipple procedure at the time of his recurrence (8 months). Two patients with Gardner's syndrome are of particular interest. A 56-year-old woman underwent resection of a 4-cm villous ampullary tumor, followed by recurrence and laser–cautery ablation 13 and 22 months after surgery. Follow-up at 60 months has shown no subsequent recurrence. A 56-year-old man underwent local resection after multiple episodes of pancreatitis and suffered recurrence at 36 months followed by multiple endoscopic stent relocations and laser ablations. Mean length of time of recurrence in the five patients was 35 months (8–72 months), showing the importance of longitudinal follow-up.

There were no deaths associated with local resections. Five patients suffered complications, including two wound infections. One patient suffered gastrointestinal bleeding from colonic diverticular disease. Another patient with ampullary adenocarcinoma and diabetes who was a poor operative risk had a gastrojejunostomy performed to prevent future gastric outlet obstruction. Bowel obstruction from adhesions developed in this patient. Another patient suffered ascending cholangitis, presumably from retrograde infection of his biliary tree.

DISCUSSION

Mass lesions of the ampulla of Vater are unusual, representing less than 10% of pancreatic and periampullary

Table 1. SIGNS AND SYMPTOMS AT PRESENTATION IN 26 PATIENTS WITH AMPULLARY TUMORS BENIGN OR MALIGNANT

	No.	%
Jaundice	13	50
Pain	9	35
Pancreatitis	7	27
Weight loss	2	8
Incidental	2	8
Sepsis	1	4

tumors. Adenomas have been found in up to 0.7% of patients undergoing ERCPs in large series.[5] Ampullary tumors generally present at an earlier stage than do tumors of the pancreatic head or tail or the distal common bile duct. Their strategic location may cause early biliary obstruction with jaundice (75%), biliary colic, bleeding, or pancreatitis. Serum bilirubin and transaminases typically are elevated. Weight loss and constitutional symptoms are nonspecific and are associated more frequently with adenocarcinoma than with adenoma.

The presentation of a patient with jaundice, abdominal pain, bleeding, or pancreatitis or all four often will lead to an ERCP. The diagnosis of an ampullary tumor then may be made by direct visualization. The ERCP also is helpful in identifying the extent, size, and gross appearance of the tumor and, assuming that the ampulla can be cannulated, routinely will show biliary or pancreatic ductal dilatation or both. A biopsy of the lesion may be done with a snare or forceps, although for intra-ampullary lesions, it is recommended that the biopsy be performed in two stages. Sphincterotomy is performed, followed 3 to 7 days later by re-endoscopy with biopsy of the lesion at that time.[6,7] Sampling errors lead to inaccurate biopsy results in 15% to 40% of cases.[7] A false-negative biopsy result in a polypoid lesion is the most common error, so a biopsy diagnosis of adenoma does not rule out the presence of a deeper or remote adenocarcinoma.[8] Biopsy should be done to ulcerating lesions at the nodular edge and not at the ulcer base. Immunohistochemical staining for carcinoembryonic antigen may be beneficial in differentiating carcinoma from normal and adenomatous tissues.[9]

Experience is being accrued in the use of endoscopic ultrasound (EUS) for the evaluation of intraduodenal lesions, including ampullary tumors.[10-12] The EUS yields high-resolution images of the duodenum, ampulla, bile, and pancreatic duct walls, pancreatic head, local lymph nodes, and neighboring blood vessels. The EUS can show tumor extension into the wall of the duodenum or head of the pancreas as well as lymph node involvement. In a recent study of 49 patients comparing computed tomography, magnetic resonance imaging, and EUS, the sensitivity for detecting tumors less than 3 cm in diameter was 93% for EUS, 67% for magnetic resonance imaging, and 53% for dynamic computed tomography. Overall, the effectiveness of EUS at staging when combined with ERCP approximated 90% for the primary tumor and 75% for lymph node involvement. The technique remains less widely available than computed tomography or magnetic resonance imaging. Experience will determine the role of EUS in the diagnosis of periampullary lesions, but proponents consider it the most accurate single method for local tumor staging in ampullary lesions.

Pathologic studies have confirmed an adenoma–carcinoma sequence analogous to that of adenocarcinoma of

Table 2. PRIOR SURGICAL OR ENDOSCOPIC INTERVENTIONS IN NINE PATIENTS PRIOR TO LOCAL RESECTION AT DUKE UNIVERSITY MEDICAL CENTER

Age (yr)	Sex	Intervention	Interval to Local Resection
36	M	Exploration, transduodenal biopsy of mass	1 mo
42	F	Endoscopic stent	1 wk
44	F	Cholecystectomy; endoscopic stent	20 yr, 1 wk
53	M	Laparoscopic cholecystectomy	8 mo
53	M	Laparoscopic cholecystectomy	12 mo
56	M	Cholecystectomy; transhepatic stent	2 yr, 1 mo
57	F	Local resection, benign tumor	5 yr
60	M	Cholecystectomy, common bile duct exploration	2 mo
70	M	Cholecystectomy, choledochojejunostomy	4 mo
72	F	Endoscopic stent	1 wk
77	M	Endoscopic stent	1 wk
80	F	Cholecystectomy, common bile duct exploration	4 mo

the colon. A high incidence (42%–91%) of residual adenomatous tissue in ampullary adenocarcinomas has been found.[13–15] Numerous investigators consider ampullary adenomas to be premalignant lesions.[14,15] In a study of patients with familial adenomatosis coli, adenomas of the ampulla developed in 74% when observed an average of 7.7 years.[16] These patients should be screened, therefore, not only by colonoscopy but by upper endoscopy as well.

Because surgical options for treating ampullary tumors are limited to transduodenal resection, pancreaticoduodenectomy, or bypass, fitness for a major operation must be determined. Patients with small adenomas may undergo a local excision to include a margin of apparently normal duodenal mucosa. Pancreaticoduodenectomy should be performed if margins are not safely obtainable, if a frozen section shows carcinoma, and in selected patients with ampullary obstruction even when histologic confirmation of cancer is not possible. Patients occasionally will have adenoma on frozen section but carcinoma on final pathologic examination. Such patients should undergo interval pancreaticoduodenectomy.[2] Patients with small adenocarcinomas who are unfit for or who refuse radical resection may be managed by local excision. Endoscopic stenting is a viable alternative for the relief of obstruction in otherwise unresectable patients or if obstruction recurs after resection.[17,18]

Statistical comparison of local resection to pancreaticoduodenectomy is impossible because of small numbers of patients and selection bias. Six recent series, including this report, examine local resection for adenocarcinoma in patients either unfit for or who refused pancreaticoduodenectomy, or in whom cancer was discovered only on permanent pathologic section.[19–23] The 5-year survival rate of these 68 patients was 40%. Pancreaticoduodenectomy, conversely, yielded 5-year survival rates of 32% to 63% in three recent series.[24–26] Shutze et al.[27] reviewed 15 other collected series totaling 520 patients from 1975 to 1990, with a combined survival of 40%. The survival rate in periampullary cancer (*i.e.*, duodenum, distal bile duct, or head of pancreas) traditionally is reported to be approximately 10% to 20% at 5 years. This disparity exemplifies why an aggressive diagnostic and therapeutic course of action should be attempted for ampullary tumors.

Treatment of recurrent disease can be problematic. Patients with benign lesions or polyposis syndromes may require repeat local excision. Four patients in this series underwent re-excision or laser ablation of benign adenomatous mucosa. Patients with Gardner's syndrome are particularly challenging, and endoscopic surveillance and therapy have proved beneficial. Pancreaticoduodenectomy should be considered for large recurrent adenomas or for locally recurrent malignancy. The Hopkin's group reported the results of 11 patients with ampullary tumors who were reoperated on for attempted cure.[28] Ten of 11 patients underwent pancreaticoduodenectomy at a median interval of 2 to 4 months. The complication rate in these patients was comparable to that in primary pancreaticoduodenectomy.

In summary, local resection is curative and the procedure of choice for resectable benign ampullary lesions. Pancreaticoduodenectomy is the procedure of choice for ampullary cancer in patients who are fit for the procedure and who consent to it. Local resection gives good palliation and a chance of cure to a significant number of patients with small cancers or who refuse pancreaticoduodenectomy. Semiannual or annual endoscopy for follow-up after local resection is mandatory to detect recurrence and offers the best chance of curative treatment.

References

1. Gray G, Browder W. Villous tumors of the ampule of Vater: local resection *versus* pancreatoduodenectomy. South Med J 1989; 82: 917–920.
2. Asbun HJ, Rossi RL, Munson JL. Local resection for ampullary tumors: is there a place for it? Arch Surg 1993; 128:515–529.
3. Farouk M, Niotis M, Branum GD, et al. Indications for the technique of local resection of tumors of the papilla of Vater. Arch Surg 1991; 126:650–652.
4. Kahn MB, Rush BF Jr. The overlooked technique of ampullary excision. Surg Gynecol Obstet 1989; 169:253–254.
5. 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.
6. Ponchon B, Berer F, Chavaillon A, et al. Contribution of endoscopy to diagnosis and treatment of tumors of the ampulla of Vater. Cancer 1989; 64:161–167.
7. Yamaguchi K, Enjoji M, Kitamura K. Endoscopic biopsy has limited accuracy in diagnosis of ampullary tumors. Gastrointest Endosc 1990; 36:588–592.
8. Bourgeois N, Dunham F, Verhest A, et al. Endoscopic biopsies of the papilla of Vater at the time of endoscopic sphincterotomy: difficulties in interpretation. Gastrointest Endosc 1984; 30:163–166.
9. Yamaguchi K, Enjoji M. Adenoma of the ampulla of Vater: putative precancerous lesion. Gut 1991; 32:1558–1561.
10. Tio TL, Mulder CJJ, Eggink WF. Endosonography in staging early carcinoma of the ampulla of Vater. Gastroenterology 1992; 102: 1392–1395.
11. Zimmer T, Ziegler K, Bader M, et al. Localization of neuroendocrine tumors of the upper gastrointestinal tract. Gut 1994; 35:471–475.
12. Buck JL, Elasyed AM. Ampullary tumors: radiologic-pathologic correlation. Radiographics 1993; 13:193–212.
13. Perzine KH, Bridge MF. Adenomas of the small intestine: a clinicopathologic review of 51 cases and a study of their relationship to carcinoma. Cancer 1981; 48:799–819.
14. Kozuka S, Tsubone M, Yamaguchi A, et al. Adenomatous residue in cancerous papilla of Vater. Gut 1981; 22:1031–1034.

15. Baczako K, Buchler M, Rampf W, et al. Klinik und Feinstuktur des papillenkarzinomas. Deutsche Mediginishe Wochenchrift 1984; 109:1629–1634.
16. Noda Y, Watanabe H, Iida M, et al. Histologic follow-up of ampullary adenomas in patients with familial adenomatosis coli. Cancer 1992; 70:1847–1856.
17. Bickerstaff KI, Berry AR, Chapman RW, et al. Endoscopic sphincterotomy for the palliation of ampullary carcinoma. Br J Surg 1990; 77:160–162.
18. Huibregtse K, Tytgat GNJ. Carcinoma of the ampulla of Vater: the endoscopic approach. Endoscopy 1988; 20:223–226.
19. Robertson JFR, Imrie CW, Hole DJ, et al. Management of periampullary carcinoma. Br J Surg 1987; 74:816–819.
20. Goldberg M, Zamir O, Hadary A, et al. Wide local excision as an alternative treatment for periampullary carcinoma. Am J Gastroenterol 1987; 82:1169–1171.
21. Trazi RY, Hermann RE, Vogt DP, et al. Results of surgical treatment of periampullary tumors: a 35-year experience. Surgery 1986; 100:716–723.
22. Newman RJ, Pittam MR. Local excision in the treatment of carcinoma of the ampulla of Vater. J R Coll Surg Edinb 1982; 27:154–157.
23. Knox RA, Kingston RD. Carcinoma of the ampulla of Vater. Br J Surg 1986; 73:72–73.
24. Jones BA, Langer B, Taylor BR, et al. Periampullary tumors: which ones should be resected? Am J Surg 1985; 149:46–52.
25. Neoptolemos JB, Talbot IG, Carr-Locke D, et al. Treatment and outcome in 52 consecutive cases of ampullary carcinoma. Br J Surg 1987; 74:957–961.
26. Willett CG, Warshaw AL, Convery K, et al. Patterns of failure after pancreaticoduodenectomy for ampullary carcinoma. Surg Gynecol Obstet 1993; 176:33–38.
27. Shutze WP, Sack J, Aldrete JS. Long-term follow-up of 24 patients undergoing radical resection for ampullary carcinoma, 1953 to 1988. Cancer 1990; 66:1717–1720.
28. McGuire GE, Pitt HA, Lillemoe KD, et al. Reoperative surgery for periampullary adenocarcinoma. Arch Surg 1991; 126:1205–1212.